The University of the Witwatersrand

School of Economic and Business Sciences

Masters in Economics Research Report 2018

Interactions of Stock Market Turnover and Exchange Rate Volatility as Determinants of Net FDI Inflows into Emerging Economies: An African Empirical Analysis

By

Ipeleng Mokgosi

Student Number: 743090

Supervisor: Dr. Nyasha Mahonye

Date: 12 September 2018

ABSTRACT

Investment by multinational firms into emerging markets can simply be put down to the attraction to new markets and their attractive operating environments. The cost of operation and ultimate profit will depend on the exchange rate between home country and foreign country. This study analyses the effects that African country exchange rate volatility and its' interactions with stock market activity against G-7 nations has on the net foreign direct investment inflows into Africa. GARCH (1, 1), VAR and VECM methods were used for estimation of the results in this study. The findings are that stock market activity does drive the volatility of the exchange rate over an annual basis in some cases. Additionally, the exchange rate volatility is simply not a causal influence on whether more investment money flows into and African country versus flowing out.

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1. INTRODUCTION

The growth prospects of an economy are highly reliant on the productive capacity that exists within an economy. The growth and maintenance of such capacity requires investment from both government and the private sector. International finance literature has primarily focused on analysing the determinants of exchange rate changes (Deveruex and Lane, 2002), which is mainly modelled using portfolio investment flows across countries. In developing countries, portfolio investments have not been the main source of investment inflows in recent years. The main source of investment has been foreign direct investment (UNCTAD, 2017). [1] It is therefore important for future literature on cross-border investment flows to analyse how the exchange rate dynamics, which are in theory influenced by short term portfolio flows, affect foreign direct investment flows.

The beneficial effects of foreign direct investment (FDI) inflows have been extensively addressed within past economic literatures. In theory, much of the positive effects of multinational corporation (MNC) investment into developing countries manifest as technology spillovers. Theoretically, the growth of domestic firms improves because of the efficiency gains from having a new owner that incorporates their best practice technology into the domestic firm. The technological benefits can be cost competitive or output competitive. That is, cheaper ways of producing a product or service can improve profit margins of the domestic firm. In the latter cases, the technology brought in could result in a better product which is then more favoured within the market. All this growth can potentially occur over a short time because domestic firms will not need to spend as much money on research and development (R&D) and or wait for patent approvals of new technology. Domestic firms can purely benefit from the past R&D spending of MNCs (Blomstrom, M., and Sjoholm, 1999; Blomstrom, M., Kokko, A., and Zejan, 1994; Damijan *et al*, 2001).

Africa's contribution to the global economy has largely been through the export of natural resources. African countries that are the richest in natural resources have historically been at an advantage when it comes to the ability to grow the domestic economy (Asiedu, 2006). Natural

[1] The United Nations Conference on Trade and Development (UNCTAD) World Investment Report 2017 also shows that in 2016 FDI inflows into Africa was $59 billion less than half of the flows that went to developing Asia and Latin America.

resources that attract foreign investors are not merely the physical gold and oil which can be extracted from the ground. Human resources are an important factor in attracting FDI simply because the local economy should have the basic skills and sometimes the technological knowhow to absorb foreign investment and make productive use of it (UNCTAD, 2005).

The degree of integration to global financial markets (through less restrictive capital controls) will allow for easier flow of funds in and out of a country. The efficiency benefits will be the most positive for short-term portfolio investments which are of a smaller size in monetary value compared to the size of FDI. On the other hand, foreign direct investment occurs with a longer term view in mind. Investment decisions are usually made knowing that 1) returns are uncertain, 2) the investment will be difficult to reverse and 3) given the first two points, the success or failure of an investment decision is heavily reliant on timing (Dixit and Pindyck, 1994).

This study is an empirical analysis of African countries as an investment destination for long-term private investors from developed countries that make up the G-7.[2] Historical findings have indicated that Africa has been a residual recipient of FDI inflows as a total share of the global FDI pie. Between 1980 and 2009, the share of global FDI flows going to Africa did not rise above 3.2% (Anyanwu, 2012). Additionally, not more than 5% of those inflows came from other African countries over a similar period (UNCTAD, 2005). The investment flows originating from developed western countries have recently reached $US 1 trillion, but most go to developing Asian countries. Africa's hope seems to rest in the recent rise in investment flows from Asia mainly due to China's economic rise (UNCTAD, 2017).

Analysis of the exchange rate risk factor is an important research topic for the mere fact that for the many natural resources Africa has, the benefits will only be fully realized when there is infrastructure that will improve the productive capacity of the economy. In a post Bretton Woods global monetary economy, to ignore the effects of free-floating currencies on the returns from doing international business would be of big concern.

The focus on the G-7 countries is relevant for this study given that there is a small share of FDI going to Africa and the outward flows coming from developed nations like those that make up the G-7 have slowed in recent years. The exchange rate in this study is a trade weighted index of

[2] The countries that make up the G-7 are Canada, France, Germany, Italy, Japan, U.K and USA.

the G-7 country currencies versus the currency of an African country. The intuitive thinking is that measuring African currency volatility against the G-7 and testing the significance of the correlation to net FDI will give a snapshot into how FDI flows are on average driven by exchange rate risk relative to developed western nations.

The African countries that were analysed are; Egypt, Kenya, Nigeria and South Africa. Exchange rate volatility's interaction with stock market turnover ratio is addressed within the process of estimating exchange rate volatility with GARCH models. That is, stock market turnover is a proxy for stock market activity which is used as an independent variable within the variance model of the exchange rate index.

The rest of study proceeds as follows: Section 2 presents a brief theoretical background on the effects of exchange rate risk on FDI inflows. Section 3 provides a brief literature review of similar work done in the past. Section 4 presents the step by step methodology that was employed to obtain the calculation of certain variables and the estimation of the results. Section 5 presents the data section in which the data sources, descriptive statistics and preliminary tests are addressed. Sections 6 and 7 provide the results and policy implications thereof respectively, from there the paper proceeds to close in Section 8 and have an appendix at the end.

2. THEORETICAL BACKGROUND

The intrinsic nature of FDI is that it is permanent. To put this in way which doesn't imply finality, investment decisions that are considered as FDI are of such a large value that it becomes extremely difficult to reverse them once investment has been made. In some regards, the size of the monetary value would be a limited way of viewing what FDI actually entails. FDI is about having some sort of substantial control over a firm or organization into which investment is being placed. Control is achieved by buying a large enough stake within the firm (which generally will cost a lot of money). The other way in which an investment is considered FDI is to have procession of at least 10 percent of the voting rights within the firm (Crowley and Lee 2003).

The permanent nature of FDI is the foundation on which the basic theory of cross-border investment risk has been developed. An important explanation of how large investment decisions are made by firms was put forward by Dixit and Pindyck (1994). In a nutshell, firms that have

access to the opportunity to invest in a promising project have to weigh up the risks of going forward with the investment decision. The amount of time available to a firm to assess the positives and negatives of a possible future investment into a project is considered to be an 'asset'. Dixit and Pindyck liken this 'asset' to a financial call option. A firm with this luxury is thought to simply have an offer to purchase some predetermined share in another firm, where the offer is only valid for a certain period of time. Therefore, the firm with the offer is under no obligation to make the purchase but has the right to do so if it pleases.

Offers for investment opportunities are 'assets' because they allow a firm (usually a multinational corporation (MNC)) evaluate the potential benefits to potential asset acquisition. In the case where a good investment opportunity presents itself, further evaluation will involve analysing the risk that the favourable market conditions will suddenly change after an irreversible investment has occurred.

The second major theoretical analysis into how FDI flows are affected by uncertainty is based on production's ability to be flexible to changes in economic risk factors across different countries. Notable contributions to this theory come from the likes of Sung and Lapan (2000). The basic theory states that it would be efficient and wise for MNCs to place production facilities in multiple countries when faced with uncertainties deriving from the exchange rate risks' effect on production input cost uncertainties. The premise for such a theoretical decision lies in the ability of company management to consistently manage the cost-benefit calculations of producing in each production location and deciding to fund production in the country which will be most advantageous for the firm's profits. Given little exposure to exchange rate volatility, having one production facility in one country will be ideal for profits given that there will be less international transactions risks associated with exporting (Sung and Lapan, 2000).

The two theories mentioned above differ with regards to how MNCs make their investment decisions. In a situation where one is aware of the potential operational risks, the "options approach" stipulates that decisions are made *ex ante*. In the 'production flexibility' approach, investment flow decisions are made *ex post* the observed risk environment (Goldberg and Kolsatd, 1994).

In both approaches, the risks that the MNCs will likely always consider will be the factors that affect the return from investment, also known as profits. The factors are input costs (such as labour) and output prices. Related to the profitability of the firm will be the value of the firm, which will rise when profit increase and fall when the opposite is true. In many cases, past research in the field of FDI and exchange rates has focused on FDI inflows (Klein and Rosengren, 1992; Sung and Lapan, 2000; Goldberg and Koldstad, 1994). Intuition should imply that, for the FDI inflows that come in, one must consider the outflows going out to other countries. It is fair to assume that in some cases FDI inflows are not adding to past investment but rather merely replacing outflows. The way in which FDI is measured is the one subtle difference that this study employs. That is, FDI inflows net of outflows are used in this study to make sure the values used are net of any MNC disinvestment or outflows from domestic firms seeking growth opportunities outside their African home country.

In an assumed frictionless global financial investment market, analysis of stock markets and exchange rates has historically dealt with the degree to which stock returns are affected by exchange rate risk. An investor's share of foreign assets within the portfolio always carries exchange rate risk, even the risk free foreign asset equivalents would be considered as pure exchange rate risk assets (Solnik, 1974). Accommodative capital controls and general deregulation of financial markets starting in the 1970s has meant that investors from developed countries have been able to take advantage of the gains from diversifying portfolios internationally. Important for achieving positive returns from international diversification are the size of transaction costs and the depth of assets available for acquisition (Tesar and Werner, 1992). Therefore, in theory the less developed countries that receive portfolio investments from developed countries would have more activity within their financial and stock markets. The exchange rates should be less volatile to reflect the confidence international investors have in such markets.

Higher volumes of stocks traded are in theory related to the price changes of stocks. Assuming there are two types of investors (or traders). There are those who are 'long' stocks (optimists) and there are those who are 'short' stocks. Stock price-Volume theory suggest that the direction of correlation depends on how much each type of investor trades shares given information that is suited to their style of investment. Carpenter and Upton (1981) suggest that traded volume is a

proxy for the type of information that flows the most (i.e. whether positive news flow more than negative news and vice versa). In theory the costs of holding a short position are deemed to be high, thus ensuring that traded volume tends to increase the most in bull markets (Jain and Joh, 1986; Jennings, Starks and Fellingham, 1981). Additionally, higher stock market turnover indicates less perceived risk of that market. Tauchen and Pitts (1983) suggested that the prices variability of stocks fall as the traded volume rises due to a higher number of stock traders participating in the market.

3. LITERATURE REVIEW

Seminal literature on the dynamics of exchange rates was primarily focused on developing theoretical models that operated within a money market and goods market framework. In a model where it is assumed that economic agents are rational beings and that assets are perfect substitutes for one another regardless of the country of origin, Fleming (1962) and Mundell (1963) put forward the ideas that different macroeconomic policies had effects on exchange rates through different channels. The supply dynamics in the money markets operate to change the relative returns (i.e. interest rates) between countries thereby incentivising rational investors to move funds to the country that maximizes returns. Fiscal policy affects domestic demand for money, where money for transactions purposes has to be repatriated by reducing ownership of interest earning assets and vice versa. The shift in the demand for owning assets shifts the interest rate in the short run, which affects the attractiveness of domestic assets to international investors.

Dornbusch (1976) went on to reach theoretical conclusions that were consistent with the Mundell-Fleming model by incorporating the “consistent expectations” into the “rationality” assumption. Such expectations would go on to suggest that changes to interest rates caused by policy implementation will be anticipated by economic agents. Therefore investors will act to minimize their losses by moving funds in such a manner so that interest rates and the exchange rate moves in the opposite direction to what was theoretically implied by expectations.

Stock markets exists to connect buyers and sellers of securities, and now more than ever investors (especially in developed financial markets) have the ability to place their money in many foreign markets that promise good returns. Research findings that point to a better

integrated global financial system are by Kanas (2000), who concluded that since 1987, there has been significant volatility spillovers from stock returns to exchange rates in the six developed nations studied.[3]

The pricing of risk for a stock is said to depend on both local and international factors. Solnik (1974) found that the stock price changes of 299 stocks in 8 developed countries occurred due to both domestic and international factors. Global systemic risk is not as dominant a factor as domestic factors in stock price changes. Griffin and Stulz (2001) found that exchange rate shocks had a very small impact on U.S. and Japanese excess stock returns (between 1975 and 1997) compared to the more substantial impact of real industry shocks. This suggests that exchange rate risk is sufficiently hedged away for it to be an important factor for international portfolio investment.

Karpoff (1987) surveyed literature on stock market volume traded and stock price volatility, and found that in most cases, researchers found the relationship to be positive. Higher volumes of stocks traded resulted in more frequent price changes, especially over daily frequencies. Given the findings by Tesar and Wernar that U.S. and Canadian investors had portfolios which were more weighted towards domestic stocks (1992), the implication is that investors developed countries are generally not eager to invest abroad. Thus when they do one can assume that the rewards of investing abroad outweigh the risks. Thus higher traded volumes in developing countries show less perceived risk about those markets and economies.

In terms of analysing the size of the impact that exchange rate dynamics have FDI inflows, the economic theory generally focuses on how multinational firms decide to invest in the presence of exchange rate risks. Cushman (1985) analysed bilateral investment flows between the USA and five other industrialized countries. The results indicate that the expected real appreciation of a foreign currency has a significant effect on bilateral investment flows. Given this currency appreciation, Cushman (1985) modelled that the US firms were likely to invest less in the foreign country if the US firm 1) imports intermediate inputs from abroad and 2) if production of output occurs in the foreign country. These two scenarios simply make goods imported from the foreign country too expensive, which decreases profit margins.

[3] The countries in this paper were; USA, Canada, Japan, Germany, France and the UK.

The risk effect of exchange rates on bilateral investment flows was further investigated by Goldberg and Kolstad (1994). They analysed how short-term volatility in exchange rates impacted a multinational firms' decisions by place production facilities in the domestic economy or in a foreign country. The findings were that the decision to increase share of production abroad was significantly influenced by an increase in exchange rate volatility. That means that risk averse investors will likely move a larger share of production to another country when exchange rate volatility risks are high. These findings were for bilateral flows between the USA, Japan, Canada and the U.K. The effects of exchange rate volatility remained similar regardless of whether the exchange rate shocks were caused by real or monetary factors.

Sung and Lapan (2000) arrived to similar conclusions as Goldberg and Kolstad (1994) with regards to the manner in which firms should manage exchange rate risk. Assuming a multinational firm selling a homogenous good abroad,[4] the authors model and conclude that such a firm will be best positioned to maximize profits when it has production bases in both the host and home country. This will allow firms to shift production to the most advantageous bases given the exchange rate at the time. Thus exchange rate volatility will tend to increase initial FDI flows to end market countries where production facilities do not exist.

Benassy-Quere, Fontagne and Lahreche-Revil (1999) said that in theory, the purpose of FDI funds will determine whether they are a complement or substitute to trade. A conclusion that the authors settled on was that a firm that plans to serve the foreign market will see FDI as a substitute for trade. In such a case, the authors suggests that a depreciating foreign currency increases FDI flows into the foreign market due to the reduced real cost of doing so (i.e. more acquisitions will occur). Analysing 42 developing countries that receive their FDI from 17 developed countries, the authors found a statistically significant correlation between price competitiveness and exchange rate stability. A 1 point increase in exchange rate volatility reduced FDI flows to a developing country by 0.63%. Thus, a developing country's currency appreciation was found to decrease FDI inflows (except for oil exporting nations, the effect was opposite in such cases).

[4] Note that Sung and Lapan (2000) additionally assumed that the firm was risk-neutral and that due entry sunk costs with plants having decreasing average costs, only one plant could be opened in each location.

Exchange rate levels were shown to determine the magnitude of FDI inflows into the U.S. by Klein and Rosengren (1992). They found that the FDI inflows into the U.S. increased when the U.S. Dollar depreciated because the depreciation increased the wealth of the foreign firms that bid to acquire U.S. assets. These findings were consistent with the findings of Froot and Stein (1991) who too concluded that the strength of the U.S. Dollar negatively affected FDI inflows into the U.S. between 1973 and 1988. Froot and Stein (1991) also found that portfolio investments were insignificantly affected by the value of the U.S. Dollar.

Udoh and Egwaikhide (2008) analysed the effect of exchange rate volatility[5] on FDI inflows into Nigeria between 1970 and 2005. The authors found that higher exchange rate volatility had a negative effect on FDI inflows to Nigeria. In their opinion, the results made sense because the volatility of exchange rates creates uncertainty about the outcome resource allocation transactions.

Further research into the risks that effect FDI inflows into Africa has touched on the institutional factors that influenced foreign investor decisions. Asiedu (2006) found that the heightened political uncertainty and the increased corruption amongst politicians had negative effects on FDI to Sub-Saharan African countries. These are the negatives that were found to blunt the positive effects of having good legal systems, plentiful natural resources and a large economy.

A pivotal component that affects the manner in which FDI flows is the exchange rate regime of a country. A Multinational corporations' decision to pursue initial investment and the decision to move into a new market with the aim of exporting, will be influenced by the exchange rate regime. In the case where one currency is pegged to the currency of a developed country, Xing (2004) found that FDI flow from Japan to China's manufacturing sector increased rapidly between 1981 and 1995. The influx of Japanese investment occurred due to the wealth effect as the Chinese Yuan was pegged to the US Dollar, which grew weaker against the Japanese Yen. The Yen strengthened by 86% against the Yuan over that period. This meant that Japanese MNCs had 86% more purchasing power of Chinese manufacturing assets and relative wages in China remained low, making operations cheaper to run and Japanese goods manufactured in China more competitive in global markets.

[5] Udoh and Egwikhide (1996) used GARCH (1, 1) models to obtain the exchange rate volatility.

Exchange rate pegging allows a country to control inflation by pegging it to the currency of a country which has relatively more stable and low inflation. Free floating exchange rates allow for the adjustment of relative prices so as to allow countries with less growth and cheap labour to have weaker currencies, thus allowing them export cheaper goods than more developed countries. Bouoiyour and Rey (2005) found that a free floating exchange rate caused the Moroccan dirham to be more volatile against 15 European trade partners. As the volatility of the real exchange rate increased, fewer exports occurred between 1960 and 2000. The authors also found that FDI occurred in Morocco as a substitute for imports.

The ability to operate in a foreign country at cheaper input costs is not the sole variable that MNCs have to think about when contemplating making investments. The other piece to the puzzle is the ability to repatriate profits or pull out capital if conditions become unsuitable for making profits. Reinhart and Montiel (1999) found that the total capital flows into 15 Asian countries were not statistically significantly affected by the imposition of capital controls. However, the composition of flows was altered by capital controls. That is, stricter capital controls were found to increase long-term FDI flows and reduce short-term portfolio flows. Thus capital controls can have a positive effect on a recipient developing country because it means the economy is less reliant on the 'hot money' which is usually associated with portfolio investments. The relative share of FDI to portfolio flows is also influenced by the depth of stock market development and U.S. interest rates. Simply put, better stock markets make portfolio investing easier and tighter U.S. monetary policy makes financial assets in other countries more attractive, thus in both cases portfolio investment flows will increase as a share of total investment flows into the 15 Asian countries under observation.

Contrary to Reinhart and Montiel's (1999) findings, Desai, Foley and Hines (2006) point to theory that capital controls in developing countries can prevent interest rate convergence, which creates higher capital costs of investing for MNC's. Thus ultimately, less FDI inflows occur for the developing country. Between 1982 and 1997, Desai, Foley and Hines found that the growth of MNC assets in developing countries increased after capital controls were removed in the recipient country. Additionally, the volatility of MNC profits fell as capital controls were less strict, making for more attractive investment environment.

A large proportion of FDI flow analysis has historically focused on flows that occur within the manufacturing sectors. The reason for this focus on manufacturing is that the theory that MNCs are attracted to investing in countries that have relatively cheaper assets and costs of operation can be easily analysed. Nunnenkamp (2002) found that the traditional view that FDI flows to nations with large and thriving markets still persisted in the 1990s. Furthermore, FDI inflows to service sectors were flows that occurred with the aim of servicing the local market. Nunnenkamp also makes it clear that for the market size to be a FDI attracting factor, institutional quality still needed to exist within the recipient country.

Goldberg (2004) adds to the debate that FDI into services occurs for different reason than FDI into the manufacturing sector. Goldberg suggests that FDI into the financial sector of emerging countries serves to improve finance options for domestic firms to grow. Additionally, introducing foreign banks into the domestic market can help attract more FDI inflows due to the cost of finance falling. The cost of finance may decrease because of the higher competition and due to improved regulatory institutions that need to keep an eye on the larger sector. Debt markets also become less volatile due to the presence of internationally backed banking firms that can better handle short term losses without restricting their finance to the local economy by much.

4. METHODOLOGY

To analyse the effects of stock market turnover on the volatility of the exchange rates, countries which have stock exchanges that are internationally recognized as being liquid and up to international standards were chosen for analysis. The reason is that countries and stock exchanges that are part of the Financial Times Stock Exchange (FTSE) series have been screened for liquidity and minimum float requirements before they are accepted into the index series. Additionally, the FTSE Country Classification Advisory Committee classify countries into developed, advanced emerging, secondary emerging and frontier markets according to a set of minimum standards that indicate market quality.[6]

The FTSE Country classifications for the African countries in this study are as follows. South Africa is an ‘Advanced’ emerging economy. Egypt is a ‘Secondary’ emerging economy. Nigeria

[6] Information of FTSE global indexes was found from the FTSE Russell “Indexing the World” whitepaper 2016.

and Kenya are 'Frontier' markets. This is a good mix of countries as they span different market development categories and there is a country for each major geographical region of Africa. There were 8 African frontier markets in the series; Nigeria and Egypt were chosen on the basis that they simply had the largest stock market capitalizations within that sub-category.[7]

The likes of Kanas (2000) and Solnik (1987) contributed to exchange rate variation analysis by finding correlations to stock market returns. To differentiate from past literature, stock market activity was used as a determinant variable within the variance equation of a simple OLS model of exchange rate volatility. Stock market turnover as a percentage of market capitalization was used as a proxy for Stock market activity. The basic logic here is that African country stock markets that experience high activity relative to stock market activity within the G-7 markets will be seen as less risky by international investors, hence the higher activity. In, theory the expectation is that less relative stock market activity in an African stock exchange will result in higher exchange rate volatility. The stock market turnover ratios (TOR) were calculated as follows:

$$\mathbf{TOR_{it}} = \frac{VT_{it}}{MCAP_{it}} \quad (1)$$

Where $\mathbf{VT_{it}}$ = Value Traded (in US$) for country ***i*** in year ***t***.

$\mathbf{MCAP_{it}}$ = Total Market Capitalisation (in US$) for country ***i*** in year ***t***.

The turnover ratios are represented as a percentage. The turnover ratio of the G-7 countries will be combined into one ratio by simply working out the average percentage turnover for over all the G-7 countries. The G-7 turnover ratio in a given year *t* will be represented by $\mathbf{GTOR_t}$. Therefore the relative turnover ratio between the G-7 countries and each African country '*i*' will be:

$$\mathbf{RTO_{it}} = \frac{\mathbf{GTORt}}{\mathbf{TORit}} \quad (2)$$

The exchange rates that were observed in this research study were simply a trade weighted exchange rate index. Therefore, the G-7 countries have had the nominal value of their currencies relative to the nominal value of the developing country currency calculated as an arithmetic

[7] Morocco was initially part of the list but the lack of data on some variables warranted its exclusion.

average. The weight each G-7 country currency has received is equal to the proportion of trade as a percentage of developing country's total trade with the G-7 countries.[8] The general formula for such a trade weighted exchange rate is as follows:

$$TWE_{it} = \phi \; x \; [\frac{e_{it}}{e_{i0}}][w_{it}] \quad (3)$$

Where TWE_{it} = the trade weighted exchange rate

e_{it} = the direct nominal exchange rate of developed country ***i*** in year ***t***.

e_{i0} = the direct nominal exchange rate of developed country ***i*** in the base year.

w_{it} = the trade weight of G-7 country ***i*** in year ***t***.

ϕ = the product of the bracketed terms for the the 7 developed countries that make up the G-7.

The choice to use trade weights was made on the basis that more weight should be placed on the G-7 currencies that are exchanged regularly with African countries through trade transactions.

The study moves on to measuring the volatility of TWE_{it} and RTO_{it} by using their conditional variances which are modelled by GARCH. The model employed in this study is the simple GARCH (1, 1). Notwithstanding the fact that past work by Udoh and Egweikhide (2008) and Crowley and Lee (2003) use the GARCH (1, 1) to model the exchange rate volatility, that they would go on to utilize to analyse its effect on FDI. Hansen and Lunde (2005) concluded that many of the GARCH iterations were better than GARCH (1, 1) at modelling some stock returns but none were better at modelling exchange rate dynamics. The general representation of a GARCH (1, 1) for this study is:

$$TWE_{it} = YD_{it} + CA_{it} + \epsilon_t \quad (4)$$

And

$$h_t = B1 + B2*h_{t-1} + B3*\epsilon_t^2 + B4*RTO_{it} \quad (5)$$

[8] The weights were calculated using bilateral trade data from the COW Trade_4.0 dataset from www.correlatesofwar.org.

Where equation 4 is the mean equation and equation 5 is the variance equation. YD_{it} is the interest rate difference between the G-7 country average government bond yield and the African country government bond yield. CA_{it} is the current account balance of the African country (measured in US$).

The two methods used to estimate the relationship between exchange rate volatility and net FDI inflows are the Vector Auto-regression (VAR) method and the Vector Error correction method (VECM). The decision to use these methods primarily lies in their simplicity. It is estimated as a simple OLS regression but in a multivariate setting. The other reason is that this estimation method uses the dependent variable as a function of its lagged self and lagged versions of other independents variables (including lag zero). This requires less a prior expectations about the signs of variable coefficients.

The choice of which method to employ was determined by whether there was any cointegration amongst the variables involved. To test for cointegration the Johansen Cointegration test was utilised.

The primary equation of estimation is:

$$\mathbf{NetFDI_{it} = NetFDI_{it-j} + VTWE_{it-j} + CGDP_{it-j} + GDEBT_{it-j} + COC_{it-j} + ROL_{it-j}} \quad (6)$$

The rest of the equations of estimations within the multivariate system are:

$$\mathbf{VTWE_{it} = NetFDI_{it-j} + VTWE_{it-j} + CGDP_{it-j} + GDEBT_{it-j} + COC_{it-j} + ROL_{it-j}} \quad (7)$$

$$\mathbf{CGDP_{it} = NetFDI_{it-j} + VTWE_{it-j} + CGDP_{it-j} + GDEBT_{it-j} + COC_{it-j} + ROL_{it-j}} \quad (8)$$

$$\mathbf{GDEBT_{it} = NetFDI_{it-j} + VTWE_{it-j} + CGDP_{it-j} + GDEBT_{it-j} + COC_{it-j} + ROL_{it-j}} \quad (9)$$

$$\mathbf{COC_{it} = NetFDI_{it-j} + VTWE_{it-j} + CGDP_{it-j} + GDEBT_{it-j} + COC_{it-j} + ROL_{it-j}} \quad (10)$$

$$\mathbf{ROL_{it} = NetFDI_{it-j} + VTWE_{it-j} + CGDP_{it-j} + GDEBT_{it-j} + COC_{it-j} + ROL_{it-j}} \quad (11)$$

Equations (7) to (11) are employed to check for the existence of varying directions of causal relationships amongst the variables. The variables within the system are described as follows:

- $\mathbf{NetFDI_{it}}$ is the net FDI inflows (in $US) into country i.

- $VTWE_{it-j}$ is the volatility of the trade weighted exchange rate of country i. It is calculated as the conditional variance from equation (4).
- $CGDP_{it-j}$ is the per capita GDP growth of country i. This variable is stated in percent terms (%).
- $GDEBT_{it-j}$ is the external debt stocks of country i measured in $US.
- COC_{it} is the measurement of Control over Corruption in country i.[9]
- ROL_{it} is the measure of the quality of Rule of Law in country i. [10]

The first two variables in the above list are the main causal relationship this study has attempted to understand. The per capita GDP growth is simply a proxy for the growth of the African market from a foreign investor's view. GDP growth was included based on findings Alfaro et al. (2000) and Hermes and Lensink (2000) that showed that FDI and growth are correlated.[11] The expected sign for the $CGDP_{it}$ coefficient in equation (6) is positive.

Influenced by the findings of Deveruex and Lane (2003), external debt stocks were included in the estimations because developing countries are generally not in the position to borrow on international markets in their own currency. This implies that exchange rate volatility can have severe macroeconomic effects on a developing economy because debt servicing costs can change drastically. Therefore, the expectation is that higher levels of debt are associated with lower exchange rate volatility. The expected sign for the coefficient of $GDEBT_{it-j}$ is negative with the causal relation most likely going from exchange rate to debt.

COC_{it} and ROL_{it} are included as the factors that account for institutional quality of the African countries. Asiedu (2006) used similar variables, where the finding was that higher levels of corruption were bad for attracting FDI, while good legal systems improved the attractiveness of sub-Saharan African countries to FDI. The expected sign for these variables is positive for equation (6).

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[9] This is a measure of the perceptions of grand and small use of public power for private gain. The scale ranges from -2.5 (weak rule of law) to 2.5 (strong rule of law). Therefore a score of zero would mean that the rule of law is of a moderate quality. For more information see: http://info.worldbank.org/governance/wgi/#doc.

[10] Measures the perceptions people have with regards to the quality of property rights, courts, police and contract enforcement. The scale range from -2.5 (weak control of corruption) to 2.5 (strong control of corruption).

[11] Additionally, the likes of Ajami and BarNiv (1984) state that developed countries tend to attract more investment because they have larger markets. Thus GDP growth will be a proxy for market growth which could attract more FDI inflows.

To reinforce significance of the causal relationships found among the different variables, the granger causality test was employed for these VAR and VECM regressions. For the VAR, the Granger Causality test was used. In the VECM case, the linear hypothesis test was used.

Additional post estimation tests are performed to test for the quality of the models being used. For both the VAR and VECM regressions, the Lagrange-multiplier test was performed to test for the existence of any autocorrelation in the residuals at each lag order. To test whether the disturbance terms are normally distributed; a simple Jarque-Bera test for normality is performed and interpreted.

5. DATA

5.1 DATA SOURCES

The data for many of the variables were sourced or calculated from variables from datasets produced by the World Bank. The variables that are from the World Banks' World Development Indicators (WDI) is; GDP per capita growth, Current Account, government external debt stocks and net FDI inflows. The variables for Control of Corruption and the Rule of Law were sourced from the World Banks' World Governance Indicators dataset.

Stock market turnover ratios and the long-term government bond yields used to calculate interest differences were sourced from the Federal reserve of St. Louis FRED database. The government bond yields of the four African countries were taken from the International Monetary Fund's (IMF) International Financial Statistics dataset.

To calculate the exchange rate index, official exchange rates were taken from the World Bank's WDI dataset and the trade weights were calculated using bilateral trade data from the Correlates of War dataset.

All data collected is annual data. The sample period for almost all except two of the variables is from 1984 to 2014. Control of Corruption and Rule of Law has a sample period from 1996 to 2014.

5.2 DESCRIPTIVE STATISTICS

Table 1(1A and 1B) illustrates the summary statistics of all the variables used to obtain estimation results for the four African countries. On average, Nigeria and Egypt had the largest net FDI inflows. The net FDI inflows into South Africa and Kenya showed less deviation than those in Nigeria and Egypt. The former two of the four countries also had the highest net FDI inflows at their peaks.

Between 1996 and 2014, the variables measuring the quality of Rule of Law (ROL_{it}) and Control over Corruption (COC_{it}) were on average the lowest in Nigeria, with Egypt coming in second last place in terms of these institutional quality measurements. Kenya and South Africa had on average, better institutions with the latter being a distance ahead of all the other three countries under observation. The currencies of Kenya and South African were also the two least volatile relative to the G7 currencies. It is clear from these statistics that the better quality of institutions could have a bearing on lowering the volatility of a country's currency.

PANEL 1 and PANEL 2 Descriptions:

In Panel 1 (see Appendix) the clear take away from the net FDI plots is that net inflows have generally remained positive throughout the period of 1984 to 2014. At a closer glance, the net FDI inflows have consistently stayed at stable near zero level before (with the exception of South Africa). In all four countries the drastic swings in net FDI inflows occur post 2000, with the biggest undisturbed increases appearing approximately between 2004 and 2006 for all four countries. The countries experienced some of their largest crashes in net FDI inflows for the period observed generally between 2008 and 2011. Egypt and South Africa had the biggest undisturbed crashes (in nominal money values) in those tough economic times. Between 2012 and 2014, the net inflows into South Africa increased and have reduced by approximately half the increase in this sub-period. Over the same sub-period Nigeria's net inflows were moving in a downward direction, while in Egypt and Kenya inflows were on the rise. Over the whole sample period, all countries have experienced an upward trend in net FDI inflows.

In Panel 2, the observation is that between 1984 and 2014 there has been a clear and common depreciation of the African currencies against the basket of G-7 countries. The trend before 2000 is a downward one, where after that the African currencies have maintained a stable and flat relationship compared to the G-7 basket. It is clear from just looking at these time plots that most

of the volatility in the currencies (although small to negligible) might have occurred before the year 2000, suggesting that in the latter years there should be little to no relationship between the exchange rate index volatility and the net FDI inflows. The general reason for the strength of the African currencies against the G-7 basket in the early years was due to the relatively weak currencies to the smaller European countries before the European Union and the Euro was formed (note that the Japanese currency also drove much of the weakness in the G-7 basket).

5.3 PRELIMINARY TEST RESULTS

Unit Root Tests:

The vital requirement before the multivariate estimations were performed was that the variables were stationary across time. The standard unit root test results indicate that many of the variables in the dataset have a consistent order of integration across the four African countries under observation. The two primary tests to be considered are the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron test (PP). These tests were run at the optimal lags as suggested by the AIC and SBIC statistics (see Table A3 in appendix). The ADF and PP test statistics (in Tables A1 and A2 respectively) indicate that many of the variables are not stationary in level form. The two variables that consistently exhibit stationarity in level form are per capita GDP growth (seen as perCapGDP in the table) and the exchange rate index volatility (seen as Ex.Vol in the table).

Many of the non-stationary variables are integrated of order one. The implication is that, differencing the variables once was sufficient to obtain stationarity. ADF and PP test results point to only two variables with an integration order greater than one. The two variables are external debt stocks (ExtDebt**)** and perceptions of the quality of Rule of Law (ROL), which only occurred for Kenya. The Government bond yield difference (YieldDiff) is I (1) for South Africa and Egypt, and I (0) for Nigeria and Kenya. ROL is I (0) in South Africa. See Table A4 in appendix for full summary of order of integration for all variables.

TABLE 1A

Country	Stats	Net FDI	GDP gro.	G7 Stk. Turnover	Afr. Stk. Turnover	Current Acc.	Exch. Rate	ROL	COC
SA	Obvs	31	31	31	31	31	30	19	19
	Mean	2.49e+09	0.459	106.877	18.5678	1.94e+09	51.3916	0.1526	0.3604
	Std. Dev.	3.06e+09	2.2496	49.7877	11.825	4.3e+09	60.6885	0.062	0.2863
	Min	-4.4e+08	-4.158	44.9783	2.92	-8.4e+09	1.7128	0.0725	-0.116
	Max	9.89e+09	4.1711	225.504	35.37	8.5e+09	219.9243	0.2706	0.7329
Country	**Stats**	**Net FDI**	**GDP gro.**	**G7 Stk. Turnover**	**Afr. Stk. Turnover**	**Current Acc.**	**Exch. Rate**	**ROL**	**COC**
EGY	Obvs	31	31	31	26	31	30	19	19
	Mean	2.54e+09	2.1552	106.877	28.3427	-7.13e+09	184.210	-0.168	-0.588
	Std. Dev.	3.19e+09	1.7514	49.7877	21.07	6.09e+09	304.6716	0.2255	0.1095
	Min	-4.8e+08	-1.1859	44.9783	4.73	-2.7e+10	0.8846	-0.663	-0.779
	Max	1.16e+10	5.2922	225.504	82.88	3.98e+08	1174.19	0.0213	-0.409

TABLE 1B

Country	Stats	Net FDI	GDP gro.	G7 Stk. Turnover	Afr.Stk. Turnov.	Current Acc.	Exch. Rate	ROL	COC
NIG	Obvs	31	31	31	26	31	30	19	19
	Mean	2.85e+09	2.0115	106.877	7.9134	7.69e+09	32.4967	-1.204	-1.18
	Std. Dev.	2.73e+09	7.0813	49.7877	6.9421	8.36e+09	95.612	0.1298	0.1246
	Min	1.89e+08	-13.068	44.9783	0.43	-3.5e+09	0.02	-1.427	-1.431
	Max	8.84e+09	30.3422	225.504	29.4	2.44e+10	380.8542	-1.039	-0.892
Country	**Stats**	**Net FDI**	**GDP gro.**	**G7 Stk. Turnov.**	**Afr.Stk. Turnov.**	**Current Acc.**	**Exch. Rate**	**ROL**	**COC**
KEN	Obvs	31	31	31	23	31	30	19	19
	Mean	1.22e+08	0.8466	106.877	5.1247	-2.4e+09	2.9898	-0.892	-1.021
	Std. Dev.	2.06e+08	2.3343	49.7877	3.198	2.5e+09	3.7627	0.1463	0.0959
	Min	-394430.6	-3.953	44.9783	1.3355	-9.4e+09	0.1623	-1.046	-1.16
	Max	9.44e+08	5.5575	225.504	14.784	-4437393	12.2663	-0.417	-0.856

To further reinforce the findings of the order of integration of the variables, an additional unit root test was performed. Given the small sample used in this study, the generalized least squares Dickey-fuller test (DF-GLS) results were also considered. As explained by May (2015), this test (initially brought forth by Elliott, Rothenberg and Stock (1996)) performs at an optimum level when dealing with small sample sizes and when one is relatively less sure of the trend or mean that is present in the data. The DF-GLS tau statistics (see Table A5 and A6) confirm that the exchange rate index is in fact non-stationary in levels. In Egypt this variable is integrated of order 1, while in the other nations it remains I (1) consistent with the ADF and PP test findings.

There were a few differences between the DF-GLS and the ADF and PP results. Still referring to Egypt, Net FDI and ROL are I (2) compared to I (1) as suggested by the ADF and PP results. For the South African data, DF-GLS suggests ROL is not stationary in levels and that net FDI inflow levels are stationary. The South African DF-GLS findings do not seem to be supported by the clear upward trend that exists in Net FDI inflows (see Panel 1 diagrams in Appendix).

Johansen Test for Cointegration:

The results (see Table A21 in Appendix) give a clear indication that only one country (Egypt) shows signs of cointegration within its data series. There is no cointegration amongst the non-stationary variables for South Africa, Nigeria and Kenya. Therefore the method of estimating multivariate equations was the vector error correction method for Egypt. The other three countries results were straightforwardly obtained using vector auto regressions (VAR).

Arch LM Test:

This test was performed for four lags. The results (Table A22 in the Appendix) show that South Africa and Kenya were the only two countries where ARCH effects were significantly present for all four lags. Egypt shows signs of significant volatility clustering for only lag one. The Nigerian results show no significant arch effects in the exchange rate index residual at all four lags.

6. EMPIRICAL RESULTS

GARCH (1, 1) Results:

The regression results for the GARCH model are presented in tables A14 to A17 in the Appendix. Half of the cases indicate that RTO_{it} does not have a significant correlation to $VTWE_{it}$. That is, in Nigeria and Egypt the lower stock market activity relative to the G-7 turnover is in no way related to the volatility of the Nigerian naira and Egyptian pound respectively. In South Africa and Kenya, RTO_{it} has a positive and significant coefficient (at 1% and 5% respectively). Higher stock market activity in the G-7 countries relative to the activity in these two Africa markets resulted in an increase in the volatility of the exchange rate index.

The only mean equation which showed any conventional level of significance for any of the variables was for Kenya (see Table A16 in Appendix). An increase in the current account balance is correlated to an appreciation of the Kenyan shilling. This makes economic sense because foreign international investors may view a negative current account balance as bad for their investments due to the potential inflation that might arise. Thus investors will likely pull their money out causing depreciation (Dhakal, Nag, Pradhan and Upadyaya, 2010). All the GARCH models exhibited normally distributed error terms (see Shapiro-Wilk test results in Table A18 of Appendix) and the autocorrelation coefficients showed no signs of autocorrelation.

The country that had the worst outcome in terms of the GARCH (1, 1) modelling the exchange rate is Nigeria. This is confirmed by the insignificant arch LM test statistic (see Table A21), showing that there is no volatility clustering within the residuals of the exchange rate index. The Autocorrelation Q-stats (see Appendix, Table A19) show no signs of autocorrelation with all the lags in all four countries.

Main VAR/VECM Equation Results:[12]

The main result outcomes (Table 2A on page22 and Table A8 to A12 in Appendix) are at best described as mixed. In the South African equation (in Table 2A), there are merely two independent variables which are significant at any of the conventional levels. Most notably, it turns out that the past volatility (one year lag) of the Rand against a basket of G-7 currencies does not have a significant causal relationship with future period values of net FDI inflows. The only two significant coefficients were for past net FDI inflows and per capita GDP growth (both

[12] Note that the decision to use one lag for the VAR estimations is due to the fact that the VAR estimations at 3 or 4 lags did not meet stability conditions. The lags suggested by the AIC and SBIC can be seen in Table A7 in the Appendix.

significant at a 10% level). FDI inflows from the previous year turn out to be correlated to a fall in the FDI inflows the following year. A possible explanation for the negative sign could be explained by South Africa's influence as a major source of FDI into the rest of Africa. Throughout the 1990's, South Africa was biggest source of FDI funds to Africa by an African country. Therefore, FDI inflows to South Africa could possibly have a reinforcing effect, but these inflows could in the next year become outflows that service the expansion of South African companies into the rest of Africa. Thus, on a net basis, outflows from South Africa might rise substantially in the following year causing net FDI inflows to decrease (UNCTAD, 2005).

TABLE 2A:

DEP.: NetFDI.		**South Africa (VAR)[13]**	**Egypt (VECM)**	**Nigeria (VAR)**	**Kenya (VAR)**
CE	Lag 1		-0.3219* (-1.95)		
	Lag 2				
Net FDI	Lag 1	-0.4942* (-1.81)	-0.5482*** (-2.95)	-0.2514 (-1.29)	-0.9334*** (-3.48)
	Lag 2				
Exc. Vol.	Lag 1	-1.87e+08 (-0.76)	-4.11e+08*** (-3.49)	6.14e+07 (0.06)	1.10e+08* (1.65)
	Lag 2				
Ext. Debt	Lag 1	0.0336 (0.39)	-0.0876 (-0.27)	-0.0432 (-0.83)	-0.0968 (0.81)
	Lag 2				
GDP Grow	Lag 1	7.57e+08* (1.85)	-1.04e+09** (-2.36)	1.16e+08** (2.56)	2.50e+07 (0.62)
	Lag 2				
COC	Lag 1	-1.56e+08 (-0.02)	8.05e+09 (1.61)	4.38e+09 (1.43)	1.02e+09 (0.72)
	Lag 2				
ROL	Lag 1	-6.88e+09 (-0.52)	-7.98e+09 (-1.08)	8.00e+08 (0.35)	2.13e+08 (0.17)
	Lag 2				
Cons.		-1.29e+08 (-0.09)	1.39e+08 (0.23)	4.79e+08 (0.12)	-1.67e+08 (-1.26)
R-Sqd		0.4301	0.9194	0.4558	0.5428
RMSE		3.7e+09	2.4e+09	1.4.e+09	4.2e+08
P>chi2		0.0458	0.0000	0.0271	0.0108
*****Significant at 1% **Significant at 5% *Significant at 10%**					

[13] The type of multivariate estimation method used is stated in parentheses.

GDP growth from the previous year has a positive causal relation to current FDI inflows. A one percentage point increase in the per capita GDP growth rate causes an increase of approximately $U758 million in net FDI inflows the following year. The implication is that growth in the size of the market in South Africa has effects of inducing more FDI inflows than outflows from the country. The negative sign of the lagged net FDI suggests that there is no investment reinforcement over a year on year basis.

The lagged exchange rate volatility coefficient for South Africa is negative. Observing the $VTWE_{it}$ coefficient for the other countries reinforces the mixed findings of past literature with regards relationship between FDI and exchange rate volatility. In Egypt, lagged $VTWE_{it}$ has a negative and significant (at a 1% level) to $NetFDI_{it}$. Therefore, a one standard deviation increase in the volatility of the Egyptian pound against the basket of G-7 currencies causes a $US400 million decline in net FDI inflows. The $VTWE_{it}$ coefficient is however positive for Nigeria and Kenya. It is only significant in Kenya (at 10%). When the Kenyan shilling is more volatile relative to the G-7 basket by one standard deviation, the net FDI inflows going to Kenya increase by about $US110 million. According to theory, the negative sign of the $VTWE_{it}$ coefficient in Egypt would imply that MNCs primarily invest for re-export. In Kenya, the positive sign of $VTWE_{it}$ theoretically implies that much of the investment flowing to this nation occurs with the aim of supplying the local market with good and services.

The results in Table 2A do show that there is a variable that has a consistent coefficient sign for all four African nations. The sign of lagged $NetFDI_{it}$ is negative in all four of the countries, where the only insignificant coefficient was for Nigeria. The absolute values of the coefficients were all less than one, suggesting that the impacts are small. The coefficients for Egypt and Kenya were both significant at 1%.

GDP growth is another variable that is significant in at least three of the four countries. Similar to the finding in South Africa, past GDP growth in Nigeria has a positive impact on $NetFDI_{it}$. In Egypt the causal effect is negative. Both the Egypt and Nigeria $CGDP_{it}$ coefficients are significant at 5% with the absolute effect on $NetFDI_{it}$ both being approximately negative $US104 million for the former and positive $US116 million for the latter.

External government debt stocks (ExtDebt), perception of control over government corruption (COC_{it}) and perceptions of the quality of rule of law (ROL_{it}) were all insignificant at conventional levels. The latter two variables are important to note because one would expect the perceptions of having better institutions to be a pivotal factor in determining the degree to which long term foreign investment flows into a country. Yet again, measuring FDI in 'net inflows' could be at fault. The reasoning is that FDI outflows from these African countries could well be driven by the COC_{it} and ROL_{it} values of possible recipient countries. That is, if African multinational firms are attracted to investing in countries with better control over corruption, net FDI inflows will decrease if foreign MNCs don't view better African institutions with the same degree of positivity.

The next set of equations (Table A8 in Appendix) deals with the causal effects that lagged independent variables have on exchange rate volatility. The most notable coefficients in this table are those of the lagged $NetFDI_{it}$. Lagged $NetFDI_{it}$ is only significant for Egypt and Kenya (at 1%). Higher net FDI inflows had an increasing effect on the volatility of the Egyptian pound against the G-7 basket of currencies, while in Kenya the shilling became less volatile given higher net FDI inflows in the previous year. In the Kenyan case, $NetFDI_{it}$ and $VTWE_{it}$ have the opposite causal effect on each other (based on tables 2A and A8). The Kenya plot of $NetFDI_{it}$ in Panel 1, shows an upward trend in net FDI inflows which hover slightly above zero until around 2006/7. The implication is that there has been a counteracting relationship going on. Higher $VTWE_{it}$ increases net FDI, and the following year the higher FDI inflows reduce $VTWE_{it}$, keeping both $VTWE_{it}$ and $NetFDI_{it}$ stable in the earlier years of the sample period. Note that the same process cannot be said to apply to Egypt because the p-value of the entire equation is higher than 0.05. The Table A8 equations for South Africa and Nigeria are also insignificant.

The results in Table A10 (in Appendix) are rather important to the holistic picture of the macroeconomic relationships estimated within this study. GDP growth is significantly affected by changes in per capita growth from the previous year in South Africa, Egypt and Nigeria. The results in Tables A10 indicate that the two lagged variables that cause higher GDP growth one year on (in South Africa) are GDP growth and COC_{it} (significant at 1% and 10% level respectively). Therefore, in South Africa, the previous year's growth amplifies next year's growth and the populations' perception that government corruption is well dealt with will have a

positive impact on growth. Per capita growth is also positively affected by lagged COC_{it} in Egypt (but to a smaller degree and significant at 5%). The other lagged variable that has a significant positive impact on Egyptian growth is having larger stocks of external debt. The lagged versions of ROL_{it}, $CGDP_{it}$, $VTWE_{it}$ and $NetFDI_{it}$ all have significant negative causal effects on growth in the next year, in Egypt. In Kenya, the impacts of past $VTWE_{it}$, ROL_{it} and $CGDP_{it}$ are all significant but in the positive direction.

With regards to perceptions about institutions in Kenya, per capita GDP growth from the previous year had a negative effect on COC_{it}. In Nigeria, better ROL_{it} reinforced ROL_{it} to be higher in the following year (significant at 5%). The more volatile the naira was against the basket of G-7 countries, the more people perceived the rule of law in the country to be higher in the following year. These were the only significant equations and coefficients from Tables A11 and A12.

7. POLICY IMPLICATIONS

South Africa:

Based on the evidence, the volatility of the Rand relative to the basket of G-7 countries does not affect the value of net FDI inflows one year into the future. Clearly, the indication here is that exchange rate risks have not a pivotal factor in attracting more FDI inflows than outflows. South Africa been one of the top African counties when attracting FDI simply because it has had the some of the best institutions on the continent supplemented by a good financial sector. The results of this study do not find a variable that has a clear effect on net FDI inflows. The significant effects of past GDP growth and past net FDI inflows should be interpreted with caution given the significance is at a 10% level. It looks as though making certain that the mining sector remains as a foreign investment friendly environment is best for South Africa, given that in 2004 the investment into the South African mining sector accounted for almost half of the $US 15 billion flowing into the whole continent (UNCTAD, 2005). Promoting GDP growth through a healthy natural resources sector could go a long way to making sure that South Africa continues to attract a large proportion of FDI that flows to sub-Saharan Africa. The growth of the economy could serve to attract FDI into the services sector, consistent with the analysis of Goldberg (2004) and Nunnenkamp (2002).

Egypt:

The findings for Egypt suggest that over the late 1990 to early 2000s, as the Egyptian pound became volatile against G-7 currencies net FDI to the country decreased. The implication is that Egypt has primarily not been a destination for foreign exports rather than a production hub for export to foreign markets. The nature of the working relationship to international markets has not slowed in recent years. A large proportion of the investment inflows to Egypt in 2015 have been to the primary resource sector, mainly the gas reserves in the Western desert (UNCTAD, 2017). This should shift more production capacity to the country. Hence the larger GDP growth could now be driven by FDI because the country supply domestic energy markets with cheaper domestic gas and rely less on importing oil. Any excess gas can then be exported, having a further positive affect GDP growth. This study does conclude that in Egypt, there has been no clear causal link found between relative stock market activity, exchange rate volatility and net FDI inflows.

Kenya:

The Kenyan results indicate that stock market activity has a bearing on the degree of exchange rate volatility. The VAR output indicates that higher currency volatility has been good for growth of the economy. Attracting more net FDI has risen over the sample period due to higher volatility, but one should be careful to suggest that creating uncertainty within the exchange rate is a good thing. The pricing inconsistencies that occur due to higher volatility could end up hurting the profitability of businesses that operate on international markets (May and Farrell, 2017). In a situation where growth of the domestic market tapers, the negative macroeconomic impacts could be severe. Thus developing improved financial systems would go a long way to creating stability in financial variables, which would be of great benefit in dire economic periods.

Nigeria:

The relative activity in the stock market does not result in a more stable naira, and generally this will be the case simply because the Nigerian economy is too reliant on crude oil. Stability of the economy and the perceptions that foreign investors have of Nigeria will usually be at the mercy of changes in commodity prices. Additionally, the limitations of the conditional variance of the exchange rate as a true representation of the economy mean that many of the Nigerian findings in

this study may not be a true reflection of the macroeconomic relationships that exist. Thus, possible policy suggestions for Nigeria will be limited to simply 'the diversification' of the economy.

Limitations of the study:

Due to the lack of higher frequency macroeconomic data for many of the variables, the analysis on exchange rate volatility was limited to an annual basis. Most volatility that occurs in variables tends to be most evident in shorter time frequencies (notably exchange rates) (May and Farrell, 2017); therefore, although some volatility was captured there is room to expand on this study by employing the methods using high variables measured at a higher frequency.[14]

Additionally, the different findings for each African country may have been due to differences that exist between different regions of Africa. There is thus scope to analyse the relationships addressed in this study, just including countries from a single region and comparing the results.

8. CONCLUSION

This study has presented a basic annual multivariate analysis of the relationship that net foreign direct investment inflows have with the volatility of a trade weighted exchange rate index. Using relative stock market turnover as a determinant variable with the variance equation of a GARCH (1, 1) model, the finding is that stock market activity only had a significant effect on exchange rate volatility in South Africa and Kenya. VAR and VECM estimations show that net FDI inflows were not affected by exchange rate volatility of the exchange rate index in all the countries observed in the study (i.e. South Africa, Egypt, Nigeria and Kenya). Furthermore, the implications are that in two of the countries (e.g. Egypt and Nigeria), relative stock market activity is not correlated to exchange rate volatility. Additionally, none of the African countries' currency volatility relative to the mean of G-7 currencies has an effect on net FDI inflows. Thus there is no definitive link that has been found between stock market activity, and net FDI inflows via exchange rate volatility for the four African countries observed between 1984 and 2014.

[14] Note that the limitation to high frequency data generally occurred for data that is not financial in nature, such as the measures of corruption and the quality of laws of a country.

9. AKNOWLEDGEMENTS

It is with great pride and pleasure that I thank my supervisor Dr. Nyasha Mahonye for the assistance given to ensure the steady and well thought out progress of the research report.

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11. APPENDIX

TABLE A1: Augmented Dickey-Fuller Tests

	South Africa		Egypt		Nigeria		Kenya	
	Test Stat	5% CV	Test Stat	5% CV	Test Stat	5% CV	Test Stat	5% CV
NetFDIinf	-0.750	-2.986	-2.069	-2.989	-1.008	-2.989	-1.028	-2.989
ExtDebt	1.128	-3.000	-2.128	-2.989	-1.779	-2.992	2.251	-2.989
C/A	-0.879	-2.997	1.191	-2.989	-2.021	-2.989	0.715	-2.989
Exc. Rate	-3.119	-2.992	-5.903	-3.000	-72.529	-2.992	-5.110	-2.992
YieldDiff	-1.663	-2.989	-0.835	-3.000	-6.501	-3.000	-4.308	-2.994
Ex. Vol	-5.610	-2.986	-2.559	-3.000	-4.332	-3.000	-4.420	-3.000
perCapGDP	-3.154	-2.989	-2.455	-2.989	-4.503	-2.986	-3.107	-2.989
ROL	-3.116	-3.000	0.166	-3.00	-2.319	-3.00	0.350	-3.00
COC	0.219	-3.000	-1.841	-3.00	-2.321	-3.00	-2.135	-3.00

TABLE A2: Phillips-Perron Unit Root Tests

		South Africa		Egypt		Nigeria		Kenya	
		Test stat	5% CV	Test stat	5% CV	Test stat	5% CV	Test stat	5% CV
NetFDIinf	Z(rho)	-13.748	-12.660	-6.898	-12.660	-2.648	-12.660	-14.498	-12.660
	Z(t)	-2.830	-2.986	-1.868	-2.986	-1.208	-2.986	-1.860	-2.986
ExtDebt	Z(rho)	1.273	-12.500	-7.069	-12.660	-7.661	-12.660	5.563	-12.660
	Z(t)	1.285	-3.000	-1.845	-2.986	-2.067	-2.986	2.756	-2.986
C/A	Z(rho)	-5.086	-12.660	4.293	-12.660	-9.793	-12.660	2.279	-12.660
	Z(t)	-1.313	-2.986	1.570	-2.986	-2.284	-2.986	0.961	-2.986
Exc. Rate	Z(rho)	-4.587	-12.628	-4.150	-12.628	-9.680	-12.628	-3.316	-12.628
	Z(t)	-4.509	-2.989	-3.360	-2.989	-5.344	-2.989	-3.727	-2.989
YieldDiff	Z(rho)	-7.601	-12.660	-3.900	-12.500	-27.096	-12.50	-34.616	-12.628
	Z(t)	-2.208	-2.986	-1.284	-3.000	-6.501	-3.00	-8.210	-2.989
Ex. Vol	Z(rho)	-31.024	-12.660	-17.869	-12.50	-18.410	-12.500	-21.757	-12.500
	Z(t)	-5.610	-2.986	-4.143	-3.00	-10.056	-3.000	-4.420	-3.000
perCapGDP	Z(rho)	-16.342	-12.660	-15.371	-12.660	-24.781	-12.660	-17.960	-12.628
	Z(t)	-3.175	-2.986	-3.050	-2.986	-4.503	-2.986	-3.456	-2.989
ROL	Z(rho)	-12.734	-12.5	0.932	-12.5	-7.912	-12.5	3.343	-12.5
	Z(t)	-3.095	-3.00	0.420	-3.00	-1.979	-3.00	0.701	-3.00
COC	Z(rho)	-0.199	-12.5	-7.243	-12.5	-6.815	-7.228	-5.913	-12.5
	Z(t)	-0.155	-3.00	-2.140	-3.00	-1.821	-2.135	-2.00	-3.00

TABLE A3: Selection-order Criteria for ADF and PP tests

		South Africa		Egypt		Nigeria		Kenya	
		AIC	SBIC	AIC	SBIC	AIC	SBIC	AIC	SBIC
NetFDIinf	Stat	46.237	46.467	45.786	45.889	44.339	44.910	41.249	41.324
	Lag(s)	4	1	2	1	1	1	1	1
ExtDebt	Stat	49.0477	49.1457	46.622	46.718	47.372	47.516	43.257	43.353
	Lag(s)	1	1	1	1	2	2	1	1
C/A	Stat	46.1974	46.4302	46.12	46.248	48.158	48.254	44.248	44.343
	Lag(s)	4	3	1	1	1	1	1	1
Exc. Rate	Stat	7.7477	7.8443	10.41	10.652	3.699	-3.796	1.928	2.025
	Lag(s)	1	1	4	4	1	1	1	1
YieldDiff	Stat	2.7276	2.8236	4.6695	4.7608	5.2518	5.401	7.519	-7.64
	Lag(s)	1	1	1	1	0	0	2	1
Ex. Vol	Stat	21.3773	21.4253	7.1215	7.1724	0.4111	4895	3.3956	3.4453
	Lag(s)	0	0	1	0	1	0	0	0
perCapGDP	Stat	4.0553	-4.1513	3.764	3.86	6.538	6.586	-4.4564	4.5523
	Lag(s)	1	1	1	1	0	0	1	1
ROL	Stat	-3.1706	-3.1234	-1.5042	-1.4098	-1.323	-1.211	-1.708	-1.614
	Lag(s)	0	0	1	1	2	1	1	1
COC	Stat	-1.5842	-1.3961	-1.717	-1.6992	-1.679	-1.490	-2.323	-2.276
	Lag(s)	4	1	1	1	3	3	0	0

TABLE A4: Order of Integration (for ADF and PP)

	SA	EGY	NIG	KEN
NetFDIinf	I(1)	I(1)	I(1)	I(1)
ExtDebt	I(1)	I(1)	I(1)	I(2)
C/A	I(1)	I(1)	I(1)	I(1)
Exc. Rate	I(1)	I(1)	I(1)	I(1)
YieldDiff	I(1)	I(1)	I(0)	I(0)
Ex. Vol	I(0)	I(0)	I(0)	I(0)
perCapGDP	I(0)	I(0)	I(0)	I(0)
ROL	I(0)	I(1)	I(1)	I(2)
COC	I(1)	I(1)	I(1)	I(1)

TABLE A5: DF-GLS Unit Root Tests

	South Africa		Egypt		Nigeria		Kenya	
	Tau Stat	5% CV	Tau Stat	5% CV	Tau Stat	5% CV	Tau Stat	5% CV
NetFDIinf	-5.458	-3.378	-2.155	-3.378	-2.187	-3.378	-0.404	-2.876
ExtDebt	-1.349	-3.544	-1.707	-3.378	-1.985	-3.378	-2.603	-2.962
C/A	-2.808	-3.378	-0.493	-3.378	-2.716	-3.378	-0.956	-3.378
Exc. Rate	-1.974	-3.391	-1.175	-3.443	-0.934	-3.200	-1.271	-3.200
YieldDiff	-2.211	-3.378	-3.173	-3.604	-4.318	-3.116	-3.505	-3.378
Ex. Vol	-6.019	-3.378	-2.559	-3.000	-4.291	-3.452	-4.811	-3.505
perCapGDP	-3.406	-3.378	-1.736	-2.876	-4.503	-2.986	-3.638	-3.378
ROL	-3.327	-3.584	01.607	-4.929	-4.605	-3.030	-3.499	-3.828
COC	-1.202	-2.989	-2.825	-3.584	-2.578	-3.229	-2.348	-3.584

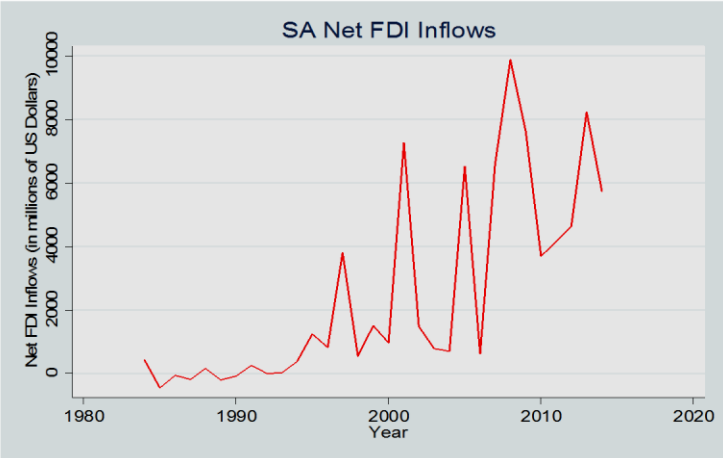
TABLE A6: Order of Integration for DF-GLS Test Results

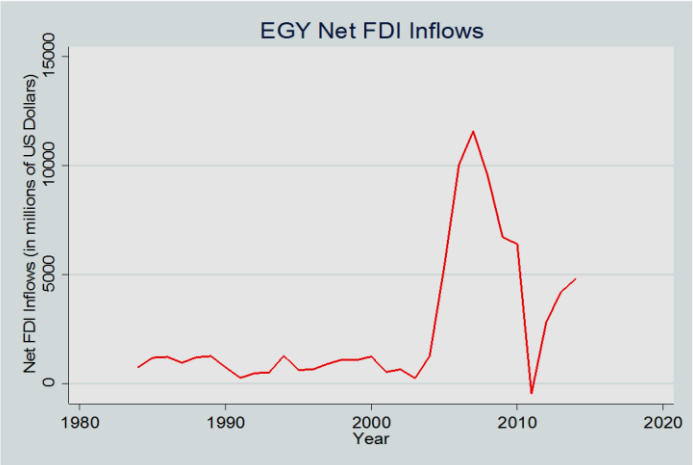
	SA	EGY	NIG	KEN
NetFDIinf	I(0)	I(2)	I(1)	I(2)
ExtDebt	I(1)	I(1)	I(1)	I(2)
C/A	I(1)	I(1)	I(1)	I(1)
Exc. Rate	I(1)	I(2)	I(1)	I(1)
YieldDiff	I(1)	I(1)	I(0)	I(0)
Ex. Vol	I(0)	I(1)	I(0)	I(0)
perCapGDP	I(0)	I(1)	I(0)	I(0)
ROL	I(1)	I(2)	I(0)	I(2)
COC	I(1)	I(1)	I(1)	I(1)

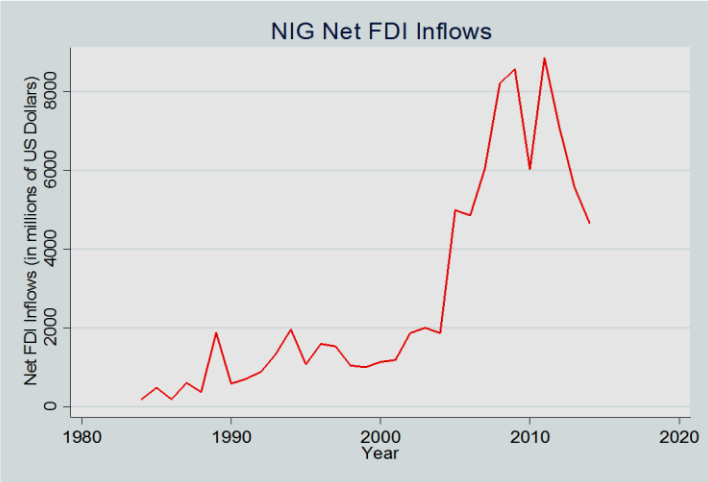
TABLE A7: Jarque-Bera Tests

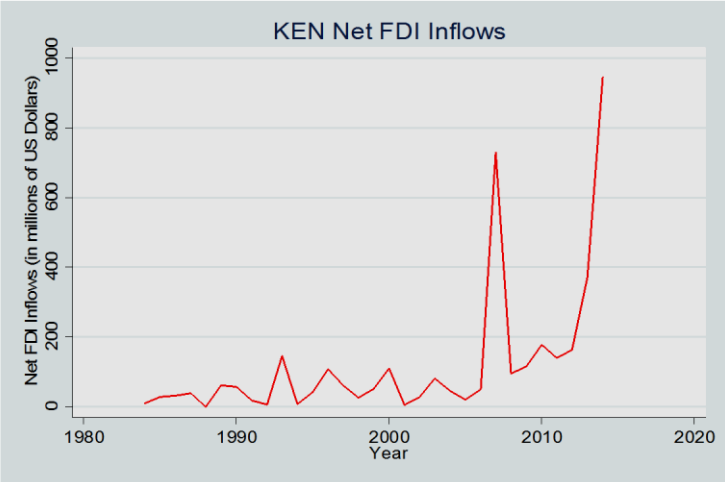
	Equation	Chi2	df	Prob > chi2
SA	Net FDI	0.482	2	0.7859
	Exch. Rate Vol.	0.495	2	0.7809
	Ext. Debt	0.165	2	0.9207
	Per Cap. GDP growth	1.016	2	0.6018
	COC	1.626	2	0.4435
	ROL	0.196	2	0.9066
	All	3.980	12	0.9838
	Equation	**Chi2**	**df**	**Prob > chi2**
EGYPT	Net FDI	1.084	2	0.5915
	Exch. Rate Vol.	2.962	2	0.2274
	Ext. Debt	0.236	2	0.8889
	Per Cap. GDP growth	0.706	2	0.7027
	COC	1.367	2	0.5049
	ROL	0.227	2	0.8929
	All	6.581	12	0.8840
	Equation	**Chi2**	**df**	**Prob > chi2**
NIGERIA	Net FDI	0.131	2	0.9365
	Exch. Rate Vol.	50.476	2	0.0000
	Ext. Debt	0.130	2	0.9371
	Per Cap. GDP growth	0.601	2	0.7405
	COC	1.612	2	0.4467
	ROL	0.158	2	0.9240
	All	53.108	12	0.0000
	Equation	**Chi2**	**df**	**Prob > chi2**
KENYA	Net FDI	0.538	2	0.7643
	Exch. Rate Vol.	0.791	2	0.6732
	Ext. Debt	0.411	2	0.8143
	Per Cap. GDP growth	0.753	2	0.6853
	COC	0.081	2	0.9602
	ROL	1.256	2	0.5336
	All	3.830	12	0.9863

PANEL 1: Diagrams of Net FDI inflows

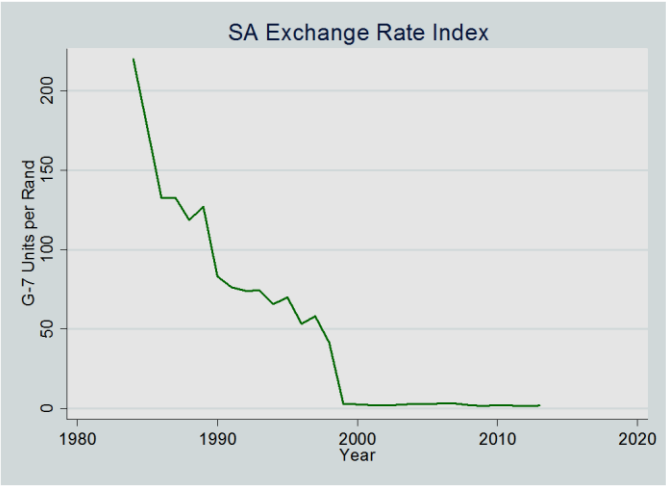


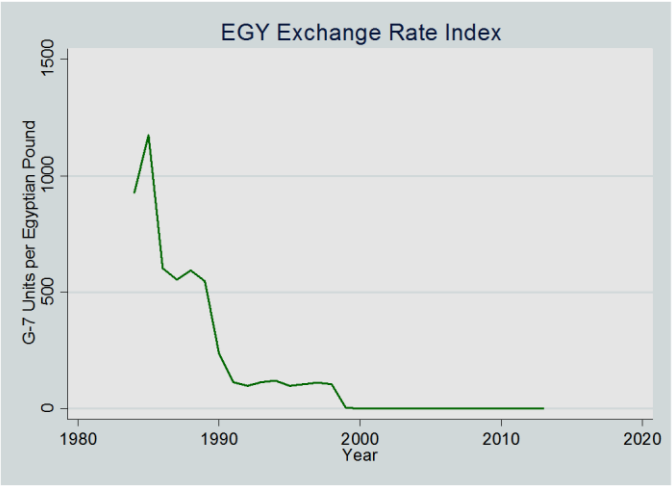


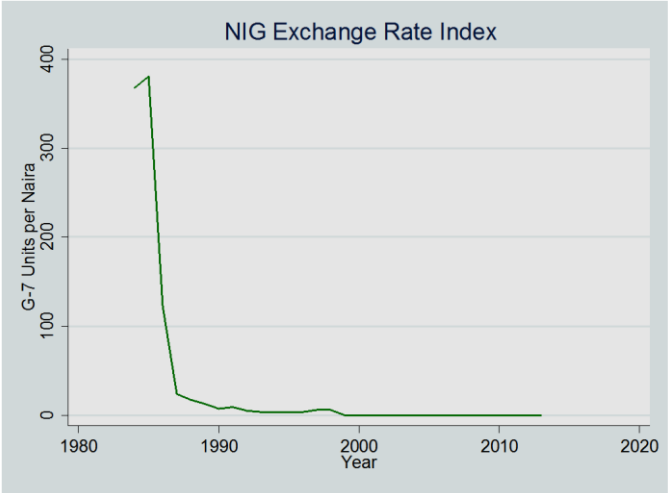




PANEL 2: Diagrams of the exchange rate index







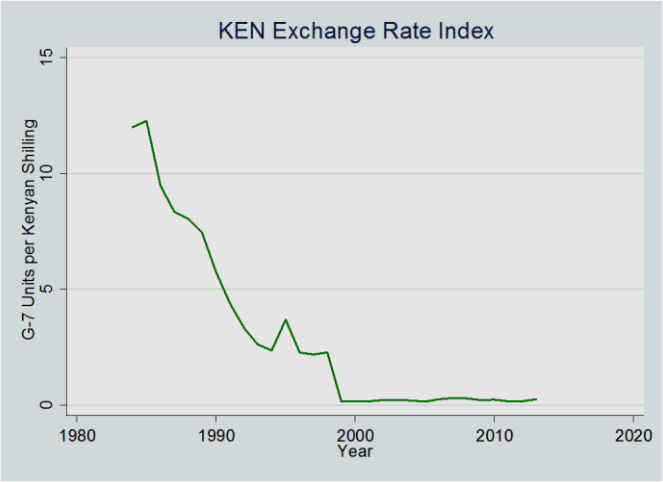


TABLE A8:

DEP.: Exc. Vol.		South Africa (VAR)	Egypt (VECM)	Nigeria (VAR)	Kenya (VAR)
CE	Lag 1		2.90e-10 (0.57)		
	Lag 2				
Net FDI	Lag 1	-1.63e-10 (-0.85)	1.59e-09*** (2.78)	-5.35e-11 (4-1.17)	-2.57e-09*** (-4.16)
	Lag 2				
Exc. Vol.	Lag 1	0.1436 (0.83)	0.2626 (0.72)	0.0319 (0.13)	-0.2407 (1.58)
	Lag 2				
Ext. Debt	Lag 1	1.38e-10** (2.26)	-1.51e-09 (-1.49)	1.51e-11 (1.24)	-8.69e-11 (-0.32)
	Lag 2				
GDP Grow	Lag 1	0.1537 (0.54)	-0.3717 (-0.27)	-0.0146 (-1.36))	-0.0436 (-0.47)
	Lag 2				
COC	Lag 1	2.906 (0.44)	-12.7142 (-0.82)	0.8021 (1.11)	-4.3577 (-1.42)
	Lag 2				
ROL	Lag 1	-15.7424* (-1.68)	4.5753 (0.20)	-0.4462 (-0.83)	2.2462 (0.78)
	Lag 2				
Cons.		2.7471*** (2.70)	-0.3388 (-0.18)	3.1010 (3.20)	0.8746*** (2.89)
R-Sqd		0.5238	0.6874	0.2167	0.7793
RMSE		2.597	7.3219	0.3326	0.9551
P>chi2		0.5697	0.2021	0.7994	0.0000
*****Significant at 1% **Significant at 5% *Significant at 10%**					

TABLE A9:

DEP.: Ext. Debt		South Africa (VAR)	Egypt (VECM)	Nigeria (VAR)	Kenya (VAR)
CE	Lag 1		-0.6270*** (-5.59)		
	Lag 2				
Net FDI	Lag 1	-0.6419 (-1.04)	0.4689*** (3.72)	1.1070* (-1.73)	-1.0771** (-2.14)
	Lag 2				
Exc. Vol.	Lag 1	2.40e+09*** (4.35)	-1.64e+08** (-2.06)	-4.80e+08 (-0.15)	5.82e+07 (0.47)
	Lag 2				
Ext. Debt	Lag 1	-0.0007 (-0.04)	0.1214 (0.54)	0.2648 (1.55)	-0.2723 (-1.21)
	Lag 2				
GDP Grow	Lag 1	-4.07e+08 (-0.44)	-9565428 (-0.03)	-4.33e+08*** (-2.89)	1.21e+08 (1.60)
	Lag 2				
COC	Lag 1	1.36e+10 (0.64)	2.87e+09 (0.84)	-1.33e+10 (-1.32)	2.23e+09 (0.89)
	Lag 2				
ROL	Lag 1	2.43e+10 (0.81)	-2.86e+08 (-0.06)	1.03e+10 (1.36)	-1.29e+09 (-0.55)
	Lag 2				
Cons.		-1.83e+10 (-0.56)	-7.15e+07 (-0.17)	1.63e+10 (1.21)	-1.44e+08 (-0.55)
R-Sqd		0.5800	0.8944	0.6225	0.4658
RMSE		8.3e+09	1.6e+09	4.6e+09	7.8e+08
P>chi2		0.0007	0.0000	0.0001	0.0575

*****Significant at 1% **Significant at 5% *Significant at 10%**

TABLE A10:

DEP.: PerCaGDP		South Africa (VAR)	Egypt (VECM)	Nigeria (VAR)	Kenya (VAR)
CE	Lag 1		2.85e-11 (0.35)		
	Lag 2				
Net FDI	Lag 1	-1.05e-10 (-0.80)	-1.52e-10* (-1.68)	-8.26e-11 (-0.08)	-1.79e-09 (-1.28)
	Lag 2				
Exc. Vol.	Lag 1	-0.1951 (-1.64)	-0.1728*** (-3.02)	-6.6804 (-1.29)	1.0185*** (2.93)
	Lag 2				
Ext. Debt	Lag 1	5.19e-11 (1.23)	3.74e-10** (2.34)	3.16e-10 (1.18)	2.82e-10 (0.45)
	Lag 2				
GDP Grow	Lag 1	0.5091*** (2.57)	-0.6211*** (-2.88)	-0.2663 (-1.13)	0.6319*** (2.98)
	Lag 2				
COC	Lag 1	8.1072*	4.9257** (2.02)	173661 (1.10)	0.4402 (0.06)
	Lag 2				
ROL	Lag 1	1.2893 (0.20)	-10.7536*** (3.5992)	-29.2318** (-2.46)	13.5436** (2.06)
	Lag 2				
Cons.		1.5354 (2.19)	-0.1207 (-0.41)	-5.0362 (-0.24)	-0.5237 (-0.76)
R-Sqd		0.4614	0.8587	0.3275	0.5788
RMSE		1.7931	1.1554	7.3118	2.1775
P>chi2		0.0481	0.0001	0.2570	0.0038

*****Significant at 1% **Significant at 5% *Significant at 10%**

TABLE A11:

DEP.: COC		South Africa* (VAR)	Egypt (VECM)	Nigeria (VAR)	Kenya (VAR)
CE	Lag 1		-1.15e-11 (-1.09)		
	Lag 2				
Net FDI	Lag 1	1.67e-11** (-2.23)	5.92e-12 (0.50)	1.53e-11 (1.15)	8.09e-11 (1.53)
	Lag 2				
Exc. Vol.	Lag 1	-0.0065 (-0.97)	0.0058 (0.76)	-0.0257 (-0.37)	0.0189 (0.0131)
	Lag 2				
Ext. Debt	Lag 1	-1.26e-12 (-0.53)	-1.31e-11 (-0.62)	-3.19e-12 (-0.90)	-3.23e-11 (-1.37)
	Lag 2				
GDP Grow	Lag 1	-0.0116 (-1.03)	-0.0061 (-0.21)	0.0064** (2.04)	-0.0232*** (-2.92)
	Lag 2				
COC	Lag 1	0.4367* (1.68)	-0.5780* (-1.80)	-0.1884 (-0.90)	-0.0371 (-0.14)
	Lag 2				
ROL	Lag 1	-0.9924*** (-2.71)	0.729 (1.54)	-0.1997 (-1.27)	-0.1334 (-0.54)
	Lag 2				
Cons.		0.0365 (0.92)	0.0137 (0.35)	-0.184 (-0.65)	0.0218 (0.84)
R-Sqd		0.3648	0.5781	0.4160	0.5461
RMSE		0.1017	0.1518	0.0968	0.0819
P.chi2		0.1853	0.6984	0.0974	0.0147

*****Significant at 1% **Significant at 5% *Significant at 10%**

TABLE A12:

DEP.: ROL		South Africa (VAR)	Egypt (VECM)	Nigeria (VAR)	Kenya (VAR)
CE	Lag 1		-1.70e-11*** (-3.31)		
	Lag 2				
Net FDI	Lag 1	4.69e-12 (0.76)	1.91e-11*** (-3.32)	7.55e-12 (0.48)	5.61e-11 (1.00)
	Lag 2				
Exc. Vol.	Lag 1	-0.0012 (-0.22)	-0.0028 (-0.77)	0.1407* (1.73)	0.0063 (0.45)
	Lag 2				
Ext. Debt	Lag 1	1.25e-12 (0.64)	3.80e-11*** (3.70)	-5.09e-12 (-1.21)	-9.14e-12 (-0.36)
	Lag 2				
GDP Grow	Lag 1	-0.0114 (-1.24)	0.0274** (1.99)	0.0006 (0.16)	-0.0051 (-0.60)
	Lag 2				
COC	Lag 1	0.2772 (1.28)	0.1231 (0.1561)	0.1815 (0.73)	-0.483* (-1.72)
	Lag 2				
ROL	Lag 1	-0.2942 (-0.98)	0.2163 (0.94)	0.6456** (3.46)	-0.2469 (-0.94)
	Lag 2				
Cons.		0.0297 (0.91)	-0.0035 (-0.18)	-0.9379*** (-2.81)	0.0173 (0.62)
R-Sqd		0.2784	0.8396	0.5418	0.4167
RMSE		0.0832	0.0738	0.1146	0.0871
P>chi2		0.8139	0.4931	0.0108	0.1618

*****Significant at 1% **Significant at 5% *Significant at 10%**

TABLE A13: Lag Selection-order Criteria (VAR/VECM)

Country	AIC		SBIC	
	Statistic	Lag	Statistic	Lag
South Africa	-296.611	3	-292.776	3
Egypt	-305.726	4	-301.892	4
Nigeria	-300.276	4	-296.442	4
Kenya	-310.95	3	-308.408	3

TABLE A14:

South Africa GARCH(1, 1)				
Mean Model:				
		Coefficient	Std. Error	P > z
	Yield Difference	-4.4193	3.9437	0.262
	C/A	-1.94e-10	1.11e-10	0.861
	Cons.	-20.1861	24.3175	0.406
Conditional Variance Model:				
	RTO	0.6503***	0.0838	0.000
	Cons.	-2.1140	1.4667	0.149
Arch:				
	Arch (lag 1)	0.2543	0.2377	0.285
	Garch (lag 1)	0.2066	0.3386	0.542
***Significant at 1% **Significant at 5% *Significant at 10%				

TABLE A15:

Egypt GARCH (1, 1)				
Mean Model:				
		Coefficient	Std. Error	P > z
	Yield Difference	9.2567	52.6873	0.861
	C/A	-3.73e-09	2.04e-08	0.855
	Cons.	53.033	65.146	0.416
Conditional Variance Model:				
	RTO	0.0342	2.7919	0.990
	Cons.	4.2789	36.9954	0.908
Arch:				
	Arch (lag 1)	-0.1079	0.7454	0/885
	Garch (lag 1)	1.0571	2.0639	0/685
***Significant at 1% **Significant at 5% *Significant at 10%				

TABLE A16:

Kenya GARCH(1, 1)				
Mean Model:				
		Coefficient	Std. Error	P > z
	Yield Difference	0.0013	0.0400	0.975
	C/A	4.29e-10***	9.93e-11	0.000
	Cons.	3.3962***	0.5214	0.000
Conditional Variance Model:				
	RTO	0.0305**	0.0139	0.028
	Cons.	-1.3577*	0.701	0.053
Arch:				
	Arch (lag 1)	0.7912**	0.3688	0.032
	Garch (lag 1)	-0.2630**	0.1175	0.025
***Significant at 1% **Significant at 5% *Significant at 10%				

TABLE A17:

Nigeria GARCH(1, 1)				
Mean Model:				
		Coefficient	Std. Error	P > z
	Yield Difference	-0.0444	0.3596	0.902
	C/A	8.05e-12	1.85e-10	0.965
	Cons.	2.5992	4.1992	0.536
Conditional Variance Model:				
	RTO	0.0062	0.039	0.875
	Cons.	1.1965	1.8685	0.522
Arch:				
	Arch (lag 1)	0.2335	0.4647	0.615
	Garch (lag 1)	-0.6291	0.7653	0.411
***Significant at 1% **Significant at 5% *Significant at 10%				

TABLE A18: Shapiro-Wilk test for Normal data (for exchange rate volatility)

	South Africa	Egypt	Nigeria	Kenya
Obs.	31	26	26	23
W	0.2427	0.8563	0.535	0.3458
V	24.668	4.109	13.298	17.113
z	6.642	2.896	5.303	5.775
Prob>z	0.0000	0.0019	0.0000	0.0000

Table A19: AC and PAC

Lag(s)	**South Africa**		**Egypt**		**Nigeria**		**Kenya**	
	Q	Prob>Q	Q	Prob>Q	Q	Prob>Q	Q	Prob>Q
1	0.0403	0.8409	2.199	0.1381	1.9036	0.1677	0.0033	0.9546
2	0.1021	0.9502	3.415	0.1813	4.8973	0.0864	0.1397	0.9325
3	0.1642	0.9832	3.63	0.3043	5.4154	0.1438	0.5782	0.9014
4	1.8499	0.7633	3.661	0.4538	5.7514	0.2185	0.6643	0.9557
5	1.8499	0.8695	7/399	0.1926	5.8415	0.3219	0.7211	0.9818
6	1.8539	0.9326	9.669	0.1393	6.0242	0.4205	0.7798	0.9926
7	1.8585	0.9673	11.942	0.1025	6.0242	0.5369	0.8274	0.9972
8	1.8668	0.9848	12.009	0.1508	6.0415	0.6426	0.8435	0.9991
9	1.8752	0.9933	14.634	0.1015	6.0672	0.7332	1.1253	0.9991
10	1.8894	0.9971	15.793	0.1057	6.8223	0.7421		
11	1.9069	0.9988	16.375	0.1278	7.0217	0.7973		
12	1.9297	0.9995						
13	1.9579	0.9998						

Table A20: VAR/VECM regression statistics

	South Africa	Egypt	Nigeria	Kenya
Sample	1998 - 2014	1999 - 2014	1998 - 2014	1999 - 2012
No. of Obvs.	17	16	17	14
AIC	98.9856	86.3937	96.2825	87.8265
HQIC	99.1903	86.5248	96.4871	87.6491
SBIC	101.0442	88.9529	98.341	89.7437
Log Likelihood	-799.3781	-638.1497	-776.401	-572.7857

TABLE A21: Johansen Cointegration test

	Maximum rank	Trace Statistic	5% critical value	Max Statistic	5% critical value
South Africa (VAR)	0	19.4341*	47.21	17.8818	27.07
	1	7.4214	29.68	0.4493	20.97
	2	0.0000	15.41	0.0000	14.07
	3	0.0000	3.76		3.76
	4				
	5				
	Maximum rank	Trace Statistic	5% critical value	Max Statistic	5% critical value
Egypt (VECM)	0	119.9350	94.15	72.1993	39.37
	1	47.7358*	68.52	23.5618	33.46
	2	24.1740	47.21	12.9747	27.07
	3	11.1993	29.68	11.1992	20.97
	4	0.0001	15.41	0.0001	14.07
	5	0.0000	3.76	0.0000	3.76
	Maximum rank	Trace Statistic	5% critical value	Max Statistic	5% critical value
Nigeria (VAR)	0	17.1285*	29.68	15.3488	20.97
	1	1.7797	15.41	1.7797	14.07
	2	0.0000	3.76	0.0000	3.76
	3				
	4				
	5				
	Maximum rank	Trace Statistic	5% critical value	Max Statistic	5% critical value
Kenya (VAR)	0	30.9172*	47.68	20.1047	27.07
	1	10.8125	29.68	8.1865	20.97
	2	2.6260	15.41	2.6260	14.07
	3	0.0000	3.76	0.0000	3.76
	4				
	5				

The * indicates the trace statistic and rank at which cointegration occurs.

TABLE A22: ARCH LM Test

Country	Lags	Chi2	df	Prob > Chi2
South Africa	1	18.395*	1	0.000
	2	10.844*	2	0.0044
	3	9.855*	3	0.0198
	4	10.467*	4	0.0332
Egypt	1	7.873*	1	0.0050
	2	0.009	2	0.9958
	3	1.111	3	0.7745
	4	6.223	4	0.1831
Nigeria	1	2.961	1	0.0853
	2	4.907	2	0.0860
	3	5.795	3	0.1220
	4	5.501	4	0.2396
Kenya	1	20.072*	1	0.0000
	2	16.114*	2	0.0003
	3	19.198*	3	0.0002
	4	18.574*	4	0.0010

***is the indication of arch effects are present.**