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EFFECT OF EXCHANGE RATE VOLATILITY ON CAPITAL FLOWS IN SOUTH AFRICA

BY

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Dissertation Submitted in Fulfillment of the Requirements for the Degree of Master of Management in Finance and Investment

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ABSTRACT

This paper empirically investigates the effect of exchange rate volatility on capital flows for the period 2000:q1 – 2014:q3 in South Africa. In addition, the paper examines the impact that the exchange rate volatility exerts on the different forms of capital flows. Consequently, the aim of the study is to examine whether the volatility in the exchange rate is a significant determinant of foreign investor capital into South African markets as well as to empirically establish the dynamic relationship that can be observed between capital flows and exchange rate volatility.

A trade weighted exchange rate was constructed from which the conditional variance GARCH (1,1) model is applied to estimate exchange rate volatility. The findings from the multiple regression analysis reveal that exchange rate volatility has a statistically significant negative impact on the aggregated capital flows to South Africa. Using the bi-variate vector autoregressions (VARs), the Granger-causality test, impulse response and variance decomposition, the results show there is a dynamic interrelationship between exchange rate volatility and the aggregated and disaggregated capital flows. Furthermore, the VAR specifications results reveal that portfolio flows exhibits a strong bi-directional causality with exchange rate volatility as well as explaining a significant percentage of innovations in exchange rate volatility. This suggests that fluctuations in the exchange rate can be explained by portfolio flows into South Africa's capital markets.

The recommendations for authorities resulting from the findings include, a monetary policy that mitigates the rand exchange rate volatility in an effort to attenuate the adverse subduing effects it has on capital flows in South Africa. Further broadening financial instruments and derivatives available for investors to hedge against exchange rate volatility and a meticulous management of portfolio flows is imperative to ensure prevention of its destabilizing effect on the exchange rate.

Keywords: Exchange rate volatility, trade weighted exchange rate, capital flows, GARCH

DECLARATION

I, **Muma Ng'ambi**, hereby declare that this research report entitled: Effect of Exchange Rate Volatility on Capital Flows in South Africa is my own, unless otherwise as specified in the references and acknowledgments. It is submitted in fulfillment of the requirements for the degree of Master of Management in Finance and Investment at the University of the Witwatersrand, Johannesburg. It has not been previously submitted for any degree or examination in this or any other university.

_____

Muma Ng'ambi

Student Number : **358982**

Signed at_____

On the _____ day of _____ 20__

DEDICATION

I dedicate this research to my late brother John Kumwenda whose words of encouragement and wisdom never left my heart and motivated me through my studies. May your soul rest in peace. To my parents and siblings no words can adequately express my gratitude, I love you.

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CHAPTER ONE: INTRODUCTION AND BACKGROUND OF STUDY

1.1 INTRODUCTION

Over the last decade there has been a surge of capital flows from international investors into Africa's capital markets. This attraction has been fuelled by Africa's promising growth prospects as well as the improved financial markets that allow for diversification. The well needed benefits of these capital flows into these developing countries include alleviating poverty, promoting growth and economic development, financing savings gap, resource allocation and job creation (Dornbusch, 1998; Reisen and Soto, 2001; Ahmad *et al*., 2012).

Serven (2003) posits that exchange rate volatility is expected to be an increasing function of financial liberalization. Thus, as South Africa and other African economies further reform their financial systems they become vulnerable to more oscillations in the exchange rate. The stability of the exchange rate has been shown to be a paramount influence on employment, resource allocation, export growth and private investments (Serven and Solimano, 1991; Aron *et al*., 2000). Bahmani-Okooee *et al*. (2014) find that exchange rate volatility hinders economic activity and reduces trade flows. In the same vein, Soleymani and Akbari (2011) find a negative relationship between exchange rate uncertainty and investment. A study by Goldberg (2009) found that exchange rate volatility tends to boosts investment, whilst Bailey and Tavlas (1991) found the relationship to be ambiguous. Kiyota and Urata (2004) advocate that the reason for this possible inconsistency is the "aggregation problem", as previous studies aggregated national level data without an industry break down. On the other hand, De Vita and Abbott (2004) engender this lack of a distinct and congruous pattern of results on no consensus on whether the nominal or real exchange rate should be used when measuring the exchange rate volatility.

However, most of this research is for developed countries, emerging markets in Asia and Europe, and focus on the effect of exchange rate volatility on trade flows, economic growth or FDI. To the best of my knowledge there has not been a paper for South Africa that

focuses on the effect of exchange rate volatility on capital inflows. Hence, this paper serves to fill the aforementioned research gap.

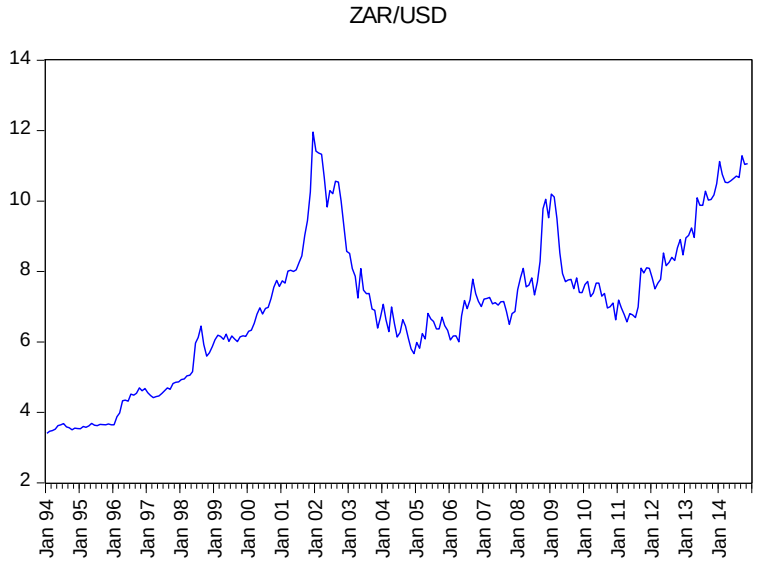
1.2 BACKGROUND

South Africa prior to democracy had a dual exchange rate regime. The dual exchange rate regime was essentially made up of the commercial rand and the financial rand. The commercial rand was used for current account and international trade transactions, whilst the financial rand was for capital account transactions that consisted of capital flow investments by non-residents (Eun *et al*., 2012). Post the 1994 democracy, South Africa implemented a plethora of economic reforms and normalizing the exchange rate to a bilateral foreign exchange regime was one of them. Like many other countries, South Africa, after the dissolution of Bretton Woods fixed exchange rate regime, now has a floating exchange rate regime in an Inflation Targeting monetary policy framework. This means the value of the rand is dictated by the supply and demand forces in the foreign exchange rate market. Floating exchange rate regime can be argued to be a double edged sword, in that although it allows for free flow of capital into the country, it also causes the exchange rate to be volatile (Grenville and Gruen, 1999; Kočenda and Valachy, 2006; Choudhry, 2005).

Figure 1 shows the evolution of the South African rand against the US dollar for the twenty years post 1994 democracy and it is evident that the rand has generally exhibited volatility against the US dollar. However, this volatility seems to have been rampant after 2003 and even more aggravated after the world financial crisis of 2007. This provides an indication that financial turmoil from advanced economies filters into emerging economies and gives rise to exchange rate volatility, as is evident in the case of South Africa (Coudert *et al*., 2001). Exchange rate trends reflect various fundamental issues. Ghura and Grennes (1993) assert that higher levels of real exchange rate misalignment are in concomitant with macro economic instability, in addition Giannellis and Papadopolous (2011) proffer that a highly misaligned exchange rate will be highly volatile. South Africa like most African nations is

dependent on the global economy so volatility of the rand can be a threat to international competitiveness and thwart growth prospects.

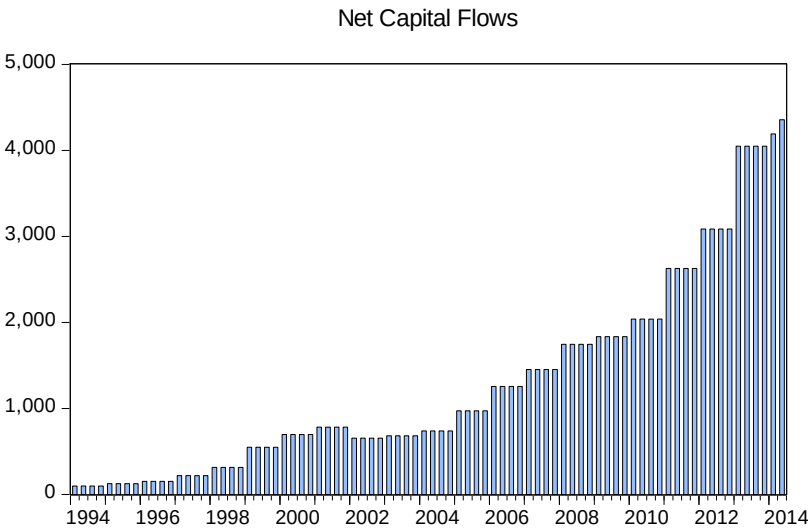
FIGURE 1. MONTHLY EXCHANGE RATE TREND OF THE RAND AGAINST THE US DOLLAR FROM 1994-2014.



SOURCE: BLOOMBERG DATABASE

South Africa rekindled international investor interest following the post apartheid rescinding of economic sanctions and the implementation by government of various capital account liberalization policies (Rangasamy, 2014). Since the 1995 abolishment of the financial rand and external financial liberalization, gross capital flows to South Africa has been on the rise, as evident in figure 1.1. The composition of capital flows to South Africa have prominently been in the form of portfolio investments (Mohammed, 2005; Brambila-Macias and Massa, 2010) , which Aron *et al*. (2007) state were encouraged by the inception of the "asset swap" mechanism in 1995 and the presence of a large domestic capital market. The opening of capital account to foreign investors has necessitated the free movement of the much needed capital flows into South Africa, that has facilitated the improvement of its financial markets and the stimulation of domestic consumption and growth (Rangasamy, 2014).

FIGURE 1.1 NET CAPITAL FLOWS TO SOUTH AFRICA FROM 1994-2014



Source: South African Reserve Bank, (SARB) data base.

1.3 PROBLEM STATEMENT AND IMPORTANCE OF STUDY

Due to its sophisticated financial markets and developed business infrastructure, South Africa draws a large amount of capital inflows. Capital flows can be linked to boosted investor confidence that stems from the perception of improved domestic economic conditions. Gelb (2005) suggests that inflows into the South Africa economy are not driven by resource seeking motive but rather confidence in the economy and its macroeconomic stability. However, in recent years South Africa has seen tepid growth prospects, rampant labor strikes, increased unemployment, exchange rate instability and very low savings rate, all of which discourage investors. From the foregoing, South Africa is in dire need of foreign capital flows to galvanize its domestic economy, alleviate low domestic savings, improve employment prospects and propel growth levels (Aron *et al*., 2010).

The fundamental concept is that exchange rate volatility increases transaction and hedging costs and abates potential gains from international diversification, which in turn has a

contractionary effect on the flow of funds (Caporale *et al*., 2013). Additionally, exchange rate volatility affects the price discovery of assets therefore hindering the investor's ability to make informed decisions on portfolio structuring and valuation of returns. Given this, it is essential to understand the link between exchange rate volatility and capital inflows to South Africa and investigate the direction of this relationship. This inquiry into the effect of exchange rate volatility on capital flows in South Africa provides insight into whether international investors consider exchange rate volatility when directing funds into South African capital markets. In light of the aforementioned, the direction of this relationship will help inform policy makers on possible response tools on how to sustain and maintain capital flows as they are crucial to the South African economy. A supplementary analysis directed at unpacking the links and influence of exchange rate volatility on the apportioned forms of capital flows (Portfolio Flows; Foreign Direct Investment, (FDI); Other Foreign Investment, (OFI)) could further enlighten the policy formulation.

1.4 OBJECTIVES AND RESEARCH QUESTIONS

The objective of the study is to investigate empirically, the effect of exchange rate volatility on capital inflows into South Africa and establish whether a statistically significant relationship exists between the two variables.

Specifically, the study attempts to answer the following questions:

- What is the direction of response of capital flows to exchange rate volatility?
- Is there causality that runs between exchange rate volatility and capital flows?
- Is the impact of exchange rate volatility on capital flows to South Africa dependent on the form of capital flow?
- Are international investor risk perceptions influenced by the exchange rate volatility experienced in South Africa?
- Is exchange rate volatility a significant determinant of capital inflows in South Africa? If so, is this observed across all the different forms of capital flows? (Portfolio Flows; Foreign Direct Investment, (FDI); Other Foreign Investment, (OFI)).

1.5 OUTLINE OF THE STUDY

This study is divided into five chapters. Chapter one is the introduction and background, problem statement and importance of study. Chapter two reviews the empirical and theoretical literature on the interconnectedness between exchange rate volatility and capital flows. Chapter three provides the research methodology and describes how the study is to be carried out. Chapter four is devoted to analysis, presentation and interpretation of the econometric results. Finally chapter five will draw conclusions, policy recommendations and suggestions for further study from the empirical results.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter gives a brief review on the empirical and theoretical literature related to the topic under study. The purpose of this chapter is to articulate the conceptual foundations of the research and provide an assessment of the theories pertaining to the possible causes of exchange rate volatility, measures of exchange rate volatility and the relationship between real exchange rate volatility and capital flows. It is essential as it enriches the understanding of the variables to include in the econometric model and the expected signs of the coefficients.

The chapter is organized as follows : section 2.2 links exchange rate regime and exchange rate volatility; section 2.3 sheds lights on whether there is a relationship between an inflation monetary policy and Exchange rate volatility; section 2.4 probes into whether capital flows cause exchange rate volatility; section 2.5 brings attention to the possible causes of exchange rate volatility; section 2.6 provides an review of work done by other researchers on foreign exchange rate and capital flows; section 2.7 explores the nature and relationship between exchange rate uncertainty and portfolio investment; section 2.8 discusses measures of exchange rate volatility; section 2.9 probes into whether it matters if exchange rate volatility is measured using nominal exchange rate or real exchange rate; section 2.10 concludes the chapter.

2.2 EXCHANGE RATE REGIME AND EXCHANGE RATE VOLATILITY

Policy makers when considering which exchange rate regime to adopt, have to choose one they feel best brings a balance with all other macroeconomic policies. With fixed exchange rates, the authorities rigidly fix (peg) the local rate of exchange with a foreign currency of choice. Under the floating exchange rate the currency is allowed to be dictated by market demand and supply. The South Africa Reserve Bank (SARB) has adopted a floating noninterventionist policy but retains some control by being able to buy or sell other currencies to defend the local rand.

Bénassy-Quéré *et al*. (2001) remark that exchange rate regime constitutes as a determinant of portfolio composition. However, portfolio investors would be inattentive to the regime provided there are derivatives to hedge their exposures. Foreign direct investors on the other hand, bear in mind and heed to the exchange rate regime as they are unable to hedge their long term horizon exposures.

Studies in literature have found a difference in the observed exchange rate behavior under the variant exchange rate regimes (Mussa, 1986; Flood and Rose, 1999; Carrera and Vuletin, 2002; Kočenda and Valachy, 2006). Mussa (1986) recognizes that the variability in both real and nominal exchange rate alternates substantially and systematically with exchange rate regime. Mussa (1986) further show that the variance witnessed in real exchange rate is of greater magnitude with floating exchange rates as compared to fixed. The complexity of monetary policy under floating regime can be said to drive volatility of exchange rates (Kodongo and Ojah, 2014). Kočenda and Valachy (2006) highlight that although the exchange rate regime is a strong contributor to the exchange rate volatility and more so under floating regime, it can also be driven by country specific effects.

Flood and Rose (1999) provide evidence that floating exchange rates cause more variability than fixed rates. They follow (Friedman, 1953) argument that the instability of an exchange rate is an indicator of a fundamentally unstable economic structure and that floating exchange rate need not lead to a wavering exchange rate if macroeconomic conditions are stable.

On the contrary, Carrera and Vuletin (2002) found that fixed regimes induces more volatility than floating regimes. They found that the degree of commitment to the regime linearly affects the exchange rate stability. When government maintains its commitment to the fixed exchange rate the volatility is lower than floating, but if the central reserve bank do not maintain commitment to the fixed regime, the volatility is higher (Carrera and Vuletin, 2002). In addition, a study by Grilly and Kaminsky (1991) argued that real exchange rate volatility depends on the particular historical period rather than the exchange rate regime. Gregorio *et al*. (2005) in the context of Chile, find that though in the short term the floating regime does cause fluctuations to the exchange rate, in the long

term exchange rate irregularity has been less for Chile compared to other countries that adopted a floating regime.

2.3 INFLATION TARGETING AND EXCHANGE RATE VOLATILITY

South Africa in 2000 introduced formal inflation targeting. The lower and upper bands are about 3%and 6% respectively. The main goal was to maintain price stability as a principal goal for monetary policy and every other policy subordinated to this (Heever, 2001). The known advantages of inflation targeting are that coordination of government and central bank on the same inflation target is enhanced, and ameliorates the transparency and dependability of the central bank. The drawbacks being as inflation targeting heavily relies on forecasts, these are not always accurate (Mishkin, 2000; Van der Merwe, 2004). As South Africa pursues the inflation target at any costs the central bank raises interest rates and this destabilizes other the macro economic variables.

From economic theory, through the uncovered interest rate parity, inflation can influence exchange rate volatility through interest rates. Literature exploring the nexus of inflation targeting and exchange rate instability draws different conclusions (Mishkin, 2000; Edwards, 2006; Kočenda and Valachy, 2006; Rose, 2007). Most of economists posit that exchange rate variability is due to fact that under inflation targeting policy the exchange rate must be allowed to float, which induces volatility (Mishkin, 2000; Gregorio *et al*., 2005; Rose ,2007; Berganza and Broto,2012)

Mishkin (2000) points out that emerging economies cannot ignore the impact of inflation targeting policy on exchange rates; that under inflation targeting exchange rate fluctuations are unavoidable. Kočenda and Valachy (2006) attribute exchange rate volatility to rises in inflation, and achieving stable and low inflation promotes less volatility in exchange rates.

Berganza and Broto (2012) by modeling a panel data set for thirty seven emerging countries, compare the effects of inflation targeting on exchange rate volatility in countries that use inflation targeting as monetary policy and those that do not. With inflation targeting as a binary dummy variable, the regression results came out positive and

significant, which lead to a conclusion that inflation targeting does induce exchange rate variability. In addition, they state that beyond the cost of rapid exchange rate fluctuations under inflation targeting is the benefit of being able to contain it through foreign exchange intervention by the central bank. An added advantage that countries that do not employ inflation targeting forfeit (Berganza and Broto, 2012).

However, Edwards (2006) points out that a free float exchange rate regime is a prerequisite for inflation targeting but contended that for the countries in the study; adoption of the inflation targeting does not augment nominal exchange rate variability and that the implementation of inflation targeting has reduced conditional volatility in most countries because the predictability of the policy mitigates shocks.

Furthermore, Rose (2007) in trying to answer the question as to whether inflation targeting comes at a cost of exchange rate volatility, regresses exchange rate volatility against a binary dummy variable for nations that employ inflation targeting as a monetary policy and zero for otherwise. The reported coefficients of the regression were all negative, hence an inference was drawn that exchange rate volatility is considerably less under inflation targeting. Furthermore, the author pointed out that alongside reduced exchange rate variability there were recorded less reversals or sudden stops of capital in countries that employed inflation targeting

2.4 CAPITAL FLOWS CAUSING EXCHANGE RATE VOLATILITY

The focal point of this paper is to assess the impact of exchange rate volatility on capital flows. The literature has suggested that the surge of capital flows through improved capital mobility infrastructure has put pressure on exchange rates causing them to fluctuate or deviate from long run equilibrium (Siourounis, 2004; Kodongo and Ojah, 2012).

Seminal work by Siourounis (2004) investigates empirically for 5 countries (USA, Switzerland, Japan, UK, & Germany) the association between capital flows and nominal exchange rates, and established that capital mobility tends to prompt exchange rate movement. Empirically they found correlations between exchange rates and capital flows.

The researchers probed deeper and through impulse response and variance decomposition found equity capital flows as the biggest source of oscillations experienced in nominal exchange rate in all countries except Japan.

Dua and Sen (2006) inspect the implications of capital flow levels and their volatility on the Indian rupee. The results show that there is lasting relationship between rupee exchange rate oscillations and level and volatility of capital flows. After running a variance decomposition to show determinants of the exchange rate, capital flows was prominent determinant among other variables included in the model.

Rashid and Husain (2010) found that change in capital flow does Granger cause real effective exchange rate instability. The authors recommend that to stymie the detrimental repercussions of capital flows on exchange rate, policy makers particularly in emerging markets should deepen the financial markets, improve regulatory and supervisory infrastructure, and execute sound macroeconomic policies, as these cushion the effect of the capital flows to the macroeconomic variables and financial markets.

Combes *et al*. (2012) term the outcome of capital flows on real exchange rates as the "transfer problem". The results show a positive correlation exists with the real exchange rate appreciation and capital flows.

Conversely, Han-Kim and Singal (2000) find that the concern that free flowing capital exacerbates exchange rate volatility is not valid. The evidence provided shows that capital flows have no causality in appreciating real exchange rates or even making them volatile. They also find that instead currency volatility in emerging markets is alleviated by capital flows which in turn encourage investors as there is a lower currency risk.

2.5 CAUSES OF EXCHANGE RATE VOLATILITY

Giannellis and Papadopoulos (2011) advance a strong case that "exchange rate is an endogenous variable and that exchange rate volatility depends on economic fundamentals". In attempting to inspect the causes of exchange rate volatility in the EMU, the authors divide the causes into three groups: monetary side, real side and the stock market.

Industrial production is used as a proxy for real side variable and the results show that it has no effect on exchange rate variability in all sampled countries. Using stock market development as a proxy for stock market variable, it was established that the stock market caused exchange rate volatility in only two of the sampled countries. Interest differential was used to gauge the monetary variable effect on exchange rate volatility and found that in all the countries this variable had a significant effect on exchange rate variability. This was an apparent contradiction to a paper by Kočenda and Valachy (2006), where the effect on interest rate differential was found to be immaterial to causing exchange rate volatility and only became material under floating regime.

South Africa being one of the world's largest Gold producers, Dumitrescu *et al*. (2012) aver that the exporting of this commodity engenders volatility in the South African rand. In attempting to investigate the direction of causality from exchange rate volatility and the gold price, the results show that periods of volatility in the gold price are trailed by episodes of unpredictability in the South African rand, making gold price a variable in explaining Rand fluctuations. This is corroborated by Chen and Rogoff (2003) who similarly found that the price of commodities drives the real exchange rate observed in New Zealand and Australia. Bodart *et al*. (2012) further substantiate this theory by concluding that commodity prices are long term determinants of the real exchange rate if the commodity is about twenty percent of overall net exports of that country.

Coudert *et al*. (2011) posit that the financial crisis of July 2007 heightened exchange rate volatility across emerging markets. The results presented show that financial crises in developing nations elicit exchange rate volatility in emerging market economies.

Devereux and Lane (2003) in trying to elucidate on the driving forces of bilateral exchange rate find that, the presence of large external debt can come at a cost of exchange rate variability as it reduces efficiency of macroeconomic variables to respond to exogenous shocks. They further state that increased financial linkages between countries leads to a soothing effect on the bilateral exchange rate variability in developing countries.

Hviding *et al*. (2004) regress the variability in exchange rate to the ratio of reserve adequacy and an indirect correlation is found, indicating that one of the benefits of a country holding sufficient reserves is that it reduces the exchange rate volatility.

2.6 FOREIGN EXCHANGE RATE AND CAPITAL FLOWS

Kodongo and Ojah (2013) use panel data across 9 African countries to explore the influence real exchange rates exert on cross–border flows into Africa. The evidence presented by the paper show conflicting results on the direction of the relationship. On one hand the depreciation in the exchange rate led to an increase in foreign direct investments and conversely at the same time it led to a reduction in portfolio flows. Kodongo and Ojah (2013) suggest that the direct relationship observed with exchange rates and portfolio flows is driven by the perception of investors, that a reduction of the exchange rate may be signaling further future depreciations therefore, withdrawal of funds is imperative to maintain the value of the portfolio. This is in contrast with Combes *et al*. (2012) who find the opposite to be true, in that an increase in real exchange rate elicits an increment in the capital flow.

Choi *et al*. (2012) in their study differentiate between low and high level currency volatility in Korea, as well as try to link this to capital flows. They find that low volatility attracts capital flows into the Asian country and the opposite is true for high volatility. They look at individual capital flows and found that FDI flows, compared to portfolio flows, bond flows and bank loan flows seem to attract higher capital under higher exchange rate instability, whilst for the other capital flows forms increased exchange rate variability had a detrimental consequence. This result was further supported by the impulse response that showed that a shock from the exchange rate diminished most of the various capital flows not including FDI. Goldberg (2009) lends support to this theory by stating that empirically, exchange rate volatility tends to boosts the production capacity located abroad, hence this tends to increase FDI.

In an apparent contradiction, the empirical outcomes presented by Sharifi-Renani and Mirfatah (2012) showed that exchange rate instability adversely impacted FDI in Iran.

Bleaney and Greenaway (2001) lend support to this theory, by discovering that the reduction of investment level in fourteen Sub-Saharan countries was caused by the variability in the exchange rate volatility.

In turn, Servén (1999) models empirically for 94 developing nations the impact of exchange rate volatility on private investment, the results robustly show an inverse correlation between the variables. In a similar research examining the linkage between exchange rate uncertainty and investment in some Sub-Saharan African countries, Soleymani and Akbari (2011) also found a negatively significant relationship between the two. Moreover, the results reveal that the lags of the coefficients of exchange rate uncertainty are also significantly negative, meaning that investors consider exchange rate volatility in prior periods. The paper further shows that the negative impact of exchange rate uncertainty has a more pronounced adverse consequence on investment than the magnitude that a positive impact of growth in GDP has on investment.

Caporale *et al*. (2013) in their examination of the influence of exchange rate uncertainty on international portfolio flows to developed countries find that when they divided the portfolio flows into bond flows and equity flows, there was some inconsistency in results for the different countries, but concluded that exchange rate variability incites investors to reduce their financing in portfolios to mitigate exposure to exchange rate volatility.

Conversely, Darby *et al*. (1999) propose that a threshold exists at which exchange rate volatility can be disadvantageous to investment. They find that overall exchange rate variability depresses investment in France and Germany but only temporarily in United Kingdom and Italy. Further evidence is provided that the industry the funds are directed to plays a role to these findings. For example, exchange rate volatility does not depress investment in high tech investments or investments in financial services such as pensions.

2.7 EXCHANGE RATE UNCERTAINTY AND PORTFOLIO INVESTMENT

With increased liberalization of financial markets, there has been an expanded scope for portfolio diversification into African markets due to its low correlations with developed economy markets (Alagidede *et al*., 2011). This section relates to the role volatility in a currency plays on the portfolio inflow decisions of investors. The dominant form of capital flows into South Africa has been highlighted to be in the form of portfolio flows (Mohammed, 2005; Ahmed *et al*., 2007)

Kodongo and Ojah (2014) try to investigate if Africa's volatile currencies require a risk premium from equity investors. Their findings prove that foreign exchange rate risk is conditionally priced in African stock exchange markets, meaning that investors find exchange rate uncertainty as kernel in their equity investment decisions. They propose that international investors in African equity markets should make use of hedging instruments against currency fluctuations. Similarly Carrieri and Majerbi (2006) state that because exchange rate volatility diminishes international diversification benefits, investors in emerging stock markets require a premium on returns for exchange rate volatility .

From South Africa, Muzindutsi and Niyimbanira (2012) inquire whether exchange rate risk is priced in the Johannesburg stock exchange (JSE). The results show that portfolio investors are concerned with exchange rate risks that result from movements in the currency. They also find that on aggregate the impact the exchange rate volatility on the JSE is not balanced and therefore this risk is unable to be diversified.

There has been a paucity of literature that focuses on portfolio flows and exchange rate to emerging markets and most research has focused on industrialized countries. Ganguly and Breuer (2010) find there to be twice as much volatility in developing countries as compared to developed nations. Hall *et al*. (2010), in their paper say that developing nations experience higher exchange rate volatility as compared to more established countries due to their foreign exchange markets being thinly traded. They further suggest that if these economies broadened and deepened their financial markets with a greater

variety of currency hedging instruments, this will assist in curbing exchange rate volatility in these nations.

2.8 MEASURES OF EXCHANGE RATE VOLATILITY

The most universally accepted definition of a financial variable volatility is the standard deviation of returns. Engle and Patton (2001) try to answer the question "what is a good volatility measure?" In doing so, they conclude that the best volatility capturing model must be able to superiorly forecast volatility. At a general level the authors divide volatility models into two classes, the conditional variance that we find in ARCH and GARCH models and the stochastic volatility that they describe as not being functionally observable. They probe deeper and state that the best model must be capable to capturing the stylized financial asset price facts, volatility clustering and mean reversion. The GARCH model in the paper is documented to superiorly be able to capture the aforementioned asset price traits of the Dow Jones Industrial Index. The Drawback they found with the GARCH model was that the empirical specifications were dependent on the frequency of the sampling.

Poon and Granger (2005) review the stochastic, ARCH models, option implied and historical methods of volatility forecasting. Based on their forecasting results they found that implied volatility performed the best and stochastic was the worst performer of the four.

Many papers have modeled exchange rate variability in different ways, and it has been left to the writer's discretion as to which model is preferred and most able to capture the essence of their research purpose. Most literature has either made use of the GARCH and ARCH models variations or variations of standard deviations models. McKenzie and Brooks (1997) in favor of conditional variance ARCH and GARCH models posit that the problem with other models is that they overlook stochastic generating process of the exchange rates.

Kenen and Rodrik (1986) utilize three different standard deviation models namely the standard deviation error of the real exchange rate from the log linear trend, the standard

deviation error of the real exchange rates from first-order auto regressive equation and the standard deviation of the percentage change of real exchange rate . The authors defend their choice of modeling based on their different views of the formation of expectations.

Schmidt and Broll (2009) suggest a substitute measure of exchange rate volatility that is only able to capture the part of this volatility that is not explained by law of one price. They elaborate further by arguing that currency volatility that is explained by the law of one price is a predictable factor as it is based on known information. Thus the authors try to focus on the unexplained part and define this as the real exchange rate volatility. This is derived by subtracting the actual variance of the real exchange rate from the extracted volatility explained by the law of one price.

Dominguez (1998) employs double measures of exchange rate volatility; the GARCH model which they feel accounts fully for the leptokurtosis and volatility clustering of daily exchange rate changes. Black* and McMillan (2004) lend support by saying that GARCH model offers a more accurate representation of exchange rate volatility than other models. Implied volatility method was also employed by the Dominguez (1998), the option implied volatility was generated by using foreign currency options and the estimate was extracted as a measure of exchange rate uncertainty.

Coudert *et al*. (2011) were in favor of using the squared returns of monthly exchange rates over the GARCH model. The reason proffered was that the results for both measures of volatility are very close and that squared returns are more straightforward to calculate parameters as well as interpret.

2.9 REAL EXCHANGE RATE VS NOMINAL EXCHANGE RATE

Real exchange rates are the bilateral rates (nominal exchange rates) deflated by consumer price index (Kenen and Rodrik, 1986).

On answering the question as to which exchange rate when plugged into models accurately captures volatility, McKenzie and Brooks (1997) try to elucidate on this matter by assessing the impact of using an ARCH model with nominal and real exchange rates . They

found a marginal difference which was immaterial and concluded that its makes no difference whether the estimation of the ARCH model was used with nominal or real exchange rates. The results were similar to an earlier seminal paper done by Thursby and Thursby in 1987(McKenzie and Brooks, 1997).

Demir (2010) for robustness tests replaced the real exchange rates with the nominal exchange rates and uncover that the results were no different from those estimated with the real exchange rate, they also found a correlation of 0.92 between the nominal and the real exchange rates.

In addition, Ganguly and Breuer (2010) define the real exchange rate as being a function of the nominal exchange rate and relative price differential. They modeled the difference in volatilizes when measured by nominal and real exchange rate in industrialized countries versus developing countries. Nominal exchange rate volatility was recorded greater than real exchange rate volatility in developing countries as compared to industrialized countries. This difference was attributed to the variant economic policies between the two worlds; these include disparities in price dynamics and the superior ability of advanced economies exchange rates to adjust to shocks. In a variance decomposition, nominal exchange rate was found to contribute highly to real exchange rate volatility in the long and short horizon for both developed and developing economies (Ganguly and Breuer, 2010).

2.10 CONCLUSION

To conclude, it is evident from literature in section 2.4 -2.5 that some form relationship exists between exchange rate volatility and all forms of capital flows as documented by the various researchers. The results presented by the researchers concerning this relationship are inconsistent but this is owed to the various countries under investigation and different analysis tools employed by the authors. Section 2.2 and 2.3 inform that inflation targeting monetary policy as well as the exchange rate regime influence the core traits of exchange rates and this is amplified in emerging markets with weaker macroeconomic fundamentals. Section 2.8 elucidates on the various methods of measuring/capturing exchange rate volatility. The results are ambiguous as to which model is superior however most authors advocate that results of most measures are very close and is left to the discretion of the author to choose which model is preferred. Section 2.9 confirms that the preponderance of the literature found that results do not vary when modeling exchange rate volatility with nominal or real exchange rate.

As apparent from the review most studies conducted have predominantly focused on developed economies and there is a paucity of research on African developing markets with particular attention to South Africa. This study will therefore fill the gap in the literature as there is limited literature focusing on the topic, the effect of exchange rate volatility on capital flows in a South African perspective.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

This chapter explains the methodology and empirical analysis that is utilized in this study relying on the literature reviewed in Chapter 2. The main thrust of this study is to assess the impact of exchange rate volatility on capital inflows to South Africa.

The chapter is divided into 6 sections; 3.2 details the data and the conversion to logarithms of variables; 3.3 presents the method of calculation of trade weighted exchange rate; 3.4 specifies the modeling of exchange rate volatility; 3.5 presents unit root tests; 3.6 specifies the regression model; 3.7 presents three models that aid in analyzing the directions and providing a linkage between capital flows and exchange rate volatility; 3.8 summarizes the chapter

3.2 VARIABLE SELECTION AND METHODOLOGY

The variables selected are informed by the literature review, as suggested determinants of capital flows. The variables include; platinum and gold, based on literature higher commodity prices are expected to enhance the flow of investment capital; Interest rate serves as a proxy for investors' ability to earn returns; GDP serves as a standard for size of the economy, from economic theory a large GDP can have a material impact the welfare of investors and thereby increasing capital flow; Exchange rate volatility is modeled using GARCH (1,1)(*equation 9*) ;Trade weighted exchange rate is as specified in section 3.2 (equation *3)*. The Data collected is quarterly data that spans from January 2000 to September 2014. The data is collected from various data bases, such as, South African Reserve Bank (SARB, 2014) online, International Financial Statistics (IFS) online database and Bloomberg database.

For the study E-views 8 statistical package is utilized. The software allows for various estimation techniques explained in this chapter, as well as to present various graphical illustrations.

Each series is converted to log returns, calculated by the first difference of natural logarithm as depicted below,

$$\frac{}{} *100 \quad (1)$$

Where, refers to the return of the variable for example Gross Domestic product (GDP) at period t. refers to the value of the variable at period t. - refers to the value of the variable at the previous t-1 time.

3.3 THE REAL EFFECTIVE TRADE WEIGHTED EXCHANGE RATE

The constraint of applying bilateral exchange rate is its limitation to only measure the value of a country's currency comparative to one other country, hence not being able to fully reflect the overall value of the currency with all other major trading partner countries. The real effective exchange rate is a representation of the currency of a country in relation to an index of major trading partners.

The construction of the weighting index is as follows:

$$\frac{}{}, \quad , \quad (2)$$

such that ;

Where denotes the total value of exports of country *a* to country *b,* denotes the total value of imports from country *b* to country *a*, where country *a* is South Africa . is total value of exports of country *a* , is the total value of imports of country *a.*

We follow Kodongo and Ojah (2014) in using the AFRO Index methodology of calculating trade weighted exchange rate as follows:

$$\frac{}{} \hat{} \quad (3)$$

Where is the calculated trade weighted index , $RER_{a,t}$ is the local currency- country B the real exchange rate at time t , W_{ab} is the weight index calculated in equation (2)

This trade weighted real effective exchange rate is a more robust representation of the South African rand exchange rate, as it is able to capture the movements across the various countries. The Data on the import and export volumes is obtained from the Department of Trade and Industry, data base 2014. This trade weighted exchange (TradeEX) rate is employed to model the exchange rate in the preceding section.

3.4 METHOD OF CALCULATION OF EXCHANGE RATE VOLATILITY

Exchange rate volatility loosely stated can be said to be a measure of the fluctuations in the bilateral exchange rate experienced in a country. As highlighted in the literature review, there are various ways of calculating exchange rate volatility. The conditional variance, general autoregressive conditional heteroskedastic (GARCH (1,1)) advanced by Bollerslev (1986) to model exchange rate volatility in this research.

The data used in modeling the exchange rate volatility is the log difference return of the trade weighted exchange rate of South Africa's major trading partners as explained in the section before, calculated as follows:

$$\frac{}{-} \qquad (4)$$

Where Rt is the daily trade weighted exchange rate return, is the trade weighted exchange rate today - is the exchange rate yesterday.

The GARCH (1,1) is an extension of autoregressive conditional heteroskedastic (ARCH) advanced by Engle (1982). Bollerslev (1986) GARCH model just like the ARCH model, includes as an explanatory variable the lags of the squared error terms but extends to include the lags variance term as an explanatory variable.

The GARCH (1,1) equation includes two equations, the mean equation and variance equation respectively:

(5)

(6)

The mean equation (5) is written as an exogenous variable X and the error term, the conditional variance equation (6), is a function of three terms , the the mean term ,the squared error terms the ARCH term ,the squared variance terms the GARCH term. Prior to estimating the GARCH model, ARCH existence is tested for in the residuals (Brooks, 2002).

The test procedure is as follows;

An initial regression on autoregressive AR (1) model for the trade weighted exchange rate is performed and the residuals are obtained from the ordinary least squares. The AR (1) model is written as follows (Engle, 1982)

(7)

Where TradeEX is the trade weighted exchange rate, is the constant, is the error term, *k* is the number of lags, is the lagged term. The lag length selection *k,* of the dependent variable, TradeEX, is determined by dropping insignificant lags until the last lag is significant.

After obtaining the residuals from the preceding step, a regression on the squared residuals on own *q* lags is performed,

(8)

Where, is the constant, is the squared residual term, *q* is the lag length, is the error term.

The above equation tests the null hypothesis of no ARCH effects in the residuals series:

=

Against the alternative hypothesis:

The test statistic (TR^2) critical value is calculated by multiplying the number of observations (n) by R-squared and evaluated against the (q) (chi-squared). If $TR^2>$ (q), the null hypothesis of no ARCH will be rejected and the conclusion of the presence of ARCH effects confirmed. Otherwise if $TR^2<$ (q), the null hypothesis is not to be rejected and hence there is no ARCH effects in the residual series.

If ARCH is found in the series, the GARCH (1, 1) model can be estimated using the following model (Bollerslev, 1986)

(9)

Where squared error term, is the ARCH (p) term, and squared variance term, is the GARCH (q) term. The aforementioned GARCH (1,1) model is the modeled exchange rate volatility, hereafter the term ExVOL is maintained in the research to assess the effect of exchange rate volatility on capital flows in South Africa.

3.5 UNIT ROOT TESTS

Unit root tests ensure that the data is stationary in order to avoid spurious results in the estimations. When a series is non stationary it exhibits a trend. The standard OLS regression procedures on non stationary data can lead to false conclusions and wrong inferences, therefore the trending feature of data needs to be removed to avoid this problem. The short coming of most macroeconomic variables, are that they are non-stationary (Brooks, 2002). The relevance of unit root tests for this research is to avoid the aforementioned “false results” in the regression model, as this will lead to wrong inferences and defeat the purpose of the research.

According to Asteriou and Hall (2007) stationary series must exhibit,

- mean reversion in that it fluctuates between the bands of the long-run mean
- theoretical correlogram will die out as the lag-length increases

Informal analysis is one of the approaches a unit root test can be performed. This compromises of graphical displays that involve a visual plot or inspection of the correlograms by looking autocorrelations functions (ACF).

The focus of the paper is to use Augmented Dickey Fuller (ADF) an extension of the Dickey and Fuller (DF). This augmented version includes added lagged terms of the dependent variable to get rid of autocorrelation. Gujarati (2003) avers that introducing additional lags of the dependent variable into the equation increases the terms and in turn reduces correlation in error terms. Brooks (2002) in favor of the ADF, discredits the DF, states the later has critical values that are greater and can result to a rejection of the null hypothesis even if correct.

The hypothesis being tested with this model is whether the series is non stationary i.e. containing a unit root

The null hypothesis of the unit root : =0 , against the alternative hypothesis : 0 , of no unit root. This means that rejection of the null hypothesis implies that the series is stationary. Conversely if the null hypothesis is not rejected, a conclusion that the series has a unit root can be drawn, meaning that it is non stationary.

The data generating process is as follows:

(10)

Where are the lags of the dependent variable, and is error term, k is the augmented lag length of the dependent variable, which will be determined through e-views 8, where the lagged variables will be dropped until the last lag is significant

To induce stationary to a non-stationary series, the variable, *yt* must be differenced *d* number of times before it becomes stationary, this is also known as being integrated of the order of *d.*

Once the variables in the model have been tested for unit root and stationary induced, regressions and other econometric tests can be carried out without running into spurious regression.

3.6 MODEL SPECIFICATION

A multiple regression will be specified to evaluate and describe the relationship between capital inflows and exchange rate volatility, as well as other variables.

The regression model takes the following form:

(11)

Where

- ln = natural logarithm of the variable as explained in equation (1)
- = error term
- GDP $_{i.t}$ = Gross domestic product at time t
- = gold price at time t
- = exchange rate volatility at time t
- = platinum at time t
- = interest rate at time t
- = trade weighted exchange rate at time t

3.6.1 CAPITAL FLOWS

The classification of capital flows at a disaggregated level that is adopted for the paper is as follows;

1. Portfolio flows which comprises the sale and purchases of bonds and equity securities listed on capital markets
2. Foreign direct investment (FDI), involves an investment where ownership accounts for 10 percent of voting rights
3. Other foreign investment (OFI), consists of currency, foreign loans, bank deposits between companies and governments.

The data is obtained from the SARB (2014) website.

3.7 CAUSALITY ANALYSIS

The rationale of this research paper is to try and test the significance of exchange rate volatility as a determinant of capital inflows. Granger (1969) Causality test is most widely used to test the direction of causality between variables. This test follows the argument that if one variable 'granger causes the other', the lags of that variable should be significant in the equation (Brooks, 2002). For this study, the lag length is specified with the Schwartz Bayesian information criteria (SBIC). The objective is to choose the number of parameters capable of minimizing the value of the information criteria. According to (Brooks, 2002) SBIC is able to deliver the correct order model without it being too large. The author further asserts that although strongly consistent it tends to be less efficient

The SIC is specified as follows

SIC = — (12)

Where is the covariance matrix, T number of observations, as total number of regressors in the equation. The lowest SIC implies a good fit.

To determine the Granger-causality between exchange rate volatility and capital flows, the bivariate vector autoregression (VAR) model that considers all variables in the system as endogenous is used,

The model is as follows:

(13)

(14)

Where $ExVol_t$ and $CAPFLOW_t$ are the exchange rate volatility and capital flows (Foreign direct investment, Portfolio Investments, other foreign investments) for South Africa at time *t;* is the error term; *k* is the optimal lag length chosen using the Schwartz Bayesian information criterion (SBIC) as noted above.

From equation (13) and (14) the null hypothesis for the causality tests are that capital flows do not Granger-cause exchange rate volatility

From ExVOL to CAPFLOW equation (13)

If H_0= =0

Failure to reject the null hypothesis indicates that exchange rate volatility does not Granger-cause capital flows.

From CAPFLOW to ExVol equation (14)

If H_0= =0

Failure to reject the null hypothesis implies that capital flows does not Granger-cause exchange rate volatility.

3.7.1 VAR DIFFERENCED TO FIRST LEVEL

It is a stylized fact that financial times series are non stationary so differenced data is preferred to induce stationary, as to avoid invalid results (spurious regression) with non-stationary data (Asteriou and Hall, 2007).

The representation of the VAR equations in first difference are specified as follows

(15)

(16)

Where represents the difference operator, $ExVol_t$ and $CAPFLOW_t$ are the exchange rate volatility and capital flows respectively , and are error terms. The null hypothesis follows

From ExVOL to CAPFLOW equation (15)

If H_0= =0

The null hypothesis above indicates that exchange rate volatility does not Granger-cause capital flows.

From CAPFLOW to ExVol equation (16)

If H_0= =0

The Null hypothesis above indicates that capital flows does not Granger-cause exchange rate volatility.

3.7.2 IMPULSE RESPONSE

A benefit of a VAR model is it can be used for forecasting and structural inference (Stock and Watson, 2001). It allows for visual analysis of the impact of a unit shock to the forecast error of the dependant variable through an impulse response graph. A unit shock is transmitted to the equations in the VAR system and the response of the variables is traced dynamically in future time periods. For the intention of this paper, the impulse response illustrates visually the response of capital inflows both aggregated and disaggregated to a single shock from exchange rate volatility. Additionally, the impulse response provides the signs of the effects, negative or positive, that exchange rate volatility induces in the capital

flows. Over the time horizon a shock to a stable impulse response system is able to progressively die out (Brooks, 2002).

3.7.3 VARIANCE DECOMPOSITIONS

Variance decomposition just like impulse response is useful to assess how shocks to the dependant variable reverberate through time. It involves explaining the fraction of the forecast error of dependant variable is attributed to the innovations of the explanatory variable and itself (Brooks, 2002). In context of the research variance decomposition is able to show what percentage of variation in capital flows is explained by itself and also explained by exchange rate volatility.

3.8 SUMMARY

The chapter focused on specifying the regression equation to test the impact of exchange rate volatility on capital flows on an aggregated level to South Africa. The construction of the trade weighted exchange rate is explained and the GARCH (1,1) is specified for the subsequent modeling of trade weighted exchange rate volatility. The VAR models through the granger causality, variance decompositions and impulse response, are specified to analyze the structural inference and deduce the direction of causality of the exchange rate volatility on the behavior of capital flows. The Augmented Dickey Fuller (ADF) tests for unit roots in the economic variables. The evidence revealed in the test results is analyzed and interpreted in the chapter four.

CHAPTER 4: TESTS AND ANALYSIS

4.1 INTRODUCTION

Employing the various models specified in chapter three, this chapter is meant to outline, analyze and interpret the results. Additionally, the results obtained from econometric techniques employed in this chapter are meant to aid in answering the following research questions: Is exchange rate volatility an important determinant of capital inflows in South Africa? Does causality exist between exchange rate volatility and capital flows in South Africa? What movement innovation does exchange rate volatility elicit in capital flows? What is the direction of response of capital flows to exchange rate volatility?

The study incorporates quarterly data stretching from the year 2000 to the year 2014. The data is obtained from South African Reserve Bank online, International Financial Statistics (IFS) online database and Bloomberg database. All the data is transformed to returns calculated by the first difference of the natural logarithm computed as —. Where

is any of the variables; for example capital flows.

The entire chapter is divided into seven sections-; 4.1 describes the construction of the trade weighted exchange rate with South Africa's major trading partners; 4.2 models the exchange rate volatility using GARCH(1,1) model; 4.3 provides the summary statistics of all the data; 4.4 documents the results of stationary/unit root tests; 4.5 shows the regression results; 4.6 the Granger-causality tests are presented and interpreted; 4.7 presents the impulse response and variance decomposition analysis; 4.8 summarizes the main chapter findings.

4.2 CONSTRUCTION OF THE TRADE WEIGHTED EXCHANGE

As stated in chapter 3, by using a trade weighted exchange rate the study is not limited to the relative value of the rand to one other currency, but rather able to reflect a holistic view of the value of the rand against a basket of its major trading currencies.

The weight assigned to each country depends on the quantity of bilateral trade between South Africa and that country. The weighting index structure is constructed from data obtained from the Department of Trade and Industry data base (2014) and selection of the trade partners is based on the largest trading partners to South Africa of 2014. The weights assignments are outlined in table 4.1.

TABLE 4.1 WEIGHTS OF SOUTH AFRICA'S TRADING PARTNERS AS OF 2014

Country	**Weight of Trade (%)**
China	27.90
Europe • Germany • Netherlands • Belgium	26.50 16.84 5.53 4.14
United states	14.76
Japan	10.48
India	9.33
United Kingdom	7.50
Korea	3.53
TOTAL	100.00

Source : Department of Trade and Industry(2014) and Authors Computations

The trade weighted exchange rate for the purposes of this research is calculated as follows

^ (1)

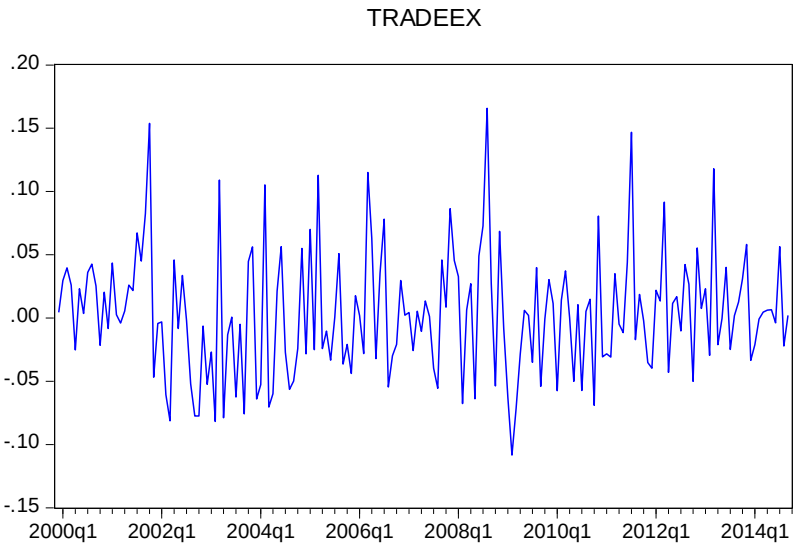
Where; is the calculated trade weighted index , $RER_{a,t}$ is the bilateral exchange rate of the domestic currency (rand) against one of the major trading currencies at time t , W_{ab} is the weight index corresponding to each trade partner as shown in the table 4.1 . The data on the bilateral exchange rates of the rand with the major trade partners is obtained from Bloomberg (2014). The trade weighted exchange rate is the series utilized to symbolize the

exchange rate volatility for the purposes of empirically investigating the impact of this exchange rate volatility on capital flows to South Africa.

4.3 MODELING EXCHANGE RATE VOLATILITY

Using the constructed trade weighted exchange rate series in section 4.2, this section models the exchange rate volatility of the aforementioned series using a GARCH (1,1) model advanced by Bollerslev (1986). Figure 4.1 shows that the trade weighted exchange rate series exhibits volatility clustering. Volatility clustering is one of the inherent features of financial time series; it implies that large and small movements in the value of the trade weighted exchange rate trail each other, as observed in figure 4.1 (Brooks, 2002).This provides motivation of the existence of ARCH in the trade weighted exchange rate, however formal testing is still required to confirm this hypothesis.

FIGURE 4.1 TRADE WEIGHTED EXCHANGE RATE LINE GRAPH 2000Q2-2014Q2



Source: Authors own computations and EViews 8

ARCH tests serve as formal testing for ARCH in a series. Table 4.2 provide strong evidence for rejecting the null hypothesis of no ARCH at 5% significance level, this is indicative of the presence of ARCH effects in the trade weighted exchange rate. Consequently, due to the presence of ARCH in the residual series of the trade weighted exchange rate, it is therefore possible to estimate a GARCH (1,1) model.

TABLE 4.2 ARCH TEST RESULT

Heteroskedasticity Test: null hypothesis no ARCH

TradeEX	F-statistic	4.800	Prob.F	0.0326**

Note : ** indicates 5% level of significance , TradeEx stands for trade weighted exchange rate

The GARCH (1,1) presented in table 4.2A model satisfies the non negativity rule for the coefficients. Similarly it satisfies the rule that the summation of the coefficients of the ARCH and GARCH term should be not more than one. The results reveal persistent conditional volatility in the trade weighted real exchange rate because the summation of the ARCH (p) term and GARCH (q) term is almost to the value of one. The aforementioned GARCH (1,1) model is henceforth termed ExVOL and used for the econometric analysis to evaluate the effect of exchange rate volatility on capital flows in South Africa.

TABLE 4.2A : RESULTS OF THE ESTIMATED GARCH (1,1) MODEL

	Coefficient	z-Statistics	standard errors
Mean Equation			
c	1.0301	2.6578	0 .9095
TradeEx(-1)	0.5908	10.7882	0.0278
Variance Equation			
c			
ARCH(p)	0.09132**	3.8976**	0.0490
GARCH(q)	0.86962**	23.1309**	0.0884

source : EViews 8

Note : ** represents 5 % level of significance ,the table reports the estimation for the GARCH(1,1) model given by :

ARCH(p) represents the squared error terms term GARCH(q) represents the squared variance terms the GARCH term

TABLE 4.2B: RESULT OF ARCH TEST APPLIED TO GARCH(1,1) MODEL

Heteroskedasticity Test: null hypothesis no ARCH

ExVOL	F-statistic	1.0251	Prob.F	0.3712

Note : ExVOL stands for exchange rate volatility

A subsequent ARCH test is performed on the estimated GARCH (1,1) model to ascertain that the estimated model adequately removed the ARCH effect. The results reported in

table 4.2B reveal that the variance equation is well specified as the GARCH (1,1) model does not exhibit additional ARCH effects because the "no ARCH" null hypothesis is accepted.

4.4 DESCRIPTION OF DATA

Before evaluating the empirical impact of exchange rate volatility on capital flows, the summary statistics provided in table 4.3 serves as preliminary analysis to glance at some basic characteristics of the data.

The Jarque-Bera tests significantly reject the null hypothesis of normality for all variables, therefore confirming the non normal distribution of the financial variables. The kurtosis for all the variables exceeds three; this is termed excess kurtosis; and an indication of fat tails in the distribution. Likewise, leptokurtic distribution is evident in all the variables .All the variables except the trade weighted exchange rate are negatively skewed. An interesting observation that can be made is that, if the standard deviation measure is used as a proxy for volatility this instance, the Trade weighted exchange rate records the highest volatility with a standard deviation of 0.34074. This can be a pre- inference that the South African rand weighted against its major trading partners does exhibit some form of variability.

TABLE 4.3: DESCRIPTIVE STATISTICS

Variables	CAPFLOW	GOLD	GDP	INTEREST	PLATINUM	TradeEX
Mean	0.126784	0.027358	0.015124	-0.012538	0.019644	0.004236
Std.Dev	0.119399	0.068555	0.277053	0.080104	0.136159	0.340742
Skewness	-0.807348	-1.368795	-7.117713	-0.686865	-2.888013	1.301441
Kurtosis	3.606563	6.467178	52.82816	4.235789	16.32564	5.213036
Jarque-Bera	7.066002**	46.34984***	6378.045***	8.108983**	500.9708***	27.72225***
Observations	57	57	57	57	57	57

the table displays the summary statistics for the variables for the period 2000q1:2014q3.

Where CAPFLOW, GDP and TradeEX are Capital Flows , Gross Domestic Product and Trade Weighted Exchange rate , respectively. "Std.Dev" denotes standard deviation, ** and *** indicate statistical significance at 5% and 1% , respectively.

4.5 UNIT ROOT TESTS

The significance of unit root tests is to avoid results that show statistical significance even when there is lack of meaningful linkage. The Augmented Dickey-Fuller (ADF) test is employed in the series to assess the presence of unit root in the dependent and independent variables. The results of the test are reported in table 4.5.

TABLE 4.4: UNIT ROOT TEST RESULTS 2000Q1 - 20014Q3

	Augmented Dickey-Fuller (ADF) with a constant	**Order of Integration**
Capital flows (level) Capital flows (first difference)	-2.331 -7.213***	I(1)
GDP (level) GDP(first difference)	-7.483*** -8.654***	I(0)
Gold(level) Gold(first difference)	-7.241*** -6.930***	I(0)
Interest rate(level) Interest rate(first difference)	-4.122*** -8.237***	I(0)
Platinum(level) Platinum(first difference)	-7.195*** -7.394***	I(0)
TradeEx(level) TradeEX(first difference)	-7.498*** -6.595***	I(0)
Critical value 1% -3.43	Critical value 5% -2.86	Critical value 10% -2.57

Notes: *** indicates 1% level of significance. The ADF tests are based on the null hypothesis of unit root.

The results reveal that all variables except capital flows are stationary in levels. The null hypothesis of unit root at level is significantly rejected because the t values for all variables except capital flows are more negative than the critical value at 1%. These variables being integrated of order zero is not a surprising result because the variables are already transformed to logarithmic returns – this means they have already been differenced. Capital flows is the only variable that needs integrated to the first order to induce stationary.

From the above results it is possible to proceed to carry out regressions and other empirical tests that will produce results that have meaningful economic sense.

4.6 REGRESSION RESULTS

The multiple regression serves as groundwork analysis of the association between the modeled exchange rate volatility in section 4.2 and capital flows. The estimated results employing the ordinary least squares are reported in table 4.5. The adjusted r^2 value shows that 51.12 % variation in capital flows can be explained by the model which is an indication of a moderate fit. The Durbin-Watson statistic of 2 indicates that the model is free from auto correlation. All the explanatory variables have the theoretically expected sign. Platinum and gold show no statistical significance as determinants of capital flows to South Africa. An increase platinum and gold prices leads to an increase in capital flows by 0.0906 and 0.1850 units respectively. The coefficients of GDP and interest rates have 10% level of significance, and an increase in these variables leads a boost in capital flow of 0.0366 and 0.1010 units respectively. Exchange rate volatility exerts a significant negative effect on capital flows, reducing it by a significant -8.1853 units. This empirical result is in uniformity with results previously found in research by Carrieri and Majerbi (2006) ,Soleymani and Akbari (2011) and Bleaney and Greenaway (2001); that exchange rate volatility has a deleterious effect on capital flows. An additional observation that can be stressed is that the constructed trade-weighted exchange rate also retards capital flows. This can give an indication that sound exchange rate and trade policies and may be an antidote to prevent capital flow withdrawals.

Dissecting the results, a conclusion that the depressing impact on capital flows engendered by the volatility in exchange rates can be a sign of risk adverse foreign investors in the South African market who are deterred by this exchange rate variability. It appears that it is safe to state that exchange rate volatility filters into the decision making of the investors, causing them to reduce their susceptibility to exchange rate volatility in the South African economy by opting to redirect their funds to steady exchange rate economies.

TABLE 4.5: ORDINARY LEAST SQUARES ESTIMATION RESULTS FOR THE IMPACT OF EXCHANGE RATE VOLATILITY ON CAPITAL FLOWS IN SOUTH AFRICA

Dependent variable: Capital Flows

Explanatory Variables	Estimated Coefficients
Constant	0.0262 [0.0363]
GDP	0.0366* [0.0633]
Interest Rates	0.1010* [0.1963]
Platinum	0.0906 [0.1298]
Gold	0.1850 [0.2695]
Exchange rate volatility[a]	-8.1853** [4.9474]
Trade weighted exchange rate[b]	-3.2506* [0.5907]
Adjusted r^2	0.5112
Durbin-Watson stat	2.0930
S.E. of regression	0.1162
F-statistic	2.2308**

Notes : * and ** denote 10 % and 5% level of significance ,respectively . GDP stands for Gross Domestic Product . In brackets[ ] are the Standard errors remedied for auto-correlation and heteroskedasticity with Newey-West.

a. modeled by the conditional variance from GARCH(1,1)

b. authors own computation as described in section 4.2

4.7 GRANGER CAUSALITY TEST RESULTS

To probe deeper into the interrelationship that exists with exchange rate volatility and the various capital flows into South Africa, the Granger-causality test is able to supplement the regression analysis and provides the characteristics of the causality between the variables.

The results presented in table 4.7 are obtained from the bi-variate vector autorregression (VAR) model.

TABLE 4.6: GRANGER-CAUSALITY TESTS

Null Hypothesis	χ^2	**P-value**	**Decision**
Real exchange rate volatility does not Granger-cause capital flows	4.8923*	0.0866*	Reject null hypothesis
Capital Flows does not Granger-cause Real exchange rate volatility	0.2395	0.8871	Do not reject null hypothesis
Real Exchange rate volatility does not Granger-cause Portfolio Flows	5.3172	0.0700*	Reject null hypothesis
Portfolio Flows does not Granger-cause Real exchange rate volatility	13.5657	0.0011**	Reject null hypothesis
Real exchange rate volatility does not Granger-cause FDI	3.2583	0.1961	Fail to reject null hypothesis
FDI does not Granger-cause Real exchange rate volatility	0.5712	0.7512	Fail to reject null hypothesis
Real exchange rate volatility does not Granger-cause OFI	5.1845	0.0748*	Reject null hypothesis
OFI does not Granger-cause Real exchange rate volatility	0.5133	0.7736	Fail to reject null hypothesis

Source: Authors own computations using E-views 8 .

* , ** indicate 10% and 5% level of significance , respectively. Where OFI and FDI stands for Other Foreign Investment and Foreign Direct investment, respectively

The results presented in table 4.6 provide evidence that the null hypothesis that real exchange rate volatility does not Granger-cause capital flows can be rejected at 10 % significant level, concluding that real exchange rate volatility does Granger-cause capital flows to South Africa. The relationship between capital flows and exchange rate volatility is a unidirectional causal relationship; there is no indication of causality flowing from capital flows to exchange rate volatility. Contrary, Rashid and Husain (2010) and Dua and Sen (2006) confirm a profound influence of aggregated capital flows on exchange rate volatility, however this causality is only evident with portfolio flows as reported in table 4.6. The nature of causality between portfolio flows and exchange rate volatility is bi-directional. Foreign direct investment (FDI) and exchange rate volatility exhibit no evidence of any

form of causality. Other foreign investments (OFI) exhibit unidirectional causality from exchange rate volatility.

A plausible explanation to finding a bi-directional causality only in portfolio flows is that, South Africa attracts most of its foreign investment in the form portfolio flows owing to the sophisticated bourses and credible institutional infrastructure. The stability of the rand will filter into the decision making of the investors. Similarly, since the rand is allowed to float, its variability levels can be said to be dictated by market forces such as foreign capital flow. Loosely stated, these two variables can be said to feed each other hence the result of bi-directional causality.

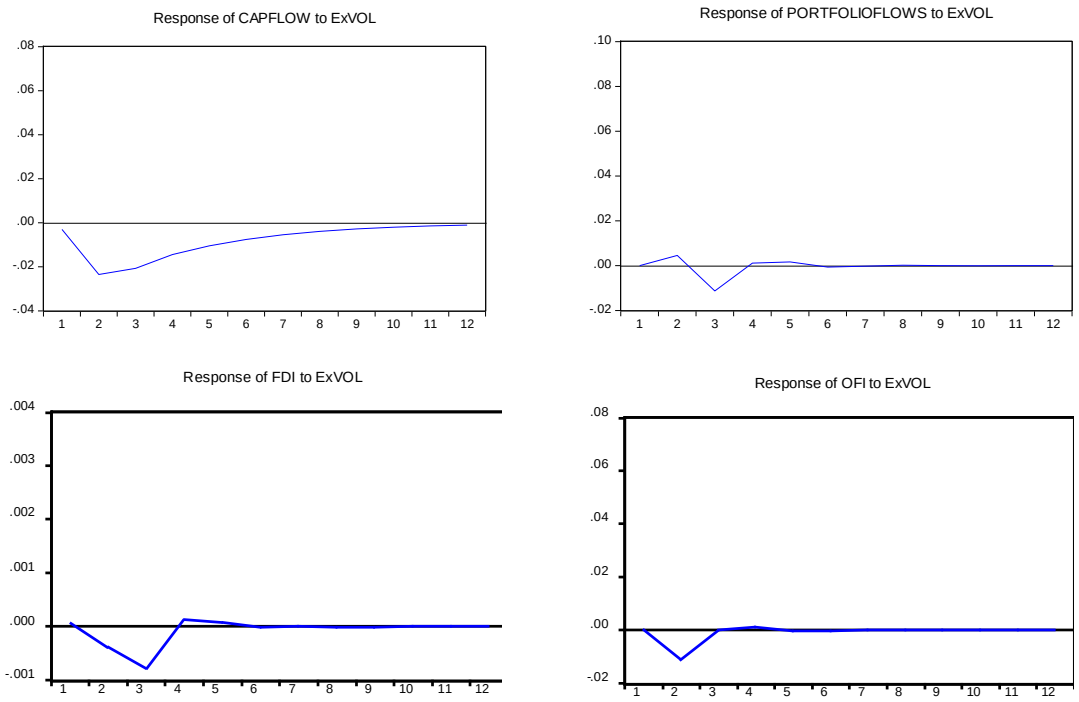
4.8 IMPULSE RESPONSE

To disseminate further the interconnection between exchange rate volatility and the aggregated and disaggregated capital flows, impulse response analysis is conducted. This innovation accounting is able to show the short-run directional response of capital flows to a unit standard deviation shock of exchange rate volatility over the chosen 12 quarter period (3 years). From the results depicted in Figure 4.2, it is evident the impacts of a unit shock of exchange rate volatility vary across the capital flows. First, a unit shock to the aggregated capital flows leads to a reduction in the capital flows. The negative shock does not have a permanent effect, by the 9th quarter the shocks start to gradually die. In principal, excess fluctuations in the exchange rate increases the costs of hedging and escalates the uncertainties of the returns they expect to earn hence, leading investors reducing their financing activities (Choudhry, 2005; Caporale *et al*., 2013). The response of the portfolio flows to one standard deviation shock of exchange rate volatility has an immediate positive effect then a negative effect, and then the shock gradually dies. The pickup in portfolio flows due to the currency volatility could be attributed the attractive increased yield caused by higher risk premia (Ahmed *et al*., 2007). The eventual decline of portfolio flows is intuitive; as portfolio investors are eventually unable to measure the returns of their rand investments due to the variability of the exchange rate leading them to pull out funds from the South African economy and placing them in a stable exchange rate economy. Due to portfolio flows less resilient nature it is easy for investors to pull

funds out in times of distress and refund in favorable times, hence the up and down movement depicted in figure 4.2. The response of foreign direct investment (FDI) and other foreign investment (OFI) can be said to have transitory diminishing effects that eventually die out by the fourth quarter. Due to its more permanent nature, the negative shock to FDI is very minimal compared to portfolio flows and OFI.

It is noteworthy that all the shocks seem to be transitory and eventually gradually die out by the 12th quarter. This is an indication that the system is stable and autocorrelations are low (Brooks, 2002). In conclusion, the results show that each variable has a varied impact horizon but the negative directions of the responses are consistent with theoretical predictions.

FIGURE 4.2 IMPULSE RESPONSE OF DEPENDANT VARIABLES EXCHANGE RATE VOLATILITY OVER 12 PERIODS



source : Authors own computations using E-views 8

Notes: FDI , OFI and ExVOL stand for Foreign direct investment , Other foreign investment and exchange rate volatility, respectively.

4.8.1 VARIANCE DECOMPOSITION

For the purposes of this study the variance decomposition is able to map out the portion of the forecast error variance of the aggregated and disaggregated capital flows that can be explained by innovations in exchange rate volatility or by itself. The results reported in tables 4.7A -4.7D show that the forecast error variance of each variable is largely explained by its own innovations. The results show that as the time horizon increases, the variable explains less of its own innovations. Table 4.7A the variance decomposition of the capital flows, shows that by the tenth month exchange rate volatility explains a higher percentage of capital flows innovations 4.447 % and by the twelfth horizon 5.151%. This coincides with the findings in section 4.7, that exchange rate volatility does Granger-cause capital flows. An attention-grabbing observation is that, Capital flows explains 8.705% exchange rate volatility innovations by the twelfth horizon which is 3% higher than the innovation of capital flows explained by exchange rate volatility in the same horizon; one can argue that the variance decomposition demonstrates a bi-directional causality between these two variables that the Granger-causality tests is not able to detect. In table 4.7B exchange rate volatility in the twelfth horizon explains 4.482% of the innovations in portfolio flows, and portfolio flows explains 10.235% innovations in exchange rate volatility, which is twice as much of its own innovations explained by exchange rate volatility. This is consistent with the findings in section 4.7 of a bi-directional causality between the two variables and portfolio flows having a higher statistical significance in Granger-causing exchange rate volatility. Table 4.7C and 4.7D show that FDI and OFI explain less of the innovations in exchange rate volatility, and exchange rate explaining 4.387% and 1.152% in FDI and OFI innovations by the twelfth horizon, respectively. The finding that foreign direct investment (FDI) explains less than 1% of variations in exchange rate volatility over the 12 quarters corroborates with Kosteleteou and Liargovas (2000) who find that FDI can only provoke exchange rate volatility in countries that attract substantial amounts of FDI .Capital flows to South Africa is mainly composed of portfolio flows and very little FDI. This substantiates the findings in table 4.7B, that portfolio flows induces exchange rate volatility in South Africa.

Succinctly, in relation to the study these results show that exchange rate volatility shocks are important in explaining the variations to each of the different forms of capital flow to South Africa. As observed in the results presented, the fluctuations experienced in the rand exchange rate can be said to be influenced by portfolio flows to South Africa's capital markets.

Tables 4.7A – 4.7D: Decomposition of the forecast error variances for quarterly capital flows and exchange rate volatility

TABLE 4.7A: VARIANCE DECOMPOSITION OF CAPITAL FLOWS

horizon	Error variance of capital flows explained by		Error variance of Exchange rate volatility explained by	
	ExVol	CAPFLOW	CAPFLOW	ExVol
1	0.000	100.000	8.319	91.681
2	0.013	99.987	11.877	88.123
3	0.119	99.881	11.755	88.245
4	0.5279	99.472	10.862	89.138
5	1.163	98.837	10.030	89.970
10	4.447	95.553	8.666	91.334
12	5.151	94.849	8.705	91.295

TABLE 4.7B: VARIANCE DECOMPOSITION OF PORTFOLIO FLOWS

horizon	Error variance of Portfolio flows explained by		Error variance of Exchange rate volatility explained by	
	ExVol	PORTFLOW	PORTFLOW	ExVol
1	0.000	100.000	0.0038	99.962
2	0.881	99.119	0.304	99.696
3	3.184	96.816	6.305	93.695
4	4.038	95.962	9.566	90.434
5	4.260	95.740	9.930	90.070
10	4.480	95.520	10.231	89.769
12	4.482	95.518	10.235	89.765

TABLE 4.7C: VARIANCE DECOMPOSITION OF FOREIGN DIRECT INVESTMENT (FDI)

horizon	Error variance of FDI flows explained by		Error variance of Exchange rate volatility explained by	
	ExVol	FDI	FDI	ExVol
1	0.000	100.000	0.509	99.491
2	2.413	97.587	0.649	99.351
3	3.764	96.236	0.555	99.445
4	4.158	95.842	0.581	99.419
5	4.309	95.691	0.585	99.415
10	4.387	95.613	0.591	99.409
12	4.387	95.613	0.591	99.409

TABLE 4.7 D: VARIANCE DECOMPOSITION OF OTHER FOREIGN INVESTMENT (OFI)

horizon	Error variance of OFI flows explained by		Error variance of Exchange rate volatility explained by	
	ExVol	OFI	OFI	ExVol
1	0.000	100.000	0.027	99.973
2	0.267	99.733	0.382	99.618
3	0.531	99.469	0.979	99.021
4	0.782	99.218	1.210	98.790
5	0.903	99.097	1.310	98.690
10	1.129	98.871	1.463	98.537
12	1.152	98.848	1.476	98.524

4.9 SUMMARY

To comprehensively answer the inquisition outlined in chapter one, this chapter presented the test results from the econometric analysis; applying the various techniques as outlined in chapter three. The focal point is to empirically understand the effect of exchange rate volatility on capital flows and assess the interactions between the two.

By capturing exchange rate volatility using GARCH (1,1) in section 4.2, it is established in section 4.5 regression results that there is a statistically and significant negative relationship with capital flows. The results from Granger-causality, impulse response and variance decomposition assist in examining the interactions between capital flows and exchange rate volatility, and from the results observed there is a notable strong dynamic relationship that is evident between exchange rate volatility and the various forms of capital flows. The negative relationship found in the regression analysis is robustly confirmed through the impulse response results in section 4.7 that shows exchange rate volatility causes a slump in aggregated capital flows to South Africa and the individual forms of capital flows.

These results have subsequently guided the conclusions drawn and policy recommendations made, as delineated in chapter five.

CHAPTER 5: CONCLUSION, POLICY RECOMMENDATIONS AND FRUTHER RESEARCH SUGGESTIONS

5.1 CONCLUSION

The study attempted to empirically identify the impact and the dynamic relations between exchange rate volatility and capital flows to South Africa using quarterly data from 2000 to 2014. The investigation stretches further to analyze the effect exchange rate volatility has on the different forms of capital flows.

A trade weighted exchange rate of the rand against its major trading partners was constructed from which the GARCH (1,1) model forwarded by Bollerslev (1986) was used as a measure to encapsulate the exchange rate volatility of this trade weighted exchange rate of the rand. With capital flows as the dependant variable, the regression analysis results showed that exchange rate volatility has a statistically negative impact on aggregated capital flows to South Africa. The result points to the argument that exchange rate volatility is not advantageous as it induce a negative investor sentiment that leads to a reduction in the flow of funds to South Africa.

An association is found through the Granger-causality tests conducted. The results showed that on an aggregated level exchange rate volatility does Granger-cause capital flows to South Africa but not vice versa. Similarly, when the tests were conducted on the different forms of capital the results showed that exchange rate volatility does Granger-cause portfolio flows and other foreign investments (OFI) at 10% significance level but no causality runs between foreign direct investment (FDI) and exchange rate volatility. Interestingly portfolio flows is the only form of capital flow that has bi-directional feedback with exchange rate volatility. Thus giving a conclusion that there is a correlation between exchange rate volatility and current and past values of the aggregated capital flows, other foreign investments (OFI) and more so with portfolio flows.

The short run dynamics captured through impulse response find that a unit shock of exchange rate volatility subdues all forms of capital flows to South Africa. The negative direction of the shock although not permanent, is consistent with the regression results.

This leads to the inference that there is an indirect interrelationship between exchange rate volatility and capital flows, and that exchange rate volatility elicits capital flight. Additionally, as capital flow to South Africa is driven by confidence in its macroeconomic stability, the volatility in the currency can be viewed as a symptom of unstable underlying macroeconomic structure which ultimately reduces investor confidence in South Africa's economy. The variance decomposition proves that forecast error variance of each variable is initially largely caused by its own innovations rather than exchange rate volatility but as time elapses exchange rate volatility begins to explain more of the innovations in the capital flows. An attention drawing result is that, portfolio flows explains more of the innovations in exchange rate volatility by the twelfth quarter, in comparison to the other foreign investments (OFI) and foreign direct investment (FDI). This result corroborates with the bi-directional causality found between exchange rate volatility and portfolio flows in the granger-causality test. This finding suggests that portfolio flows may not be as beneficial to the receiving nation as it places volatility inducing pressure on the exchange rate.

5.2 POLICY RECOMMENDATIONS

The inference derived from the results is that there is a notable interrelation between exchange rate volatility and capital flows and that exchange rate volatility can be said to be a variable that investors take into consideration in their investment decisions to South Africa. Some policy recommendations can be drawn from these results.

The consistent results of the negative association between capital flows and exchange rate volatility which are clear from the regression analysis signs and impulse response highlight the relevance of effective management of the exchange rate volatility in South Africa. Given that capital flows play a vital role in a country's ability to ameliorate the savings gap , promoting growth , deepening financial markets, job creation and transfer of skills just to name a few. It is therefore important for South Africa to encourage investors to direct and sustain the flow of funds to the economy to reap the benefits. As South Africa has adopted a floating exchange rate, fluctuations are inevitable. A tightly managed-floating regime within

a relatively constricted fluctuation band to reduce the degree of exchange rate volatility would be beneficial as it would not discourage investors too much. Thus, keeping the exchange rate volatility within a band will boost investor confidence and this can be an antidote to dampen capital flight.

The second policy issue emanates from the twofold findings of portfolio flows statistically Granger-causing exchange rate volatility and also portfolio flows explaining a very high percentage of the exchange rate volatility innovations as reported in the error variance decomposition results. South Africa attracts most of its funds through portfolio flows because of its sophisticated financial sector but this seems to be causing a disservice to the economy by causing exchange rate volatility. In response, government should place restrictions on capital flights during distress periods as well as limits or controls on short term portfolio funds injected into the economy that can be easily be pulled out, in an effort to attenuate the destabilizing effect on the exchange rate. Additionally, the exchange rate policy should be such that it mitigates excess volatility and is able cushion any shocks from the portfolio flows.

The exchange rate volatility is modeled on the trade weighted exchange rate of the rand against its major trading partners, this could be an indication that South Africa needs to link its trade policy system with the monetary policy so that shocks to trade are not transferred to the exchange rate and the monetary system is resilient to any risks associated with the trade sector.

As observed from the results, exchange rate volatility deters capital flows to South Africa. By broadening the financial instruments and derivatives available to hedge against exchange rate volatility not only will this lead to curtailment of capital flight, but it will also boost investor confidence in the financial market and exchange rate volatility will not factor in investor decision making as they will be able to hedge their positions.

5.3 FURTHER RESEARCH SUGGESTION

The study is limited to South Africa. Future empirical work can be extended to other African countries to evaluate the variations of how exchange rate volatility impacts capital flows in those countries. The results of this study propose an adverse and significant connection between these two variables. Further analysis as to whether a threshold to which exchange rate volatility deters capital flows can be a possible extension of this research.

Also, this research highlighted a strong link between portfolio flows and exchange rate volatility in South Africa. Future research can probe deeper into this relationship not only in the South African context but also include other developing nations. Investigating what other factors play a role in this relationship, if portfolio flows induces exchange rate volatility in all the countries and whether the hypothesis that this relationship is only prominent in countries that attract a lot of portfolio flows holds.

REFRENCES

Ahmad, N., Hayat, M.F., Luqman, M., & Ullah, S. (2012). The causal links between foreign direct investment and economic growth in Pakistan. European Journal of Business and Economics, 6.

Ahmed, F., Arezki, R., & Funke, N. (2007). The composition of capital flows to South Africa. Journal of International Development, 19(2), 275-294.

Alagidede, P., Panagiotidis, T., & Zhang, X. (2011). Why a diversified portfolio should include African assets. Applied Economics Letters, 18(14), 1333-1340.

Aron, J., Leape, J., & Thomas, L. (2010). Foreign Portfolio Investment and Capital Markets in South Africa. [Online]. Available at

http://www.academia.edu/999128/Foreign_Portfolio_Investment_and_Capital_Markets_in_South_Africa [Accessed on 18 June 2014].

Asteriou, D., and Hall, S.G. (2007). Applied Econometrics: New York: Palgrave Macmillan.

Bahmani-Oskooee, M., Harvey, H., & Hegerty, S.W. (2014). Exchange rate volatility and Spanish-American commodity trade flows. Economic Systems,38(2), 243-260.

Bailey, M. J., and Tavlas, G. S. (1991). Exchange rate variability and direct investment. The Annals of the American Academy of Political and Social Science, 106-116.

Bénassy-Quéré, A., Fontagné, L., and Lahrèche-Révil, A. (2001). Exchange-rate strategies in the competition for attracting foreign direct investment. Journal of the Japanese and international Economies, 15(2), 178-198.

Berganza, J.C. and Broto, C. (2012). "Flexible inflation targets, forex interventions and exchange rate volatility in emerging countries." Journal of International Money and Finance 31(2): 428-444.

Bodart, V., Candelon, B., and Carpantier, J.F. (2012). Real exchanges rates in commodity producing countries: A reappraisal. Journal of International Money and Finance, 31(6), 1482-1502.

Bollerslev, T. (1986). Generalized Autoregressive Conditional Heteroskedasticity. Journal of Econometrics, 31(3), 307-327.

Black, A.J. and McMillan, D.G. (2004). Long run trends and volatility spillovers in daily exchange rates. Applied Financial Economics, 14(12): 895-907.

Bleaney, M. and Greenaway, D. (2001). The impact of terms of trade and real exchange rate volatility on investment and growth in sub-Saharan Africa. Journal of development Economics, 65(2): 491-500.

Brambila-Macias, J. and Massa, I. (2010). The Global Financial Crisis and Sub-Saharan Africa: The Effects of Slowing Private Capital Inflows on Growth. African Development Review, 22(3), 366-377.

Brooks, C. (2002). Introductory econometrics for finance. *International edition*.

Caporale, G.M., Menla Ali, F. and Spagnolo, N. (2013). Exchange rate uncertainty and international portfolio flows.

Carrera, J. and Vuletin, G. (2002). The effects of exchange rate regimes on real exchange rate volatility. A dynamic panel data approach. University of La Plata and University of Maryland.

Carrieri, F. and Majerbi, B. (2006). The pricing of exchange risk in emerging stock markets. Journal of International Business Studies, 37(3): 372-391.

Chen, Y.C. and Rogoff, K. (2003). Commodity Currencies. Journal of International Economics, 60(1), 133-160.

Choi, K., Chung, K. and Kim, S. (2012). Capital Inflows and Exchange Rate Volatility in Korea. Bank of Korea .Working Paper No. 2012-16 [Online] . Available at

https://editorialexpress.com/cgibin/conference/download.cgi?db_name=SED2013&paper_id=890 [Accessed on 22 June 2014].

Choudhry, T. (2005). Exchange rate volatility and the United States exports: evidence from Canada and Japan. Journal of the Japanese and International economies, 19(1), 51-71.

Combes, J.L., Kinda, T. and Plane, P. (2012). Capital flows, exchange rate flexibility, and the real exchange rate. Journal of Macroeconomics, 34(4), 1034-1043.

Coudert, V., Couharde, C. and Mignon, V. (2011). Exchange rate volatility across financial crises. Journal of Banking & Finance, 35(11), 3010-3018.

Darby, J., Hallett, A.H., Ireland, J., and Piscitelli, L. (1999). The impact of exchange rate uncertainty on the level of investment. The Economic Journal, 109(454), 55-67.

Demir, F. (2010). Exchange rate volatility and employment growth in developing countries: Evidence from Turkey. World Development, 38(8), 1127-1140.

Department of Trade and Industry, (2014). South Africa.

Devereux, M.B. and Lane, P.R. (2003). Understanding bilateral exchange rate volatility. Journal of international economics, 60(1), 109-132.

Dominguez, K.M. (1998). Central bank intervention and exchange rate volatility. Journal of International Money and Finance, 17(1), 161-190.

Dornbusch, R. (1998). Capital controls: an idea whose time is past. Essays in International Finance, 20-27.

Dua, P. and Sen, P. (2006). Capital flow volatility and exchange rates: the case of India. Central for Development Economics, Department of Economics, Delhi School of Economics.(Working Paper No. 144).

Dumitrescu, M.E., Arezki, M.R., Freytag, M.A., and Quintyn, M.M. (2012).Commodity Prices and Exchange Rate Volatility: Lessons from South Africa's Capital Account Liberalization, 12-168. Andrews McMeel Publishing.

Engle, R. (1982), Autoregressive Conditional Heteroskedasticity with Estimates of United Kingdom Inflation, Econometrica, (50), 987-1008.

Edwards, S. (2006). The relationship between exchange rates and inflation targeting revisited, National Bureau of Economic Research.

Engle, R.F. and Patton, A.J. (2001). What good is a volatility model. Quantitative finance, 1(2), 237-245.

Eun, C., Kilic, R., and Lai, S. (2012). A Tale of Two Exchange Rates : South Africa's Dual Exchange Rate Experiment. [Online]. Available at

http://www.frbatlanta.org/documents/research/seminars/seminar_kilic_060112.pdf. [Accessed on 10 June 2014].

Flood, R.P. and Rose, A.K. (1999). Understanding exchange rate volatility without the contrivance of macroeconomics. The Economic Journal 109(459), 660-672.

Friedman, M. (1953). The case for flexible exchange rates.

Ganguly, S., and Breuer, J.B. (2010). Nominal exchange rate volatility, relative price volatility, and the real exchange rate. Journal of International Money and Finance, 29(5), 840-856.

Gelb, S. (2005). South–South investment: the case of Africa in Africa in the world economy–The national, regional and international challenges. Fondad, The Hague.

Giannellis, N. and Papadopoulos, A.P. (2011). What causes exchange rate volatility? Evidence from selected EMU members and candidates for EMU membership countries. Journal of International Money and Finance, 30(1), 39-61.

Goldberg, L.S. (2009). Exchange Rates and Foreign Direct Investment. The Princeton Encyclopedia of the World Economy, 393-396.

Ghura, D., and Grennes, T.J. (1993). The real exchange rate and macroeconomic performance in Sub-Saharan Africa. Journal of Development Economics, 42(1), 155-174.

Granger, C.W. (1969). Investigating causal relations by econometric models and cross-spectral methods. Econometrica: Journal of the Econometric Society, 424-438.

Grenville, S., and Gruen, D. (1999). Capital flows and exchange rates. Capital Flows and the International Financial System.

Grilly, V. and G. Kaminsky (1991). Nominal exchange rate regimes and real exchange rate: evidence from the United States and Britain, 1885–86. Journal of Monetary Economics, 27(2), 191-212.

Gregorio, J. D., Tokman, A., and Valdés, R. (2005). Flexible exchange rate with inflation targeting in Chile: Experience and issues.

Gujarati, D. N. (2003). Basic Econometrics, 4. McGraw-Hill.

Hall, S., Hondroyiannis, G., Swamy, P.A.V.B., Tavlas, G., and Ulan, M. (2010). Exchange-rate volatility and export performance: Do emerging market economies resemble industrial countries or other developing countries? Economic Modeling, *27*(6), 1514-1521.

Han-Kim, E. and Singal, V. (2000). The fear of globalizing capital markets. Emerging Markets Review, 1(3), 183-198.

Heever, J. (2001). A note on inflation targeting in South Africa. South African Journal of Economics, 69(1), 168-177.

Hviding, K., Nowak, M., and Ricci, L.A. (2004). Can higher reserves help reduce exchange rate volatility?

Kenen, P.B. and D. Rodrik (1986). Measuring and analyzing the effects of short-term volatility in real exchange rates. The Review of Economics and Statistics, 311-315.

Kiyota, K., and Urata, S. (2004). Exchange rate, exchange rate volatility and foreign direct investment. The World Economy, *27*(10), 1501-1536.

Kosteletou, N., and Liargovas, P. (2000). Foreign direct investment and real exchange rate interlinkages. Open Economies Review, 11(2), 135-148.

Kočenda, E. and Valachy, J. (2006). Exchange rate volatility and regime change: A Visegrad comparison. Journal of Comparative Economics, 34(4), 727-753.

Kodongo, O. and Ojah, K. (2012). The dynamic relation between foreign exchange rates and international portfolio flows: Evidence from Africa's capital markets. International Review of Economics & Finance, 24, 71-87.

Kodongo, O. and Ojah, K. (2013). Real exchange rates, trade balance and capital flows in Africa. Journal of Economics and Business**,** 66, 22-46.

Kodongo, O. and Ojah, K. (2014). Conditional pricing of currency risk in Africa's equity markets. Emerging Markets Review, 21, 133-155.

McKenzie, M.D. and Brooks, R.D. (1997). The impact of exchange rate volatility on German-US trade flows. Journal of International Financial Markets, Institutions and Money, 7(1), 73-87.

Mishkin, F.S. (2000). Inflation targeting in emerging market countries, National Bureau of Economic Research.

Mohammed, S. (2005). The impact of international capital flows on the South Africa Economy since the end of apartheid [Online].Available at http://www.policyinnovations.org/ideas/policy_library/data/01386/_res/id=sa_File1/Mohamed_Capital_Flow.pdf. [Accessed on 12 June 2014].

Mussa, M. (1986). Nominal exchange rate regimes and the behavior of real exchange rates: Evidence and implications. Carnegie-Rochester Conference Series on Public Policy, Elsevier.

Muzindutsi, P.F. and Niyimbanira, F. (2012). The exchange rate risk in the Johannesburg Stock Market: an application of the arbitrage pricing model. Readings Book: 663.

Poon, S. H., and Granger, C. (2005). Practical issues in forecasting volatility. Financial Analysts Journal, 61(1), 45-56.

Rashid, A. and F. Husain (2010). Capital inflows, inflation and exchange rate volatility: an investigation for linear and nonlinear causal linkages. Working Papers & Research Reports, 2010.

Rangasamy, L. (2014). Capital Flows: The South African Experience. South African Journal of Economics, 82(4), 551-566.

Reisen, H., and Soto, M. (2001). Which Types of Capital Inflows Foster Developing-Country Growth? International finance, 4(1), 1-14.

Rose, A.K. (2007). A stable international monetary system emerges: Inflation targeting is Bretton Woods, reversed. Journal of International Money and Finance, 26(5), 663-681.

Schmidt, C.W. and Broll, U. (2009). Real exchange-rate uncertainty and US foreign direct investment: an empirical analysis. Review of World Economics, 145(3), 513-530.

Servén, L. (1999). Macroeconomic uncertainty and private investment in LDCs: an empirical investigation, Banco Mundial.

Sharifi-Renani, H. and M. Mirfatah (2012). The Impact of Exchange Rate Volatility on Foreign Direct Investment in Iran. Procedia Economics and Finance, 365-373.

Siourounis, G. (2004). Capital flows and exchange rates: an empirical analysis. London Business School IFA, Working Paper(400).

Stock, J. H., and Watson, M. W. (2001). Vector autoregressions. Journal of Economic perspectives, 101-115.

Serven, L., and Solimano, A. (1991). *An* empirical macroeconomic model for policy design: the case of Chile (No. 709). The World Bank.

Servén, L. (1999). Macroeconomic uncertainty and private investment in developing countries: An empirical investigation. World Bank Policy Research Working Paper, (2035).

Servén, L. (2003). Real-exchange-rate uncertainty and private investment in LDCs. Review of Economics and Statistics, 85(1), 212-218.

Soleymani, M., and Akbari, A. (2011). The relationship between exchange rate uncertainty and investment in some of Sub-Saharan African Countries. International Journal of Business and Public Management, 1(1), 123-138.

South African Reserve Bank. (SARB), 2014.

Van der Merwe, E. (2004). Inflation targeting in South Africa.South African Reserve Bank Pretoria, South Africa.