ANALYSING THE EXCHANGE RATE VOLATILITY RELATIVE TO TRADE BALANCE: THE CASE OF SACU COUNTRIES

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ABSTRACT

The term exchange rate volatility is widely used in the financial market. The exchange rate is determined in the foreign exchange market, which is said to be the largest market in the world and it trades financial assets. Many studies have shown that researchers, relevant practitioners and policy makers pay lots of attention to the issue of exchange rate and volatility. Volatility is known to be very important when it comes to making decisions in financial trading activities that are based on fluctuations on return.

This study has two main objectives, namely to analyse the kind of relationship between exchange rate volatility and trade balance in the selected member states of the SACU region in which the selected countries are Botswana, Namibia, Swaziland and South Africa. The second objective of this study was to determine the impact between exchange rate volatility and trade balance in the selected member states of the SACU region.

The time series data which was used in this study was from the period 1986 to 2016. The Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model, the impulse response functions and variance decompositions are used in the analysis. Results show that there is a short-run relationship between exchange rate volatility and trade balance. It was found that there is a positive and negative impact between these two variables, with high volatility. Furthermore, this study recommends all Central Banks in the SACU region to intervene in order to mitigate exchange rate volatility.

LIST OF PUBLICATIONS/CONFERENCES PROCEEDINGS

There were no publications and conference presentations while this study was being done.

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LIST OF ABBREVIATIONS AND ACRONYMS

ADF: Augmented Dickey-Fuller

APA: American Psychological Association

ARMA: Autoregressive and Moving Average

ARCH: Autoregressive Conditional Heteroscedasticity

BWP: Botswana Pula

CMA: Common Monetary Area

ECM: Error Correction Model

E-GARCH: Exponential Generalized Autoregressive Conditional Heteroscedasticity

FDI: Foreign Direct Investment

GDP: Dross Domestic Product

GARCH: Generalized Autoregressive Heteroscedastic Model

IMF: International Monetary Fund

NAD: Namibian Dollar

PP: Phillips-Peron

Prob.: Probability

RMA: Rand Monetary Area

SACU: Southern African Customs Union

SARB: South African Reserve Bank

SZL: Swaziland Lilangeni

VECM: Vector Error Correction Model

ZAR: South African Rand

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DEDICATION

I would like to dedicate this thesis to my mum, dad and sister Towela. Thank you for the encouragement, motivation and support you gave me during the process of this study. God bless you.

DECLARATIONS

I, Haansende Christine Mazuba, hereby declare that this study is my own work and is a true reflection of my research, and that this work, or any part thereof has not been submitted for a degree at any other institution.

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CHAPTER ONE: INTRODUCTION

1.1 Background of the study

The Southern African Customs Union (SACU), which was established in 1910, consists of Botswana, Lesotho, Namibia, South Africa and Swaziland. However, this study focuses on Swaziland, Botswana, South Africa and Namibia. Lesotho was excluded due to insufficient data which is supposed to be used for estimation. SACU is the world's oldest customs union which is still in operation. This is one of the most efficient customs unions in the world. With the exception of Botswana, member states in this union also belong to the Common Monetary Area (CMA) which links them into a monetary union. Monetary unions are said to be one of the ways in which it can improve economic integration. Botswana withdrew from the CMA because it was trading more with the United Kingdom and less with South Africa, and purposed to formulate and implement its own monetary policy, and to make necessary adjustments in the exchange rate in response to shocks affecting its economy. However, Botswana maintained a close link between its national currency and the rand as it constitutes a large percentage of the currency basket, with the rand taking 60-70 percent of the weight (Grandes, 2003, as cited by Nainda, 2014).

The South African Rand became a legal tender in other CMA member states when the South African Reserve Bank (SARB) was established in 1921. ''Since the rand is legal tender in the other three countries, South Africa compensates each of the countries for forgone seigniorage'' (Tavlas, 2008, p.7). Even with this benefit, member states are encouraged to come up with common industrial policies, agricultural policies, policies on competition, and policies on intellectual property. They are encouraged to do so to make sure that SACU policies are well coordinated.

However, the South African rand was no longer a legal tender in Swaziland since 1992. Subsequently, following the events of interruption in 2003, Swaziland reauthorized the use of the South African rand as legal tender alongside the Lilangeni, its national currency (Nainda, 2014).

Tavlas (2008) further explains that this compensation is based on a formula which is equal to the product of two-thirds on the annual yield of the most recently issued long-term South African government bond, and the volume of rand estimated to be in circulation in the member country concerned. Even though this is the case, other member states were given the right to use their own currencies after the Rand Monetary Area (RMA) agreement which was revised to establish the CMA. While this was meant to give member states the responsibility to manage their own monetary policies and their own financial institutions, there is not much independence on monetary policy. According to Tavlas (2008) Lesotho introduced the Loti in 1980, Namibia introduced the Namibian dollar in 1993, and Swaziland introduced the Lilangeni in 1974. These currencies have been pegged (at par) to the South African rand from the time they were introduced, even though they are not legal tender in South Africa.

The currency union was established on December 5, 1974, with the enforcement of the RMA agreement between South Africa, Swaziland and Lesotho. In 1986, the CMA was established with the enforcement of the Trilateral Monetary Agreement among governments of Lesotho, Swaziland and South Africa. The trilateral agreement in association with the bilateral agreement provided a framework for exchange rate and monetary policies in South Africa, Swaziland and Lesotho. The bilateral agreement governed their access to the South African exchange market. However, the multilateral agreement replaced the trilateral agreement when Namibia

joined the CMA in 1992. It is worth stating that before independence in 1990, by design of being the fifth province of the Republic of South Africa, Namibia was a member of SACU. By declaring independence, Namibia had to be out and re-joined again in 1992.

The main objectives of the multilateral agreement were to sustain economic development in the less developed member states and to make sure that all members would acquire equal benefits. This agreement included the advantage of stabilising exchange rates which increased the level of trade in the region. In this agreement, Lesotho, Swaziland and Namibia had to defend their peg to the South African rand as a requirement because the SARB has the responsibility of protecting the external value of the South African rand from the rest of the world (Nainda, 2014).

Although South Africa follows a floating exchange rate regime, over the past years it underwent quite a number of regimes. The first regime was when the rand was pegged to a fixed British Pound in 1961 (first quarter) to 1971 (second quarter). In the third quarter of the year 1971, South Africa changed its regime, pegging its rand either to a floating United States Dollar or the British Pound. This regime was used for three years. In 1974 (third quarter), South Africa started using the controlled independent float. This is a regime in which devaluations used to take place every few weeks. The use of this regime ended in the second quarter of the year 1975. From 1975 to 1979 (first quarter) a fixed regime was used, and the rand was pegged to the United States Dollar. In the next four years the exchange rate regime changed to a dual foreign exchange rate. In 1983, the unification to a floating rand exchange rate regime was used until the year 1985. South Africa then returned to the dual system for about 9-10 years and then went back to using the unification to floating rand regime. It was in 1999 that the floating exchange rate regime was maintained

until to date. When South Africa became a democratic country in 1994, managing the exchange rate regime became a priority so that it could help the country maintain macroeconomic stability and consistency in its economic growth.

Since the CMA currencies are pegged to the South African rand, the South African monetary authorities follow the floating exchange rate arrangement. Hence, the exchange rate approach of Lesotho, Swaziland and Namibia share certain characteristics of a currency board. With this type of exchange rate arrangement, the central banks of Lesotho, Swaziland and Namibia are able to acquire domestic assets, given that domestic currency issues are fully backed by foreign reserves. It should be noted that Botswana follows a fixed peg exchange rate regime which is characterised as an adjustable peg.

Nainda (2014) cited Harris et al. (2007) saying that Swaziland, Lesotho and Namibia do not benefit equally even after South Africa started using the floating exchange rate regime. With this been the case, the three countries have been using fiscal policies in order to respond to shocks (getting rid of inequality will require institutional building or institutional sharing). This is done by borrowing in the domestic markets and in the foreign markets, which has resulted in the reduction in stock of their international reserves.

Tavlas (2008) states that the features of the CMA are very important to take note of:

- The CMA is not a complete monetary union. It is a combination of the currency board and the monetary union. Each CMA country has a national central bank but there is no regional central bank to which they can consign the standard instruments of monetary policy. Even though monetary policies are set by the SARB, public officials of central banks from the four CMA countries have

meetings on a quarterly basis to discuss the level at which interest rates in their respective countries trailing those in South Africa should be set.

● The authorities of Namibia, Swaziland and Lesotho have the advantage of conducting national monetary policies. These monetary policies may have appeared to be similar to those of South Africa.

● The budgetary disciplines among the CMA countries are supported by legislation, the SARB's conservative stance, and the requirement that Namibia, Swaziland and Lesotho completely support the supplying and distribution of national currencies with foreign exchange reserves.

● In the context of the bilateral agreement between South Africa and Lesotho, and South Africa and Namibia, the amount of reserves in Lesotho and Namibia should be the same amount as the total summation of their respective domestic currencies.

● The transfer of funds has no restrictions. These funds with either current purposes or capital purposes are free to move among the member states of the CMA at any time. Investments from South Africa crossing over to the smaller member states do not have any restrictions. Therefore, this helps in developing the economy and improving economic integration.

● Mobility in goods and capital are highly mobile among the member states of the Common Monetary Union. However, this is not the case for labour. Immigration procedures and requirements are highly followed among the member states.

● Since the currencies of the smaller member states have been pegged to the South African rand, it is easy to convert these currencies into the rand. However,

it should be noted that the Swaziland's lilangeni no longer has a 1:1 linkage with the South African rand, even though the linkage has been maintained in practice. Ever since the link between the rand and lilangeni was broken in 1986, the rand was no longer a legal tender in Swaziland. With this been the case, Swaziland is not entitled to any compensatory payments from South Africa.

● Even though the multilateral agreement was introduced, bilateral agreements have been continuously used over time. Especially between South Africa and any of the smaller member states.

● Considering the parity maintained against the South African rand, member states of the CMA carry the same exchange rate as the South African rand. Therefore, the member states of the CMA (excluding Swaziland) cannot change their exchange rate for the benefit of maintaining international competitiveness.

● The SARB have control over the foreign exchange reserves which is a common pool for the member states of the CMA. Central banks from the member states, including authorised dealers have got access to the foreign exchange market found in South Africa. Upon request, the foreign exchange market can be made available to them by the SARB.

The Southern African Customs Union has an organisational structure which is used since the member states have to meet every year to discuss every matter relating to the Customs Union Agreement. The first body of this organisational structure is the Council of Ministers. This group has one minister from each member state of the SACU region to represent their countries. This body has the greatest authority in decision-making in the SACU region. The second body is the Commission, which is the administrative body. This group has senior officials, technical liaison committees

and an agricultural liaison committee. The third body is the Tribunal. This group is independent with experts that report directly to the council of ministers. The tribunal is held accountable for setting tariffs and the anti-dumping mechanism. The Ad Hoc Tribunal is the fourth body and it is responsible for settling disputes. The fifth body is the Secretariat. This group has the responsibility to take care of day-to-day operations of the revenue pool.

SACU member states agreed on maintaining a common external tariff, share customs revenues, and coordinate policies and decision-making on trade issues. Hence, SACU has a common revenue pool which intends to make up for the imbalances in tax collections that arise from asymmetric trade patterns (Nainda, 2014). The most important exports of goods in South Africa and Namibia are minerals such as uranium and refined zinc, while the most important exports of goods in Swaziland and Lesotho are agricultural products such as sugar. The key services for trade found in the SACU sub-region are retail services, financial services, construction services, business services and educational services.

Once the Southern African Customs Union was formed, it was very clear that three features were very important. The first feature was that the integrated economies having separate political jurisdictions had the necessity to allow goods and services to flow among the member states. The second feature was that the South African tariff was been used in the Southern African Customs Union as an instrument in the industrial policy. This was done to encourage industrialisation in South Africa. The third feature was that the SACU agreement provided a mechanism and a formula to distribute revenue among the member states. This was due to a common external tariff which generates revenue that has to be distributed among the member states.

The SACU revenue is an important mechanism fiscal resource used across Botswana, Lesotho, Namibia and Swaziland. The revenue-sharing arrangement is calculated with three basic components. The first one is the share of the customs pool, the second one is the share of the excise pool, and the third one is the share of the development budget. The SACU member states collect all customs and excise duties which are then pooled in a Consolidated Revenue Fund of South Africa. Using the revenue formula, the customs revenue is distributed through quarterly payments. Lesotho and Swaziland are highly dependent on the SACU revenue, while Botswana and Namibia are less dependent because they each have a broad tax base.

Botswana, Swaziland, Lesotho and Namibia receive large portions of total government revenue. However, with South Africa been the country that has the highest GDP among the SACU member states, it receives more than half of the total revenues from the pool through the excise duties. While, Botswana, Lesotho, Swaziland and Namibia do receive most of their revenues from the customs union-component. This makes the smaller member states exposed to the possibility of been negatively affected to fluctuations in the level of customs collections. The customs revenue formula does not distribute revenue based on each of the member states imports of goods which are subject to import tax, but its distributions of revenue are based on the member states share of trade across the SACU region. It allocates customs revenue and excise revenue of forecasts reconciled collections against actual collections and intra-trade data. South Africa has little dependence on the smaller member states for a small share of their imports.

Revenue payments are there to compensate the smaller member states of the SACU region because of the disadvantages they face for been part of the customs union. Firstly, the SACU smaller member states do not have the right to set tariffs and

excise duties. This makes them lose out in fiscal autonomy and restricted sovereignty over trade and industrial policy. Secondly, the SACU smaller member states have been buying goods at prices that are higher than those at the global market. The fact that trade barriers such as tariffs were introduced, an increase in prices higher than the global market prices could not be ignored. While the smaller member states are suffering from these high prices, South Africa is been compensated for by accruing benefits in industries found in South Africa. Thirdly, economic activities have been disproportionately distributed at the industrial centres of South Africa. This causes polarised development.

It is very important that member states of the SACU region may not enter other trade agreements with third parties without informing the other member states. This is due to the fact that the SACU region gives preference to multilateral framework agreements. Another reason is because the SACU agreement emphasises on commitment of the member states to the goals of the customs union.

Botswana, Lesotho, Swaziland and Namibia have argued that they are not been compensated well for these disadvantages that they face from been a member of SACU. This argument is derived from the fact that the smaller member states have compliant positions in the SACU region. It has been difficult to establish new industries in the smaller member states in terms of the SACU region providing protection for infant industries. Procedures needed to consult the smaller member states on what South Africa has been doing is not enough. Another fact is that there has been difficulty in concluding the type of trade agreement that should be used with governments of the non-member states. Another issue causing arguments of no compensation is the time period in which the customs union revenue is distributed. It

takes about two years for the customs union revenue to be distributed. This time lag is derived from how the revenue formula is implemented.

Countries in the SACU region are driven by export industries. These industries are the main drivers of job creation and the reduction in poverty across the member states of the SACU region. From the time apartheid ended in South Africa, in 1994, economic growth has been improving in the SACU region. Even though economic growth in the SACU region started to improve, it began to slow down in 2011. This happened in the same period the world experienced the global economic slowdown. The downfall in the economic growth was caused by the reduction in economic growth of the SACU member states' major trading partners, the United States and the Euro area. This had a direct impact on the performance of the SACU member states which affected the mining industries and the manufacturing industries.

Goods and services that are imported into the member states of the SACU region all receive the same import duty or import tariff. In this regard, all member states of SACU share the same policy on tariff issues. This means that the member states have to negotiate on trade agreements with third parties. Firstly, they have to decide on which common trade policy should be used. Secondly, they have to decide on how the customs revenue should be shared amongst them. Thirdly, they have to manage their own affairs collectively by negotiating with third parties. On the other hand, goods and services among the member states of SACU move freely without any duty attachments. Otherwise, boarder procedures are mandatory when there is anything to do with animals and any plant health issues are been faced. This may help avoid any unnecessary diseases from been spread across the countries.

It is believed that the Southern African Customs Union is one of the trade arrangements in Africa which is functioning effectively (Nainda, 2014). It possibly

could be the most integrated market in Africa. To add on, Memela (2010) mentions to say that the 1993 African Development Report states that SACU and CMA pose as very good examples of regional integration schemes that have been a success in Africa. These two groups have shown that a mutual combination of sub-regional arrangements which cooperate in terms of trade and monetary issues affect economic integration positively.

Many studies have suggested that it is possible that SACU is the oldest customs union in the world. The customs union plays a very important role in South Africa and the rest of the member states. South Africa is the largest economy in the Southern African Customs Union and the most industrialised economy in the SACU region. Lesotho, Namibia and Swaziland highly depend on South Africa for its goods and services. These countries, including Botswana import quite a lot of goods from South Africa while South Africa imports much less from the smaller countries. Many researchers have proven this to be true throughout the years. Nainda (2014) acknowledges the fact that about 95% of the Gross Domestic Product in the CMA is from South Africa. This gives more power to South Africa to make most of the decisions in the CMA. There is a huge gap in the per capita Gross National Product between South Africa and the rest of the member states of the SACU region.

Many countries sign cooperation agreements with other countries around the world so that they can benefit from technological spill-overs, human capital and reduced transaction costs in order to take advantage of economies of scale which could occur in small markets. Hence there is need for improving their economies and economic linkages. The SACU region has signed a number of trade agreements, some of which include the SACU-Mercosur Preferential Trade Agreement, SACU-India Trade

Negotiations and the SACU-China Trade Negotiations. Member states of the SACU region gain access and exposure to other larger regional markets.

With different economic profiles and different levels of development, the SACU region has to face a number of challenges. First off, progress of the customs union is negatively affected. This is due to the fact that economic sizes of member states are different and that their levels of development are very different. The SACU region does not own its own budget and does not have the authority to come up with its own laws to regulate and monitor areas of their own interest. The Regional Trade Agreement's and the administrative capacity of SACU become weak and burdened because member states of SACU do not have industrial strategies which are aligned with the customs union's objective. Infrastructure in terms of transportation and communication is a huge challenge for member states in the SACU region. The SACU region does not have the authority and resources to apply its initiatives. This causes member states not to act in accordance with agreements. Member states of SACU who also belong to other groups like the Southern African Development Community bring in confusion in terms of policy objectives and loyalty to various treaties.

Trade relation in the SACU region is more like a one-sided action. The smaller countries trade more with South Africa than with themselves. Nainda (2014) noted that exports from South Africa have a high percentage level of the total intra-SACU trade. The SACU region uses the protectionist external trade regime. This regime makes sure that the members of this region should refrain from allowing imports that could be produced efficiently from countries that are not members of the region. This makes countries in the SACU region export large amounts of their goods and services to the rest of the world. For example, these member states export their

products to the European Union and the United States. On the other hand, it is believed that imports have a huge positive impact on the level of reserves. Even though South Africa receives the largest share of benefits in this trading business, the trade partnership which SACU holds is beneficial for all the member states. This trade pattern indicates that the smaller member states take advantage of this opportunity to enable them to reduce trade deficit.

Real exchange rate is known to be an important determinant of export and import because it is necessary for a country's international competitiveness. An exchange rate is said to be volatile if it changes over time. It becomes more volatile if magnitude in the change of exchange rate is large. An exchange rate that is volatile may cause unwanted changes in the level of prices, changes in the volume of international trade, changes in investment, and changes in the amount of aggregate output and the sectoral output. These are some of the reasons why many countries around the world try to stabilize exchange rate volatility.

A country's international competitiveness can be shown through the trade balance, which indicates a trade deficit or a trade surplus. Musawa (2014) states that "the trade balance is derived from the balance of payment which is the statistical record of a country's transaction with the rest of the world" (p. 192). The balance of payments has detailed records of international economic transactions in any economy. These accounts of the balance of payments help researchers and policy makers understand the level of an economy's integration with the rest of the other economy's in the world. Monetary settlements between individuals of a domestic country and individuals of a foreign country are recorded in the accounts of the balance of payments. These are mostly referred to as external accounts. Transactions of goods been transferred in the form of foreign aid are also recorded in the balance of

payments accounts. Having provided this background, it is now necessary to reflect on the problem that warrants this study.

1.2 Statement of the problem

The exchange rate is known to have negative effects in the domestic markets and causes high risks to many exporters. These effects are reflected in the economy through the direction of the balance of payment. When exports are less than imports there will be an imbalance favouring a deficit. This has a bearing on economic growth and related particularities. For instance, any shock that targets the export sector will impact on both employment and foreign exchange earnings. Thus, it is important to investigate the impact of exchange rate volatility on trade balance (Shipanga, 2009, p.4). Researchers have only looked at the SACU countries in isolation and not as a region. Therefore, this study will analyse how the SACU region is affected by exchange rate volatility and trade balance.

1.3 Objectives of the study

This study has two objectives which are as follows:

- To analyse the kind of relationship between exchange rate volatility and trade balance in selected SACU countries.
- To determine the impact of exchange rate volatility on trade balance across SACU countries.

1.4 Hypotheses

The following are the hypotheses of this study:

H₀: There is no short-run relationship between exchange rate volatility and trade balance in selected SACU countries.

Hₐ: There is a short-run relationship between exchange rate volatility and trade balance in selected SACU countries.

H₀: Exchange rate volatility does not Granger cause trade balance across SACU countries.

Hₐ: Exchange rate volatility Granger causes trade balance across SACU countries.

H₀: Trade balance does not Granger cause Exchange rate volatility across SACU countries.

Hₐ: Trade balance Granger causes exchange rate volatility across SACU countries.

1.5 Significance of the study

This study will be useful to policy makers in the context of shedding light in the areas of management of exchange rate volatility and trade balance. The study will further contribute to existing literature on exchange rate and trade related issues in the SACU region.

1.6 Limitation of the study

Although the study is based on SACU member states, however, there is lack of data on Lesotho. As such, Lesotho has been excluded from the study.

1.7 Delimitation of the study

The main focus of this study is to analyse the nature of the relationship between exchange rate volatility and trade balance in Swaziland, Botswana, South Africa and Namibia. Lesotho has been excluded because it may not contribute to the fulfilment of this study and may be problematic in the quantitative modelling process.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter provides a theoretical and empirical literature review which explains concepts that were explained by other authors, scholars and researchers. This chapter explains in detail about what exchange rate volatility and trade balance are all about.

2.2 Literature Review

Exchange rate is a term that is widely used in finance. It is basically defined as the rate at which a currency (e.g. domestic currency) will be exchanged for another currency (foreign currency). Ever since the Bretton Woods came to an end in the early 1970's, the relationship between the exchange rate volatility and trade balance, including other macroeconomic variables stirred up a lot of attention to many researchers. The foreign exchange market (also known as the currency market) is a decentralized market that determines exchange rates. This market is known as the largest market in the world when it comes to trading financial assets.

Volatility takes place when price movements randomly occur naturally in every market. Statistically it is measured as the sample standard deviation (Ntawihebasenga, Mung'atu and Mwita, 2015). Volatility found in exchange rate may be caused by changes in money supply, income, interest rates and other market fundamentals. Volatility is a representation of risk. However, volatility and risk are not equal because volatility increases risk. The exchange rate risk is referred to as the amount of money that can be potentially lost due to the change in exchange rate (Suranovic, 2010). It can also be referred to as the exposure to unexpected changes in the

exchange rate between two currencies (Ntawihebasenga, Mung'atu and Mwita, 2015). Removing exchange risk from exchange markets is impossible because involved parties (exporters and importers) become affected by exchange rate volatility. However, there are management tools that are available for firms to mitigate the impact of exchange rate risk, even though they do not provide for commercial and financial operations and are not available to all firms.

The financial asset is characterised by its return and is mostly considered as a random variable. This random variable is also known as the asset volatility. It is mostly used for estimating the value of market risk. Market risk is one of the sources of uncertainty in many financial institutions. These risks make it possible for values of portfolio to reduce when there is a change in market factors such as price and indices of securities, changes in interest rates and changes in currency rates. The market risk significantly influences the value of financial institutions that have been exposed.

A number of methods have been used to estimate financial institutional exposure in which volatility has played an important role. One of the methods is the Value-at-Risk methodology. This method is mostly used and applied in practical events. Asset volatility is the unreliability of values of returns from holding assets that are risky over a given period of time. Financial institutions have an advantage when asset volatility is estimated in the right way. Parameters which are estimated using the Value-at-Risk methodology can be made on a daily basis, weekly basis, or even a yearly basis. The most acceptable estimates are the ones made on a daily basis because market events tend to change rapidly. One other method used in estimating financial institutional exposure is the dynamic risk management method. This

method requires correct estimates of historical volatility and a short-term forecast which can be referred to as conditional volatility estimation.

In the world of trade, exporters are said to be either risk averse or risk lovers. For instance, if an individual is risk averse an increase in exchange rate volatility will influence them to reduce the volume of trade and reallocate their production of goods and services towards markets in the domestic economy. Contrary to belief, it is argued that a risk averse individual will cause an increase in exchange rate volatility to influence exporters to increase volume of trade (De Grauwe, 1988, as cited in Musonda, 2008). This is done to increase their export revenues and is commonly known as the income effect of exchange rate volatility. Moving along with this argument, exporters would export less and reallocate their resources to other sectors when individuals are less risk averse as exchange rate volatility increases. This is well known as the substitution effect.

Many studies state that volatility is very important for making decisions in finance which are based on fluctuations on return. This is to say that researchers, relevant practitioners and policy makers pay lots of attention to the issue of exchange rate and volatility. These fluctuations in exchange rate may be important for systematic reasons and the implications they have on other countries. For example, policy makers are interested in information on exchange rate volatility because they want to learn about what to expect in the market about policies and what is not certain about them.

Having a clear understanding on volatility will be a good advantage in asset pricing, managing risk as well as calculating the Value-at-Risk and portfolio allocation. Some of these policy makers want a rapid increase in their exports in hopes of improving their trade and current account balances (Huchet-Bourdon and Korinek, 2011). It is

also important to note that exchange rate volatility is important in determining monetary policy because they have an effect on domestic goods and domestic prices. Financial institutions find volatility important because it helps them know the current value of volatility in the managed assets and it helps them predict the future values of these managed assets. Financial institutions which are involved in options trading find volatility forecasting very useful too.

Estimating accurate values of financial indicators in volatility forecasting is a very difficult and challenging task. This is true even for researchers who are experts in this field. These financial indicators seem to be difficult to estimate accurately because their interconnections are too complicated. However, not so accurate values of current financial indicators and future expected values can be calculated by using mathematical modelling. These mathematical models can calculate estimates that are of value to financial institutions of their market trend in the future. Experts that have had difficulty in estimating values of financial indicators are forced to believe that future events cannot be predicted. Contrary to belief, empirical evidence has shown that future events can be predicted. Ladokhin (2009) gives an example of how financial volatility exhibits features of clustering and autocorrelation, in which values in the future depend on values of the past. Therefore, these features of volatility justify the fact that mathematical models are able to predict estimate values of financial indicators.

There are two types of exchange rate volatility namely; volatility and misalignment. Some researchers define volatility as short-term fluctuations of nominal or real exchange rates about their longer-term trends, while misalignments are defined as a significant deviation of the actual real exchange rate from its equilibrium level (this could be under-valuation or over-valuation). From the time the Bretton Woods

system ended in 1973, exchange rate volatility has been increasing substantially. Trade balance can be affected by volatility and misalignments. Ramautarsing (2016) believes that more attention should be on the real exchange rate than the nominal exchange rate because the real exchange rate is the one that drives international competitiveness.

Exchange rate serves as an important key variable for different sectors in an open economy when it comes to price signalling. Nainda (2014), in reporting a study by Aron et el. (1997) mentions to say that real exchange rate and its stability shows itself as an influence on many important variables such as exports and private investment. When exchange rate volatility increases pricing of goods and services, it ends up affecting importers who end up spending more money on the same quantity of goods. Changes in the prices of goods and services may cause serious implications on business profits and its survival in the business enterprise.

A flexible exchange rate regime has lower exchange rate volatility than a pegged exchange rate regime. A currency that is pegged can still expose a country to fluctuations and cannot eliminate overall exchange rate volatility. A misalignment in the currency that is pegged may cause large discrete changes in the value of the currency.

David, Dikko and Gulumbe (2016) recognizes a paper by Engle (1982) as being the first notable study done on volatility modelling of financial time series, which developed an Autoregressive Conditional Heteroscedasticity (ARCH) model to capture significant correlations between observations that are largely apart and time variant. As researchers continued to make use of the ARCH and GARCH models, it became easy for them to simultaneously account for the most prominent features of exchange rate volatility. The first feature has been that exchange rate volatility is

autocorrelated. The second feature is that it displays periodic patterns such as daily patterns and weekly patterns. The third feature is that it includes changes in prices.

There is a variety of methods used to measure volatility such as standard deviation, the historical volatility and the implied volatility. Historical volatility is described as volatility that can be obtained from a series of exchange rate in the past over a given time period (Omolo, 2014). With this type of measure the standard deviation in the changes of every day prices can be calculated and lengthened to annual volatility. Implied volatility is a type of measure that looks at what is in the future. Calculations are made from estimates of individuals participating in the market. Time horizon should be taken into consideration over which variability should be measured including the level of aggregation of trade flows.

Abdalla (2012) posits out that financial time series such as stock returns, exchange rates and other financial series which are crucial for correct model specification, estimation and forecasting exhibit stylized patterns. These stylized patterns are very important. They should be taken into consideration when modelling and forecasting volatility. The most common stylized facts are as follows:

Fat tail distribution: This type of distribution is also referred to as excess kurtosis. This occurs when the distribution of any of the financial time series deviates consistently from normal distribution. This could be the case if there are more large or small changes than a normal distribution.

Volatility clustering and persistence: This stylized fact shows that large price changes are more likely to be followed by large price changes and small price changes are likely to be followed by small price changes. This indicates the persistence in shocks. The large price changes are likely to increase volatility in the future, which will therefore, increase the rate of return on stock that is

required and reduce the price of stock. "Volatility clustering is nothing but accumulation or clustering of information" (Abdalla, pg. 218, 2012). Engle (2004) cited by Abdalla (2012) mentions that volatility clustering reflects on the fact that news is clustering over time. According to this stylized fact, shocks on return are caused by the changes in conditional volatility.

Inter-temporal relations: This stylized fact states that positive inter-temporal relations exist between expected returns and conditional variances. Asymmetric volatility responds to the fact that returns reflect the existence risk premiums that vary in time.

The leverage effect: In financial markets, depreciation is followed by higher volatility. According to past studies, researchers have discovered that volatility is higher when there are negative shocks of the same magnitude. It has been proven that negative returns seem to be important predictors of volatility compared to positive returns (Engle, 1993, as cited by Omolo, 2014). When the value of stock reduces it increases the financial leverage, making stock riskier. Hence, an increase in volatility. Shocks on return will lead to changes in conditional volatility.

Regular events: Events such as holidays and weekends affect exchange rate volatility. Many researchers have found that volatility of exchange rates returns or percentage changes is lower during weekends and holidays compared to weekdays.

Mean reversion: This fact states that volatility will always go back to its original level of volatility. When volatility increases or decreases, it will eventually return to the level it was at before it changed. It does not matter whether it takes a short period of time or longer period of time.

Transmission mechanisms: It has been observed that volatility moves at the same pace with assets and markets over time. This stylized fact is very useful in portfolio management, calculating Value-at-Risk, option pricing, optimizing portfolio, hedging, allocating assets and selecting stock.

Autocorrelation in absolute and squared returns: The slow decay of autocorrelation is a manifestation of volatility clustering. It also gives evidence of conditional heteroscedasticity. Linear autocorrelation is insignificant in low-frequency returns series. On the other hand, it is mostly significant in absolute returns and squared returns. Autocorrelation is able to remain significant in long lags.

Even though literature on the relationship between exchange rate volatility and trade balance is growing, empirical evidence seems to vary in all parts of the world, be it developing countries or developed countries. Some countries find that exchange rate volatility affects trade balance positively, while other countries find that exchange rate volatility affects trade balance negatively. In some other cases, some findings show that the exchange rate volatility may affect trade balance in both ways, positively and negatively. However, Musonda (2008) contends that a lot of empirical evidence shows that an increase in exchange rate volatility may lead to a decrease in trade balance.

There are different types of models that have been used to model and forecast volatility. The most common models used are naive models, regression-based type models, and the option-based forecasts. The naive models are time series volatility

forecasts while the regression-based models and the option-based forecasts are the sophisticated models. The volatility forecasting models are explained in more detail:

Naive Models: These types of models are based on future volatility forecasts on past information (variances or standard deviations). Naive models include the Random Walk, Moving Average models and the Exponentially Weighted Moving Average models. Theoretically speaking, using the naive models is no longer desirable for computing historical volatility. However, it is very common for academic researchers and traders to use recent observations in calculating historical volatility estimates. The Random Walk model is very simple to use. The assumption followed by the Random Walk is that the forecast of the next period's volatility best used is the current period's volatility. The Moving Average model and the Exponentially Weighted Moving Average model are very similar. The Moving Average model is based on the fact that the most recent data are the ones that give the most accurate forecasts. This is because data that goes back way in the past does not give enough information on volatility in the recent period. The Exponentially Weighted Moving Average carries more weight into the latest data. This makes forecasts in the recent past more reliable.

Regression-based forecasts: These consist mostly of GARCH type models such as the simple regression, the ARMA models, the ARCH class conditional volatility models, and other models. The simple regression and the ARMA models predict volatility in the future which is based on volatility data in the past, while the ARCH models predict volatility which is based on return data from the past.

Option-based forecasts: Volatility is normally used as an input when calculating option prices. Once volatility has been derived, it becomes implied volatility.

Implied volatility is more superior to volatility in the past. Hence, historical information is not a necessity when predicting volatility from option prices. Markets with option prices reveal the true volatility estimates of the market. If the market is efficient, it is highly possible that the implied volatility is the most suitable forecast.

The Dornbusch overshooting model (exchange rate overshooting hypothesis) argues that the interaction between monetary shocks and sticky prices drives the high levels of volatility in exchange rate. In the short-run, the level of foreign exchange rate rises at a very high level when there are changes in monetary shocks. Therefore, the equilibrium level will be reached in a short period of time when prices in the financial market change. As prices of goods respond to the change in prices in the financial market, their reaction will be neutralized by the exchange rate volatility causing a long-term equilibrium effect. It is believed that when current monetary shocks and future monetary shocks occur the nominal exchange rate will fluctuate.

Trade balance is a term that is widely used and monitored internationally. A country may experience a balanced trade (when the value of exports equals the value of imports), trade surplus (when the value of exports exceeds the value of imports) or a trade deficit (when the value of imports exceeds the value of exports). A trade deficit represents the debts extended over a single-year period while a trade surplus represents credits over a single-year period. A trade deficit that occurs continuously means that the total external debt to foreigners keeps building up. This is the same for a trade surplus which occurs continuously. It means that credits continue building up. If a trade surplus occurs after a trade deficit took place the previous year then the

surplus will represent a repayment of the previous year's debt. The same goes for trade deficit occurring after a trade surplus. The trade deficit will represent a repayment of the previous year's credit.

Theories on exchange rate and trade balance have been analysed through two different phenomenons (Huchet-Bourdon and Korinek, 2011). The first one is the J-curve effect. This phenomenon states that when a domestic country's exchange rate increases or experiences depreciation, the price of exports in terms of foreign currency will decrease. This will cause the quantity demanded of the domestic country's exports to increase. Imports from foreign countries will become more expensive causing their quantity demanded to decrease. This suggests that output and real income in the economy will expand. This is because there will be an increase in expenditure on domestic outputs.

By implication, an increase in exchange rate is supposed to reduce trade deficit in a country and hence, restore equilibrium in trade balance. However, this all depends on the price elasticity of exports and imports of the country. Trade balance will still have a deficit in the short run, for at least up to 6 months. Thereafter, trade balance will begin to improve in the long run and will begin to have a surplus. This phenomenon is called a J-curve because the net trade balance is plotted on the vertical axis while time is plotted on the horizontal axis. When trade balance responds to an increase in exchange rate, the graph looks like a curve of the letter J.

The second phenomenon is the Marshall-Lerner condition. Huchet-Bourdon and Korinek (2011) mention to say that this condition gives an explanation to why trade balance does not improve when the value of a nation's currency reduces. The Marshall-Lerner condition states that, for a depreciation in exchange rate to have a

positive impact on trade balance, the sum of the price elasticity of exports and price elasticity of imports should be greater than one in absolute terms. Just like the J-curve effect, an increase in the exchange rate will cause the price of exports to reduce. This means that imports will become expensive and their quantity demand will reduce.

A trade deficit is said to be good for an economy or bad for an economy. The same belief is true for a trade surplus. Sometimes a trade deficit is interpreted as a sign that an economy is growing vigorously. On the other hand it may give off signals of an economy facing problems. However, Suranovic (2010) makes emphasis on the fact that trade deficits should not be viewed with any interest because they are too small to warrant any positive or negative interpretation.

Many researchers have revealed quite a number of misunderstandings about trade imbalances and its implications. There are some reasons to why these misunderstandings exist. The first reason is because of the term itself, 'deficit'. The word itself brings in negative thoughts. For example, to say that 'an economy's trade balance has a deficit' that already sounds like it is a really bad thing. On the other hand, the term surplus gives off a positive thought. An economy would definitely want to have a surplus in their trade balance.

A second reason for these misunderstandings may be the sense of inequity or injustice because foreigners will not buy as much domestic goods as individuals would buy foreign goods. It is believed that fairness only takes place when exchange in international goods is done by both parties. Many observers should note that the balance of payments of a country is always in balance. Even if a country has a trade deficit it does not mean that the exchange in goods and services are not equal.

A third reason for these misunderstandings would be the fact that trade deficits are bad in some countries while trade surpluses are good for the economy as it produces positive outcomes. Many countries have experienced high international debt after having trade deficits in their trade balance, while many other countries have experienced positive impacts after having trade surpluses in their trade balance. With all these misunderstandings, one should not rush into concluding what a trade deficit or trade surplus represent in an economy. In order to recognise whether a trade imbalance is a good, bad, or something that does not matter, it is best to recognise the circumstances it has fallen in.

Many researchers have used different approaches in analysing the relationship between exchange rate volatility and trade balance. In 2014, Musawa estimated the short run and long run impact of exchange rate on trade balance in Zambia. The technique that was used in his estimations was the Vector Error Correction Model (VECM) for the period 2000-2010. The results showed that there was no impact in the short run and that there was an impact in the long run.

Shipanga (2015) investigated the effects of exchange rate volatility on the export flows of Namibia. Quarterly time series data was used for the period 1998-2008. The techniques used in this study where the Error Correction Model (ECM), moving average standard deviation, mean-adjusted relative change and the GARCH. The results suggested that there was a positive and negative effect of exchange rate volatility on exports in Namibia.

Serenis and Tsounis (2012) measured the impact of exchange rate volatility on exports in Germany, Sweden and UK. In this study quarterly data was used for the period 1973-2010. The technique used in this study was the VECM (Vector Error

Correction Model). The results suggest that there are negative effects between exports and exchange rate volatility.

In 2013, Barasa determined the relationship between exchange rate volatility and Balance of Payments in Kenya. The study adopted a quantitative comparative design which used the linear regression model technique. The findings concluded that exchange rate volatility has a negative effect on Balance of Payments.

Abdalla (2012) used the Generalized Autoregressive Heteroscedastic Model approach to model the exchange rate volatility in a panel of nineteen of the Arab countries. The study looked at daily observations over a period of 1st January 2000 and 19th November 2011. The results suggest that negative shocks have a higher next period volatility than positive shocks. It concluded that exchange rate volatility can be modelled by the class of GARCH models.

In 2010, Goyal and Arora used the GARCH model to analyse exchange rate volatility and the effectiveness of Central Bank actions in India. This study used time series data of daily observations from 1st November 2005 to 31st December 20018, and monthly observations from January 2002 to December 2008. Findings show that Central Bank communications outperforms more traditional policy variables.

Ramautarsing (2016) used the Vector Error Correction Model (VECM) to determine the role of exchange rate volatility on trade flows in South American countries. Results suggest that there is ambiguity to some extent with respect to the volatility-trade nexus.

In 2015, Ntawihebasenga, Mung'atu and Mwita applied the GARCH approach to modelling volatility in Rwanda exchange rate returns. The data used in this study was the daily exchange rate series for the period June 2009 to June 2014. Results in

this study showed that the GARCH model is a perfect fit in modelling the Rwanda exchange rate returns.

Marreh, Olubusoye and Kihoro (2014) used the ARMA-GARCH approach to model volatility in the Gambian exchange rates. The daily Euro and United States dollar exchange rates against the Gambian dalasi were used from the period 2003 to 2013. Results in the study showed that the return series had a heavy-tailed distribution and that there was a high persistence of volatility in the Gambian foreign exchange market.

In 2011, Huchet-Bourdon and Korinek examined the impact of exchange rates and their volatility on trade flows in China, the Euro area and the United States. The model used in this study was the GARCH, while using monthly data from January 1999 to June 2009. Findings show that exchange rate volatility has a slight impact on trade flows.

In 2014, Lotfalipour and Bazargan estimated the effect of real exchange rate volatility on trade balance in Iran. The data used was from the year 1993 to the year 2011. This study used the unit root tests, the GARCH approach and the balance panel data model. Results show that there is no significant effect of real effective exchange rate on trade balance.

2.3 Summary

Volatility is known to be important in decision making in the financial sector. The most common stylized facts characterised by volatility is the fat tail distribution, volatility clustering and distribution, the leverage effect, and regular events such as

holidays and weekends. Different approaches in many countries have been used to analyse the relationship between exchange rate volatility and trade balance such as the Vector Error Correction Model (VECM), Error Correction Model (ECM), and the Generalised Autoregressive Conditional Heteroscedastic (GARCH) model. With these approaches various results have been found.

CHAPTER THREE: METHODOLOGY

3.1 Research Design

This study follows a quantitative approach as it involves econometric modelling in evaluating the relationship among the various economic variables.

3.2 Data Analysis

The first tests that were conducted were for stationarity and cointegration. The Phillips Peron test and the Johannsen Cointegration test were used to ascertain whether the data is stationary or not and for cointegration respectively. A Granger causality test was also performed to ascertain causality and the direction of causality. Upon completing these tests, the comprehensive models were applied.

Firstly, the Generalized Autoregressive Conditional Heteroscedastic (GARCH) model was used in this study to analyse the relationship between exchange rate volatility and trade balance. Secondly, the impulse response functions and variance decompositions obtained from a Vector Autoregressive (VAR) Model were employed in this study. The impulse response functions show how each variable responds to shocks while variance decompositions demonstrate how much each variable contributes to fluctuations in the dependent variable. The GARCH model gives information of volatility that is observed in the short run (ARCH term) and in the long run (GARCH term). The summation of the ARCH term and the GARCH term should not exceed 1. If the summation is equal to 1 then the volatility shocks are permanently persistent. If the summation of the ARCH and GARCH term is less than 1 then the volatility shocks are temporary.

There are different types of symmetric and asymmetric models that have been used to model the exchange rate volatility. The most common models used are the ARCH and GARCH models. These models can capture daily, weekly and monthly frequencies in the change in exchange rate volatility. It should be noted that researchers have used different techniques in estimating exchange rate volatility. However, Dlamini (2014) and Shipanga (2009) used the GARCH model to estimate exchange rate volatility.

This study adopts the general framework of the GARCH model, GARCH (p, q), from Abdalla (2012), which is expressed as follows:

$$\sigma_t^2 = \omega + \sum_{j=1}^{q} \alpha_j \, \varepsilon_{t-1}^2 + \sum_{t=1}^{p} \beta_i \, \sigma_{t-1}^2 \qquad (1)$$

Where p is the number of lagged σ^2 terms and q is the number of lagged ε^2 terms. This study adapts the specification used by Shipanga (2009), which is as follows:

$$TB_t = \mu + \delta_1(V)_{t-1} + \delta_2(GDP)_{t-1} + \delta_3(FDI)_{t-1} + e_t \qquad (2)$$

Where TB_t is the Trade Balance at time t; V is the exchange rate volatility; GDP is the domestic real GDP; FDI is the foreign real GDP; μ is a constant term; δ_1, δ_2, and δ_3, are coefficients for exchange rate volatility, domestic real GDP and foreign real GDP respectively; and e_t is the residual.

The first step in estimating the GARCH is to test whether there is an ARCH effect. This is done by testing the presence of heteroscedasticity. The ARCH model is a special case of the GARCH model. These two models are better explained in terms of ARMA. Abdalla (2012) states that the test procedure is performed by obtaining the residuals e_t from the Ordinary Least Squares regression of the conditional mean equation which could be a combination of autoregressive (AR) and moving average

(MA) process (i.e. ARMA process) or AR and MA separately. After obtaining the residuals, the next step is to regress the residual squares by its values from the past. Then test the null hypothesis that there are no ARCH effects in the residuals. Contrary to the null is the alternative hypothesis that provides that there is an ARCH effect.

GARCH models have a variety of time series such as simple regression, ARMA models, and the ARCH conditional volatility models. ARMA models are able to predict volatility in the future, which is based on historical volatility data. The ARCH models are able to predict volatility from historical return. As for simple regression this is an autoregressive process in which volatility is expressed as a function of its own lagged values and its error term. David, Dikko and Gulumbe (2016) as cited from Bollerslev (1986) and Taylor (1986) state that the GARCH model allows the conditional variance to be explained by information in the past, such as shocks and variances. Ever since exchange rate volatility has been increasing after the Bretton Woods system ended, the ARCH models became more popular (Omolo, 2014).

The ARCH model is said to be a regression model which has the conditional volatility as the response variable and lags of the squared returns of the past as the covariates. The ARCH model of order has the assumption that the conditional variance is linearly dependent on the time series values of the last q square. However, the ARCH (q) model has got three problems that it faces. The first problem is that it may be possible to generate non-stationarity in the conditional variance equation. The second problem is that it may be difficult to decide on the value that q should take. An ARCH process with a very large order is required to capture the dynamics found in the conditional variance. The third problem is that the violation of the non-negativity constraints may occur. This may cause the forecast of negative variances.

Using the GARCH model may help in solving the problems faced by the ARCH model. The ARCH model becomes generalized. Thus, the GARCH model is an approximation to a higher order of the ARCH model. The GARCH model investigates volatility and persistence. Hence, allowing linear dependency of the conditional variance by the ARCH model. This non-linear time series has been designed to capture volatility clustering and unconditional return distributions.

There are quite a number of GARCH extensions, some of which are the Integrated GARCH, Exponential GARCH, and the GJR-GARCH. These models assume that positive and negative results have the same effect on volatility. However, this assumption has been violated a number of times by stork returns. Empirical evidence shows that negative results increases volatility more than it would by positive results. This is called the leverage effect in which the Exponential GARCH is used to measure. This Exponential GARCH was been used in this study. It is known to be the most widely used extensions of the GARCH.

The Exponential GARCH has a few advantages which make it better than the other GARCH models. Firstly, Volatility of this model is measured by the conditional variance and it is a multiplicative function of lagged innovations which are precisely and clearly expressed. Secondly, the volatility's reaction to negative and positive news is asymmetric. The leverage effect which shows that volatility increases when unexpected stock returns decreases, and that volatility decreases when unexpected stock returns increases. Thirdly, strong parameter restrictions and covariance stationarity are generally distributed simultaneously. Lastly, the estimated coefficients found in the Exponential GARCH model are not restricted to positive values. They may also be negative values.

3.3 Procedure

Data used in this study was obtained from the World Bank data base for the period 1986-2016. The indicators used are: terms of trade which serves as a proxy for trade balance, real effective exchange rate, domestic real GDP (Gross Domestic Product) which serves as a proxy for countries' competitiveness, and FDI (Foreign Direct Investment) percentage of GDP which serves as a proxy for foreign real GDP.

3.4 Research Ethics

All records/data in this study was kept locked on a hard drive until the study was completed. Once the study was done all records were deleted. Informed consent was obtained from all participants in this study and works done by other researchers was acknowledged with the use of APA (American Psychological Association) referencing style.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Introduction

Chapter four presents the results of the study and discusses them from testing for stationarity, cointegration, Granger causality tests and the Generalized Autoregressive Conditional Heteroscedastic model. It also includes discussions of results from estimations of the impulse response functions and variance decompositions obtained from a Vector Autoregressive (VAR) Model.

4.2 Results from tests

4.2.1 Testing for stationarity

The stationarity test results are shown in Table 4.1 below.

Table 4.1: Unit root tests: ADF and PP in levels and first difference

Variable	Model Specification	Augmented Dickey-Fuller		Phillips-Peron		Order of Integration
		Level	First difference	Level	First difference	
FDI_t	Intercept	0.0084**	0.000**	0.000**	0.000**	0
	Intercept and trend	0.0011**	0.000**	0.000**	0.000**	0
GDP_t	Intercept	1.000	0.0001**	1.00	0.000**	1

	Intercept and trend	0.852	0.0002**	0.943	0.000**	1
V_t	Intercept	1.000	0.0004**	1.000	0.000**	1
	Intercept and trend	0.714	0.007**	0.984	0.001**	1
TB_t	Intercept	0.984	0.000**	0.998	0.000**	1
	Intercept and Trend	0.917	0.0001**	0.995	0.000**	1

Source: Values obtained from Eviews

*Note: ** rejection of the null hypothesis at 5%.*

In testing for stationarity, the Augmented Dickey-Fuller (ADF) test and Phillips-Peron (PP) test were used. The use of more than one test is to compare the results and ensure strong results. Table 4.1 above shows the results of unit root test in levels and first difference. The results in Table 4.1 show that Foreign Direct Investment (FDI) is stationary in levels with the exception of the rest of the variables. These variables were further differenced once and became stationary.

4.2.2 Testing for Cointegration

The cointegration test results are shown in Table 4.2 below.

Table 4.2: Pedroni Residual Cointegration Test

	Panel		Group	
	Statistic Value	Prob. Value	Statistic Value	Prob. Value
Variance ratio	1.237434	0.1080	-	-
Rho statistic	1.188866	0.8828	2.011714	0.9779
PP statistic	1.836209	0.9668	2.382325	0.9914
ADF statistic	0.206039	0.5816	0.200744	0.5796

Source: Values obtained from Eviews

Note: Test critical value is at 1%, 5% and 10%.

After establishing the order of integration of the variables, testing for cointegration was done. This was done in order to test for the presence of any long-run relationship. Table 4.2 above shows the results obtained from the panel cointegration test based on Pedroni Residual Cointegration. The results in Table 4.2 show that the p-values are greater than the critical values. This shows that there is no cointegration implying that there is no long-run relationship among the variables.

4.2.3 Granger Causality Test

The Granger causality test results for the four variables are shown in table 4.3 below.

Table 4.3: Granger Causality test

	Dependent Variable in regression			
Regressor	TB	V	GDP	FDI
TB	0.00	0.1795	0.0005**	0.5680

V	0.0948*	0.00	0.0355**	0.5305
GDP	0.8531	0.7544	0.00	0.1331
FDI	0.3277	0.4163	0.9104	0.00

Source: Values from Eviews

Note: a) TB denotes trade balance, V denotes exchange rate volatility, GDP denotes Gross Domestic Product, and FDI denotes Foreign Direct Investment.

b) * and ** means rejection on null hypothesis of no Granger causality at 10% and 1% respectively.

The results in Table 4.3 show that the probability between trade balance and Gross Domestic product is 0.0005, which is less than the critical value 0.01. This implies that trade balance can help predict Gross Domestic Product. Table 4.3 also shows that the probability (0.0948) between exchange rate volatility and trade balance is below the critical value 0.1, while the probability (0.0355) between exchange rate volatility and Gross Domestic Product is below the critical value 0.01. This implies that exchange rate volatility can help predict both trade balance and Gross Domestic Product.

4.2.4 Descriptive Statistics of the yearly exchange rate series

Various descriptive statistics were calculated and reported in Table 4.4 as follows.

Table 4.4: Descriptive statistical results

Statistics	ZAR	BWP	SZL	NAD
Mean	6.329112	4.966359	6.329112	6.329112

Median	6.459693	4.949664	6.459693	6.459693
Maximum	14.70961	10.90115	14.70961	14.70961
Minimum	2.036033	1.678941	2.036033	2.036033
Standard deviation	3.257508	2.582934	3.257508	3.257508
Skewness	0.599753	0.485134	0.599753	0.599753
Kurtosis	2.867560	2.432570	2.867560	2.867560
Jarque-Bera (JB)	1.881123	1.631889	1.881123	1.881123
Probability	0.390409	0.442221	0.390409	0.390409
Number of Observations	31	31	31	31

Source: Values from Eviews

As shown in Table 4.4, skewness and kurtosis clearly indicates the departure from normality. The skewness of the South African Rand, Swaziland Lilangeni and the Namibian Dollar show that their data is positive and moderately skewed implying that the model produces moderately accurate results. While the Botswana Pula shows that its data is positive and fairly symmetrical implying that the model produces fairly accurate results.

The values of kurtosis for all four currencies show that they have a similar sharpness in the peak of their data distributions. The value of standard deviation for all four currencies is close to the acceptable value of 1. This means that the dispersion of data is not far from the mean, implying that performance of future predictions in returns is very good.

4.2.5 Heteroscedasticity test (Testing for ARCH effect)

Before using the GARCH model, testing for heteroscedasticity has to be conducted.

Table 4.5: Testing for ARCH effect

Currencies	ZAR	BWP	SZL	NAD
ARCH-LM statistic test	2.726368	1.236185	0.930079	3.277237
P-value	0.0109**	0.2267	0.3603	0.0028**

Source: Values from Eviews

Note: H$_0$: (a) There is no ARCH effect; (b) Rejection of null hypothesis at 5%.

Table 4.5 above shows the results of the heteroscedasticity test where ZAR represents the South African Rand, BWP represents the Botswana Pula, SZL represents the Swaziland Lilangeni, and NAD represents the Namibian Dollar. As shown in Table 4.5 the P-values of the South African Rand and the Namibian Dollar show that they have an ARCH effect and therefore, these variables require to be estimated using the GARCH. The Botswana Pula and the Swaziland Lilangeni have no ARCH effect and as such, for them there is no need to proceed to the GARCH.

4.2.6 Estimation results of GARCH Model

The Autoregressive Conditional Heteroscedasticity (ARCH) Model and Generalized ARCH Model are used as volatility models for a variable whose variance is not constant. The ARCH is a special case of the GARCH. Table 4.6 below shows estimation results of the GARCH model.

Table 4.6: GARCH model results

Currencies	ω	α	β	α + β	R-Squared	Probability	
						ARCH(-1)^2	GARCH(-1)
ZAR	1.04E+21	0.872626	-0.276685	0.595941	0.548082	0.3893	0.6032
NAD	4.72E+18	0.387889	-0.072414	0.315475	0.681897	0.4941	0.9561

Source: Own

In Table 4.6, the probability of the ARCH term for both currencies is greater than the critical value 0.05. This means that volatility cannot be predicted by the ARCH term. This also applies to the GARCH term since they both have a higher value than the critical value 0.05.

The presence of volatility is determined by summing up the root of the autoregressive model of α+β, where α is the ARCH term and β is the GARCH term. This is referred to as the rule of thumb, if:

α+β < 0.5, strongly efficient

0.5 <= α+β <= 1, weak form of efficiency

α+β > 1, no efficiency

Table 4.6 shows the summation of the ARCH term and GARCH term for the South African Rand and the Namibian Dollar. The summation of the South African Rand is greater than 0.5 but less than 1. In this regard, it supports the weak persistent presence of volatility. However, the R^2 of about 0.548082 suggests that about 55% of

the total variation in the regressand is explained by the regressors with 45% accounted for by the error term. The summation of the Namibian Dollar is less than 0.5. This implies that the presence of volatility shocks is strongly persistent. However, the R^2 of about 0.681897 suggests that about 68% of the total variation in the regressand is explained by the regressors with 32% accounted for by the error term.

4.2.7 E-GARCH model results

Table 4.7: Estimation results of E-GARCH model

Currencies	C(6) Long-run volatility	C(7) Leverage effect
ZAR	0.784636	-0.371961
NAD	0.588542	-0.020606

Source: Values from Eviews

Table 4.7 shows the results of the E-GARCH model which represent the long-run volatility and the leverage effect. The leverage effect refers to a negative correlation between the daily asset returns and its changes in volatility. As shown in the table, both leverage effects of -0.371961 for ZAR (South African rand) and -0.020606 for NAD (Namibian dollar) are negative. This means there is negative correlation between asset returns and ZAR, and between asset returns and NAD.

4.2.8 Impulse Response Functions

The results of the Impulse Response Functions are shown under appendices. These results show how the variables TB, FDI, GDP, and exchange rate volatility respond to shocks of each other.

Appendix A shows the response of TB to shocks in FDI, GDP and exchange rate volatility. The response of TB to shocks in FDI is positive. These effects appear to be permanent but only after seven quarters. This is because the variable found a new level of equilibrium as it did not go back to its initial level of equilibrium. The response of TB to shocks in GDP is negative and appears to have transitory effects due to it going back to zero. The response of TB to shocks in exchange rate volatility is positive and appears to be permanent.

Appendix B shows results of how FDI responds to shocks in GDP, trade balance and exchange rate volatility. FDI responds to both shocks in GDP and exchange rate volatility positively. These shocks have a permanent effect on FDI. However, these permanent effects happen at different periods of time. The permanent effect to shocks in GDP only happens between the sixth quarter and the seventh quarter, while the permanent effect to shocks in exchange rate volatility happens between the fifth quarter and the sixth quarter. The FDI responds to shocks in TB in a negative way. Its response had transitory effects. In the third quarter it went back to zero and then later on the effects became negative again

Results of the impulse response of GDP to shocks in the other variables are shown in appendix C. The GDP responds to shocks in all the other three variables negatively. However, these negative effects were only transitory to shocks in FDI and shocks in exchange rate volatility. Results show that the effects from shocks in FDI went back

to its original value, zero, in the sixth quarter, while the effects from shocks in exchange rate volatility went back to its original value in the eighth quarter. The response of GDP to shocks in TB appears to have a permanent effect.

Lastly, results of the impulse response of exchange rate volatility to shocks in trade balance, GDP and FDI is shown in appendix D. Exchange rate volatility responds to shocks in Foreign Direct Investment positively. This effect appears to be a permanent one. The response of exchange rate volatility to shocks in GDP is also positive with a permanent effect. This effect becomes permanent in the fourth quarter. On the other hand, the response of exchange rate volatility to trade balance is negative and it appears to have a transitory effect. This effect returns to the value zero in the sixth quarter.

4.2.9 Forecast Error Variance Decomposition

The Forecast Error Variance Decomposition shows how much the fluctuation in GDP, FDI, and exchange rate volatility are caused by TB. ''This technique determines how much of the forecast error variance for any variable in a system is explained by innovations to each explanatory variable, over a series of time horizons'' (Stock and Watson, 2001:106 as cited by Sheefeni and Ocran, 2013, p.95). Table 4.8 below shows the results of Forecast Error Variance Decomposition for trade balance over the horizon of 10 periods.

Table 4.8: Forecast Error Variance Decomposition for Trade Balance

Variance Decomposition of TB				
Period	FDI	GDP	TB	V
1	0.035663	1.135274	98.82906	0.0000
4	1.422498	1.425751	96.64983	0.501920
6	3.237587	1.156896	93.34320	2.262321
8	4.758488	0.893717	88.75400	5.593798
10	5.840914	0.712080	82.97905	10.46795

Source: Values obtained from Eviews

Note: FDI denotes Foreign Direct Investment, GDP denotes Gross Domestic Product, TB denotes Trade Balance, and V denotes Exchange Rate Volatility.

As shown in Table 4.8, the forecast error variance decomposition in TB is 98.82906, having the highest share in the first period. It is largely attributed to itself in the first 6 quarters, with a share of 93.34320 in the sixth quarter. Afterwards, the variables FDI and V took a notable share in contributing to the fluctuations of TB. As shown in Table 4.8, FDI took a notable share of 4.758488 in the eighth period while V contributed by an amount of 5.593798 in the eighth period. Their contribution continued to increase as the horizon increased. In the tenth period, the contribution of FDI increased to 5.840914 while the contribution of V increased to 10.46795.

4.4 Discussion

In order to analyse the kind of relationship that exists between the exchange rate volatility and trade balance of selected countries in the SACU region, the selected variables had to undergo different tests. The first test that was done was to test for stationarity. All the variables were found to be stationary. Foreign Direct Investment is stationary in levels implying that it is integrated of order zero. While Gross Domestic Product, Exchange Rate Volatility and Trade balance are integrated of order one.

After testing the variables for stationarity, the Pedroni Residual Cointegration test was used to test for cointegration. The results indicate that there is no long-run relationship among all the four variables but a short-run relationship. This proves that the exchange rate volatility is sticky in the SACU region. From the Granger causality test results, trade balance can help in predicting GDP. This result is not consistent with any of the hypotheses of this study because it is not one of the objectives of this study. However, exchange rate volatility can help in predicting both TB and GDP. Exchange rate volatility been able to predict trade balance is consistent with one of the hypotheses of this study. Since these variables are characterised by a short-run relationship, it is difficult for firms to adjust production in order for them to maintain their profits.

Before using the GARCH model, the heteroscedasticity test was conducted. Among the four currencies, only the South African Rand and the Namibian Dollar have the ARCH effect. Therefore, these two variables were estimated using the GARCH model. After estimating the GARCH model, the results showed that there is a weak presence of volatility in the South African Rand while the Namibian Dollar has a

strong presence of volatility. For both currencies, the summation of the ARCH term and GARCH term was less than one. This implies that the volatility shocks are temporary.

The variables were also estimated using the E-GARCH model. The results showed that the leverage effects of both currencies are negative. This implies that there will be negative shocks which will cause high volatility in the model. When the asset prices reduce, stock of a company become riskier, hence they will become more volatile. This effect is generally referred to as been asymmetric. In other words, a fall in stock prices occurs with a larger increase in volatility compared to a fall in volatility which occurs when there is a rise in stock prices. Haas, Krause, Paolella, and Steude (2013) and Park (2011) as cited by Baur and Dimpfl (2017, p.3) state that the leverage effect usually increases volatility only in bear markets. An increase in this volatility will lead to negative returns in the future.

Once the GARCH model was estimated the impulse response functions and variance decompositions obtained from a VAR model were employed to check how trade balance responds to shocks of the other variables and how TB influences the other variables. Trade balance has a positive response to shocks in FDI and exchange rate volatility. The response that trade balance receives appears to be permanent after a period of time. On the other hand, responses to shocks in Gross Domestic Product are negative. Results also show that FDI and exchange rate volatility contribute to fluctuations in trade balance. Their contribution increases over time.

4.5 Summary

In this chapter, various tests were done and produced several results. Again, the analysis and discussion were undertaken in detail and produced the results that were obtained from estimating the variables of selected countries in the SACU region and such discussed respectively. It was found that exchange rate volatility and FDI influence fluctuations in trade balance and have a positive impact on it.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter concludes the study. In an attempt to conclude the chapter, the way forward is to set polices and end up being recommended for the SACU region. Finally, some areas that need to be considered for further studies are suggested.

5.2 Conclusion

This study was conceived around two objectives which are to analyse the kind of relationship that exists between exchange rate volatility and trade balance and also to determine the impact between exchange rate volatility and trade balance. In order to achieve these objectives, the GARCH model, impulse response functions and variance decompositions were applied.

The variables used were found to be stationary. After testing for stationarity, the variables were tested for cointegration. The findings show that there is a short-run relationship among the variables; exchange rate volatility, trade balance, foreign direct investment, and gross domestic product. Therefore, the alternative hypothesis for this study of an existence of a short-run relationship between exchange rate volatility and trade balance was accepted. This short-run relationship implies that exchange rate volatility in the SACU region is flexible. This may cause easy variation on the trade balance.

Currency depreciation in any of the SACU countries will cause an increase in their exchange rates. This will make exports in the SACU region cheaper and imports more expensive. Findings show that shocks in exchange rate volatility will improve

trade balance. This means that appreciation of currencies in the SACU region will deteriorate trade balance and lead to trade deficit. Therefore, depreciation in the short-run is expected to reduce trade deficits. With depreciation in the SACU region, it suggests that expenditure on domestic outputs (in this case output in the SACU region) increases, thereby, expanding the gross domestic product.

In determining the impact between exchange rate volatility and trade balance, testing for Granger causality was ideal for this study. Findings in this study show that trade balance can be predicted by exchange rate volatility in the SACU region. Whatever happens to exchange rate, it is possible to know what will happen to trade balance. For example, if exchange rate is devalued or increases trade balance will decrease. With a high increase in exchange rate the SACU region will predict a trade deficit, which is not good for the economy. This characteristic of predicting may help the economy decide on ways of overcoming the unwanted outcome.

Results on the estimation of the GARCH model and the E-GARCH model also show the impact between exchange rate volatility and trade balance. These findings show that the persistence of the presence of volatility shocks is both strong and weak. The strong persistence of these shocks was found in South Africa, while the weak persistence of these shocks was found in Namibia. These volatility shocks are negative and will cause high volatility, implying that asset prices have declined.

Results on the impulse response functions show that trade balance responds to shocks in exchange rate volatility positively, and that these responses become permanent overtime. On the other hand, responses of exchange rate volatility to trade balance are negative. In the first quarters it responds negatively and then responds positively. Once it becomes positive this response becomes permanent. Findings

from the forecast error variance decomposition indicate that exchange rate volatility contributes to fluctuations in the trade balance.

Overall, these test results prove that there is a relationship between exchange rate volatility and trade balance in the SACU region. There is a positive and negative impact between these two variables in the short-run.

5.3 Policy recommendations

Policies play an important role in simplifying decision making. This is very advantageous for policy makers. In the case of volatility ''International trade and investment decisions are much more difficult to make if the exchange rate value is changing rapidly'' (Suranovic, 2010, p.415). This may discourage investors from taking part in any of the international activities. In order to maintain these international activities and to manage fluctuations of exchange rate volatility, the central bank intervention methods have been used to help stabilize exchange rate volatility.

These intervention methods are currently been used by a lot of countries all over the world. Erdemlioglu, Laurent and Neely (2012) mention to say that central banks from the United States of America, Japan and German have intervened about 600 times from 1985 to 2004. In 2010, Goyal and Arora stated that Central Bank communication and intervention appreciates exchange rate volatility, while quantitative credit restrictions, higher interest rate differentials and policy lending rates depreciate exchange rate volatility. A study done by Chipili (2014) explains to say that central bank interventions should aim and focus on moderating the rate of change in exchange rate volatility and preventing undesirable fluctuations in

exchange rate. Chipili (2014) also shows that Zambia is one country that has its central bank intervene in the foreign exchange market. In this regard, the study recommends central banks in the member states of the SACU region to intervene in order to reduce exchange rate volatility.

With high volatility shocks in the SACU region, the central banks should intervene directly by buying their domestic currency in exchange for foreign currency. Once the demand for domestic currency increases its value will rise causing an appreciation. This will lead to a decrease in exchange rate volatility. If the SACU region decides to sell their domestic currency in exchange for foreign currency, exchange rate volatility will increase.

The SACU region may also use the indirect foreign exchange intervention method. This may be done by decreasing or increasing money supply in the economy. In order to decrease exchange rate volatility, the central banks should decrease money supply. If the central banks in the SACU region increase their money supply, then exchange rate volatility will increase. This method may take several weeks or more for its results to be shown.

Undergoing the central bank intervention methods mentioned above would mean that the SACU region should use 'The order-flow channel'. This is also known as the signalling approach which transmits private information into the foreign exchange market. It assumes that information is asymmetric. It is basically based on the idea that the central bank has more information compared to other participants in the market. This is because other participants in the market should present their transactions to the central bank. With this information the central bank may use it to shape the direction of the market. In a study, Erdemlioglu, Laurent and Neely (2012) gave an example of a business planning on revising its estimates of future demand

and building a new plant with a result of it gaining some profit. When the business decides to share its private information it then creates a channel whereby its news may affect volatility over a long period of time.

In order to avoid trade deficit and improve trade balance in the SACU region, the study also recommends that the government in the member states should implement the import-substitution policy. This policy focuses on the production of imported substituting goods.

5.4 Areas for further studies

With many macroeconomic variables (such as inflation and interest rate) affecting trade volume in the market, the study suggests that taking these variables into account when modelling exchange rate volatility against trade balance would be very important. This would give a more clear and complete picture on the relationship between exchange rate volatility and trade balance.

Determining the levels of exchange rate volatility is important for policy makers and economic agents that are involved in the financial market. Exchange rate levels play an important role in debt servicing and foreign investment flows (Huchet-Bourdon and Korinek, 2011). It would be important to study the monetary system in South Africa since it determines and affects the value of the rand which directly impacts all the participating countries that are found in the CMA (Nainda, 2014). Paying much attention to this would be helpful for policy makers to make rational decisions.

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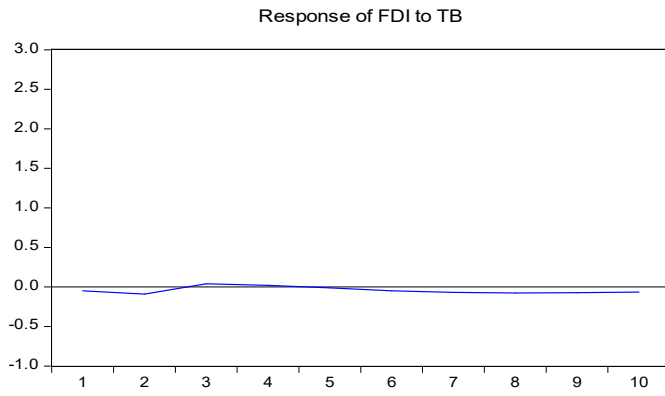
7. APPENDICES

Appendix A: Impulse response of Trade Balance (Response to Generalized One S.D Innovation)

Response of TB to FDI

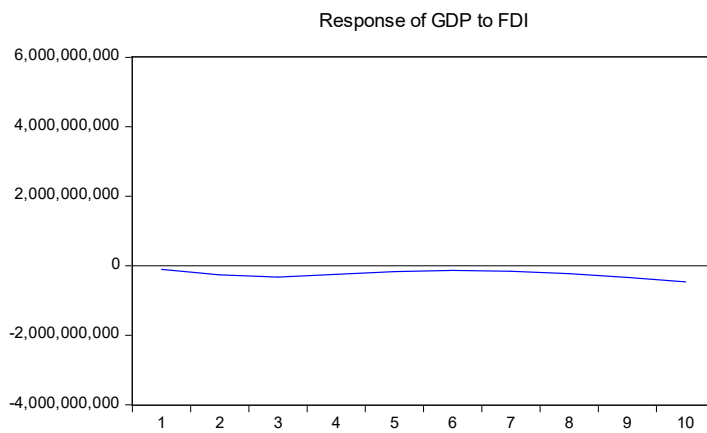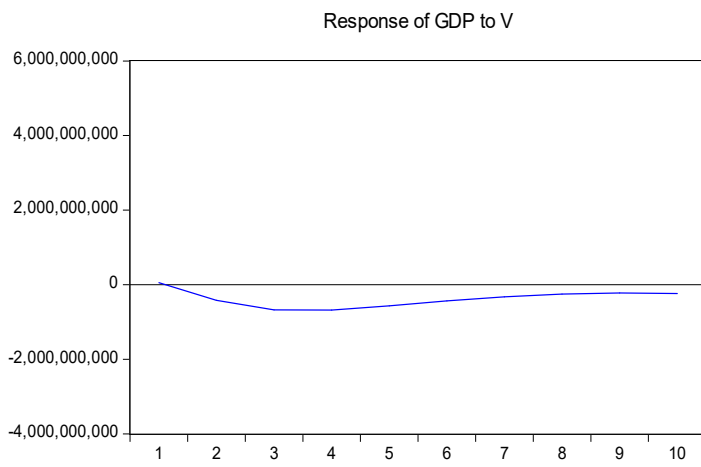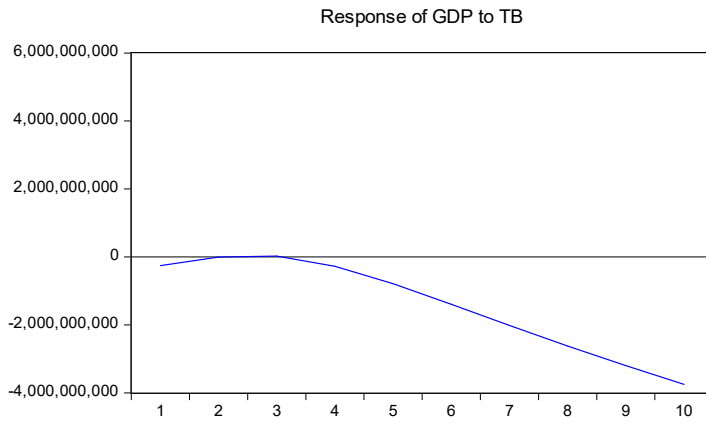Response of TB to GDP

Response of TB to V
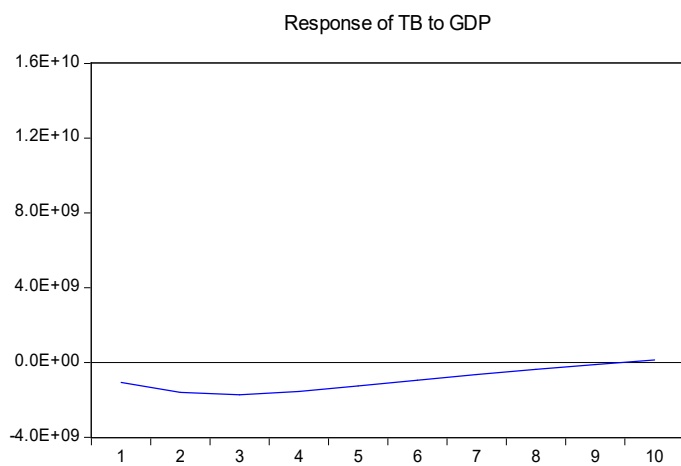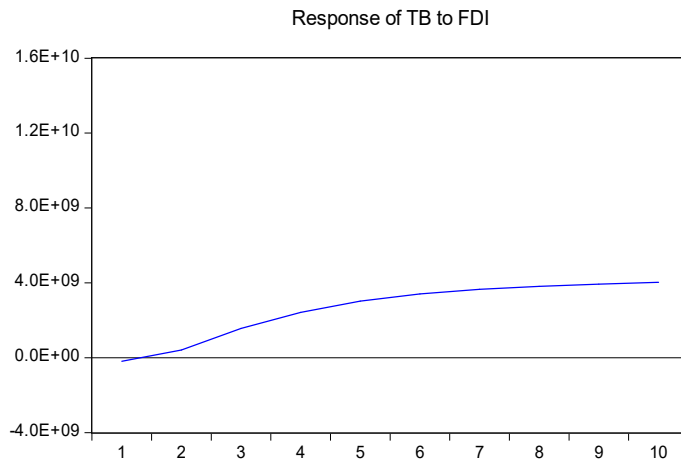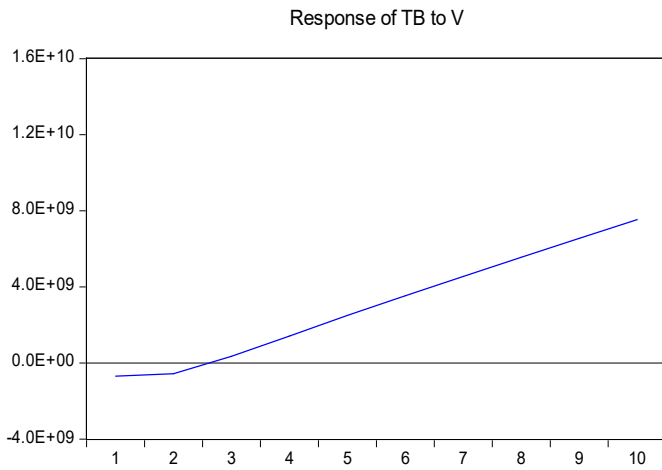
Appendix B: Impulse response of Foreign Direct Investment (Response to Generalized One S.D Innovation)
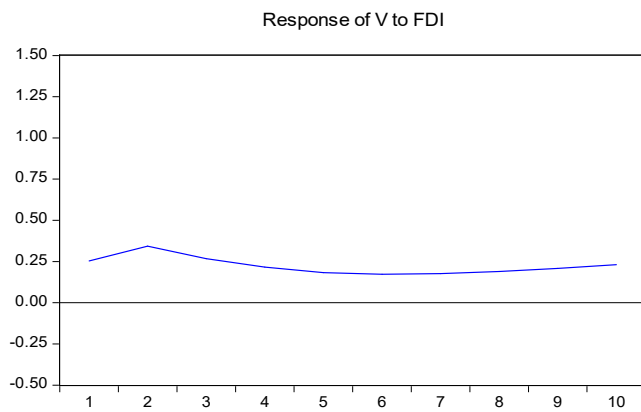
Response of FDI to GDP

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Response of FDI to TB

Response of FDI to V
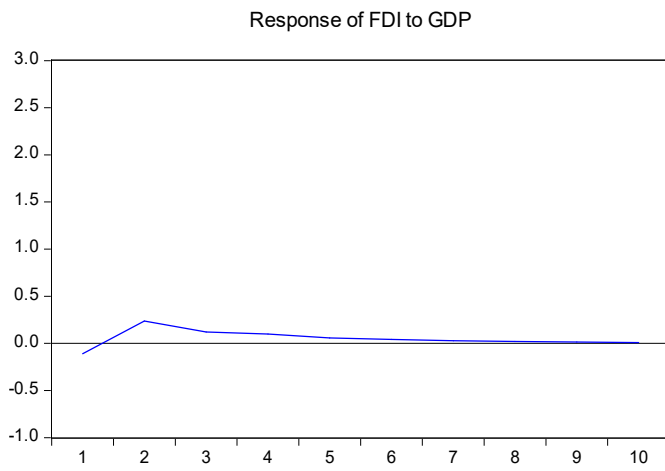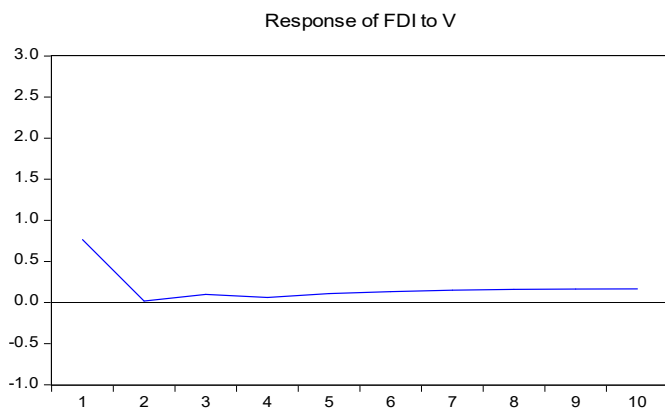
Appendix C: Impulse response of Gross Domestic Product (Response to Generalised One S.D Innovations)

Response of GDP to FDI

Response of GDP to TB
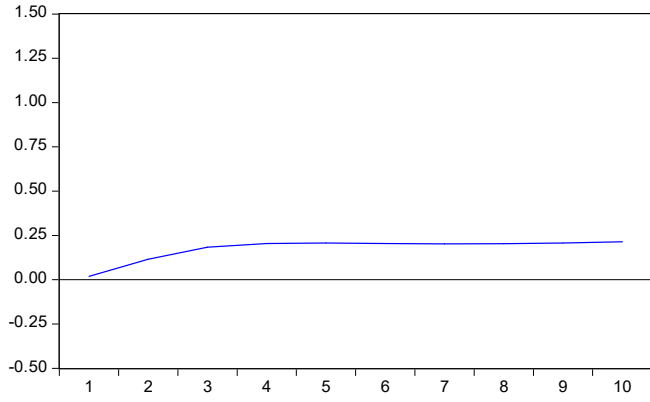

Response of GDP to V

Appendix D: Impulse response of Exchange Rate Volatility (Response to Generalised One S.D Innovations)

Response of V to FDI

Response of V to GDP

Response of V to TB