THE IMPACT OF REAL EXCHANGE RATE VOLATILITY ON UNEMPLOYMENT IN SOUTH AFRICA: (GARCH MODEL).

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Dissertation submitted in fulfilment of the requirements for the degree Bachelor of Commerce (Masters) in Economics at the (Mafikeng Campus) of the North-West University

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DECLARATION

I declare that *The Impact of Real Exchange Rate Volatility on Unemployment in South Africa:(GARCH) model."* is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Full names.. Date.................................

Signed.......................................

Signature... Date.................................
Supervisor

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DEDICATIONS

To my parents, Mr NN Matsebula and Ms T.F Sibiya, My Daughter Sphumelele Matsebula, her mother Adv. P Manyetsa, and my siblings, I dedicate this Masters Dissertation to you, I am grateful for your presence, support and motivation.

To Dr LNP Hlatshwayo, this project is dedicated to you. RIP Mhayise.

ABSTRACT

How macroeconomic models are relevant when pursuing the understanding of exchange rate has been doubted by a large portion of research since the beginning of the 1980 s. This dissertation investigates the impact of the real exchange rate volatility on unemployment in South Africa. Since the two variables are linked with the changes in output and price levels through the production function, this dissertation also covers theories that link the subjects with macroeconomic variables that cannot be ignored when analysing unemployment and exchange rates, such as economic growth, inflation, terms of trade and government expenditure. By so doing the study employs econometric instruments in measuring the relationship between the variables at hand. The Ordinary Least Square (OLS) technique will be used to get the model s numerical estimates. Argumented Dicky-Fuller stationarity test will be adopted for unit root testing and the Johansen Causality test will be used to test for the direction of causality between the variables. The vector error correction model is employed to examine the existence of a relationship amongst the variables. Finally the study incorporates the GARCH model to test volatility between unemployment and real exchange rate as well as the relationship between the variables. This study is intended to contribute to the growing body of research about South Africa s past experience with the problem of exchange rate volatility. The outcome may provide guidelines and lessons for South Africa.

The GARCH model test results indicate that unemployment is insignificant, as such non-volatile. It further suggests that there is an inverse relationship between unemployment and Real Exchange Rate. There is a significant positive relationship between GDP and unemployment. The economic theory however does not agree with these findings because an increase in GDP is expected to decrease unemployment. There is however a negative and significant relationship between unemployment and export and this happens to be theoretically correct. The study found a negative and statistically significant relationship between CPI and unemployment. These finding agree with the literature of Philips (1958) which means an increase in the level of export is associated with a fall in unemployment.

Keywords: Macroeconomic models, Real Exchange Rate Volatility, Unemployment, economic growth, GARCH Model, South Africa.

JEL Classification: A1, C12, C22, D53, G24, F31

LIST OF ACRONYMS

ADF	Augmented Dickey Fuller
ARMA	Auto Regression Moving Average
ARCH	Autoregressive Conditional Hecteroskedasticity
BoP	Balance of Payment
CPI	Consumer Price Index
CPIX	Consumer Price Index excluding mortgage interests
DF	Dickey Fuller
DW	Durbin Watson
ECM	Error Correction Model
ECT	Error Correction Term
EXPT	Net Exports
GARCH	General Autoregressive Conditional Hecteroskedasticity
GDP	Gross Domestic Product
GEPT	Government Expenditure
GFC	Global Financial Crisis
GIRF	General Impulse Response Function
IMF	International Monetary Fund
INF	Inflation
JB	Jarque-Bera test
LM	Linear Model
NDP	National Development Plan

NER	Nominal Exchange Rate
OLS	Ordinary Least Squares
P	Price
PP	Phillips Perron
PPP	Purchasing Power Parity
REER	Real Effective Exchange Rate
RER	Real Exchange Rate
SA	South Africa
SARB	South African Reserve Bank
SPMM	Sticky-Price Monetary Model
UNE	Unemployment
USA	United States of America
VAR	Vector Auto Regression
VECM	Vector Error Correction Model

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CHAPTER 1

INTRODUCTION

1.1 Introduction

One of the major economic crises that South Africa faces today is the issue of the persistent high rate of unemployment. According to the National Development Plan (NDP) (2011) the government s new growth path aims to create 5 million new jobs by 2020. The vision is to eliminate poverty and reduce inequality. To achieve all these NDP indicates that the economy must become more inclusive and grow faster. Sustainable growth and development will require higher, savings, investment and export. While on the other hand, the exchange rate volatility is also amongst the major economic challenges that policymakers are concerned with.

The exchange rate is one of the most important macroeconomic variable since it is particularly used as an instrument to determine competitiveness among countries internationally. It is being viewed as an indicator of currency competitiveness for any country and there is an opposite relationship between this competitiveness. Such that, the lower the value of the exchange rate in any country, the higher the competitiveness of the currency in that a country will be (Danmola, 2013).Basically, an exchange rate among two nations currencies is the rate at which one can be exchanged for the other. It is also observed as the cost of one currency in terms of another (Sheffrin, 2003).

However, it is important to distinguish between the nominal exchange rate and the real exchange rate, for the sake of clarity. The Nominal Exchange Rate (NER) is the number of units in a monetary concept, which measures the domestic currency that can purchase a unit of a given foreign currency. While the Real Exchange Rate (RER) is the amount at which the nominal exchange rate is measured and adjusted for differences in the inflation rate. It basically measures the relative price of two tradable goods in relation to non-tradable goods. (Black and Hartzenberg, 1995)

In this study the main research question is What is the impact of real exchange rate volatility on unemployment in South African? . In addressing this question the study will employ the vector auto-regression (VAR) to examine the existence of a relationship among the variables and the GARCH Model to test the Volatility.

1.2 Problem statement

South Africa s floating exchange system has resulted in problems of exchange rate instability. The high degree of volatile exchange rates has been a serious problem for policymakers since 1973, however in this case; the major concern is that not much research has been done to determine its impacts on unemployment.

South Africa like other countries have experienced an extensive contraction in the manufacturing sector, and later on suffered enormous unemployment as well, with trade experts claiming it was due to the rampant volatility and misalignment of dominant global currencies like the dollar (Devarakonda, 2012).

According to Obi, Ndou and Peter et al (2013), in an economy with high exchange rate volatility, exporting firms and the profit maximizing firms are not able to predict trade and income earnings because of the bigger risks which come with exchange rate instabilities. Obi et al (2013) further expresses that, the risk entailed by exchange rate volatility becomes a setback to the economies led by exports because the export price are affected which there after increase the risk and uncertainty of international connections.

According to Van der Merwe (1997) the level of exchange rate volatility like the one of South Africa is most likely related to the uncompetitive production and export structure of the country.

The pressing problem is that, South Africa s exchange rate volatility is very high and highly volatile exchange rate has a negative impact on a large number of economic variables which may lead to a setback on the country s economic growth. The volatility of the rand has shown evidence of being a danger to almost every aspect of the economy including the manufacturing industry as well as employment growth.

1.3 Significance of the study

For a country like South Africa where there are high and rising unemployment rates and the manufacturing sector not being at its best performance, understanding the relationship between exchange rate volatility and unemployment is important for the policy makers, and to the investment community who invest in its industries. Several studies such as Kyei and Gyekye (2011),Nyahokwe (2013) and Levinsohn (2008) have been conducted to investigate the determinants and causes of the increasingly high unemployment rate in South Africa and different results have been discovered. While other factors may explain the persistent high unemployment rate in South Africa, such as; the increase in labour supply in the past two decades, or the nature of economic growth, this study aims to investigate whether or not the Real Exchange Rate volatility has an impact on Unemployment in South Africa.

The South African currency is determined by demand and supply forces in the foreign exchange market, which is referred to as the floating exchange rate. This system has resulted to a volatile exchange rate in South Africa. Not much empirical studies have been done in South Africa that analyses the impact of the exchange rate volatility on unemployment together with the economic growth in South Africa.

Increasing uncertainty and volatility in exchange rates are known to have an effect on the profits of the firms, investments, economic growth as well as on international trade in all sorts of economies (Aizenmannand Marion, 1999). Belke andKass (2004) also express that volatile exchange rates is known for lowering investment in physical capital, which may then cause an increase in unemployment.

High unemployment means that the economy is not using all of the resources, specifically labour, available to it. Since it is operating below its production possibility frontier, it could have higher output if the entire workforce were usefully employed. This study can help get a better understanding the degree at which unemployment is impacted by exchange rate volatility.

Even though studies have been conducted but empirical evidence on the influence of foreign exchange market volatility on unemployment and economic growth in South Africa is inconsistent in a larger scale. In the light of the rather mixed result achieved by earlier studies, this study will take a deeper altitude of analysis to the discussion of exchange rates, unemployment and economic growth.

In addition, understanding the relationship between real exchange rates and unemployment is important from the point of view of policymakers. In order to address the issue of volatile real exchange rates, there is a need for an appropriate framework that serves as a reference point. This study is intended to contribute to the growing body of research about South Africa s past experience with the problem of exchange rate volatility. The outcome may provide guidelines and lessons for South Africa.

1.4 Research aims, objectives and research questions

1.3.1 This study aims the following;

- Investigate the long run relationship between Real Exchange Rate Volatility and unemployment rate.
- Review the causes and consequences of Volatile Real Exchange Rate and Unemployment in South Africa.
- To determine the direction of causality of the variables.

1.3.2 The objectives of the study are;

- Use the Vector Auto-Regression test to analyse the long run relationship between the variables.
- Critically evaluate economic theories on Real Exchange Rate and Unemployment, review empirical literature, as well as to compare such with previous/current studies, so as to identify existing gaps.
- The Granger Causality test will be used to analyse the direction of causality among the variables.

1.5 Hypothesis of the study

The research aims to survey the important evidence for the hypothesis that exchange rate volatility has a direct impact on unemployment in South Africa

- Null hypothesis H_0: Real Exchange Rate Volatility has no significant effect on Unemployment.
- Alternative hypothesisH_1: Real Exchange Rate Volatility has a significant effect on Unemployment.

1.6 Ethical consideration

There are no ethical considerations related to the involvement of human and animal subjects in my study.

CHAPTER 2

THEORETICAL PERSPECTIVE AND LITERATURE REVIEW

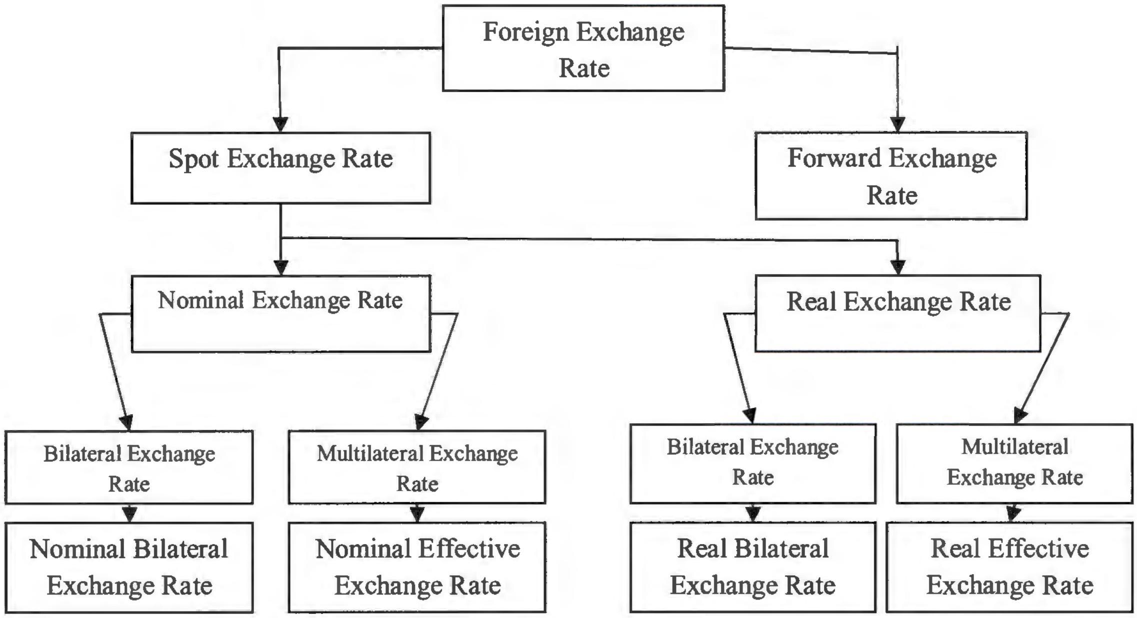
2.1. Introduction

This chapter will explore the detailed definition, causes and consequences of the two main variables under observation, which are Unemployment and Real Exchange Rate, review the theoretical and the empirical literature and finally the identification of gaps in the literature. Firstly is the detailed definition of Real Exchange Rate Volatility and its causes. Secondly is the detailed definition of Unemployment, the causes and consequences. This chapter will also look at the theoretical literature and it will mostly explore the following theories; the Basic Open Economy Model (IS-LM-BP Model), the Mundell-fleming Model, the Sticky-Price Monetary Model, Equilibrium Model and Liquidity Model, the Classical Theory of Unemployment and the Keynesian Theory of Unemployment. Finally the study will examine the empirical literature regarding the relationship between Real Exchange Rate Volatility, Unemployment and other variables.

2.2. Real Exchange Rate

The terms used as the measures of the rate of exchange in the foreign markets are somewhat tricky and can be confusing. As a result it is important to consider explaining all measures that can be used to measure foreign exchange rate in order to successfully define Real exchange rate. The following figure represents the respective measures of exchange rate used in economics;

Figure 2.2 Foreign Exchange Rate Framework



2.2.1. Foreign Exchange Rate

Bodie and Kane et al (1999) describe Exchange Rate as an obvious component affecting a country s industries competitiveness with other countries. They define Exchange Rate as the rate at which a domestic currency can be converted into another country s domestic currency, while Fourie and Burger (2010) describe Exchange Rate as the most important international price. They define it as the price which denotes the international value of exchange. For example, in March 2014, it took 10.6875 South African Rands to purchase 1 US dollar. This suggests that the exchange rate between South Africa and the United States is R10.6875 per Dollar, or rather US$0.0936 per Rand.

2.2.2. Sport Exchange Rate

Spot Exchange Rate one of the two exchange rate major types. It is defined as the conventional Exchange Rate used when immediately exchanging one currency for another (Copeland, 2008).

Fourie et al (2010) expresses that the spot exchange rate is basically a daily determined exchange rate for immediate currency trade transactions.

2.2.3. Forward Exchange Rate

The Forward Exchange Rate is the other major type of exchange rate after the Spot Exchange Rate. According to Copeland (2008), it is the rate used in contracts for exchanging one currency for another at a specific time in the future, usually within one and twelve months. On the other hand, Fourie et al (2010) defines it as the rate used for foreign exchange transactions planned to take place in the future, usually for used for the purpose of reducing uncertainty.

2.2.4. Nominal Exchange Rate

According to the Economic Times (2003), the Nominal Exchange Rate is the cost unit of one currency given in the unit number of another currency. The Nominal Exchange Rate is more or less similar to the Spot Exchange Rate. It is concerned only with the numerical exchange figures and does not cover factors like the purchasing power of the currencies.

In a fixed rate regime nominal exchange rate is determined by fiat and in a floating rate regime it is determined by the demand and supply of the currencies in question.

2.2.5. Real Exchange Rate

According to Fourie et al (2010), the real exchange rate is an adjusted rate of exchange that puts in to consideration aspects such as the difference between the two countries price levels and inflation. Copeland (2008) on the other hand defines real exchange rate as the foreign price relative to domestic good and service, alternatively the nominal exchange rate corrected for relative prices.

Defining the Real Exchange Rate is known to be somewhat complex due to a variety of factors. Hence most economist do not really know how to define or measure it, rather the correct definition is unknown. However because of the vast macroeconomic models used by economist, there are a number of definitions for Real Exchange Rate. Though, all the existing definitions of real exchange rate can be classified under two principal groups. All with the assumption each country has a single trading partner.

- The first group is based on the Purchasing Power Parity (PPP). According to the purchasing power parity the real exchange rate can be defined in the long term as the adjusted nominal exchange rate from the foreign price level ratio to the domestic price level. Known as the External Real Exchange Rate (Kipici and Kesriyeli, 1997). The Purchasing Power Parity states that the price of a basket of goods should be equated across countries when evaluated in a universal currency.
- The second group comes from the difference between goods which are tradable and those which are non-tradable. In this case Real Exchange Rate is defined as the domestic price ratio of tradable and non-tradable goods within the boundaries of a country. Described as the Internal Real Exchange Rate (Kipici et al, 1997).

Defining the external real exchange rate for a local economy can be done in relation to a single trading partner (Bilateral Real Exchange Rate) or in relation to an average of all the major trading partners (Multilateral Real Exchange Rate). The two types of Real Exchange Rate will be defined in details in the following section.

2.2.6. Bilateral Exchange Rate

Bilateral Exchange Rate is the type of exchange rate which relates to two countries' currencies. It is commonly used for computing an exchange rate which involves two currencies in a pair. The Bilateral Exchange Rates are usually the outcome of matching of demand and supply on financial markets, where in most cases the Reserve bank or Central bank acts as one of the sides of the relationship, where they are represented by their three letter symbols as well as the base currency at the beginning followed by another currency. For example ZAR/USD, in this case the South African Rand (ZAR) is the base currency. (Piana, 2001).

The Bilateral Real Exchange Rate is known to be the simplest to calculate amongst the external Real Exchange Rate indexes and it is used as a bilateral and also as a universal indicator of the external Real Exchange Rate in a case where a country belongs to a currency bloc or even when a country has a single dominating partner, as a result the bilateral Real Exchange Rate has been used broadly in empirical work, predominantly prior to the increased availability of high-powered personal computers facilitated the measuring of multilateral Real Exchange Rates (Hinkle and Montiel, 1999).

According to Hinkle et al (1999), the external bilateral Real Exchange Rate index in terms of a domestic currency *(BRERd)* between the domestic economy *(d)* and a foreign country *(f)* is given by the followingequation:

$$BRER_{dc} = \frac{E_{dc} = P_{Gf}}{P_{Gd}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2.1.$$

with (E_d) representing the nominal exchange rate index. This is defined as the units of a domestic currency per one unit of foreign currency P_{Gf} and P_{Gd} represent the foreign and the domestic general or aggregate price indexesrespectively. The subscript d_c is an indication that the Real Exchange Rate is given in terms of the domestic currency. A fall in the *BRERd,* index will result to a rise in the price or cost of domestic goods and services relative to foreign goods and services. The external bilateral real exchange rate index can equally be defined in terms of the foreign-currency, shown below:

$$BRER_{fc} = \frac{E_{fc} = P_{Gf}}{P_{Gf}} = \frac{1}{BRER_{dc}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2.2.$$

2.2.7. Multilateral Exchange Rate

The multilateral also known as the real effectiveexchange rate index (REER) it is the type of exchange rate which is used when considering multiple trading partners Rates (Hinkle et al, 1999).

According to Hinkle et al (1999), when describing exchange rates, the term "effective" has two common yet unlike meanings. Firstly, it means "weighted average," and the second and general meaning is the exchange rates which includes the effects of tariffs, subsidies, and other charges on imports and exports domestic prices.

The effective exchange rate, also known as the Trade Weighted Index, is considered to be a much more comprehensive way of analysing two currencies and is a multilateral exchange rate which is a weighted average of a collection of different currencies internationally and it normally used to see a good's overall view of a nations external competitiveness.The Multilateral exchange rate is designed to symbolize the weighted average of the different exchange rates with both domestic and abroad currencies with the foreign currency being the similar to that of nations share in trade, resulting to the term Trade Weighted Index.

The following equation shows the Real Effective Exchange Rate (REER) defined in terms of domestic-currency;

$$REER_{dc} = \Pi_{i=1}^{m} \left[E_{dci} P_{Gi}\right]^{wid} * \frac{1}{P_{Gd}} \text{..................................} 2.3.$$

where m denotes the number of trading partners and $\prod$ represents the product of the bracketed terms over the trading partners m, wid is the appropriate weight for each foreign country $i(i = 1,...m)$ and the sum of weights must equal one. The REER can equally be defined in foreign-currency terms, with is equation expressed as follows;

$$REER_{fc} = \Pi_{i=1}^{m} \left[\frac{E_{fci}}{P_{Gi}}\right]^{wid} * P_{Gd} = \frac{1}{REER_{DC}} \text{..................................} 24.$$

2.2.8. Nominal Effective Exchange Rate (NEER)

The Nominal Effective Exchange Rate (NEER) also known as the weighted nominal exchange rate of a currency is the type of exchange rate which is used to measure the average change of a currency's or a country's exchange rate as compared to all other currencies. Unlike nominal exchange rates, the Nominal Effective Exchange Rate is not determined for each foreign currency separately. Rather, it is a single number index that state what is happening to the value of the domestic currency against a whole basket of currencies. The nominal effective exchange rate becomes the real effective exchange rate in a case when it is adjusted for price changes (Weerasekera, 1992).

2.2.9. Real Effective Exchange Rate

The notion of real effective exchange rate (REER) is more than just measuring the weighted average of currencies to integrate the differences in inflation amongst trading countries. It basically integrates the concepts of Nominal Effective Exchange Rate changes together with the differences in inflation, with the sole intention of reducing the exchange rate indices by matching indices of relative prices.

The Real Effective Exchange Rate is basically the Nominal Effective Exchange Rate adjusted for price changes or for inflation differentials amongst the domestic country and the other nation included in the index. The Real Effective Exchange Rate is Rather multilateral than bilateral, since it is the exchange rate of multiple currencies.

2.3. Causes of Real Exchange Rate Volatility

The Real Exchange Rate is an important determinant of the capital account since it is the relative price of goods across different currencies. As a result, a change in Real Exchange Rate will have an effect in the traded goods competitiveness. According to Ickes (2004), there are two major causes of Volatile Real Exchange Rates.

A change in world relative demand for a country s goods (in this case we consider South Africa): Assume for some reason there were to be a shift in preferences, resulting to an increase in the total world spending on South African. This may be caused by the shifting of the private demand which would have taken place to the South African goods or because of an increase in government expenditure which its focus is on the goods. This would result to an excess demand for the South African goods, in the case of the current Exchange Rates.

In order for equilibrium to be restored, there should be an increase in the relative price of the local goods in connection to the foreign goods, as a result Real Exchange Rate must decrease and in real terms the South African currency has to rise or appreciate. This means that the South African Rand s purchasing power will increase relative to the foreign goods.

Change in relative output supply: Consider a situation in which there is an increase in the efficiency of a South Africa s output relative to foreign output, caused by a relative technology shock. With given quantity of capital and labour the South African output rises. As a result at unchanged world demand, there will be an excess supply of South Africa s output.

The positive supply shock causes a raise in the South African wealth, however not all of the raise in income will be spent on domestic goods. A potion will be spent on foreign goods. As a result there will be a larger increase in the supply of the goods than demand.

For equilibrium to be restored there must be a fall in the relative price of the goods; meaning that the exchange rate must increase and the Rand must depreciate in real terms. This appreciation in the foreign currency and depreciation in the South African Rand suggest that there has been a rise in the foreign currency purchasing power. Therefore, the relative productivity growth causes an appreciation in real exchange rate and depreciation in real currency value.

2.3. Unemployment

At a conceptual level, Unemployment occurs when someone who wishes to work cannot find employment. However, some authors, such as Fourie and Burger (2009) believe that before Unemployment is defined, the following aspects should be considered;

2.4.1. Whom to include in the labour force.
2.4.2. What is meant by being unemployed.

For the purpose of measuring unemployment, according to these two aspects, the population of the country is then divided into two; the economically active and the not economically active population. This then leads to two distinctive definition of unemployment, the strict definition and the extended definition.

Strict definition; the unemployed are only those who took specific steps to find employment in the preceding few weeks. (Fourie et al, 2009)

Extended definition; the unemployed are those who took specific steps to find employment in the preceding few weeks plus unemployed people who did not look for work, but say they are willing to work. And this group is known as discouraged workers. (Fourie et al, 2009)

According to the Department of labour (2012), unemployment means that factors of production or resources are not being utilized fully and when factors of production are not fully utilized, the growth in potential output of the country is affected.

Mankiw (2009) believes that, the fact that it takes time to match workers and jobs is one aspect that results to unemployment. The equilibrium model of the aggregate labour market has the assumption that all jobs and all employees are the same and, thus, that all employees are well suitable for all jobs equally. Say this becomes true and the labour market is at equilibrium, then unemployment would not occur as a result of a job loss: this is because; a laid-off employee would instantly find a new job at the market wage.

Mankiw (2009) further expresses that, in reality, employees have different skills and also their preferences are different, similarly, different jobs hold different characteristics. Equally important, the manner at which information about job applicants flows and how job vacancies are brought about, is not perfect, and the geographic mobility of workers is not quick.

Because, searching for a proper job requires time and aspiration, and this leads to the reduction in the rate of job findings. Without reservation, since different jobs need different skills and wages are different, unemployed workers may possibly turndown the initial job offer they receive. In this case frictional unemployment would be the unemployment caused by the time it takes the workers to search for a job.

2.4.3. Types of Unemployment

Structural unemployment: it occurs when an individual s qualification does not live up to the standards to meet the job responsibilities required by the employer. Structural unemployment also arises when the marginal revenue product of an individual falls short of the minimum wage that can be paid for a job done. The minimum wage can be regulated by law and or by the negotiations between management and unions (Beggs, 2012). On the other hand Riley, (2011) argues that Structural unemployment can also result to a situation of zero minimum wages. The degree to which structural unemployment occurs depends on the number of limitations. The higher the movement of workers from one job to the other, the lower structural unemployment becomes. Together with the mobility of labour, structural unemployment also depends on an economy s growth rate as well as the industry s structure.

According to Fourie et al (2009) it is a response to a structural change in an industry. An industry can shift from a labour-intensive to a capital intensive technology. This may result to a release in the surplus labour and structural unemployment being generated. Structural unemployment may also come about as a result of change in the tastes and preferences of the consumers. Certain goods or services may not be in demand due to technological advancements that might have taken place.

Frictional unemployment: It occurs when a person is out of one job and is searching for another. Time is generally required before that individual can get the next job, therefore, during this time, that person is frictionally unemployed. The frictional unemployment problem is minimized with efficient labour markets development, and there is almost zero time period of moving from one job to another. However, the problem of frictional unemployment can be aggravated by imperfect information (Reley, 2011)

The probability of getting employment is likely to be faster in more developed economies and as a result the probability of frictional unemployment is lower.

Frictional unemployment can also occur as a result of imperfect information in the labour market. For example, a person who is looking for a job for the first time may not be equipped with resources for finding a job and as a result remains without a job. Frictional unemployment also occurs in an organization, which stops hiring because they believe that they cannot find people who have the skills they require in their post, while in trueness such employees do exist (Mouhammed, 2011).

Cyclical unemployment: It takes place when the economy only requires fewer workforces. The Keynesian theory states that, cyclical unemployment occurs as a result of economic disequilibrium. This type of unemployment is called cyclical unemployment because it is unemployment that moves with the trade cycle. The labour demand rises with the boom of the economy, and also, when the economy goes through recession, the demand for labour contracts and the surplus is set free as unemployed labour force (Keynes, 1949).

According to Gupta (2004), Cyclical Unemployment can be a product of adverse supply and demand shocks. Adverse supply shocks occur in the form of falls in the labour force and capital inputs, increases in the costs of labour, raw materials, energy and supplies, tax rates and firms expected inflation, climate conditions and so on.

Some of these have a propensity to raise the cost of production, which, when other factors remain constant encourages firms to reduce their production. The others directly affect aggregate supply. Given the aggregate demand, the real income and employment decrease. This thereafter results in retrenchments and lay off workers (Gupta, 2004).

Seasonal unemployment: It arises from seasonal variations, for example due to changes in climatic conditions. As an example, farmers may be fully employed during cultivation, planting, weeding and harvesting times, but unemployed at other periods (Mwinga, 2012).

This type of unemployment is very common in South Africa due to effects of climatic and weather conditions on the agriculture and fishing sectors.

2.4.4. Causes of Unemployment

Wage Rigidity is one of the key factors that lead to unemployment. Which is defined as the situation where by wages fail to adjust to a level at which labour supply and labour demand is equal. In the equilibrium model of the labour market, the real wage rises or falls to the equilibrium level of labour supply and labour demand. But still, wages fail to maintain flexibility at all time. At times the real wage remains higher than the market-clearing level. (Mankiw, 2009)

Mankiw (2009) believes that Real-wage rigidity causes unemployment because, when the real wage is higher than the supply and demand equilibrium level, the labour supply quantity will be higher than the quantity demanded. As a result Firms must find a way to fairly distribute the scarce jobs amongst workers. Real-wage rigidity causes the reduction in the rate of job finding and increases the level of unemployment.

Wage rigidity can be caused by three main factors, namely; Minimum-Wage Laws, Efficiency wages and Monopoly power of unions;

Minimum-Wage Laws is act by government of preventing wages from falling to equilibrium levels causing wage rigidity. Minimum-wage laws bound firms legally. .i.e. firms are not supposed to pay their employees less than what the government has regulated as a lawful minimum wage.

For most workers, however, the minimum wage is not binding, since they earn wages above the minimum. Nevertheless for some workers, especially the unskilled and inexperienced, the minimum wage raises their wage above its equilibrium level and, as a result, reduces the quantity of their labour that firms demand. (Mankiw, 2009)

Economists believe that the minimum wage has its greatest impact on youth unemployment. The equilibrium wages of youth tend to be low for two reasons. First, because youth group is likely to be the least skilled and least experienced members of the labour force, they are more likely to have low marginal productivity. Second, the youth frequently take some of their compensation in the form of on-the-job training rather than direct pay(Mankiw, 2009).

Mankiw (2009) further stresses that, because of the minimum wage law, firms are forced to choose the number of workers to employ, even though labour supply exceeds demand, while on the other hand, it would be profitable for them to lower wages and hire more workers. As a result, the rate of job finding is reduced and the natural rate of unemployment is increased.

Efficiency wages theories: Its state that, a higher wage is more beneficial since it is more likely to result in higher output. These theories believe that: Higher wages lead to high worker productivity; the more the wage, the better the health and nutrition for workers therefore, they are more likely to work effectively. Higher wages reduces the rate of labour turn over - fewer workers quit because they are satisfied with their wages. High wages encourage workers to work effectively improves workers effort (Mankiw, 2009).
Monopoly power of unions

The wages for unionised workers are not determined by the market forces, i.e. labour demand and supply being at equilibrium. The wages of unionised workers are determined through collective bargaining of union leaders and firm management. In most cases, the result outcome is a wage rate that is above the equilibrium level. The firms therefore have to choose the number of workers to employ. Firms dislike unions; therefore they are likely to maintain high wage rates as a form of discouragement for workers to join unions. Collective bargaining is also an effective tool for employees to address other dissatisfactions, such as hours at work (Mankiw, 2009).

Unemployment can also come in a form of Structural, Frictional, Cyclical and Seasonal Unemployment, which have been just explained in detailed in the previous section above.

2.4.1. Consequences of Unemployment

Persistently high unemployment may create the following costs for individuals and for the economy as a whole:

Loss of income: Unemployment normally leads to a loss of income. In most cases a larger number of the unemployed experience a decline in their living standards and are worse off out of work. This results to a fall in spending power and an increase of number of people who fall into debt problems. For example, the unemployed may find difficulties in keeping up with their mortgage repayments and other day to day expenses (Riley, 2011).

Negative multiplier effects: The closing of a local factory resulting to the loss of hundreds of jobs can have a large negative multiplier effect on the economy as a whole. One person s spending is another s income as a result to eliminate well-paid jobs can result to a fall in demand for local services, downward pressure on house prices and second-round employment effects for businesses supplying the factor or plant that closed down (Nichols, 2012).

2.5. Theoretical Literature

2.5.1. Basic Open Economy Model (IS-LM-BP Model)

The Open Economy Model focuses on how macroeconomic concepts can have an effect on the output levels and prices, which is basically growth and inflation. The production function links the changes in unemployment to the changes in output levels. The exchange rates on the other hand are equally significant in the open economy model because it is connected with output and price changes which are as the result of the changes in fiscal and monetary policies.

The standard open economy considers the effect trading has on goods which are in the current account and assets traded which are variables in the capital account. The open economy model also considers the rising demand for export goods as well as import goods.

In the open economy total expenditure is denoted by ⍰+I+G+NX; where NX represents the net export which is measured by subtracting the level of imports from the level of exports. The exports (X) represent foreign expenditure on the domestic goods which causes an increase in domestic output levels.

In order to reach the level of domestic output demand, which increases as foreign countries spend more on local products, there should therefore be an increase in the employment of the factors of production such as labour, which will then decrease unemployment. Imports (X) in this case denote the local spending on foreign goods, in so doing the level of local production falls. When analysing the impact exports and imports have on the equilibrium level of output, it is highly essential to consider and evaluate major factors such as the real exchange rate and employment or unemployment levels which are determinants of exports and imports.

Foreign demand for domestic goods and services is represented by that country s export. The purchases of goods and services by outside countries depend on their income levels, together with other variables, just as the domestic purchases of goods and services depend on the local income levels. It is assumed that the income levels for foreign countries are constant; as a result, the demand for the amount of local goods by outside countries is also constant.

Whether the foreign countries purchase local goods, or buy goods from some other countries, or just their own goods, depends on those goods relative prices. If the local relative price is low, there will be more of our goods being purchased by foreign countries. The exchange rate then comes in as an indicator of the relative price of the local goods to foreign countries.

The impact that the trading of goods and services have on the economy, is that the IS curve must be specified for a given exchange rate. The IS curve still describes the combinations of nominal interest (*i*) rate and income (*Y*) for which the level of total spending is equal to the level of production, however, to add on, to being determined by the interest rate, total spending is also determined by the exchange rate; this is because the exchange rate has an effect on the level of net exports (NX). Under a fixed exchange rate regime, the IS curve is fixed, however not if the government changes its spending behaviour or tax rates. In the case of flexible exchange rate regime, the foreign exchange price constantly changes to insure that the demand and supply of foreign exchange is equal. This then result to changes in the domestic price of the foreign currency.

If the domestic price of the foreign currency is weaker than the local one, whenever there is a change in the domestic price of foreign currency, the IS curve shifts. If it increases (meaning that the domestic currency depreciates), local export increases, foreign exports decreases, therefore, there will be a rise in net exports (NX) in, which suggest that there has been a rise in total expenditures, as a result the will IS curve shift to the right; suggesting that local unemployment has fallen since production increased. If the domestic price of the foreign currency decreases (meaning a depreciation in domestic currency), local exports will decrease while foreign exports rise, therefore the net exports (NX) will decrease and the IS curve will shift to the left; meaning that unemployment has increased.

The following section focuses on theories of Exchange Rate. The theories of exchange rate analysed in this study are; the Mundell-Fleming Model, the Sticky-Price Monetary Model and the Equilibrium Models and Liquidity Models.

2.5.2. The Mundell-Fleming Model

The Mundell-Fleming model was initially pioneered by Robert Mundell and Marcus fleming independently. This Economic Model is basically an extension of the IS-LM model. Unlike the original IS-LM model which describes a closed economy, the Mundell-Fleming model deals with an open economy.

The Mundell-Fleming Model shows the relationship between exchange rate, interest rate and output in an economy over a short run. It was developed on the bases of the following equations:

- The IS Curve;

$$Y = C + I + G + NX \text{......................................} 2.1.$$

where Y represents Gross Domestic Production (GDP), C is consumption, I is the physical investment, G the government expenditure and NX represents net exports.

- The LM curve;

$$\frac{M}{P} = L(i, y) \text{...} 2.2.$$

where M denotes the nominal money supply, P represents the price level, L is liquidity preference, i represent the nominal interest rate and y is the income (GDP). A lower income level (Y) or higher interest rate (i) will result to less money demand.

- The Balance of Payment (BoP) Curve;

$$BoP = CA + KA \text{..} 2.3.$$

where BoP represents the balance of payments surplus, CA represents the current account surplus and KA denotes the capital account surplus.

- IS component

$$C = c(Y - T(y), i - E(\pi)\text{...}2.4.$$

where $E(\pi)$ represents the expected rate of inflation. The lower the real interest rate or the higher the disposable income result to high consumption spending.

$$I = I(I - (\pi), Y - 1)\text{...}2.5.$$

Y-1 represents the GDP in the previous period. A high lagged GDP or a lower real interest rate (i) result to the increase in investment spending.

$$NX = NX(e, Y, Y^{*})\text{...}2.6.$$

In this case *e* represents nominal real exchange rate and Y^{*}denotes the combined income of the foreign trading partners. If the domestic income (GDP) is high, then there will be high expenditure on exports. A high income of the foreign trading partners will lead to an increase spending by the foreign economies on local goods which will increase net exports.

Basically in the Mundell-Fleming model, the objective of the Real Exchange Rate is to discover the structure of consumption between locally produced commodities and those which are produced in foreign countries. For the purpose of paying detailed attention on employment level policies, the Mundell-Fleming model assumes unemployed resources, constant returns to scale as well as the fixed money wages rates; this suggests that the domestic output supply is elastic and has a constant price level.

Mundell (1963) further assumes that there will be an increase in savings and taxes relative to the rise in income, the trade balance is determined only by income and the exchange rate, that investment depends on the interest rate and also assumes that money demand is only determined by income and interest rate.

One of the basic assumptions of the Mundell-Fleming Model is that the domestic country and its trading partners specialise on producing a single commodity and all these goods are traded amongst across these countries and these goods do not perfectly substitute each other (they are imperfect substitute products). As a result the Mundell-Fleming model is a good model to economies that focus more on manufactured products instead of raw material or primary goods; this is because manufactured goods are usually imperfect substitutes of goods which are produced by the rest of the world. Because of the production specialisation assumption, the model leads to the real exchange rate going along with the terms of trade of the economy, despite the reality that the two concepts are not the same.

Even though the Mundell-Fleming model is not applicable for economies with an export market which its goods are not manufacturing sector based, the real exchange rate in this model determines the locally produced good s aggregate demand and also determines the trade balance of the economy.

2.5.3. The Sticky-Price Monetary Model

The sticky-price monetary model (SPMM), originally pioneered by Dornbusch (1976), allows the nominal and real exchange rates to shoot over and above their long-run equilibrium levels. In model it is assumed that the system has jump variables exchange rates and interest rates compensating for possible sticks in other variables notably goods prices. Consider the effects of a cut in the nominal domestic money supply. This means that the is initially a decrease in real money supply followed by an increase in interest rate which occurs so as to clear the money market. This is due to the habit of prices being sticky in the short run. There is then an increase in capital inflow accompanies by rising nominal exchange rates which comes as a result of the rise in the domestic interest. Equilibrium in the short run is reached when the expected rate of depreciation happens to be equal to the interest rate differential, While in the medium run, domestic prices start falling responding to the fall of the supply of money. This then increases the real money supply in the money market and a fall in domestic interest rates begins occurring. Then towards the long-run purchasing power parity the exchange rate will slowly begin to decline. Therefore, this model explains the depreciation in the exchange rate for countries whose interest rates are relatively high:

The first interest rate result to an intensive appreciation of exchange rate, then as prices change, a slow depreciation comes next. This happens on an on until the satisfaction of the long-run purchasing power parity. This whole process can be expressed in a three-equation structured model continuously, with domestic income and foreign variables held constant:

$$\overline{S} = i - i^{*} \ldots\ldots\ldots\ldots\ldots\ldots 2.7.$$

$$M = P + k\overline{y} - \theta i \ldots\ldots\ldots\ldots\ldots\ldots\ldots 2.8.$$

$$\overset{*}{P} = Y[\alpha + \mu(s - p) - \overline{y}] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2.9.$$

With this system it is assumed that output is fixed for simplicity because it is mostly at its long-run equilibrium. The first equation denotes the unknown condition of interest parity shown as time continues and also using absolute equivalence motivated by the model s log-linearity. The second equation represents the conditions of the domestic money market. However in this case the domestic prices cannot be normalized at zero. A change in the nominal exchange rate may still have an effect on the domestic price level. This is then considered part of the effects on prices resulted by the third equation.

The third equation comes instead of the movements in aggregated output equation. Thus, it is the assumed that aggregate demand in the function of an autonomous variable, α and a component that depends on international competition which can be considered as net exports demand.

2.5.4. Equilibrium Models and Liquidity Models

Equilibrium exchange rate models originally developed by Stockman (1980) and Lucas (1982) are used to analyse the general equilibrium model amongst two-countries by maximising the expected present value of each respective form of utility, focusing on the budget constraints and cash in advance constraints. Importantly, the equilibrium models are actually an extension or rather a generalisation of the flexible-price monetary model that allows real shocks across countries and multiple traded goods.

To simply understand the Equilibrium Model consider a world with two countries, over one period and two goods where there are flexible prices and the market is at equilibrium, just as in the flexible-price monetary model, however in this case being the total opposite to the monetary model since a distinction is only made amongst domestic and foreign goods in terms of preferences.

Further assume that all agents whether foreign or domestic are of the exact or similar homothetic preference and also that all households in both countries have the same amount of wealth and the fraction of their wealth is exactly the same in any firm s stock.

The nominal money supplies in both foreign and domestic countries are exogenous, marked at a fixed point by the government of both countries. However the foreign and domestic money demand is equal to:

$$\frac{M^d}{p_x} = \Xi \quad \text{.......} 2.10$$

$$\frac{M^{d*}}{p_{Y*}} = \Xi^* \quad \text{.......} 2.11.$$

where $P_x(p_{y*})$ represent the nominal price of the two goods, while $\Xi(\Xi^*)$ depicts the amount of the two currencies demanded, measured by goods (x and y), which is the real demand for money. The market is at equilibrium where the money demanded is equal to the money supplied.

The next section outlines theories of Unemployment, namely the Classical Theory of Unemployment and the Keynesian Theory of Unemployment.

2.5.5. Classical Theory of Unemployment

Classical economic theory of unemployment, as analysed by Pigou (1933) and Solow (1981), argues that the labour market consists of demand and supply of labour. Demand for labour is a derived demand, obtained from the declining portion of the marginal product of labour.

The demand curve is a negative function of real wage in that if wages increase the quantity demand for labour will decline and if wages decrease the quantity demand for labour will increase. The supply of labour is derived from worker's choice whether to spend part of time working or not working. Supply of hours worked is a positive function of the real wage, because if the real wage rises, workers supply more hours of work. In equilibrium, demand and supply of labour are intersected at a clearing point that determines the equilibrium real wage rate and full employment

The classical theory of unemployment is known to be a simple and obvious theory. According (Keynes 1949), classical theory of unemployment is based on two central postulates, however, practically without discussion.

These postulates are: Wage is equal to the marginal production of labour; this means that, the wage of a person who is employed and the cost of value which can be lost if employment could be reduced by a single unit (avoiding any cost that can possibly be avoided by this reduction). However, this is subject to the qualification that, there may be a disturbance in equality, according to certain principles, if markets and competition are not perfect.

The utility of a wage when a given volume of labour is employed is equal to the marginal disutility of that amount of employment; This means that, the real wage for someone employed is the one which is just sufficient to increase the volume of actually employed labour to be forthcoming. However, this is subject to the qualification that there may be a disturbance in each single unit of labour equality by combination between employable units analogue to the imperfections of competition that qualify the first postulate.

Keynes then expresses in addition that, disutility must therefore be considered to cover every kind of reason that will result to a person withholding their labour or skills instead of accepting a wage that they consider to have a utility below a certain minimum. This stipulate is related to frictional unemployment. In reality, this allows may inconsistencies of adjustments which discourage the continuation of full-employment. For example, unemployment as a result of a temporary want of balance between the relative quantities of specialised resources due to intermittent demand.

Adding on frictional unemployment, the postulate is also related to voluntary unemployment as a result of unit labour refusing or being unable, due to a slow response to change, or a just human obstinacy, or legislation, to accept to be rewarded corresponding to the product value attributable to its marginal productivity.

However these two categories (frictional and voluntary unemployment) are comprehensive. The classical postulates do not accept the likeliness of the third category, which Keynes defines as involuntary unemployment.

Subject to these qualifications, the aggregate of the resources employed are suitably determined, in accordance to the classical theory, by the two postulates. The first stipulate illustrates the demand schedule for employment, the second one provides the supply schedule; and the employment value where the utility of the marginal product balances the disutility of the marginal employment is fixed.

2.5.6. Keynesian Theory of Unemployment

Keynes (1949) doesn t agree with the Classical theory, In fact the easiest way to understand the Keynesian theory is to understand the arguments Keynes gave for Classical theory being wrong. In reality the Keynesian theory argues that markets will not automatically lead to equilibrium of full-employment, but in fact the economy could settle in equilibrium at any level of unemployment.

This means that Classical policies of non-intervention will not work. The economy will need prodding if it was to head in the right direction, and this means active intervention by the government to manage the level of demand.

Keynesian theory can be illustrated in a form of the circular flow of income. Say there was disequilibrium between leakages and injections, classical theory claims that prices would rise or fall to restore the equilibrium.

Keynes (1949), on the other hand, states that the level of output would adjust. For example, if there was, for some reason, an increase in injections, say maybe an increase in government spending. This would mean that leakages and injections will not balance. As a result of the extra aggregate demand firms would employ more people.

This result to more income in the economy, some of which would be spent and some saved. The extra spending would alert the firms in the economy to increase production, which result to an increase in employment and therefore even more income. This process would continue until it stops.

It would eventually stop because, each time income rise, the level of leakage also rises. Once leakages and injections are equal again, equilibrium is restored. This process is called the Multiplier effect.

According to Keynes (1949), the classical economists acknowledged only the possibility of frictional unemployment and that of voluntary unemployment. Keynes (1949) further accepts the significance of involuntary unemployment, however denies its place in the classical scheme of things.

The frictional unemployment concept is related to the loss of time amongst jobs, and brings no hardships. Voluntary unemployment is unemployment that is as a result of a unit labour being unable or refusing to accept a return equal to the value of the product derivable to its marginal productivity. However, is used in such manner as to entail the addition to this definition of the circumstance that the wage offered must not be below what the employee observes as appropriate minimum rate of wages.

While on the other hand, if workers turndown available employment because of wages being below minimum level, or if employed workers refuse to allow a certain rate of money to be reduced from their wages, and this result to unemployment on their part or for other because of the refusal, this is then what Keynes regard as involuntary unemployment, however, does not accept its probability.

Keynes (1949) argues against the Classical theory of employment. He poses a central question, which is: can the Classical theory explain that, in reality, at any particular wage level there are constantly those who would like employment, but are failing to find one?

Keynes generally argues, attribute involuntary unemployment to wage rigidity, or an agreement between themselves to decline to work and be paid a lower wage. That is, there is something preventing wages from declining to a level where all those are willing and able to work would be employed, less those who are frictionally unemployed. Keynes (1949) expresses two arguments contrary to this claim, one which is casual and the other fundamental.

Firstly, nominal wages and real wages are not necessarily equal, in the logic that the supposed market clearing wage and the marginal productivity of labour are attached. For instance, despite the fact that a fall in nominal wages may result to definite number of employees to leave the labour market, out of protest, these same employees may not necessarily react the same way if an increase in prices result to a reduction in their real wage.

This might raise the following question: How do employees choose their own reservation wage, as far as real wages or nominal wages are concerned?

Keynes (1949) also does not support the claim that cyclical unemployment is largely caused by the employed works refusing to accept lower wages. He argues that, in practice, wide variations in the volume of employment occur, regardless of the fact that there is change neither in the minimum real demands of labour or in its marginal productivity.

Keynes also notes that there is an inversely direct relationship between nominal and real wages, in the sense that a rise in nominal wages will result to a fall real wages, and the opposite case is also true.

Secondly, the fundamental critic Keynes (1949) makes is that, He notes that the Classical theory of employment second stipulate originates from the understanding that real wages are discussed and agreed upon by the employee and employer. Generally all wages are money wages, and a reduction in the nominal wage will result to a decrease in the real wage. Therefore, real wages usually fall to the marginal disutility of labour.

Keynes (1949) expresses that, if the classical theory of value is adopted, in which the labour price is the primary determinant of the price of the good, change in nominal wage will result to change in real wage uniformly, until there is no change in the ratio among the two variables. By this, Keynes means suggests that, there is no way the general labour can adjust its nominal wage to be equal to the productivity of labour.

Keynes (1949) would rather have the Classical school characterization in the following way; Real wages = the marginal disutility of those current employed; There is no such thing as involuntary unemployment, strictly speaking; and Supply creates its own demand.

Keynes (1949) also expresses that, a certain amount of labour employed by a particular entrepreneur involves him in two kinds of cost or expense: firstly, the price he pays for the factors of production (ignoring of other entrepreneurs) for their services currently, which Keynes calls the factor cost of the employment; and secondly, the amounts paid out by that entrepreneur to other entrepreneurs for what he has to buy from them together with the costs which he obtains by employing the equipment instead of leaving it unused, which Keynes refers to as the user cost of the employment in question.

The balance of the value of the arising output over the value of its factor cost and its user cost is the profit or, the income of the entrepreneur. The factor cost is, similar to what the factors of production regard as their income, if it is looked at from the entrepreneur s point of view. Therefore the factor cost and the profit make-up of the entrepreneur, defined as the total income resulting from the employment given by the entrepreneur.

The entrepreneur s profit is therefore defined as the quantity which he aims to maximise when he is deciding what amount, of employment to tender. Keynes then concludes that, it is sometimes acceptable, when it is looked at from the entrepreneur s perspective, to call the aggregate income, resulting from a specified amount of employment the interest of that employment.

On the contrary, the aggregate supply price of the output of a given amount of employment is the expectation of interest which will be at the best interest of the entrepreneurs to give that employment. Furthermore, in a given circumstance of resources, technique and employment s factor cost per unit, the amount of employment, in each single firm and industry and in the aggregate, depends on the value of the interest that the entrepreneurs await to get from the opposite output. Entrepreneurs will aim to fix the value of employment at the level which they expect to increase to maximum the balance of the interest contrary to the factor cost.

2.6. Empirical Studies

Despite the fact that there has been somehow a large scale of empirical studies that have been carried on real exchange rate, very little studies have been conducted on impact of real exchange volatility on unemployment or employment especially in the case of South Africa.

Demir (2010) analyse the impact of real exchange rate volatility on employment growth in Turkey. In the study the author employed different specifications and estimation techniques in analysing the subject. He did this study with a focus on a group of private firms that made a total of 26 per cent of the total value added in the manufacturing sector over 22 years, from the year 1983 to 2005. His findings were that real exchange rate volatility plays an important role in causing employment effect on manufacturing firms. He further holds that theoretical models that connect volatile exchange rate and investment that encourage the connection between volatile exchange rate and employment find uncertain outcomes depending on the given assumptions such as irreversibility problem and production technology; he however declares that the most of the available empirical studies suggests certain positive and negative correlation from volatility and ambiguity to investment.

Raimundo (2008), while investigating the relationship between unemployment and real exchange rate in Latin America, developed a general equilibrium analytical framework which came as an extension of former models so as to include labour markets distortions. This analytical model brought about a theoretically consistent measure of the external equilibrium which generated a single equation framework allowing a clear measurement of the elasticity of determinants of the real exchange rate equilibrium. The study discovered that changes in unemployment have little effects on the equilibrium Real Exchange Rate. 6% rise in the Latin America s unemployment would result to 10% appreciation in Real Exchange Rate between 1990 and 2002.

While on the other hand, Izquierdo et al (2007) find that in countries with high degrees of trade openness, real exchange rate depreciation increases employment growth. In their study they use a panel data analysis to test if real exchange rate fluctuations cause a significant impact on employment and whether the impact differs with the level of trade openness and liability dollarization in 9 Latin American countries.

Their argument is that high openness in financial markets means that the is an exposure of emerging market economies to big swings in capital flows, as well as that these swings result to large fluctuations in real exchange rate which have important micro and macro-economic implications.

Danmola (2013) examine the impact of exchange rate volatility on the macroeconomics variables in Nigeria. He Identified that exchange rate has a positive impact on Nigeria s Gross Domestic Production, Foreign Direct Investment and Trade Openness, however, a negative impact on the country s Inflation rate. In the study, the author utilized the Ordinary Least Square (OLS), Correlation Matrix and Granger Causality Test in his study and concluded that increasing domestic production in Nigeria will help eradicate economic problems that come as a result of volatile exchange rate. However the study didn t explain how other macroeconomic variables which have a direct relationship with Gross Domestic Production, such as Employment rate, can be influence by volatile exchange rate.

Dorbusch (1989) analyse the differences in real exchange rate volatility between a group of both industrialised and developing countries. The study discovers that in developing countries there is a high rate of real exchange volatility as compared to industrialised economies. He further expressed that volatility is three times higher in developing economies than in industrialised economies. However, it doesn t really clarify the reasons for the existence of such differences in volatility amongst the developing and industrialised economies. Aydin (2010) analyses the impact of volatile exchange rate in 182 countries over 35 (1973-2008). In his study he analysed panel data and discovered that the changes in the way that macroeconomics fundamentals influence the equilibrium real exchange rate differs in sub-Saharan countries as to that in less advanced countries.

Burgess and Knetter (1996) examine how employment responds to exchange rate shocks at industry level. The study employs a non-linear least square estimation method analysing the subject matter for the G-7 countries over an annual period of 29 years from 1960 to 1989. They discovered that Exchange Rate has no impact on employment, at least not in the manner at which they had expected. According to these authors, the adjustment speed in the countries in question, respond to the change in their market structure and labour market regulations. Countries which are mostly affected by the shocks and faster to adjust to adjust to equilibrium in the long-run are Japan, the United Kingdom, Canada, Italy and the United States, while Germany and France adjust slower to long-run equilibrium and are not affected by exchange rate shocks at a larger scale. This is somewhat explained by the different pricing to market practices, these prices may result to changes of exchange rate on export prices. They concluded that too little pricing to market by the United State exporters clarify employment s sensitiveness to the changes of exchange rates in the United States than in Germany.

Koren (2004) examine the employment response to the real exchange rate for Hungarian firms. He discovered that the relative importance of the demand and cost effect was highly industry specific in the Hungarian firms. However the overall exchange rate effect on labour demand was vague. Frenkel (2004) examine the effect of changes in the real exchange rate on employment in Argentina in three developing economies (Brazil, Chile and Mexico). He discovered that on average for these three economies, when the real exchange rate increases by 10 per cent will result to a 5.6 per cent increase in the unemployment rate over a two year period. He further discovered that when using the ordinary least square (OLS) regressions the same findings of real exchange rate is associated with a 6 per cent increase in unemployment per annum.

Nyahokwe (2013) did a study of almost a similar nature as the one being done here. Like our study Nyahokwe (2013) analyse the impact of exchange rate volatility in South Africa. The author used quarterly data dating from year 2000 to 2010. The study further analyses the dynamic adjustment of unemployment rate following shocks to its determinants.in the study, the author uses the cointegration and vector autoregression (VAR) and the GARCH model as well as analysis with impulse response and variance decomposition analyses to test for long-run effects and short-run changing effects on the unemployment rate, the other variables that the author uses as explanatory variables are; Exports, Real Interest Rates, and Gross Domestic Product. The findings were that the exchange rate volatility has a statistically and economically significant impact on employment. Further outcomes were that out of all the determinants of unemployment analysed in the study, real exchange rate and exports were the variables which significantly explain the variation in the unemployment, with a larger portion explained by real exchange rate. According to Nyahokwe (2013), an increase in real exchange has adverse effects on employment. A stable currency result to easy business predictions and also reduces ricks as a result a stable real exchange rate is good for trade.

This study aims to review and cover the gaps that literature, such as that of Nyahokwe (2013), leaves out. In order to do so, this study looks at the impact of Real Exchange Rate Volatility on Unemployment in South Africa, with Gross Domestic Production, Net Exports, Inflation, Government Expenditure and Real Effective Exchange Rate as the explanatory variables. The study uses quarterly data from 1995 first quarter to 2014 first quarter, this helps broaden the perspective to which the subject matter is look as, as also add on to literature.

CHAPTER 3

METHODOLOGY

3.1. Introduction

This chapter explains the different techniques that will be used in analysing the data being tested in the study and also elaborate on the methods that will be used in examining the data. It begins with the model and definition of variables the study is about and ends with the explanation of the different techniques the study will employ. To name a few techniques, to test for unit roots the study will use the Augmented Dickey Fuller (ADF) test and Phillips Perron (PP), the Johansen cointegration test for cointegration, error correction model, diagnostic and stability test.

3.2. Model Specification

The study estimates the relationship between unemployment rate and Real Exchange Rate Volatility in South Africa and other explanatory variables included in are; Economic Growth, Net Exports, Inflation and Government Expenditure. The model is therefore presented as follows:

$$UNE_t = f(GDP, EXPT, CPI, GEXP, RER, e^t) \text{..............................} 3.1.$$

Where UNE represent unemployment, GDP is the gross domestic production used to denote economic growth, EXPT represents the net exports, CPI is consumer price index used as an inflation indicator, GEXP represent government expenditure, RER stands for real exchange rate and e^t represents the error term.

The regression model must have unemployment as the dependent variable, Economic Growth, Net Exports, Inflation, Government Expenditure and Real Exchange Rate as the explanatory variables, the constants, the coefficients and the error term. It is designed as follows:

$$UNE_t = \beta_0 + \beta_1 GDP_t + \beta_2 EXPT_t + \beta_3 CPI_t + \beta_4 GEXP_t + \beta_5 RER_t + e^t \text{.....................} 3.2.$$

Logarithm will be added in the model, therefore the model will be expressed in it linear form as follows:

$$LUNE_t = \beta_0 + \beta_1 LGDP_t + \beta_2 LEXPT_t + \beta_3 LCPI_t + \beta_4 LGEXP_t + \beta_5 LRER_t + e^t \text{........3.3.}$$

Unemployment (LUNE) is the independent variable, β_0 is a constant, β_1 to β_5 are the coefficients of the variables and (e^t) is the error term.

3.3. Definition of Variables

LUNE is the natural logarithm of Unemployment rate. Unemployment rate (UN) is the dependent variable and the official unemployment is used in this study. Unemployment rate is the number of people looking for employment divided by the total number of people in the labour force. According to Okun (1962) every one percentage unit decrease in unemployment rate is associated with a supplementary output growth of three percentage units. Unemployment rate is measured as follows:

Unemployment= (Number of people unemployed/labour force) x 100 %..........3.4.

LGDP is the natural logarithm of the GDP and GDP at market prices is used as measure of economic growth. GDP is defined as all goods and services produced within the boundaries of a country in a given period of time, usually a year. The measure of economic growth is the percentage increase in the real GDP from one year to the next. (Fourie, 2009), it is calculated using this formula:

$$\mathrm{Re}\,alGDPgrowt\,hrate = \frac{GDP_t - GDP_{t-1}}{GDP_{t-1}} \times 100 \text{................3.5.}$$

LEXPT is the natural logarithm of the Net Exports and data for exports of goods and services, including gold: volume indices are used. In this context net exports refer to the difference between a country s exports of goods and services and imports of goods and services. Exports depicts the portion of an economy s total production of goods and services (GDP) that is traded with the rest of the world. The change in exports has a direct impact in an economy s foreign demand for its good and service. Net exports basically refer to the difference between exports and imports of an economy s output measured in monetary terms over a specific period.

LCPI is the natural logarithm of the CPI which is used as a measure of Inflation. The CPI data selected is that which includes food and non-alcoholic beverages and petrol. According to Fourie et al (2009) inflation as a measure of prices is an index charting changes in the prices paid by consumers. It is determined by comparing the price, in two different periods of a fixed basket of goods and services. Thus, the inflation rate is measured as follows:

$$Inflationrate = P_0 - P_{t-1} \times 100................3.6.$$

Where: $_i$ is the current average price level P and $_{t-1}$ is the average price level of the previous year.

LGEXP is the natural logarithm of the government expenditure. Government expenditure refers to the overall spending by the government which includes final goods and services purchasing, GDP, as well as the transfer of payment. The government or public sector uses the government expenditures for the running of key functions, such as education, social development and national defence. The government expenditure is generated from government borrowings and taxes amongst others.

LRER is the natural logarithm for the Real Exchange Rate. This study utilises data for Real Effective Exchange Rate of the rand which is the average for the Period- 15 trading partners - trade in manufactured goods. The Real Effective Exchange Rate is basically the Nominal Effective Exchange Rate Adjusted for price changes or for inflation differentials amongst the domestic country and the other nation included in the index.

3.4. Data Sourcing

The study utilises quarterly data covering a time line from 1995 quarter one to 2014 quarter one. The data on Unemployment, Real Exchange Rate, GDP and Net Exports is collected from the electronic database of the South African Reserve Bank (SARB), while data on CPI and Government Expenditure is obtained from Quantec Easy Data.

3.5. Analytical Technique

The analytical employed in this study is the Ordinary Least Square (OLS). The OLS method is performed using the E-views 7.0 with Economic Growth (GDP) as an independent, Unemployment and inflation as the dependent variables.

The (OLS) regression is a comprehensive linear modelling technique that can be used to model a single response variable which has been recorded on at least an interval scale. The technique may be useful to single or multiple explanatory variables and also categorical explanatory variables that have been properly coded. (Hutcheson2011)

The following econometric techniques will be used in examining the cointegration between the variables, starting with the stationary test.

3.5.1. Visual inspection

According to Gujarati and Porter (2009) the visual inspection is an econometrics technique utilised when testing for stationarity. The technique is also known as the informal method of testing stationarity it can either be presented as graphical analysis or as a correlogram test. In this study, the graphical analysis is used to show a plotted view of the variables time series, this is done so as to provide an initial picture of the time series. The method shows the trend and direction of the variables log over the time. If the log of the variables has been changing over time, the time series trend will show a rising or falling behaviour, this means the log variables are nonstationary and they are stationary if they have a constant trend.

3.5.2. Test for Stationarity (Unit Root Test)

The problem with time series data is that the independent variables can appear to be more significant than they actually are, if they tend to have the same underlying trend as the dependent variable in the model. In order to avoid a spurious relationship and form a meaningful one, all the variables must all meet the condition of stationarity.

A series is said to be stationary when the mean and variance do not change overtime. More formally a time series variable, take a random variable (Yt) for an example, is stationary if the mean of Yt is constant over time.

The variance of Yt is also constant over time and the simple correlation between Yt and Yt-k depends on the length of the lag (k) but on no other variable (for all values of K) (Studenmund, 2006). If it happens that one or more of these properties is not met, then Yt is non- stationary.

In this study variables are subjected to the Augmented Dicky-Fuller and the Phillips-Perron unit root tests so as to investigate the time series data s unit root properties.

3.5.1. Augmented Dickey-Fuller (ADF) tests

To make sure that the estimated equations are not spurious, it is crucial to test for stationarity. After insuring that the variables are stationary, then there is no need to worry about spurious regressions. The standard methods used to test for stationarity are the Dickey-Fuller test and the Augmented Dickey-Fuller (ADF) which examines the hypothesis that the variable in question has a unit root (Studenmund, 2006).

Under stationarity, Dickey-Fuller involves running three regressions; the first one without a drift of which is commonly known as a random walk, the second one with a drift and the third one with a drift and trend.

Without drift: A random walk is known to be non-stationery because it can move up and down without an inherent equilibrium and without approaching the mean of any sort. If we consider the equation:

$$X_t = \alpha X_{t-1} + \mu_t \text{.................................} 3.7.$$

Due to a unit root criterion, if =1 in probability terms, it means that it is a random walk. In this case the expected value of X_t does not converge on any value; this means that it is totally non stationary. The circumstance where =1 is called a unit root. If a variable is found to have a unit root, then the above equation (3.5.2.1.1) holds, and it means that the variables follows a random walk and therefore they are nonstationary. If <1 then it means that the expected value of X_t will eventually approach zero and therefore become stationery as the sample size increases.

On the contrary if ≥1 then it means that X_t is non-stationary and it will tend to grow at a more rapid rate. In order to a simplest form of the test, we must first subtract X_t-1 in both sides:-

$$X_t = \alpha X_{t-1} + \mu_t$$

$$X_t - X_{t-1} = (\alpha - 1)X_{t-1} + \mu_t$$

$$\therefore \Delta X_t = \beta_1 X_{t-1} + \mu_t \text{.......................................3.8.}$$

When a one sided t- test is conducted from the above equation on the hypothesis that =0, the null hypothesis H0: = 0

The alternative hypothesis H1: < 0

The null hypothesis is that X_t has a unit root, and the alternative hypothesis states that X_t is stationary. If X_t contains a unit root, it means that =1 and =0. If Xt is said to be stationary then <1 and <0

From the equation above, we can include a constant to formulate an equation with drift:-

$$\Delta X_t = \beta_0 + \beta_1 X_{t-1} + \mu_t \text{.......................3.9.}$$

In a very same way, Xt can also be assumed to have a trend, which is (t) in this case. When (t) is added to the equation as a variable, of which it should have a coefficient (Studenmund, 2006). Thus, we should have the equation as follows:-

$$\Delta X_t = \beta_0 + \beta_1 X_{t-1} + \beta_{2t} + \mu_t \text{.......................3.10.}$$

3.5.2. Phillips Perron (PP) tests

Phillips and Perron (1988) developed a number of unit root tests that have become popular in the analysis of financial time series. The (PP) unit root tests differ from the ADF tests mainly in how they deal with serial correlation and heteroskedasticity in the errors. In particular, where the ADF tests use a parametric autoregression to approximate the Autoregressive Moving-Average (ARMA) structure of the errors in the test regression, the PP tests ignore any serial correlation in the test regression.

It builds on the Dickey–Fuller test of the null hypothesis in Δ, where Δ is the first difference operator. Like the ADF test, the PP test addresses the issue that the process generating data for might have a higher order of autocorrelation than is admitted in the test equation - making endogenous and thus invalidating the Dickey–Fuller t-test (Gujarati, 2004).

Whilst the ADF test addresses this issue by introducing lags of Δ as regressors in the test equation, the PP test makes a non-parametric correction to the t-test statistic. The test is said to be robust with respect to unspecified autocorrelation and heteroskedasticity in the disturbance process of the test equation.

The following is the regression test for the PP tests is

$$\Delta Y_t = \beta_0 X_t + \alpha Y_{t-1} + U_t \text{..} 3.11.$$

where U_t is I (0) and may be heteroskedastic. The PP tests correct for any serial correlation and heteroskedasticity in the errors U_t of the test regression by directly modifying the test statistics $t\pi=0$ and $T\hat{\pi}$. These modified statistics, denoted Z_t and $Z\pi$, are given by;

$$z_t \quad = \quad \left(\frac{\hat{\sigma}^2}{\hat{\lambda}^2}\right)^{\frac{1}{2}} t\pi = 0 - \frac{1}{2}\left(\frac{\lambda^2 - \hat{\sigma}^2}{\hat{\lambda}^2}\right) \cdot \left(\frac{T.SE(\hat{\pi})}{\hat{\sigma}^2}\right) \text{........................} 3.1.2$$

$$z_\pi \quad = \quad T\hat{\pi} - \frac{1}{2}\frac{T^2.SE(\hat{\pi})}{\hat{\sigma}^2}(\hat{\lambda} - \hat{\sigma}^2) \text{..} \ 3.13.$$

The terms $\hat{\sigma}^2$ and $\hat{\lambda}^2$ are consistent estimates of the variance parameters

$$\sigma^2 \quad = \quad \lim_{T\to\infty} T^{-1}\sum_{t=1}^{T} E\left[\mu_t^2\right] \text{..} \ 3.14.$$

$$\lambda^2 \quad = \quad \lim_{T\to\infty}\sum_{t=1}^{T} E\left[T^{-1}S_T^2\right] \text{..} \ 3.15.$$

where $S_T = \sum_{t=1}^{T} \mu_t$. The sample variance of the least squares residual $\hat{\mu}_t$ is a consistent estimate of σ^2, and the Newey-West long-run variance estimate of μ_t using $\hat{\mu}_t$ is a consistent estimate of λ^2.

Under the null hypothesis that $\pi = 0$, the PP Z_t and $Z\pi$ statistics have the same asymptotic distributions as the ADF t-statistic and normalized bias statistics. One advantage of the PP tests over the ADF tests is that the PP tests are robust to general forms of heteroskedasticity in the error term μ_t. Another advantage is that the user does not have to specify a lag length for the test regression(Hendry and Wallis,1999).

3.5.3. Cointegration tests

Cointegration is an analytic technique for testing for common trends in multivariate time series and modelling long-run and short-run dynamics. Two or more predictive variables in a time-series model are cointegrated if they share a common stochastic drift. They are considered to be cointegrated if their linear combination produces a stationary time series (Gujarati, 2004).

Cointegration analysis can be performed with E- views 8.0. The Engle-Granger and Johansencointegration methods are the two methods used for conducting a cointegration test. The difference between the two methods is that, the Engel-Granger method tests for individual cointegrating relationships and estimates their parameters. On the other hand, the Johansen method tests for multiple cointegrating relationships, and estimate parameters in the corresponding vector error-correction (VEC) models. In addition, Johansen methods test linear restrictions on both error-correction speeds and the space of cointegrating vectors, and estimate restricted model parameters (Studenmund, 2006). Since the study aims to discover a relationship between multiple variables, the Johansen Cointegration is the appropriate technique to utilise.

The Johansen Cointegration technique is mainly used to test cointegration for several I (1) time series and it allows several cointegration relationships(Gujarati, 2004). The methodology for the Johansen test begins from the VAR of order p; this can be illustrated as follows:

$$Y_t = \mu + A_1 Y_{t-1} + ... + A_p Y_{t-p} + \varepsilon_t \text{.............................} 3.16$$

Y_t represents the n × 1 vector variables integrated of the order one, I (1) while ε_t depicts the n×1 vector of innovations. Thus, the VAR can be illustrated as:

$$\Delta Y_t = \mu + \prod Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-1} + \varepsilon_t \text{................................}3.17.$$

$$\text{Where} \prod = \sum_{i=1}^{P} A_{i-1} \quad \text{and } \Gamma_i = \sum_{j=i+1}^{P} Aj$$

In a case where the coefficient matrix s ($\prod$) rank has been reduced, then an n×r matrices – and † exist. $\prod = \alpha\beta^I$ and $\beta^I Y_t$ are stationary, r represent the total number of cointegrationrelationship, -depicts the adjustment parameters that the vector error correction model has and each column of †represent the cointegrating vector. According to the Johansen Cointegration test, there are two dissimilar likelihood ratio tests of the significance of these canonical corrections and as a result the reduced rank of the $\prod$ matrix (Johansen and Juselius, 1990).

The Johansen cointegration test is divided in to two categories, viz., the trace and the maximum eigenvalue, however with little difference in the inference (Gujarati, 2004). The types of Johansen tests (trace and maximum eigenvalue) are illustrated as shown below:

$$J_{trace} = -T \sum_{i=r+1}^{n} In(1 - \overline{\lambda_i}) \text{.......................................}3.18.$$

$$J_{\max\ Eigen} = -TIn(1 - \overline{\lambda_i}) \text{..}3.19.$$

Where the sample size is represented by T and i^{th} largest canonical correlation is depicted by $\overline{\lambda}$.

The null hypothesis of the trace test is; H_0: r cointegrating vectors and the alternative hypothesis is; H_1: ncointegrating vectors. The null hypothesis of r cointegrating vectors is considered by the maximum eigenvalue test while the alternative hypothesis is $r+1$ cointegrating vectors.

Johansen and Juselius's (1990) method tests other cointegrating relationships hypotheses under the following assumptions:

- Cointegrating relationships do not exist; the regression is spurious.
- There is only one cointegrating relationship at most.
- There are two cointegratingrelationships at most and so on.

The total number of cointegrating variables is given by the number of hypotheses tested. In a case were not even a single hypothesis is rejected; we can assume that the regression is spurious. If only the first hypothesis is rejected, then we can easily conclude that only a single cointegrating relationship exists. If only the first and second hypotheses are rejected, we assume that two cointegrating relationships exist. If all hypotheses are rejected, then all the variables do not contain stochastic trends. This is so since it is the only way that multiple cointegrating relationships as variables exist(Studenmund, 2006).

The tendency of cointegrated variables to revert to common stochastic trends is expressed in terms of error-correction. If y_t is an n-dimensional time series and β is a cointegrating vector, then the combination $\overline{\beta} y_{t-1}$ measures the "error" in the data (the deviation from the stationary mean) at time $t-1$. The rate at which series "correct" from disequilibrium is represented by a vector α of adjustment speeds, which are incorporated into the VAR model at time t through a multiplicative error-correction term $\alpha\overline{\beta} y_{t-1}$ (Greensladeand Henry, 2002)

The error correction model (ECM) does not have to detect the equilibrium relationships. There can be existence of pair-wise cointegration relationships among pairs of variables, but these relationships do not necessarily last forever because they might be found in the short-term disequilibrium.

The equilibrium error term was firstly proposed by Sargan (1964), and it is named as 'error correction mechanism'. The notion of error correction mechanism was promoted by Davidson and Hendry (1978) and then combines with cointegration theorem by Engle et al (1987).

Engle et al (1987) developed a means of reconciling the short run behaviour of an economics variable with its long run behaviour.ECM combines long run information with a short run adjustment mechanism. ECM specifications are to estimate the relationship between unemployed, inflation and economic growth. The ECM overcomes the problems of spurious regression through the use of appropriate differenced variables in order to determine the short term adjustment in the model.

According to Engle et al (1987), if two nonstationary variables are cointegrated, an error correction term should then then included in the model testing the time series in their first differences. The danger of spurious regression can be eliminated by the analysis of the cointegration relationship, and the error correction models can used to present the causality between the pairs of variables

The model consists of following equations;

$$\Delta Y_t = \alpha_0 \Delta X_t + \Phi ecm_{t-1} + \mu_t \text{.................................}3.20.$$

$$ecm_{t-1} = Y_{t-1} - \beta_0 - \beta_1 X_{t-1} \text{...}3.21.$$

Where ΔY_t represents the data series derived from the first difference of the time series Y_t and ΔX_t denotes the data series X_t at the fires difference level, $t = 1,2.3,...,n$ and n is dimension of the vector variable. The time series of Y_t and X_t are both integrated at the first difference level, I (1). α_0 represents the short term elasticity and the symbol φ stands for the rapidity of adjustment back to equilibrium status and μ_t is the residual value of the ECM. ecm_{t-1} represents the error correction term, and in the expression of ecm_{t-1}, β_0 denotes the constant item and β_1 is the long term elasticity. The calculation of ecm_{t-1} is derived as the residual value of the cointegration regression equation.

3.5.4. Causality Test

This application provides the evidence about the direction of causality in economic relationships. This test is important when one knows that two variables are related but one does not know exactly which variable causes the other to move. It is basically a circumstance in which one time series variable consistently and predictably changes before the other variable. It is very important because it allows researchers to analyse which variable precedes or leads to the other and such leading variables are extremely useful for forecasting purposes (Studenmund, 2006)

$$LUNE_t = \sum_{i=1}^{k} \lambda_{1i} LUNE_{t-i} + \sum_{j=1}^{k} \lambda_{2j} LRER_{t-j} + \delta_t \text{..........................} 3.22.$$

$$LRER_t = \sum_{i=1}^{n} \alpha_{1i} LRER_{t-i} + \sum_{j=1}^{n} \alpha_{2i} LUNE_{t-j} + \mu_t \text{.....................................} 3.23.$$

In the equations above, $LUNE_t$represents unemployment rates and $LRER_t$, represents the real exchange rate, both expressed in natural logarithms.

μ_t and δ_t are the white noise terms. Using general-to-specific approach, the lag length is chosen such that serial correlation is eliminated between the error terms. All possible causal relationships between the two variables are shown below:

If $\sum_{j=1}^{k} \alpha_{2j} \neq 0$ and $\sum_{j=1}^{k} \lambda_{2j} = 0$ then Unidirectional causality from $LRER_t$ to $LUNE_t$ exists

If $\sum_{i=1}^{k} \lambda_{2i} \neq 0$ and $\sum_{j=1}^{k} \alpha_{2j} = 0$ then Unidirectional causality from $LUNE_t$ to $LRER_t$ exists.

If $\sum_{j=1}^{k} \lambda_{2j} \neq 0$ and $\sum_{j=1}^{k} \alpha_{2j} \neq 0$ then Bidirectional causality between $LUNE_t$ and $LRER_t$ exist.

If $\sum_{j=1}^{k} \alpha_{2j} = 0$ and $\sum_{j=1}^{k} \lambda_{2j} = 0$ then there is no causality established between $LUNE_t$ and $LRER_t$

3.5.5. Diagnostic and Stability Testing

Diagnostic and stability tests are also known as misspecification testing. Their function is to help decide whether or not a model has been correctly specified. Diagnostic test is used to test the stochastic properties of the model, such as residual autocorrelation, heteroskedasticity and normality, among others (Takaendesa, 2004).

This study will use the ARCH LM test and WHITE Heteroskedasticity to tests for Heteroskedasticity.

3.5.5.1. ARCH LM test (Heteroskedasticity)

Autoregressive Conditional Heteroskedasticity (ARCH) model is used to characterise and model observed time series. It is used whenever there is reason to believe that, at any point in a time series, the terms will have a characteristic size, or variance. In particular ARCH model assumes that the variance of the current error term or innovation to be a function of the actual sizes of the previous time periods' error terms. (Engle, 1982)

To test for ARCH of order q, the following regression is considered:

$$e_t^2 = \beta_0 + \beta_1 e_{t-1}^2 + \beta_2 e_{t-2}^2 + \ldots + \beta_q e_{t-q}^2 + v_t \quad \text{.......................... 3.24.}$$

Under the null hypothesis that there is no ARCH,

$$H_0 : \beta_1 = \beta_2 = \ldots = \beta_q = 0 \quad \text{... 3.25.}$$

The hypothesis can be tested using the following statistic;

$$T * R^2 \rightarrow X^2(q) \quad \text{... 3.26.}$$

The ARCH test also has power against residual autocorrelation

3.5.5.2. WHITE Heteroskedasticity tests

Heteroskedasticity occurs if different error terms do not have the same variances, so that the diagonal elements of the covariance matrix are not similar.While the variance of μ_i may vary over the observations, the error terms are mutually uncorrelated. According to Gujarati (2003) the consequences of using the usual testing techniques despite the heteroskedasticity is that the conclusions we draw or the inferences we make may be very misleading.

The null hypothesis here is that there is no heteroskedasticity. We reject the null hypothesis if the p-values are less than the level of significance ($p < 0.05$).

From the auxiliary regression; $Y_1 = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \mu_i$ the test statistic is based and it as follows;

$$e_t^2 = \beta_0 + \beta_1 X_t + \beta_2 Z_t + \beta_3 X_t^2 + \beta_4 Z_t^2 + \beta_5 X_t^2 + \gamma_t \quad \text{.. 3.27.}$$

If the null hypothesis is true, then the is greater or equal to that of the sample statics.

3.5.5.3. Normality Tests

It also imported to test if the residuals are normally distributed or not. One tool that is proposed for normality test is the multivariate extension of Jarque-Bera (JB). The Jarque-Bera (1987) test is the most commonly used method for testing normality. This test works on the notion that the normal distribution has a characteristic set of moments. It works by comparing the sample versions of the coefficient of excess skewness and the coefficient of kurtosis. The JB is given as

$$JB = n\left[\frac{s^2}{\sigma} + \frac{(k-3)^2}{24}\right] \text{...} 3.28.$$

Where S is the skewness, K kurtosis and n represents the sample size. In large samples, JB follows a chi-square distribution (χ^2). The null hypothesis is that; H_0 the residuals are normally distributed and to make that decision we look at whether the value of the JB is significant, if so, then the null hypothesis is rejected and conclude that the residual are normally distributed, (Asteriou& Hall, 2007).

3.5.6. Stability Test

The stability test can be done using either the AR roots graph or the AR roots table. These tools are used to test if whether a model is reliable or not. In this study only the AR roots graph will be used to test stability. According to the AR root graph, a model is stable if the roots, which are shown as dots, are all inside the unit circle. There are two conditions for stability in the AR roots graph, namely the necessary and sufficient conditions, and they are illustrated as follows:

The necessary condition:

$$\sum_{i=1}^{n} a_i < 1 \text{..} 3..29.$$

The sufficient condition:

$$\sum_{i=1}^{n} / a_i / < 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.30.$$

There will be an existence of unit roots if:

$$\sum_{i=1}^{n} a_i = 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.31.$$

3.5.7. Impulse Response Analysis

This method is used to measure the time frame of the shocks effects over a point in time on the variable s value in the future. According to brooks (2008) the impulse response analysis is used to trace out the dependent variable s responsiveness in the VAR to shocks to each of the independent variables. Therefore, in this study, the magnitude and persistence of both the real and nominal shocks are shown to the real growth. Brooks (2008) further exposes that the impulse response function informs whether the system is stable, the shocks should gradually disappear, and this process is done through the VECM. Likewise, in this study the impulse response analysis will be employed to trace out the effects of a shock from the dependent variable on the explanatory variables.

3.5.8. GARCH Model

The least squares model makes the assumption that, when squared, the expected error terms value is similar at any given point. This assumption is known as homoskedasticity. In a case where it is not so, that is the expected value of all the error terms squared isn t similar then a problem called heteroskedasticity exists. Data is said to suffer from hecteroskedasticity when the error terms variances are not equal, where there error terms may largely be expected to be bigger or higher at some series or points of data as compare to others (Engel, 2001). Even though this may seem as a big problem, the GARCH model finds heteroskedasticity to be a variance to be modelled. Hence, it doesn t only correct the deficiencies of the least square, but it also predicts each error term s variances.

Since this study aims to estimate the impact of real exchange volatility on unemployment, the GARCH model is the relevant tool to achieve that. The GARCH model is originally based from the ARCH model developed by Engel in 1982. The ARCH model permits the error terms variance to continue changing over in order to describe data series with varying volatility. The ? terms of the ARMA mean equation are the autoregressive conditional heteroskedastic (ARCCH) procedures in which all the ? are as follows:

$$\varepsilon_t = z_t \sigma_t \text{..} 3.32.$$

As well as;

$$\sigma_1^2 = \omega + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-1}^2 \text{..} 3.33.$$

Piot-Lepeti and M Barek (2011) describe ? as an identically and independent variable which has a distribution with a mean of zero and a unit variance. ? s conditional variance ? may always change over time, even though? is serially uncorrelated. The ARCH model however has two main shortcomings, the first on is that with the ARCH (p) model only recent p residuals can have an effect on the present variance, as a result the model is known to be a short memory process. The ARCH specification appears to be more of an average specification in motion, but one with an auto regression.

The GARCH model on the other hand, allows the conditional variance to be a function of past variance and the previous observations' squares. It modifies the structure of the autoregressive under the conditional variance permitting shocks to continue over time. According to Bouchet, Clark and Lambert (2003), the GARCH model is based on the fact that the variance happens to be drawn backwards to the long-run average level over time. This can be illustrated as follows:

$$\sigma_1^2 = yV + \alpha \sigma_{t-1}^2 + \beta \mu_{t-1}^2 \quad \text{.................................3.34.}$$

with the constanty $y + \alpha + \beta = 1$. Then model is mostly illustrated as follows:

$$\sigma^2 = \omega + \alpha \sigma_{t-1}^2 + \beta \mu_{t-1}^2 \quad \text{..3.35.}$$

According to Brouchet el al (2003), for a stable GARCH model, $\alpha < \beta$ and $y = 1 - (\alpha + \beta)$ This suggests that, in the error term, there is conditional variance in the magnitudes of the previous errors' function. The 1, 1 in the GARCH (1,1) model shows that the conditional variance is a depending factor of the 1 most recent condition variance and the 1 most recent squared residuals.

The GARCH model permits a longer memory process where all the residuals in the past have an effect on the variance currently.This can happen through the lagged variance terms directly or indirectly. The GARCH measurements can be utilized to pick periods of high clustering and volatility(Brouchet el al 2003). Because of such abilities, the GARCH model has become a well-known and largely utilized tool for working with time series heteroskedastic models. This model aim to cater for volatility measure deviation that can be employed in making financial decisions where risk analysis; derivative pricing and portfolio selection are involved. In this study, the GARCH model is used to test the impact of real exchange rate volatility on unemployment in the case of South Africa.

CHAPTER 4

INTERPRETATION AND ANALYSIS OF RESULTS

4.1. Introduction

The previous chapter proposed the analytical framework and also introduced the model and techniques that the study employs. In this chapter, the main regression results on the quarterly data from 1995 to 2014 are presented. The model regresses the impact of Real Exchange Rate Volatility on Unemployment in South Africa using the five other macroeconomic variables, namely; Economic Growth, Net Exports, Inflation and Government Expenditure as independent variables. The subject objective of this study is to investigate the relationship between Real Exchange Rate Volatility and unemployment, and it is through this chapter that this objective is achieved.

4.2. Stationariy (Unit Root Tests).

The unit root in this study is conducted using both the informal and informal tests. firstly The graphical method which is the informal test was conducted and the results are presented in the form of a linear graph for visual inspection. The formal tests which are the ADF and PP tests were conducted to confirm or compliment the informal tests results. The results are presented in terms of level and first differences forms for both the informal and formal approaches in Figures 4.1 and 4.2 and Table 4.1 respectively. Figure 4.1 shows the graphical method results of the variables at levels, while Figure 4.2 shows the graphical results at first difference.

Figure 4.1 Graphical Plots of variable in level.

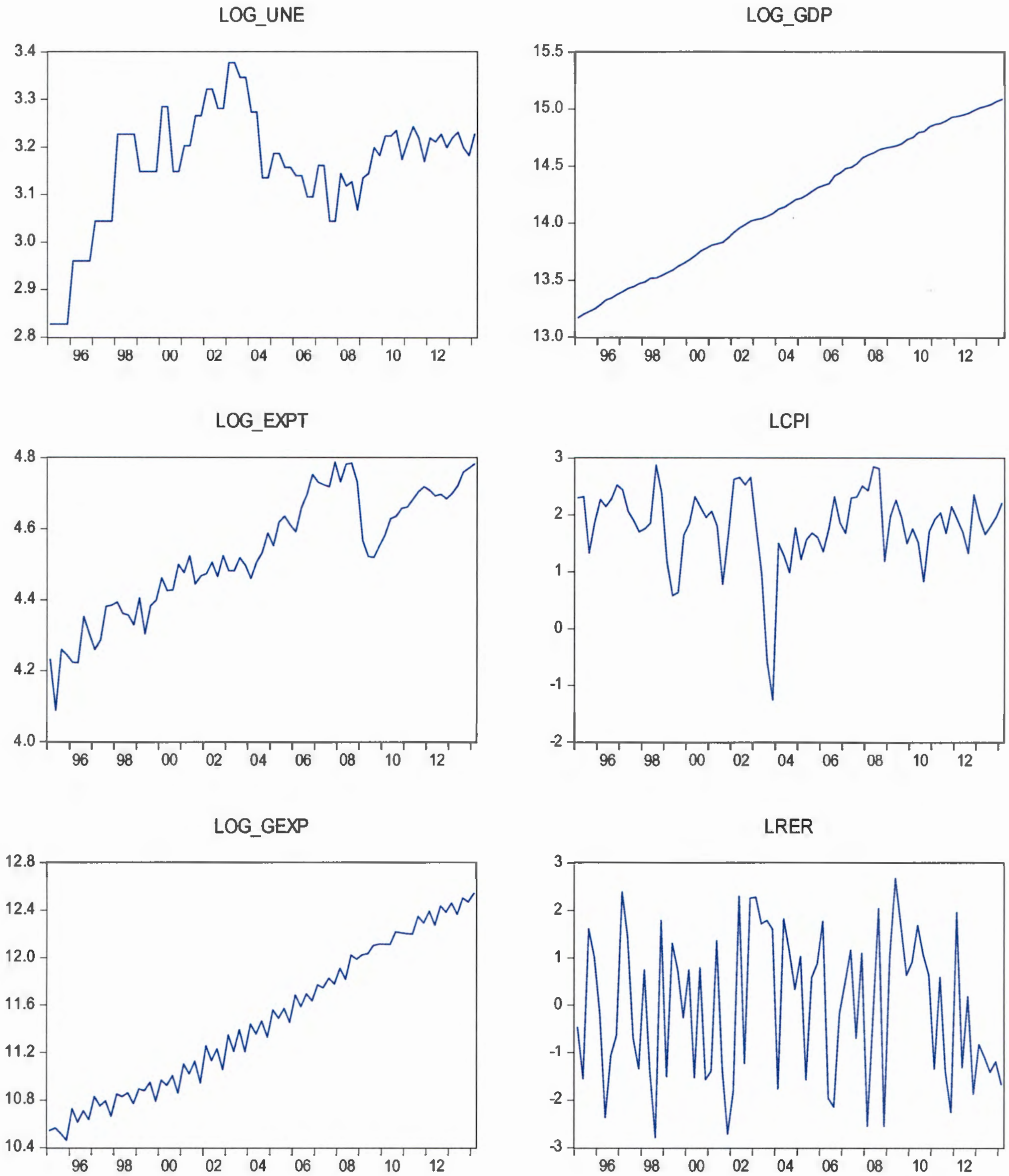


Figure 4.2 Graphical Plots of variable in first difference:

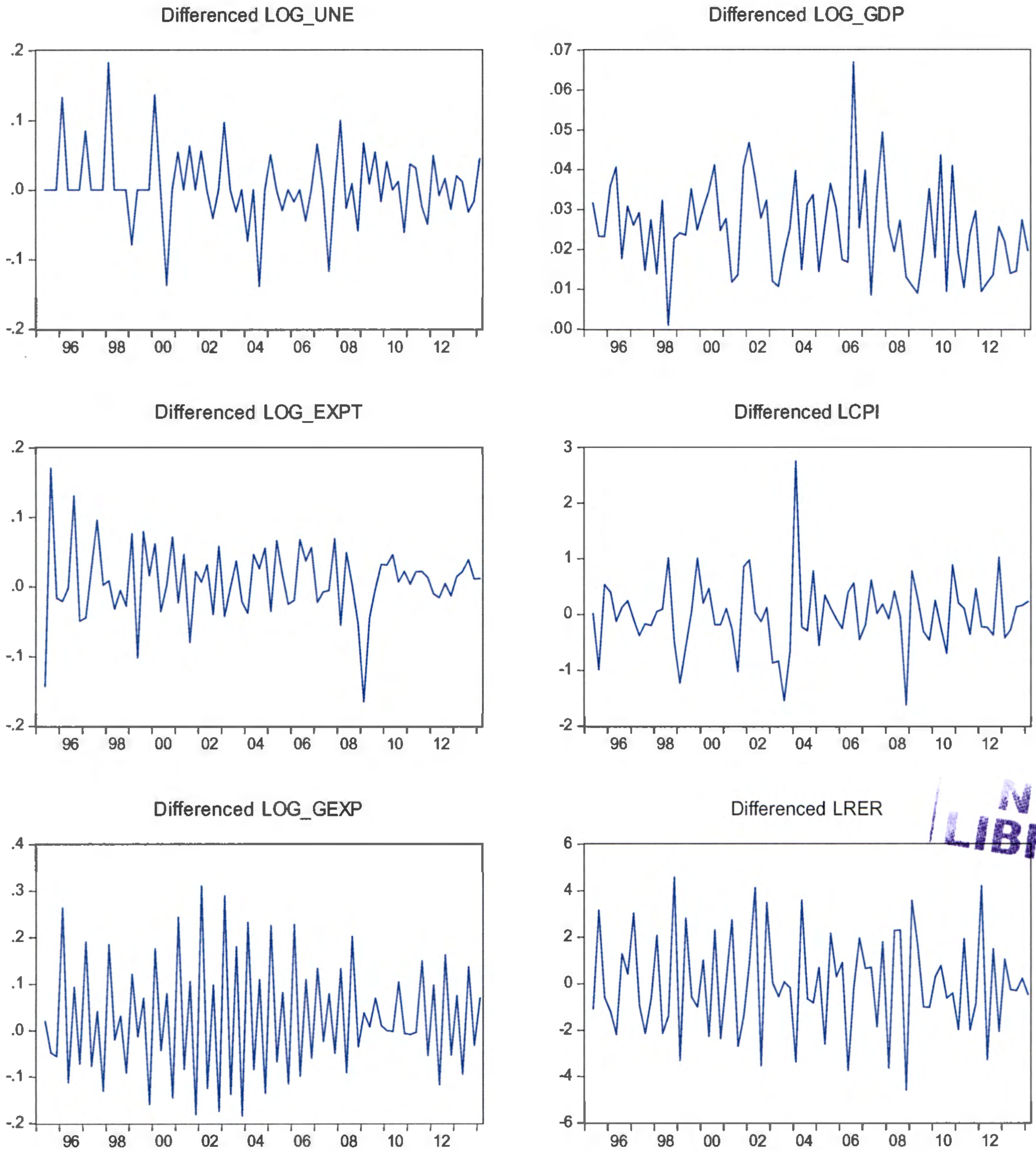


Figure 4.2 show that LGDP, LEXPT and LGEXP have a growth trend, however not stationary. Stationary in the series only exist with LUNEM, LCPI and LRER, however that is in levels before the series is first difference. After first differencing, figure 5.2 shows that all the variables are stationary, because they are all fluctuating around the zero mean, as a result we conclude that the variables are integrated of order one I(1) after being first differenced. The informal test results comply with that of the formal test shown on the next section.

Table 4.1: Results of the ADF and PP Unit Root Test

Variable	ADF				PP			
	Intercept		Trend and intercept		Intercept		Trend and intercept	
	Level	First Diff	Level	First Diff	Level	First Diff	Level	First Diff
LUNE	-3.011075**	-7.710713***	-2.800533	-7.924639***	-2.956964*	-9.281800***	-2.638484	-9.691967***
LGDP	-1.550488	-8.482209***	-0.807408***	-8.658238***	-1.578652	-8.482271***	-0.821031***	-8.658449***
LEXPT	-1.549719	-11.72027***	-3.328304*	-11.72460***	-1.218192	-11.88958***	-3.226485*	-12.16360***
LCPI	-4.546050***	-8.398991***	-4.506427***	-8.336925***	-4.613507***	-11.63023***	-4.574105***	-11.63585***
LGEXP	0.489629	-3.482188**	-1.145785	-2.684030	0.118727***	-47.10270***	-9.575097***	-54.36005***
LRER	-8.240112***	-11.02421***	-8.193593***	-10.95535***	-8.265113***	-39.75390***	-8.219632***	-45.49723***

* Statistically significant at 10% level

** Statistically significant at 5% level

*** Statistically significant at 1% level

Null hypothesis: H_0: series LUNE, (LGDP, LEXPT, LCPI, LGEXP, and LRER) is non-stationary:

Alternative hypothesis: H_1: series LUNE, (LGDP, LEXPT, LCPI, LGEXP, LRER) is Stationary:

According to the ADF test LUNE is stationary for intercept at 5% and 10% levels of significance, while at first difference LUNE together with LGDP and LEXPT are stationary at 1%, 5% and 10 % level of significance. Under trend and intercept LUNE, LGDP and LEXPT are stationary at all level of significance after first differencing them and LGDP is also stationary at all levels of significance even at level for trend and intercept. The series is therefore integrated of order I (1). We reject the null hypothesis H_0: series LUNE, LGDP and LEXPT are non- stationary and we accept the alternative hypothesis H_1: series LUNE, LGDP and LEXPT are stationary as the series variables are significant at 1%, 5% and 10 % when first differenced for trend and trend and intercept. Hence we conclude that all these variables are stationary at first differencing form or rather, the variables have no unit roots at first difference.

LCPI and LRER are stationary at all levels of significance, both at level and after first differencing them under both intercept and trend and intercept. This suggests that we the reject the null hypothesis H_0: series LCPI and LRER are non- stationary and we accept the alternative hypothesis H_1: series LCPI and LRER are stationary. While on the other hand, LGEXP is not stationary at any level of significance in level indicating that we do not reject the null hypothesis of the existence of unit root in levels for LGEXP, but there is stationary at 5% and 10% levels of significance after first differencing it, as a result We reject the null hypothesis H_0: series LGEXP is non- stationary and we accept the alternative hypothesis H_1: series LGEXP stationary.

After applying the Phillips Peron test the results show that LUNE, LGDP and LEXPT are all stationary at all of significance levels after first differencing with intercept as well as trend and intercept, with LGDP being stationary at all levels of significance even in levels under trend and intercept. While LCPI, LGEXP are LRER are stationary at all level significance in levels and in first difference with both intercept and trend and intercept, this suggest that the is no unit root, as a result we reject the null hypothesis of non-stationarity.

4.3. Cointegration Test Results

The cointegration test is important in determining if there is a long run relationship between the variables. In this study, the Johansen test cointegration is used to examine the long run relationship between unemployment and the other variables.

Table 4.2 Cointegration Rank Test Results (Trace)

Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.****
None *	0.430810	127.1602	95.75366	0.0001
At most 1 *	0.395585	85.45822	69.81889	0.0017
At most 2 *	0.226521	48.19964	47.85613	0.0464
At most 3	0.178963	29.19223	29.79707	0.0586
At most 4	0.123337	14.60042	15.49471	0.0679
At most 5 *	0.063560	4.859590	3.841466	0.0275

Trace test indicates 3 cointegratingeqn(s) at the 0.05 level

*denotes rejection of the null hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table 4.2 shows the cointegration results of the trace test. The results indicate that there are three (3) cointegrating equations existing at 5% level of significance. The null hypothesis of no cointegrating vector is rejected at none since the trace statistic of 127.1602 is greater that the critical value of 98.75366. As a result, the study concludes that, at None, cointegration exists. The null hypothesis that there is no cointergration At most 1 cointegrating vector is rejected since the trace statistic of 85.45822 is greater than the 5% critical value of 69.081889, thus cointegration exist for at most one. Going on to the test for the null hypotheses of At most 2 cointegrating vector, the trace statistic 48.19964 is greater than the 5% critical value 47.85613, suggesting that there is cointegration for at most two. The null hypotheses that there is no cointegration vector at most than 3 is accepted, since the trace statistic of 29.19223 is less than the 5% critical value of 29.79707. Therefore we can conclude that, there are three cointegrating equations at 5% critical value with the trace statistics. The conclusion is that the variables are cointegrated at None, At most 1 and At most 2 under the trace statistics. The probability value also agrees with the outcomes of the trace statistics and the 5% critical value, since it appears to be significant at None, At most 1 and At most 2 confirming the existence of the three long run relationships between the variables.

Table 4.3 Cointegration Rank Test Results (Maximum Eigenvalue)

Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob.****
None *	0.430810	41.70202	40.07757	0.0325
At most 1 *	0.395585	37.25858	33.87687	0.0190
At most 2	0.226521	19.00740	27.58434	0.4140
At most 3	0.178963	14.59181	21.13162	0.3185
At most 4	0.123337	9.740833	14.26460	0.2295
At most 5 *	0.063560	4.859590	3.841466	0.0275

Max-eigenvalue test indicates 2 cointegratingeqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

The maximum Eigen value test results in Table 4.3 shows that at none the Max-Eigen Statistic 41.70202 is greater than the 5% critical value of 40.07757, confirming that cointegration exist at none and the null hypothesis of no cointegration is rejected at None. The null hypothesis of no cointegration is also rejected at At most 1, since the Max-Eigen statistic of 37.25858 is greater than the 5% critical value of 33.87687. This confirms that there is cointegration At most 2. The null hypothesis of no cointegration cannot be rejected at At most 2, since the Max-Eigen statistic is less than the 5% critical value. Therefore we conclude that cointegration does not exist at At most 2. Same applies for at most three and at most four. Due to this outcome, the study can confidently conclude that there are two cointegration equations at the 5% critical value. The Maximum Eigen test outcome is the one used to determine the actual number of cointegrating vectors. This is because the trace test is less powerful than the Maximum Eigen test (Helmut, 2000). Hence the study concludes that there is a long run relationship between LUNE and the explanatory variables.

4.4. Vector Error Correction Model (VECM)

The VECM is a reliable tool to use when testing for cointegration and fair estimate of a relationship in the long run. Before the VECM procedure can be a use, a cointegration equation should first be detected. After finding the cointegration relationship; the estimates by the VECM can be used to identify the long run and the short run relationship. The VECM method uses the Error Correction Term (ECT) to estimate any movement from the long run equilibrium. The ECT depicts the speed of adjustment of any equilibrium towards a long run equilibrium state. The bigger the size of the ECT the faster the speed of adjustment back to equilibrium state. The previous section provided the long run relationship of the variables. Table 4.4 below present the VECM results of the short run relationship.

Table 4.4 Error Correction Model Results

	Dependent Variable: DLOG_UNE Method: Least Squares Sample: 1995Q1 2014Q1 Observations: 77				
Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Probability**	**Conclusion**
C	0.008943	(0.02242)	[0.39891]	0.6902	Insignificant
D(LOG_UNE(-1))ECM(-1)	-0.051315	(0.06154)	[-0.83388]	0.4049	Insignificant
D(LOG_GDP(-1))	0.397725	(0.65404)	[0.60810]	0.5435	Insignificant
D(LOG_EXPT(-1))	0.090818	(0.15416)	[0.58913]	0.5561	Insignificant
D(LCPI(-1))	-0.005061	(0.01160)	[-0.43647]	0.6628	Insignificant
D(LOG_GEXP(-1))	-0.106666	(0.16995)	[-0.62763]	0.5306	Insignificant
D(LRER(-1))	-0.000974	(0.00568)	[-0.17151]	0.8639	Insignificant
	R squared =0.293545 Adjusted R-Square =0.125911 S.E of Regression =0.050060 Akaike =-2.972297 Schwarz =-6.004565				

Table 4.4 above indicates that the coefficient for LUNE is -0.0513. This means that the speed of adjustment is 5.315%. With this information, we can then hold that, should there be a shift from equilibrium, only 5.315% is corrected in each quarter as equilibrium becomes restored. Since the speed of adjustment is this low, it could mean that LUNE has no strong pressure to restore the equilibrium whenever it deviates and it also suggest that there are other factors that affect unemployment in South Africa excluded from the model. LUNE is insignificant, as such; we cannot reject the null hypothesis.

LGDP has a negative and insignificant impact on LUNE in the short run. A unit increase in LGDP is expected to decrease LUNE by over 39%, which is hypothetically correct. LEXPT has a positive but insignificant impact on LUNE. Every 1% increase in LEXPT is associated with over 9% increase in LUNE. 1% increase in LGEXP is expected to decrease LUNE by over 10% and LCPI also has a negative impact on LUNE in the short run. LCPI is insignificant. LRER has a negative impact on LUNE, even though the effect is too little at around 0.09% in the short run.

The results in Table 4.4 indicate that all the variables are insignificant. As such, the null hypothesis cannot be rejected in any of the variables.

4.5. Diagnostic and Stability Tests Results

In this study the diagnostic and stability tests are used in order to test if the model proposed is good or whether it is correctly specified. The tests are conducted on the Vector Autoregration (VAR) model, and the probability value is used to indicate whether a test statistics is stationary or not. If the probability of a test statistics whose absolute value is above or equal to 5% then we accept the null hypothesis, however if the probability value is below 5%, then the null hypothesis is rejected. The white Heteroskedasticity is utilised to test for Heteroskedasticity, the AR Roots Graph for stability and theJarque-Bera for normality.

4.5.1. WHITE Heteroskedasticity

Table 4.5 White Heteroskedasticity Test

Heteroskedasticity Test: White			
F-statistic	1.798265	Prob. F(20,56)	0.0440
Obs*R-squared	30.11275	Prob. Chi-Square(20)	0.0680

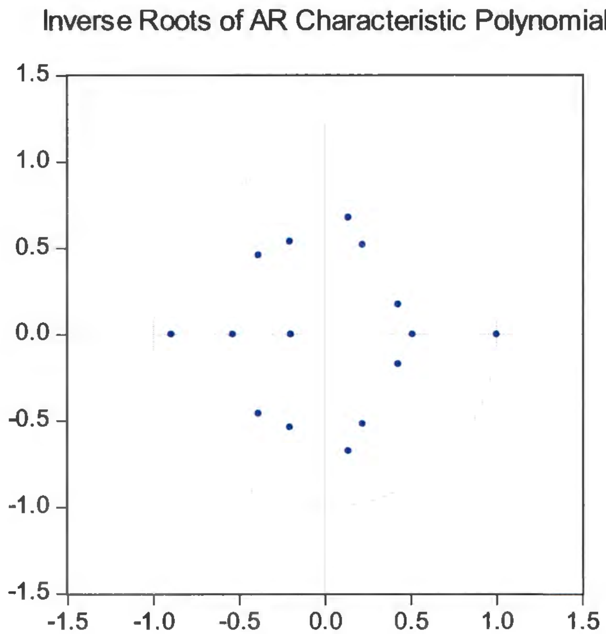
H_0: there is no heteroskedasticity

H_1: there is heteroskedasticity

Heteroskedasticity exist when the variances of error terms are not constant from one observation to another. If it is so, then we can say the residuals are heteroskedastic. In the residual in question, the null hypothesis H_0 states that there is no heteroskedasticity. This hypothesis is rejected when the probability value is less that 5%, and the alternative hypothesis H_1, which state that there is heteroskedasticity can then be accepted. The results on Table 4.5 above show that there is no heteroskedasticity between the variables since the probability of the Chi square is greater than 5 %. As a result, we accept the null hypothesis that there is no heteroskedasticity and reject the alternative, and also conclude that the residuals are homoskedastic.

4.5.2. Stability Test Results

Figure 4.3 AR Root Graph



As indicated in the previous chapter, the study employs the AR roots graph to test for whether the model is stable or not. The AR graph in figure 4.3 indicates that all the unit roots, shown as dots, are inside the circle. This means that the model which is proposed in this study is stable and statistically acceptable. As a result, the model can be used to run other test.

4.5.3. Normality Test Results

The normality test helps in determining whether the residuals are normally distributed or not. The Jarque-Bera test is the one tool mostly used to test for normality. The Jarque-Bera uses the probability value to test if the residuals are normally distributed. When the probability value is greater than 5%, then we conclude that the residual are normally distributed and not normally distributed if it is less than 5%.

Table 4.6 Normality Test Results

Null Hypothesis	**Jarque-Bera**	**Probability**	**Conclusion**
Residual are normally distributed	0.940985	0.624695	Model normally distributed

The null hypothesis state that the residuals are normally distributed. Table 4.6 indicates that the probability is greater than 5%, meaning that the residuals are normally distributed. Therefore we accept the null hypothesis and reject the alternative hypothesis. Through this outcome, the study may conclude that the model is good and it can be used for more forecasting.

4.6. Granger Causality Test Results

The Causality test is important when one knows that two variables are related but does not know exactly which variable causes the other to move. To determine whether the current and lagged values of one variable have an effect on the other, the Granger Causality test is used.

In this study the Granger causality test involves six main variables, unemployment (LUNE), economic growth (LGDP), net Exports (LEXPT), inflation (LCPI), government expenditure and real exchange rate (LRER), with unemployment (LUNE) and real exchange rate (LRER) being the main aimed variables and the rest as the additional one.

The Granger causality test determines the casual relationship between the variable by utilising the probability value and the F-statistic. A variable Granger causes another if the past and current values of the first one can contribute to predicting the second one (Granger, 1969).

Table 4.7 Pairwise Granger Causality Tests

Null Hypothesis:	Observation	F-Statistic	Prob.	Outcome.
LOG_GDP does not Granger Cause LOG_UNE		0.58990	0.6711	No causality
LOG_UNE does not Granger Cause LOG_GDP	73	0.68984	0.6017	No causality
LOG_EXPT does not Granger Cause LOG_UNE		0.41262	0.7989	No causality
LOG_UNE does not Granger Cause LOG_EXPT			0.2827	No causality
	73	1.29161		
LCPI does not Granger Cause LOG_UNE		2.26419	0.0719	Causality
LOG_UNE does not Granger Cause LCPI			0.1393	No causality
	73	1.80205		
LOG_GEXP does not Granger Cause LOG_UNE		3.45646	0.0128	Causality
LOG_UNE does not Granger Cause LOG_GEXP	73	0.84869	0.4997	No causality
LRER does not Granger Cause LOG_UNE		0.26686	0.8982	No causality
LOG_UNE does not Granger Cause LRER	73	0.42059	0.7932	No causality
LOG_EXPT does not Granger Cause LOG_GDP		0.72453	0.5784	No causality
LOG_GDP does not Granger Cause LOG_EXPT	73	4.41893	0.0032	Causality
LCPI does not Granger Cause LOG_GDP		1.30550	0.2775	No causality
LOG_GDP does not Granger Cause LCPI	73	0.58138	0.6772	No causality
LOG_GEXP does not Granger Cause LOG_GDP		0.40690	0.8030	No causality
LOG_GDP does not Granger Cause LOG_GEXP	73	2.12866	0.0874	Causality
LRER does not Granger Cause LOG_GDP		0.48115	0.7494	No causality
LOG_GDP does not Granger Cause LRER	73	0.49587	0.7388	No causality
LCPI does not Granger Cause LOG_EXPT	73	1.57947	0.1905	No causality

LOG_EXPT does not Granger Cause LCPI		0.36025	0.8360	No causality
LOG_GEXP does not Granger Cause LOG_EXPT		1.18450	0.3261	No causality
LOG_EXPT does not Granger Cause LOG_GEXP	73	2.07557	0.0943	Causality
LRER does not Granger Cause LOG_EXPT		1.18558	0.3257	No causality
LOG_EXPT does not Granger Cause LRER	73	0.75719	0.5570	No causality
LOG_GEXP does not Granger Cause LCPI		0.01971	0.9992	No causality
LCPI does not Granger Cause LOG_GEXP	73	2.27093	0.0712	Causality
LRER does not Granger Cause LCPI		2.37410	0.0613	Causality
LCPI does not Granger Cause LRER	73	0.49647	0.7383	No causality
LRER does not Granger Cause LOG_GEXP		0.68421	0.6055	No causality
LOG_GEXP does not Granger Cause LRER	73	0.34881	0.8439	No causality

The causality test is mainly aimed at unemployment (LUNE) and real exchange rate (LRER). According to the results in Table 4.7, the null hypothesis stating that LRER does not Granger Cause LUNE is insignificant, therefore null hypothesis is accepted and the alternative hypothesis which state that LRER does Granger Cause LUNE is rejected. The null hypothesis of LUNE does not Granger Cause LRER is also insignificant. As such, the null hypothesis is accepted and the alternative hypothesis rejected. These results suggest that there is no causal relationship between LUNE and LRER. This means that policy makers should not target LRER to impact LUEN and LUNE to impact LRER.

The null hypotheses that LGDP does not Granger Cause LUNE and LOUNE does not Granger Cause LGDP are both insignificant. Therefore, the study accepts the null hypothesis and rejects the alternative hypothesis. There is also no causal relationship between LEXPT and LUNE, LCPI and LGDP, LRER and LGDP, LCPI and LEXPT, LRER and LEXPT as well as LRER and LGEX. This also means that policy makers targeting any of these variables should know that they do not affect each other in such order.

The null hypothesis which states that LCPI does not Granger Cause LUNE is significant at 10% level of significant, as such we a reject the null hypothesis and accept the alternative hypothesis stating that LCPI does Granger Cause LUNE. However the null hypothesis which states that LUNE does not Granger Cause LCPI is insignificant. Therefore the study accepts the null hypothesis and rejects the alternative. This can only imply that, there is a causality relationship between LCPI and LUNE. However this relationship is only in one direction, from LCPI to LUNE.

The Granger Causality test also show a single direction relationship between LGEXP and LUNE, the null hypothesis which states LGEXP does not Granger Cause LUNE is significant at 5% significant level, but, the hypothesis LUNE does not Granger Cause LGEXP is insignificant, this implies that the causality direction is only from LGEXP to LUNE.

LGDP does not Granger Cause LEXPT, but LGDP does Granger Cause LGEXP, since it is significant at 10% level of significance. This is another relationship with a single direction.

LGEXP does not Granger Cause LCPI, however, LCPI does Granger Cause LGEXP as 10% level of significance, for that reason the null hypothesis is rejected and we accept the alternative. This is the same for LRER and LCPI, LRER Granger Causes LCPI at 10% level of significance, but LCPI does not Granger Cause LRER. This implies that, LRER changes LCPI but LCPI doesn t change LRER in South Africa. Hence policy makes should target LRER in order to affect LCPI. Same applies for the other variables with a single directed causal relationship.

4.7. Impulse Response Function (IRF)

According to Brooks (2008), the Impulse response is an important tool when aiming at tracing dependent variables responsiveness to shocks from the other variables. Table bellows shows the response of all the variables to each other. However since this study is focused on the impact of real exchange rate volatility on unemployment, we will only explain the responses of unemployment to unemployment, unemployment to real exchange rateand that of with the other explanatory variables.

Figure 4.4 IRF Results

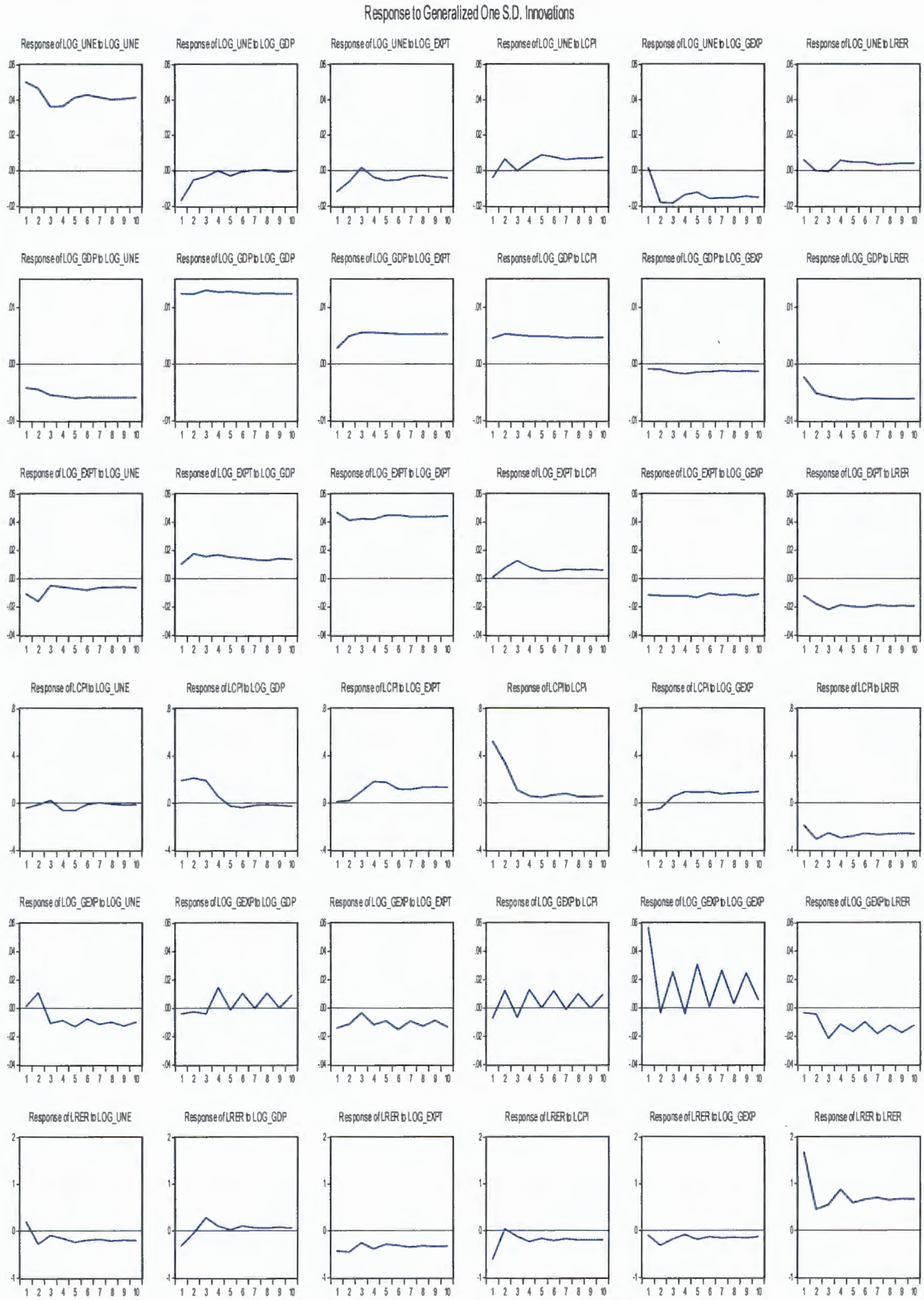


Figure 4.5 above indicates that LUNE has a positive but fluctuating response to LUNE. It first decreases between the first and third periods then continue fluctuating until the tenth period. The response of LUNE to LGDP has a negative yet increasing effects over the time periods, it however stays below zero. From the first period, the response of LUNE to LEXPT initially has a negative yet increasing effect, until it reaches a positive point just above zero at around the third period. It then starts to fall back to negative and then stays neutral at negative over the periods. LUNE to LCPI start at negative but becomes positive before reaching the second period, it then remains positive yet fluctuating over the remaining periods.

The response of LUNE to LGEXP is initially positive in the first period, it then fall sharply until it reaches negative around the second period and then remains negative throughout the period. The response of LUNE to LRER initially has a decreasing positive effect between the first and second period. From the second to third periods it has no effect on LRER then it start to increase until it starts fluctuating for the remaining periods. The response of LGDP to LUNE is negative and decreasing. LEXPT to LUNE is fluctuating yet negative and the LCPI to LUNE almost has no effect. LGEXP to LUNE initially has an increasing positive effect, but the fall from positive to negative between the second and third period, then it starts fluctuating all through. LRER to LUNE is initially positive, but ends up fluctuating at the negative side.

4.8. GARCH Model

Table: 4.8 GARCH Model Results

Dependent Variable: LOG_UNE				
Method: ML - ARCH (Marquardt) - Normal distribution				
Included observations: 77				
GARCH = C(7) + C(8)*RESID(-1)^2 + C(9)*GARCH(-1)				
Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
LOG_GDP	0.188607	0.060380	3.123660	0.0018
LOG_EXPT	-0.515192	0.076085	-6.771255	0.0000
LCPI	-0.022087	0.011193	-1.973302	0.0485
LOG_GEXP	-0.050733	0.045082	-1.125339	0.2604
LRER	-0.003868	0.003319	-1.165150	0.2440
C	3.474142	0.256814	13.52785	0.0000
Variance Equation				
C	0.000826	0.000459	1.801211	0.0717
RESID(-1)^2	1.223926	0.371369	3.295712	0.0010
GARCH(-1)	-0.151262	0.114294	-1.323446	0.1857
R-squared	-0.117028			
Adjusted R-squared	-0.195692			
Durbin-Watson stat	0.218587			

With the GARCH model, the dependent variable is represented by GARCH (-1) shown in Table 4.8, in this study the GARCH (-1) represents the variance of the residual and unemployment volatility. According to the GARCH model results above, the p value for GARCH (-1) is 0.1857, which is greater than 5%, as a result we conclude that GARCH (-1) is insignificant. This means that unemployment is not volatile. LRER is also insignificant since its p value (0.2440) is greater than 5%. Therefore we conclude that LRER is not volatile.

Real Exchange Rate (LRER): The GARCH model results in Table 4.8 indicate that LRER has a coefficient of -0.003868. Since LRER has a negative coefficient, it implies that there is an inverse relationship between LUNE and LRER, a 1% decrease in LRER will result to a 0.3868% increase in LUNE.

Economic Growth (LGDP): LGDP coefficient is positive and it is statistically significant at 5% level of significance since its p value is smaller than 5%. The positive coefficient implies that 1% increase in LGDP will result to almost 19% increase in LUEM. Hypothetically it is expected that an increase in GDP should decrease unemployment. However that is not the case in South Africa. These finding contradicts the literature of Okun (1962) who established the law which quantifies the link between a country s unemployment rate and the growth rate of its economy. Okun (1962) states that every one percentage unit decrease in unemployment rate is associated with a supplementary output growth of three percentage units. On the other hand, some studies have agreed with the findings of this study, such as Barker (2005), who holds that South African economy is a jobless growth economy, meaning that economic growth and reduction in unemployment shouldn t be always be associated.

Net Exports (LEXPT): LEXPT has a positive coefficient and also significant at 5% level of significance. According to these findings, a 1% increase in LEXPT is expected to decrease LUEN by over 51%. This is hypothetically correct, since exports are complimented by production which is complemented by labour force.

Inflation (LCPI): LCPI has a negative coefficient and it is also statistically significant since its p value is smaller than 5%. This implies that when LCPI increases, LUNE is expected to decrease. 1% increase in LCPI is associated with over 2% decrease in unemployment. These finding complements the theory of the Phillips curve, which states that there is negative relationship between unemployment rate and wage increase rate. In other words, if unemployment decreases, inflation will increase, and if inflation decreases unemployment will increase (Phillips, 1958)

Government Expenditure (LGEXP): LGEXP has positive coefficient and it is statistically in significant. According to the coefficient for LGEXP, a 1% increase in LGEXP is expected to result in an over 5% decrease in LUNE. This means that if government expenditure increases, then unemployment will decrease. This is hypothetically correct.

CHAPTER 5

RESEARCH OUTCOME/ FINDINGS, CONCLUSION AND POLICY RECOMMENDATIONS

5.1. Introduction

This chapter is the last chapter of the study. It provides the summarised findings, interpretation and conclusion. The chapter also focuses mostly on the econometrics analysis outcomes and further recommends policy perspectives for policy makers in the future.

5.2. Findings summary and conclusion

Unemployment rate in South Africa has been increasing since the early 80 s. Considering the persistent high levels rates of unemployment and the pace on which unemployment rate has been increasing in South Africa since the early 80 s, it can be easy to conclude that unemployment in South Africa has reached crisis levels. The issue has affected a larger population in South Africa and can continue to affect the economy if not controlled.

The purpose of this study was to investigate the impact of real exchange rate volatility on unemployment in South Africa, using quarterly data from first quarter of 1995 to first quarter of 2014. The study also took in to account other determinants of unemployment, being; Economic Growth (GDP), Inflation (CPI), Net exports, and Government Expenditure. Since this study was a quantitative research, relevant econometrics techniques were used to analyse and examine the model. Amongst other factors, the study embarked on investigating the long and short run relationship between the variables and to determine the direction of causation between the variables. In order to determine both the long and short run properties of the model, the Johansen cointegration approach and the VECM were employed. These techniques were chosen because of the advantages they have over those alternative techniques and their relevance to the model in question.

The results indicate that the null hypothesis which states that LUNE does not Granger cause LRER is insignificant as well as the one stating that real exchange rate does not Granger cause unemployment. Meaning that the null hypothesis was accepted in this study, to say the analysis discovered that there is no causal relationship between the LUNE and LRER. This implies that in the case of South Africa, unemployment won t be affected by the changes in real exchange rate and vice versa.

The Granger causality test indicates that LUNE does not Granger cause LGDP and LGDP does not granger cause LUNE at any level of significance. This means that changes in LUNE does not affect LGDP in South Africa. There also no causality between LEXPT and LUNE. LCPI Granger cause LUNE however LUNE does not Granger cause LUNE, this means that the causality is only unidirectional, from LCPI to LUNE. Changes in LCPI will have an effect on LUNE but the changes in LUNE will not have an effect on LCPI in South Africa.

There is a unidirectional causality between LGEXP and LUNE. LGEP Granger causes LUNE at 5% level of significance, but LUEN does not Granger cause LGEXP. There is no causality between LCPI and LGDI, LRER and GDP as well as LEXPT and LCPI. The null hypothesis which states that LEXP does not Granger cause LGDP is insignificant, as such the study cannot no reject the null hypothesis, however, as expected LGDP does Granger cause LEXPT at 1% level of significance. This implies that LEXPT will respond to the changes in LGDP, but LEXPT doesn t have an effect on LGDP. This is also the case with LGDP and LGEXP; there is unidirectional causality from LGDP to LGEXP at 10% level of significance.

LGEXP does not granger cause LCPI but LCPI granger cause LGEXP at 10% significance level. There is also a unidirectional causal relationship from LRER to LCPI. This implies that changes in LRER will cause LCPI to move, but LCPI does not have an effect on LRER. Policy makers aiming at LCPI should target LRER. This is the same to the variables with a unidirectional relationship.

The Johansen cointegration test results indicate that, for the trace test, there are three cointegration equations at 5% level of significance. As such the null hypothesis of no cointegrating vector is rejected and we accept the alternative. Cointegration exists at none, at most 1 and at most 2.The maximum Eigen value test results indicates that cointegration exist at none and at most 1.

Through this the study concludes that there are two cointegration equations for the Max-Eigen value test. As a result, the null hypothesis of no cointegration cannot be accepted, but the alternative hypothesis of cointegration is accepted. Since the Max-Eigen value test is stronger than the Trace test, we conclude that there are two cointegration equations in this study. As such a long-run relationship between LUEN and the explanatory variables is confirmed.

According to the VECM, the speed of adjustment in this study is 5.315%. This implies that if there is an interruption of the equilibrium, only 5.315% is corrected in each quarter as equilibrium becomes restored. The low speed of adjustment might be explained by the fact that, there is a possibility that there are other variable which affect unemployment that were not included in this study.

The relationship between LUNE and LGDP is negative and insignificant, while that of LUNEM and LEXPT is insignificant and positive. There is negative and insignificant relationship between LUNE and LGEXP, similar with the one of LUNE and LCPI. LUNE and LRER have negative insignificant relationship.

The GARCH model test results indicate that LUNE is insignificant, as such non-volatile. It further suggests that there is an inverse relationship between LUNE and LRER, a 1% decrease in LRER will result to a 0.3868% increase in LUNE. There is a significant positive relationship between LGDP and LUNE. Theory however does not agree with these findings. Increase in LGDP is expected to decrease LUNE. While on another note, some studies have confirmed this to be true in South Africa, that a fall in LUNE is not associated with LGDP. There is a positive and significant relationship between LUNE and LEXPT. This is theoretically correct.

According to the GARCH model, LCPI and LUNE have a negative and statistically significant relationship. These finding agree with the literature of Philips (1958). As such is it theoretically correct. An increase in LGEXP is associated with a fall in LUNE according to the GARCH model.

5.3. Policy Recommendation

With reference to this study, policy makers aiming at reducing LUNE in South Africa should target LCPI. The study has revealed that there is a negative relationship between inflation and unemployment. Policy makers in South Africa can eradicate unemployment by increasing money supply, which will increase buying power and hence spending, and as inflation will be stimulated and unemployment reduced. Policy makers in South Africa should also increase government expenditure (LGEXP), as it is according to our findings, it is expected to reduce unemployment.

An increase in LGDP will have a positive impact on LGEXP, and an increase in LGEXP will reduce LUNE, increasing LGDP may not have a direct impact on the reduction of LUNE, according to the granger causality results, but it can be a target area for policy makers to reduce LUNE in South Africa. The GARCH model on the other hand indicates that LGDP will significantly reduce LUNE in South Africa.

Increase in LEXPT is expected to reduce LUNE policy makers in South Africa should consider targeting the increase of exports so as to reduce LUNE. In a nutshell, policy makers should focus more international trade, monetary and fiscal policy to reduce the rising rates of unemployment in South Africa.

5.4. Other Areas of Research

There are a number of potential areas that further research can look into related to the study, such as;

How Foreign Direct Investment can impact Unemployment in South Africa;

Determine the relationship between exchange rate and unemployment in the manufacturing sector;

The relationship between gross capital and unemployment or real exchange rate

As well as the relationship between capital investment and youth unemployment in South Africa (the relationship between capital investment and total unemployment can also be an interesting area of research)

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APPENDIX

Appendix A: Data Used In the study

YEARS	UNE	GDP	EXPT	CPI	GEXP	RER
1995Q1	16.9	525795	68.8	9	37962	-0.6
1995Q2	16.9	542660	59.7	9.2	38715	-3.7
1995Q3	16.9	555452	70.8	2.8	36937	4
1995Q4	16.9	568493	69.7	5.5	34950	1.8
1996Q1	19.3	589256	68.3	8.7	45507	-0.2
1996Q2	19.3	613711	68.2	7.6	40729	-9.6
1996Q3	19.3	624668	77.7	8.8	44718	-1.9
1996Q4	19.3	644181	74	11.5	41646	-0.9
1997Q1	21	661183	70.8	10.5	50406	9.9
1997Q2	21	680757	72.7	6.9	46721	3.2
1997Q3	21	690911	80	5.7	48691	-1
1997Q4	21	710069	80.2	4.5	42776	-2.8
1998Q1	25.2	720010	80.9	4.8	51498	1.1
1998Q2	25.2	743653	78.4	5.4	50528	-3
1998Q3	25.2	744451	78	16.7	52138	-15.2
1998Q4	25.2	761582	75.9	9.9	47618	5
1999Q1	23.3	780195	81.9	2.2	53741	-3.5
1999Q2	23.3	798840	74	0.8	53063	2.7
1999Q3	23.3	827418	80.1	0.9	56901	1.1
1999Q4	23.3	848279	81.4	4.2	48561	-0.3
2000Q1	26.7	874150	86.6	5.4	57883	1.1
2000Q2	26.7	904844	83.6	9.2	55485	-3.6
2000Q3	23.3	942974	83.8	7.5	60084	1.2
2000Q4	23.3	966624	90	6.1	52009	-3.8
2001Q1	24.6	993739	88	6.9	66366	-3
2001Q2	24.6	1005513	92.2	5.1	61089	2.9
2001Q3	26.2	1019273	85.2	1.2	67875	-2.8
2001Q4	26.2	1061503	87.1	4.2	56659	-14
2002Q1	27.7	1112432	87.7	12.8	77283	-5.2
2002Q2	27.7	1155893	90.5	13.3	68282	9
2002Q3	26.6	1188512	87	11.6	75297	-2.4
2002Q4	26.6	1227507	92.2	13.3	63323	8.6
2003Q1	29.3	1242402	88.4	5	84626	8.8
2003Q2	29.3	1255761	88.4	1.6	73818	4.6
2003Q3	28.4	1279693	91.7	-0.8	88405	5
2003Q4	28.4	1312292	89.8	-2.5	73622	4
2004Q1	26.4	1365518	86.5	3.5	92902	-4.8
2004Q2	26.4	1386184	90.6	2.6	85474	5.2
2004Q3	23	1430199	93	1.7	95324	2.2
2004Q4	23	1479191	98.3	4.9	83346	0.4
2005Q1	24.2	1500782	94.9	2.4	104458	1.8

2005Q2	24.2	1539913	101.4	3.8	97673	-3.8
2005Q3	23.5	1597211	103.1	4.4	105973	0.8
2005Q4	23.5	1646422	100.6	4	94475	1.4
2006Q1	23.1	1675400	98.7	2.9	118663	4.9
2006Q2	23.1	1703877	105.6	4.8	107598	-6.1
2006Q3	22.1	1821774	109.6	9.2	120021	-7.5
2006Q4	22.1	1868637	115.9	5.5	113167	-0.2
2007Q1	23.6	1944670	113.4	4.4	129377	0.6
2007Q2	23.6	1961353	112.6	9	126398	2.2
2007Q3	21	2028013	112	9.2	136775	-1
2007Q4	21	2130704	120	11.3	130279	2
2008Q1	23.2	2185945	113.6	10.4	148769	-11.7
2008Q2	22.6	2228909	119.3	16.3	135925	-0.3
2008Q3	22.8	2290484	119.7	15.7	166410	6.7
2008Q4	21.5	2320602	113.5	2.3	160762	-11.8
2009Q1	23	2346401	96.3	6.2	166996	1.8
2009Q2	23.2	2367677	92.1	8.6	168388	13.5
2009Q3	24.5	2415883	91.8	6.1	180477	4.3
2009Q4	24.1	2502339	94.8	3.5	182425	0.9
2010Q1	25.1	2547698	97.8	4.8	182453	1.5
2010Q2	25.1	2661406	102.4	3.6	182179	4.4
2010Q3	25.4	2686781	103.1	1.3	202257	1.9
2010Q4	23.9	2799203	105.4	4.6	201053	0.9
2011Q1	24.8	2853365	105.8	5.9	199334	-2.8
2011Q2	25.6	2883258	108.1	6.7	198605	0.8
2011Q3	25	2952762	110.5	4.4	230609	-3.1
2011Q4	23.8	3041535	112	7.6	218604	-8.5
2012Q1	25	3070454	110.9	5.9	241038	6.1
2012Q2	24.8	3106184	109.2	4.5	214404	-2.7
2012Q3	25.2	3148672	109.7	2.8	252191	0.2
2012Q4	24.5	3230610	108.3	9.6	239316	-5.5
2013Q1	25	3302440	109.9	6	257974	-1.3
2013Q2	25.3	3348933	112.3	4.3	234886	-2
2013Q3	24.5	3397910	116.7	5.1	269441	-3.1
2013Q4	24.1	3492193	118	6.2	261059	-2.3
2014Q1	25.2	3561688	119.4	8.1	279924	-4.3

Appendix B: Johansen Cointegration Approach

Date: 10/20/14 Time: 17:49
Sample (adjusted): 1995Q4 2014Q1
Included observations: 74 after adjustments
Trend assumption: Linear deterministic trend
Series: LOG_UNE LOG_GDP LOG_EXPT LCPI
LOG_GEXP LRER
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.430810	127.1602	95.75366	0.0001
At most 1 *	0.395585	85.45822	69.81889	0.0017
At most 2 *	0.226521	48.19964	47.85613	0.0464
At most 3	0.178963	29.19223	29.79707	0.0586
At most 4	0.123337	14.60042	15.49471	0.0679
At most 5 *	0.063560	4.859590	3.841466	0.0275

Trace test indicates 3 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.430810	41.70202	40.07757	0.0325
At most 1 *	0.395585	37.25858	33.87687	0.0190
At most 2	0.226521	19.00740	27.58434	0.4140
At most 3	0.178963	14.59181	21.13162	0.3185
At most 4	0.123337	9.740833	14.26460	0.2295
At most 5 *	0.063560	4.859590	3.841466	0.0275

Max-eigenvalue test indicates 2 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LOG_UNE	LOG_GDP	LOG_EXPT	LCPI	LOG_GEXP	LRER
9.584580	-26.03066	13.24710	1.495597	20.48112	1.119902
-4.467237	28.87802	-14.96111	1.503629	-23.71120	-0.076079
3.690427	-2.935043	-2.378574	0.761378	2.936445	-0.982882
-5.108792	1.569164	-12.29492	0.173582	1.312233	0.007080
5.497690	7.341905	-13.92484	0.307826	-2.889617	-0.128237

3.940289	3.565643	-4.983399	-0.467051	-3.805875	-0.215840

Unrestricted Adjustment Coefficients (alpha):

D(LOG_UNE)	-0.001278	0.008745	0.003194	0.011309	-0.008335	-0.005945
D(LOG_GDP)	-0.001381	0.000578	-0.001316	-0.000152	-0.001294	0.002508
D(LOG_EXPT)	-0.000472	0.001280	-0.007921	0.010024	0.008899	0.003984
D(LCPI)	-0.239322	-0.245039	-0.070350	0.011494	-0.049359	0.019181
D(LOG_GEXP)	-0.020495	0.026033	-0.006697	-0.009760	-0.000443	-0.003855
D(LRER)	-0.245461	0.272488	0.670751	0.011841	0.066851	0.020740

1 Cointegrating Equation(s):		Log likelihood	423.0469

Normalized cointegrating coefficients (standard error in parentheses)

LOG_UNE	LOG_GDP	LOG_EXPT	LCPI	LOG_GEXP	LRER
1.000000	-2.715889	1.382126	0.156042	2.136883	0.116844
	(0.48791)	(0.39724)	(0.03453)	(0.38867)	(0.02252)

Adjustment coefficients (standard error in parentheses)

D(LOG_UNE)	-0.012250
	(0.05636)
D(LOG_GDP)	-0.013240
	(0.01376)
D(LOG_EXPT)	-0.004528
	(0.05154)
D(LCPI)	-2.293799
	(0.64957)
D(LOG_GEXP)	-0.196437
	(0.07037)
D(LRER)	-2.352642

	(1.87543)					

2 Cointegrating Equation(s):	Log likelihood	441.6762

Normalized cointegrating coefficients (standard error in parentheses)

LOG_UNE	LOG_GDP	LOG_EXPT	LCPI	LOG_GEXP	LRER
1.000000	0.000000	-0.042975	0.512966	-0.160523	0.189162
		(0.57443)	(0.07969)	(0.15346)	(0.04867)
0.000000	1.000000	-0.524727	0.131421	-0.845913	0.026628
		(0.16044)	(0.02226)	(0.04286)	(0.01359)

Adjustment coefficients (standard error in parentheses)

D(LOG_UNE)	-0.051315	0.285800
	(0.06102)	(0.22436)
D(LOG_GDP)	-0.015822	0.052651
	(0.01516)	(0.05574)
D(LOG_EXPT)	-0.010248	0.049270
	(0.05683)	(0.20895)
D(LCPI)	-1.199151	-0.846544
	(0.63380)	(2.33023)
D(LOG_GEXP)	-0.312732	1.285279
	(0.06902)	(0.25376)
D(LRER)	-3.569910	14.25843
	(2.03542)	(7.48346)

3 Cointegrating Equation(s):	Log likelihood	451.1799

Normalized cointegrating coefficients (standard error in parentheses)

LOG_UNE	LOG_GDP	LOG_EXPT	LCPI	LOG_GEXP	LRER
1.000000	0.000000	0.000000	0.521492	-0.172478	0.207481
			(0.08219)	(0.07177)	(0.04963)
0.000000	1.000000	0.000000	0.235521	-0.991892	0.250304
			(0.08872)	(0.07748)	(0.05357)
0.000000	0.000000	1.000000	0.198390	-0.278200	0.426273
			(0.14896)	(0.13008)	(0.08994)

Adjustment coefficients (standard error in parentheses)

D(LOG_UNE)	-0.039529	0.276426	-0.155358
	(0.06447)	(0.22442)	(0.11583)
D(LOG_GDP)	-0.020680	0.056514	-0.023817
	(0.01594)	(0.05550)	(0.02865)

D(LOG_EXPT)	-0.039479	0.072518	-0.006573
	(0.05909)	(0.20571)	(0.10618)
D(LCPI)	-1.458772	-0.640063	0.663071
	(0.66353)	(2.30988)	(1.19223)
D(LOG_GEXP)	-0.337447	1.304935	-0.645051
	(0.07246)	(0.25224)	(0.13019)
D(LRER)	-1.094553	12.28975	-8.923800
	(1.92534)	(6.70244)	(3.45943)

4 Cointegrating Equation(s):	Log likelihood	458.4758

Normalized cointegrating coefficients (standard error in parentheses)

LOG_UNE	LOG_GDP	LOG_EXPT	LCPI	LOG_GEXP	LRER
1.000000	0.000000	0.000000	0.000000	-0.020206	-0.421115
				(0.15481)	(0.09936)
0.000000	1.000000	0.000000	0.000000	-0.923121	-0.033588
				(0.02633)	(0.01690)
0.000000	0.000000	1.000000	0.000000	-0.220271	0.187137
				(0.06739)	(0.04325)
0.000000	0.000000	0.000000	1.000000	-0.291993	1.205380
				(0.35790)	(0.22971)

Adjustment coefficients (standard error in parentheses)

D(LOG_UNE)	-0.097305	0.294172	-0.294404	0.015632
	(0.06854)	(0.21726)	(0.13130)	(0.01258)
D(LOG_GDP)	-0.019903	0.056275	-0.021947	-0.002225
	(0.01752)	(0.05554)	(0.03357)	(0.00322)
D(LOG_EXPT)	-0.090689	0.088247	-0.129817	-0.003072
	(0.06297)	(0.19959)	(0.12063)	(0.01156)
D(LCPI)	-1.517491	-0.622028	0.521758	-0.777945
	(0.72908)	(2.31102)	(1.39670)	(0.13385)
D(LOG_GEXP)	-0.287587	1.289621	-0.525057	0.001698
	(0.07812)	(0.24761)	(0.14965)	(0.01434)
D(LRER)	-1.155045	12.30833	-9.069381	0.555360
	(2.11609)	(6.70760)	(4.05383)	(0.38849)

5 Cointegrating Equation(s):	Log likelihood	463.3463

Normalized cointegrating coefficients (standard error in parentheses)

LOG_UNE	LOG_GDP	LOG_EXPT	LCPI	LOG_GEXP	LRER
1.000000	0.000000	0.000000	0.000000	0.000000	-0.328778

					(0.07988)
0.000000	1.000000	0.000000	0.000000	0.000000	4.184822
					(1.01244)
0.000000	0.000000	1.000000	0.000000	0.000000	1.193716
					(0.28030)
0.000000	0.000000	0.000000	1.000000	0.000000	2.539708
					(0.52912)
0.000000	0.000000	0.000000	0.000000	1.000000	4.569725
					(1.10128)

Adjustment coefficients (standard error in parentheses)

D(LOG_UNE)	-0.143128	0.232978	-0.178341	0.013066	-0.185221
	(0.07365)	(0.21690)	(0.14961)	(0.01246)	(0.17278)
D(LOG_GDP)	-0.027015	0.046778	-0.003934	-0.002624	-0.042325
	(0.01906)	(0.05612)	(0.03871)	(0.00322)	(0.04471)
D(LOG_EXPT)	-0.041763	0.153586	-0.253740	-0.000333	-0.075854
	(0.06720)	(0.19791)	(0.13651)	(0.01137)	(0.15765)
D(LCPI)	-1.788850	-0.984416	1.209072	-0.793139	0.859724
	(0.79384)	(2.33793)	(1.61259)	(0.13430)	(1.86237)
D(LOG_GEXP)	-0.290026	1.286365	-0.518882	0.001562	-1.068224
	(0.08555)	(0.25195)	(0.17378)	(0.01447)	(0.20070)
D(LRER)	-0.787517	12.79915	-10.00028	0.575939	-9.696351
	(2.31461)	(6.81669)	(4.70184)	(0.39158)	(5.43012)

Appendix C: Vector Error Correction Model

Vector Error Correction Estimates
Date: 10/13/14 Time: 17:22
Sample (adjusted): 1995Q4 2014Q1
Included observations: 74 after adjustments
Standard errors in ( ) & t-statistics in [ ]

CointegratingEq:	CointEq1	CointEq2
LOG_UNE(-1)	1.000000	0.000000
LOG_GDP(-1)	0.000000	1.000000
LOG_EXPT(-1)	-0.042975	-0.524727
	(0.57928)	(0.16180)
	[-0.07419]	[-3.24310]
LCPI(-1)	0.512966	0.131421
	(0.08036)	(0.02245)
	[6.38343]	[5.85519]

LOG_GEXP(-1)	-0.160523	-0.845913
	(0.15476)	(0.04323)
	[-1.03726]	[-19.5698]
LRER(-1)	0.189162	0.026628
	(0.04908)	(0.01371)
	[3.85411]	[1.94238]
C	-2.053040	-2.327526

Error Correction:	D(LOG_UNE)	D(LOG_GDP)	D(LOG_EXPT)	D(LCPI)	D(LOG_GEXP)	D(LRER)
CointEq1	-0.051315	-0.015822	-0.010248	-1.199151	-0.312732	-3.569910
	(0.06154)	(0.01529)	(0.05731)	(0.63915)	(0.06960)	(2.05260)
	[-0.83388]	[-1.03498]	[-0.17881]	[-1.87618]	[-4.49309]	[-1.73922]
CointEq2	0.285800	0.052651	0.049270	-0.846544	1.285279	14.25843
	(0.22625)	(0.05621)	(0.21071)	(2.34990)	(0.25590)	(7.54662)
	[1.26321]	[0.93673]	[0.23383]	[-0.36025]	[5.02252]	[1.88938]
D(LOG_UNE(-1))	0.053201	0.016877	-0.082172	2.249559	0.490299	-5.581840
	(0.12751)	(0.03168)	(0.11875)	(1.32438)	(0.14422)	(4.25321)
	[0.41722]	[0.53276]	[-0.69194]	[1.69857]	[3.39954]	[-1.31238]
D(LOG_UNE(-2))	-0.115242	-0.009654	0.207391	1.916678	0.011836	3.9

						48147
	(0.13298)	(0.03304)	(0.12385)	(1.38119)	(0.15041)	(4.43565)
	[-0.86660]	[-0.29222]	[1.67455]	[1.38770]	[0.07869]	[0.89009]
D(LOG_GDP(-1))	0.397725	-0.130194	0.440109	10.34786	-1.502564	-21.08143
	(0.65404)	(0.16248)	(0.60912)	(6.79308)	(0.73976)	(21.8158)
	[0.60810]	[-0.80128]	[0.72253]	[1.52329]	[-2.03114]	[-0.96634]
D(LOG_GDP(-2))	-0.324266	-0.041966	0.010037	12.18168	-1.988726	30.48890
	(0.61285)	(0.15225)	(0.57076)	(6.36526)	(0.69318)	(20.4418)
	[-0.52911]	[-0.27564]	[0.01758]	[1.91378]	[-2.86901]	[1.49150]
D(LOG_EXPT(-1))	0.090818	0.065645	-0.194468	-1.968416	0.410595	-4.543694
	(0.15416)	(0.03830)	(0.14357)	(1.60111)	(0.17436)	(5.14192)
	[0.58913]	[1.71413]	[-1.35453]	[-1.22940]	[2.35486]	[-0.88366]
D(LOG_EXPT(-2))	0.124156	0.021507	-0.025145	-1.524098	0.461626	-0.542124
	(0.12995)	(0.03228)	(0.12103)	(1.34974)	(0.14699)	(4.

						33465)
	[0.95539]	[0.66616]	[-0.20776]	[-1.12918]	[3.14060]	[-0.12507]
D(LCPI(-1))	-0.005061	0.001565	0.001454	0.135984	0.014518	0.202828
	(0.01160)	(0.00288)	(0.01080)	(0.12044)	(0.01312)	(0.38678)
	[-0.43647]	[0.54313]	[0.13468]	[1.12910]	[1.10692]	[0.52441]
D(LCPI(-2))	-0.014479	2.69E-05	0.013971	-0.047424	-0.016412	0.071397
	(0.01101)	(0.00274)	(0.01025)	(0.11436)	(0.01245)	(0.36725)
	[-1.31504]	[0.00982]	[1.36250]	[-0.41470]	[-1.31789]	[0.19441]
D(LOG_GEXP(-1))	-0.106666	0.045831	-0.006525	-1.682150	-0.064565	4.234315
	(0.16995)	(0.04222)	(0.15828)	(1.76516)	(0.19223)	(5.66875)
	[-0.62763]	[1.08553]	[-0.04123]	[-0.95297]	[-0.33588]	[0.74696]
D(LOG_GEXP(-2))	-0.156266	0.026617	-0.070754	-1.211418	0.338802	-1.912634
	(0.11099)	(0.02757)	(0.10337)	(1.15277)	(0.12554)	(3.70209)
	[-1.40794]	[0.96534]	[-0.68449]	[-1.05087]	[2.69883]	[-0.5166

						4]
D(LRER(-1))	-0.000974	0.000122	-0.003315	0.109778	0.021966	-0.487115
	(0.00568)	(0.00141)	(0.00529)	(0.05898)	(0.00642)	(0.18942)
	[-0.17151]	[0.08657]	[-0.62672]	[1.86119]	[3.41984]	[-2.57160]
D(LRER(-2))	1.56E-05	0.000111	-0.004222	0.067774	0.009183	-0.297462
	(0.00394)	(0.00098)	(0.00367)	(0.04089)	(0.00445)	(0.13131)
	[0.00395]	[0.11374]	[-1.15154]	[1.65761]	[2.06236]	[-2.26543]
C	0.008943	0.026776	-0.000836	-0.470996	0.098496	-0.288617
	(0.02242)	(0.00557)	(0.02088)	(0.23286)	(0.02536)	(0.74781)
	[0.39891]	[4.80743]	[-0.04003]	[-2.02268]	[3.88422]	[-0.38595]
R-squared	0.293545	0.086551	0.179209	0.459854	0.836239	0.497654
Adj. R-squared	0.125911	-0.130199	-0.015555	0.331684	0.797380	0.378453
Sum sq. resids	0.147856	0.009125	0.128245	15.95011	0.189155	164.5016
S.E. equation	0.050060	0.012436	0.046622	0.519943	0.056622	1.669779

F-statistic	1.751112	0.399313	0.920134	3.587842	21.52008	4.174921
Log likelihood	124.9750	228.0276	130.2401	-48.22127	115.8610	-134.5591
Akaike AIC	-2.972297	-5.757503	-3.114597	1.708683	-2.725973	4.042138
Schwarz SC	-2.505257	-5.290463	-2.647556	2.175723	-2.258932	4.509178
Mean dependent	0.005399	0.025111	0.007062	0.011801	0.027369	-0.044286
S.D. dependent	0.053545	0.011698	0.046264	0.636011	0.125789	2.117981

Determinant resid covariance (dof adj.)	1.03E-12
Determinant resid covariance	2.64E-13
Log likelihood	441.6762
Akaike information criterion	-9.180439
Schwarz criterion	-6.004565

Appendix D: Granger Causality Test

Pairwise Granger Causality Tests
Date: 10/20/14 Time: 17:54
Sample: 1995Q1 2014Q1
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Prob.
LOG_GDP does not Granger Cause LOG_UNE	73	0.58990	0.6711
LOG_UNE does not Granger Cause LOG_GDP		0.68984	0.6017
LOG_EXPT does not Granger Cause LOG_UNE	73	0.41262	0.7989
LOG_UNE does not Granger Cause LOG_EXPT		1.29161	0.2827
LCPI does not Granger Cause LOG_UNE	73	2.26419	0.0719
LOG_UNE does not Granger Cause LCPI		1.80205	0.1393

LOG_GEXP does not Granger Cause LOG_UNE	73	3.45646	0.0128
LOG_UNE does not Granger Cause LOG_GEXP		0.84869	0.4997
LRER does not Granger Cause LOG_UNE	73	0.26686	0.8982
LOG_UNE does not Granger Cause LRER		0.42059	0.7932
LOG_EXPT does not Granger Cause LOG_GDP	73	0.72453	0.5784
LOG_GDP does not Granger Cause LOG_EXPT		4.41893	0.0032
LCPI does not Granger Cause LOG_GDP	73	1.30550	0.2775
LOG_GDP does not Granger Cause LCPI		0.58138	0.6772
LOG_GEXP does not Granger Cause LOG_GDP	73	0.40690	0.8030
LOG_GDP does not Granger Cause LOG_GEXP		2.12866	0.0874
LRER does not Granger Cause LOG_GDP	73	0.48115	0.7494
LOG_GDP does not Granger Cause LRER		0.49587	0.7388
LCPI does not Granger Cause LOG_EXPT	73	1.57947	0.1905
LOG_EXPT does not Granger Cause LCPI		0.36025	0.8360
LOG_GEXP does not Granger Cause LOG_EXPT	73	1.18450	0.3261
LOG_EXPT does not Granger Cause LOG_GEXP		2.07557	0.0943
LRER does not Granger Cause LOG_EXPT	73	1.18558	0.3257
LOG_EXPT does not Granger Cause LRER		0.75719	0.5570
LOG_GEXP does not Granger Cause LCPI	73	0.01971	0.9992
LCPI does not Granger Cause LOG_GEXP		2.27093	0.0712
LRER does not Granger Cause LCPI	73	2.37410	0.0613
LCPI does not Granger Cause LRER		0.49647	0.7383
LRER does not Granger Cause LOG_GEXP	73	0.68421	0.6055
LOG_GEXP does not Granger Cause LRER		0.34881	0.8439

Appendix E: WHITE Hectoskedasticity

Heteroskedasticity Test: White

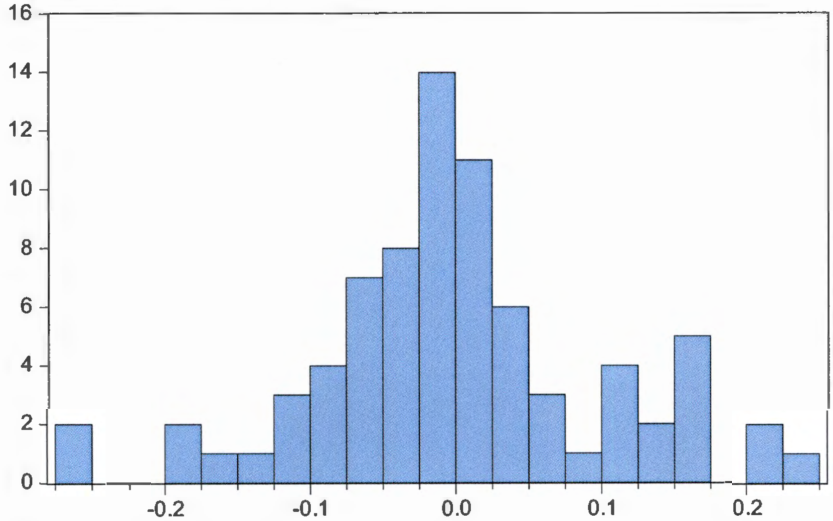
F-statistic	1.798265	Prob. F(20,56)	0.0440
Obs*R-squared	30.11275	Prob. Chi-Square(20)	0.0680
Scaled explained SS	32.52643	Prob. Chi-Square(20)	0.0380

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 10/13/14 Time: 17:09
Sample: 1995Q1 2014Q1
Included observations: 77

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.321531	3.595961	-0.923684	0.3596
LOG_GDP^2	-0.576723	0.439239	-1.313005	0.1945
LOG_GDP*LOG_EXPT	0.320891	0.922636	0.347798	0.7293
LOG_GDP*LCPI	-0.000697	0.040467	-0.017213	0.9863
LOG_GDP*LOG_GEXP	0.992609	0.631519	1.571781	0.1216
LOG_GDP*LRER	0.010657	0.017588	0.605916	0.5470
LOG_GDP	3.521621	1.963160	1.793853	0.0782
LOG_EXPT^2	0.000356	0.499045	0.000714	0.9994
LOG_EXPT*LCPI	0.009235	0.064295	0.143640	0.8863
LOG_EXPT*LOG_GEXP	-0.275192	0.685439	-0.401482	0.6896
LOG_EXPT*LRER	0.007072	0.021218	0.333325	0.7401
LOG_EXPT	-1.398963	1.883120	-0.742896	0.4606
LCPI^2	-0.001565	0.002738	-0.571728	0.5698
LCPI*LOG_GEXP	-0.006354	0.030709	-0.206908	0.8368
LCPI*LRER	-0.003254	0.002375	-1.370314	0.1761
LCPI	0.049217	0.140777	0.349613	0.7279
LOG_GEXP^2	-0.419312	0.232116	-1.806473	0.0762
LOG_GEXP*LRER	-0.013576	0.013608	-0.997622	0.3228
LOG_GEXP	-3.218693	1.530201	-2.103444	0.0399
LRER^2	0.001738	0.001143	1.520769	0.1339
LRER	-0.019714	0.060622	-0.325188	0.7463

R-squared	0.391075	Mean dependent var	0.010084
Adjusted R-squared	0.173601	S.D. dependent var	0.016180
S.E. of regression	0.014709	Akaike info criterion	-5.373766
Sum squared resid	0.012115	Schwarz criterion	-4.734546
Log likelihood	227.8900	Hannan-Quinn criter.	-5.118084
F-statistic	1.798265	Durbin-Watson stat	1.451416
Prob(F-statistic)	0.044015		

Appendix F: Histogram



Series: Residuals
Sample 1995Q1 2014Q1
Observations 77

Mean	1.95e-15
Median	-0.007852
Maximum	0.238719
Minimum	-0.272085
Std. Dev.	0.101079
Skewness	-0.013828
Kurtosis	3.540860
Jarque-Bera	0.940985
Probability	0.624695

Appendix G: GARCH Model

Dependent Variable: LOG_UNE
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 10/20/14 Time: 18:01
Sample: 1995Q1 2014Q1
Included observations: 77
Failure to improve Likelihood after 31 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(7) + C(8)*RESID(-1)^2 + C(9)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
LOG_GDP	0.188607	0.060380	3.123660	0.0018
LOG_EXPT	-0.515192	0.076085	-6.771255	0.0000
LCPI	-0.022087	0.011193	-1.973302	0.0485
LOG_GEXP	-0.050733	0.045082	-1.125339	0.2604
LRER	-0.003868	0.003319	-1.165150	0.2440
C	3.474142	0.256814	13.52785	0.0000
		Variance Equation		
C	0.000826	0.000459	1.801211	0.0717
RESID(-1)^2	1.223926	0.371369	3.295712	0.0010
GARCH(-1)	-0.151262	0.114294	-1.323446	0.1857

R-squared	-0.117028	Mean dependent var	3.161014
Adjusted R-squared	-0.195692	S.D. dependent var	0.120811
S.E. of regression	0.132104	Akaike info criterion	-2.353745
Sum squared resid	1.239057	Schwarz criterion	-2.079794

Log likelihood	99.61918	Hannan-Quinn criter.	-2.244167
Durbin-Watson stat	0.218587		