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The Effects of Fiscal Policy on the Current Account and Real Exchange Rate in South Africa

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DECLARATION

I Nwabisa Florence Ndzama .....declare that

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ABSTRACT

This dissertation empirically studies the effects of expansionary fiscal policy on the current account and the real exchange rate in the South African economy. Recursive vector auto-regressive models based on the Choleski factorization identification scheme are used in the empirical analysis. This identification approach requires the imposition of restrictions on the VAR model and the most endogenous variables are ordered last. The dissertation uses quarterly data for the period 1990:1 to 2014:4 which was collected from the South African Reserve Bank website and the World Development Indicators.

A 5-variable reduced form VAR model is used to generate various impulse response functions (which show the response of other variables to a shock to one variable), to carry out a variance decomposition (to assess how much variation in one variable is caused by another variable's error term) and to conduct Granger causality tests (to assess whether each variable Granger causes, or is caused by, each other variable). The variables examined are: the government budget deficit (GOV), the current account (CUR) (both measured as percentage of GDP), the logged real exchange rate (LREER), logged real GDP (LRGDP) and the 3–month real interest rate (RIR).

The current literature is quite inconclusive about the relationships between the government budget deficit, the current account and the real exchange rate and is generally focused on developed countries, in particular the United States. This dissertation contributes to the literature from a South African perspective. In spite of concerns about "twin deficits" (that is, when the fiscal deficit increases, the current account deficit worsens) for the South African economy, empirical evidence indicates that "twin divergence" is a more usual feature of historical data. In contrast to most of the theoretical models, the results for the South African economy suggest that an expansionary fiscal policy shocks *improves* the current account, depicting "twin divergence". The effects of fiscal deficits on the real exchange rate seem to be consistent with the conventional view, that a government budget deficit induces a real exchange rate appreciation. The "twin divergence" of fiscal policy and the current account is also explained by the greater prevalence of output shocks than fiscal shocks.

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Chapter 1

Introduction and General Orientation

1.1 Introduction

Fiscal policy is a policy that is primarily concerned with stimulating economic and social development. In the post-apartheid era the South African government has focused on addressing three major challenges; poverty, inequality and unemployment. Democracy was accompanied by high hopes that things would get better. In an attempt to address these challenges through income redistribution and restructuring the economy, the South African government kept expanding public spending, for instance, non-income generating programmes such as transfer payments and RDP houses were implemented. According to Ocran (2013) about 30% of aggregate domestic demand comes from government consumption and about 95% of this expenditure is financed through revenue generated from taxes. Therefore, the effect of fiscal policy in the economy should not be underestimated. The South African government has been effective in raising revenue through the tax system. Unfortunately in the last medium term budget, the revenue was reported as having declined by 1.7 billion rands and this further worsens the budget deficit. Increased government spending, *ceteris paribus*, translates to higher budget deficits and an increased debt to gross domestic product ratio. The question is how the government budget deficit is related to the current account and the real exchange rate.

The South African post-Apartheid period has been characterized by a more open economy as the country consistently deepened its integration in the global market (Ocran, 2009). Numerous theoretical models suggest that expansive public expenditure induces a widening current account deficit and appreciation of the real exchange rate. However, some studies argue that "twin divergence", is a more commonly observed feature of the historical economic data and further induce exchange rate depreciation (Kim and Roubini, 2008). The objective of this dissertation is therefore to contribute to the literature by examining the effects of fiscal policy shocks on the current account and the real exchange rate from a South African focused empirical study.

1.2 Background of the study

Interest in analyzing the relationship between fiscal policy, the current account and the real exchange rate was spurred by the steady increase in the United States budget deficit to around 6

per cent of gross domestic product (GDP) in 2004. This was associated with worsening current account balance reaching 5% of GDP and an appreciation in the real exchange rate. However, during the year 2000, the budget balance improved but the current account worsened and the real exchange rate appreciated (Kim and Roubini, 2008).

Therefore we cannot assume an automatic co-movement between the public expenditure and the current account deficit. For instance, Balassa (1988) found a positive co-movement between the fiscal and the current account deficits in the industrialized countries but not in developing countries. On the contrary in 1988-89, the United Kingdom maintained a strong budget balance while the current account deficit was persistently negative (Easterly and Fischer, 1990). Easterly and Fischer (1990) further argued that the effect of the budget deficit on the current account depends on monetary policy effects on the real exchange rate. For instance, a decrease in government spending in conjunction with monetary easing would result in an exchange rate depreciation and interest rate reduction, consequently domestic investment increases and the current account deficit is reduced.

These results are somewhat puzzling given the theoretical predictions that fiscal deficits induce current account deficit and real exchange rate appreciation. Theories such as the Keynesian models like Mundell-Flemming model as augmented by Dornbusch (1976) with rational expectations variants and adjusted real business cycle models with investment such as Baxter (1995) in most cases provide such predictions. Kim and Roubini (2008) posit that the precise effects depend on the type of fiscal expansion, the size of the economy, the completeness or otherwise of the international asset market structure and the specification of the model. Moreover, the impact of the 2008 global economic crisis also drew much attention to this topic.

The literature has been inconclusive about the relationship between the budget deficit, the current account balance and the real exchange rate. The fact that studies such as those mentioned above have focused on large economies, in particular the United States, indicates a gap in this literature. Thus, this dissertation is focused on examining the relationships of these variables in developing economy such as South Africa.

1.3 Research Problem

For many years, researchers have debated the relationship between the government budget deficit, the current account and the real exchange rate. Numerous empirical studies have found

that a budget deficit induces a current account deficit (the so called twin deficit) and a real exchange rate appreciation whilst many other studies have shown a twin divergence.

Thus, this study aims to assess how the current account and the real exchange rate are affected by budget deficit in South Africa, as a means of contributing to the existing literature. Similar studies have been conducted in developed economies such as the US, Canada, the UK and Australia, but have not previously been done in South Africa, to the best of my knowledge. A chronic situation of budget deficit, current account deficit and real exchange rate depreciation in South Africa draws much attention to the need to examine the relationship between these variables. Therefore, overall this study aims to create awareness about the nature of the relationship between the budget deficit, the current account and the real exchange rate in the South African context, which might inform policy makers' decisions.

1.4 Research Questions

1. Are the current account and the real exchange rate affected by government budget deficit shocks in South Africa?
2. How are the current account and the budget deficit related?
3. How are the real exchange rate and the budget deficit related?
4. How are the current account and the real exchange rate related?

1.5 Organization of the study

The study is organized into five chapters. The current chapter presents an introduction, background to the study, the research problem and the research questions. Chapter two reviews the theoretical background and empirical findings. Chapter three discusses the research methodology and data. Chapter four presents the econometric analysis and the findings. Chapter five reports the conclusion and makes recommendations and suggestions for further research.

Chapter 2

Literature Review

2.1 Introduction

A large number of studies have examined the relationship between the government budget deficit, the current account and the real exchange rate and most of them cover only developed countries, in particular the United States. This chapter will review this international literature and give more attention to studies that have attempted to quantify the relationship between these variables. Fiscal policy refers to the balance between government expenditures and income generated through taxes and other sources. When government spending exceeds revenue this is referred to as government budget deficit. The current account measures the excess of income from exports over expenditure on imports which is the trade balance but also includes the income on investments abroad. The third key variable is the real exchange rate which is a measure of the relative price of goods between different economies in real rather than nominal terms.

The discussion below will first look at the theoretical literature and secondly will review empirical results. Lastly, the chapter sums up common themes and relates them to the research questions of the current dissertation.

2.2 The Current Account

This section sets out some basic relationships between the macroeconomic variables focusing on the current account. The familiar definition of gross domestic product (GDP) in the national income accounts is,

$$Y_t = C_t + I_t + G_t + (X_t - M_t). \quad (2.1)$$

C_t is household consumption spending, I_t is corporate investment spending, G_t denotes government expenditure, X_t represent exports of domestic goods and services whilst M_t represent imports of foreign goods and services and the difference between these $(X_t - M_t)$ are net exports.

The current account is defined as the sum of net exports and net income on foreign assets:

$$CA_t = X_t - M_t + r_t B_t. \quad (2.2)$$

B_t represents assets holdings at the beginning of period t, r_t is the return on those assets and thus the term $r_t B_t$ is net income on foreign assets, which is the difference between the income received from domestic capital invested abroad and the income paid to foreign investors. Where foreign liabilities exceed foreign assets the term is negative. Net exports are typically the larger component of the current account balance and the two terms are sometimes used as substitutes. However, focusing exclusively on net exports makes the intertemporal aspects of the current account less obvious, and it is to these that I now turn.

In order to relate the external deficit to the difference between the national savings and investment, we combine equations (1) and (2) which defines the current account as follows;

$$CA_t = Y_t + r_t B_t - C_t - G_t - I_t. \quad (2.3)$$

From equation 1 we know that Y_t is the economy's GDP in period t, which is the sum of all the final goods and services produced within the boundaries of country. The terms $Y_t + r_t B_t$ when combined are referred to as gross national product (GNP). According to the national income accounting identity, national savings in an open economy can be defined as;

$$S_t = Y_t + r_t B_t - C_t - G_t. \quad (2.4)$$

Therefore combining equations (3) and (4) in an open economy we have:

$$S_t = CA_t + I_t. \quad (2.5)$$

Thus the current account can be written as:

$$CA_t = S_t - I_t. \quad (2.6)$$

Equation (6) indicates that the current account is fundamentally an intertemporal phenomena. According to Obstfeld and Rogoff (1996), the saving-investment identity is vital for analyzing how economic policies and shocks change the current account. For instance, if saving exceeds investment (i.e $S_t > I_t$) then that particular country runs a current account surplus and accumulates foreign assets (or reduces foreign liabilities). If instead investment exceeds savings (i.e $I_t > S_t$) then the country will experience a current account deficit and the country accumulates liabilities to foreigners (or reduces assets overseas). An open economy therefore has scope for funding investment opportunities that are not available to a closed economy. If

investment opportunities are good compared with the rest of the world then it makes sense to use foreign savings to fund these investments. A common example of this phenomenon is the Norwegian case, when the country ran a current account deficit in the process of funding the investments in the oil sector during the 1970s.

The intertemporal approach helps us to see that neither borrowing from nor lending to the rest of the world is an activity that can continue indefinitely (a two-period framework is the most commonly used method to illustrate this). The general equation relating the current account to holdings of foreign assets is,

$$CA_t = B_{t+1} - B_t. \tag{2.7}$$

B_{t+1} is the asset holding at the end of period t (and thus the beginning of period $t+1$). These assets can be accumulated only if the national savings exceed investment. The objective of holding asset is to accumulate wealth. But this does not mean that a country would want to keep accumulating assets indefinitely. Likewise a country will not be able to indefinitely accumulate foreign liabilities. The point is that, although the current account is not always balanced a current account deficit today must be offset by a current account surplus tomorrow, or vice-versa.

To explore the relationship between the current account and the government budget deficit it is worth distinguishing between the private sector saving decisions and the public sector saving decisions,

$$S_t = S_t^P + S_t^G. \tag{2.8}$$

S_t^P is the private sector savings, defined as the part of disposable income (Y_t) plus net income from foreign assets ($r_t B_t$) less taxes (T_t) and consumption(C_t). This gives:

$$S_t^P = Y_t + r_t B_t - T_t - C_t. \tag{2.9}$$

Government saving is defined as the difference between revenue generated through taxes (T_t) and expenditure (G_t);

$$S_t^G = T_t - G_t. \tag{2.10}$$

Then equation (5) becomes,

$$S_t^P + S_t^G = CA_t + I_t. \quad (2.11)$$

Thus, the current account in equation (6) can be rewritten as follows;

$$CA_t = S_t^P + S_t^G - I_t. \quad (2.12)$$

From the national savings we have;

$$S_t = (Y_t + r_t B_t - T_t - C_t) + (T_t - G_t) = S_t^P + S_t^G = I_t + CA_t. \quad (2.13)$$

We can rewrite equation (13) in a form that is useful for analyzing the effects of government saving decisions on an open economy, we get,

$$S_t^P = I_t + CA_t - S_t^G = I_t + CA_t - (T_t - G_t). \quad (2.14)$$

Rewriting equation (14) in terms of the current account gives;

$$CA_t = S_t^P - I_t - (G_t - T_t). \quad (2.15)$$

$(G_t - T_t)$ is the government budget deficit. If there is no change in investment, even if the budget deficit increases, the current account need not be affected because government dissaving may be offset by an increase in the private saving. In this case one can say that private saving in indeed responsive to the government budget deficit as asserted by the Ricardian equivalence, which assumes that individuals are forward-looking. This means private sector is aware that tax cuts today will be offset by an increase in tax bills in the future. Conversely, if the difference between the private savings and investment is constant over time an increase in the budget deficit will be reflected in the current account and the hypothesis of twin deficit will hold. However, the real world is more complex than these two extreme cases, hence in analysing twin deficit hypothesis one has to also look closely at the channels by which the government budget deficit influences the economy.

2.3 The Government budget deficit

The standard definition of the budget deficit is the one from debt perspective by economists for government budget deficit (Lamei, 2005 cited by Mehdi, 2015). According to Blanchard (2000), the budget deficit is defined as follows:

$$\text{Def} = rD_{t+1} + G_t - T_t. \quad (2.16)$$

Note that all variables are measured in real terms. D_{t+1} is the government debt at the beginning of year *t*, r is the real interest rate (assumed to be constant). Therefore, rD_{t+1} represent the real interest payments on the existing government debt. G_t denotes government spending during year *t* whilst T_t denotes taxes net of transfer. Therefore, the budget deficit is equal to government spending including interest payments on the debt minus taxes net transfers. The term (G_t -T_t) is referred to as budget deficit (equivalently, budget surplus). Importantly, the main distinction between "debt" and "deficit" is that, debt is a stock (that is, what the government owes as a result of deficit) whereas the budget deficit is a flow (that is, how much the government borrows in a given year).

Let us now look at what constrains the government budget. According to Blanchard (2000), the government budget constraint at year t is expressed as follows:

$$D_t - D_{t+1} = Def. \tag{2.17}$$

By substituting equation (1), the government budget constraint can be rewritten as follows;

$$D_t - D_{t+1} = rD_{t+1} + G_t - T_t. \tag{2.18}$$

D_t is the government debt in the current period, D_{t+1} is the government debt from the end of last year and their sum gives us a change in debt between the two periods. The right hand side is the budget deficit from equation (1). Notably, the government budget constraint links the change in debt to its initial level (which affects the real interest payment) and to current year's government spending and taxes. Now, assuming that in year t, the government decreases taxes by 1, this leads to an increase in debt by one at the end of year t, (or at the beginning of year two). The Ricardian equivalence argument is that due to tax reduction forward thinking individuals will save extra money in year t since tax is expected to increase in year $t + 1$ to offset higher government debt. Hence, this proposition postulates that a tax cut has no effect of consumption, which implies that increase in private sector savings is equal to public sector dissaving. Total saving is therefore unchanged as well as the investment. The reality is that tax cuts rarely occur and individuals do not think that far into the future. It is therefore safe to conclude that budget deficit have an important effect on total demand, interest rate, gross domestic product and other variables (Blanchard, 2003). According to Keynesian theory, it is government's primary duty to create economic stability and government balance or imbalance should not be considered.

Keynes believed that if government spends through borrowing for production expansion purposes, borrowing and spending can improve the financial condition of a country (Biasenodon, 2004 cited by Mehdi, 2015). As a result, the budget deficit is not necessarily a bad and unsuitable issue if is for the right cause. All is needed is a timed deficit that generates beneficial consequences.

2.4 The real exchange rate

Both relative costs of living in different countries and relative prices of countries' exports and imports often display dramatic short term and long term shifts. For instance, the real depreciation leads to a shift in demand, both foreign and domestic, towards domestic goods. A real depreciation makes South African goods relatively cheaper abroad and foreign goods relatively more expensive leading to both an increase in domestic output and an improvement in the trade balance (Blanchard and Johnson, 2013). Therefore, international relative prices have long been at the centre of open-economy analysis. Hence, the inclusion of the real exchange rate in this study is vital to explore how it is related to the fiscal policy and affected by its shocks. In reality, economies produce and consume large amounts of commodities and services, many of which have prices that differ from country to country because of factors such as transport costs, tariffs and other trade barriers. This dissertation is focused on the ratio of national price levels (i.e, the real exchange rate). Blanchard and Johnson (2013) express the exchange rate as follows;

$$RER \equiv \frac{E\,P_B}{P_A}. \tag{2.19}$$

The real exchange rate, RER is equal to the nominal exchange rate, E (the price of domestic currency in terms of foreign currency) multiplied by the foreign price level, P_B, divided by the domestic price level, P_A. In the short-run, when prices are fixed, the nominal exchange rate changes will entail real exchange rate changes. Whilst in the long-run we expect the nominal exchange rate to adjust to offset inflation differentials. In this case, in the short-run we can take the two price levels P_A and P_B as given. This implies that the nominal exchange rate is reflected one for one in a real depreciation. For example, in the case of a rand/dollar exchange rate (i.e indirect method), if the rand depreciates against the dollar by 10% (i.e a 10% nominal depreciation), and if the price levels in United States and South Africa do not change, the South

African goods will be 10% cheaper compared to the United States' goods (this is a 10% real depreciation). Analogous reasoning applies to real exchange rate "appreciation".

This study analyses effective rather than bilateral real effective exchange rate, as the real effective rate measures the international competitiveness of a country against its trading partners and to avoid potential biases associated with the choice of base country in bilateral real exchange rate analyses. The basic question is, why do national price levels differ? The basic building block is the "law of one price", which states that in the absence of trade barriers, a commodity should sell for the same price world-wide (when prices are measured in a common currency) (Obstfeld and Rogoff, 1996). The mechanism supposedly enforcing the law of one price is arbitrage. If such arbitrage were pervasive, not only would hats sell for the same price in South Africa and United States, so would the golf lessons. Most of the empirical evidence show that the law of one price fails dramatically in practice, even for products that commonly enter international trade. It has been mentioned that it is because of transport costs, official trade barriers and non-competitive market structures. Due to these reasons, some goods and services become completely non-tradable.

For the purpose of this dissertation, let us further look at the theoretical relationship between the real exchange rate and the fiscal policy. In the case of real exchange rate, the conventional view of economic theories such as Mundell-Fleming is that expansionary fiscal policy leads to the real exchange rate appreciation and this is through a nominal exchange rate appreciation when there is perfect capital mobility, a flexible exchange rate regime and price rigidity. Suppose that starting from the budget balance, the government decides to increase defence spending and eventually run a budget deficit. What will happen to the exchange rate? According to Blanchard (2000), increases in government spending leads to an increase in aggregate demand for goods and services, leading to an increase in domestic output. As output increases, people will demand more money for immediate consumption. This leads to an upward pressure on the interest rate to control excess demand for money, as a result the exchange rate will decrease, in other words, domestic currency appreciates.

Both a higher interest rate and the appreciation of domestic currency decrease the demand for domestic goods, offsetting some of the effects of government spending on demand and output. As a result, both the appreciation of currency and increase in output decrease net exports. In

other words, the appreciation of currency decreases exports and increases imports, and the increase in output increases imports further due to an increase in domestic income. These theoretical views bring an expectation that-empirical evidence will show such relationships, in particular positive relationship between budget deficit and the current account deficit.

Conversely, the so called "J-Curve" theoretically explains the effect of the real exchange rate depreciation on the current account balance. The J-curve is a curve that describes the time lag with which a real currency depreciation improves the current account (Krugman and Obstfeld, 2003). The main argument illustrated by this curve is that it takes time for the markets to fully adjust to changes in relative prices. According to this curve, the primary effect of real depreciation is to raise the value of the precontracted level of imports in terms of domestic products because exports measured in domestic output do not change while imports measured in domestic output rise immediately, which induces a decline in the current account.

Looking at the production side, in response to real depreciation, the producers of exports may extend production plants, equipment and increase labour force, which takes time. Whilst on the consumption side, the domestic producers might have to build new retailing outlets abroad to expand significantly foreign consumption of domestic products, which is also a time-consuming process. These adjustments result in an improvement in the current account in the long run. Therefore, it should not be a surprise if the empirical results suggest that in the short-run real exchange rate depreciation deteriorates the current account.

2.5 Empirical Literature

In recent decades more attention has been devoted to the analysis of monetary policy than fiscal policy (Sims, 1980, Bernanke and Mihov, 1998 and Fatas and Mihov, 1919). According to Perotti (2002) it is difficult to generate the required data at high enough frequency and over sufficiently long horizons, and thus few studies examine the effects of fiscal policy compared to those studying the monetary policy. However, recent studies on monetary policy also emphasize the link between the fiscal and monetary policy in both theory and practice. Blanchard and Perotti (2002) originally applied the structural VAR method to analyse the effects of the fiscal policy shocks during the post-war period in the US. To achieve identification, this study relied on institutional information about the tax transfer system and the timing of tax collection to

construct the automatic response of fiscal policy to economic activity and to identify the fiscal policy shocks. Perotti (2002), in a study on the OECD countries economies, extended the methodology of Blanchard and Perotti (2002) by studying the relation between fiscal and monetary policy and the effects of fiscal policy on the level of prices, interest rates and output.

Subsequent studies, such as those discussed below, extend the analysis to the open economy. Recent contributions examine the relationship between the government budget deficits, the current account and the real exchange rate. In the 1980's the United States simultaneously experienced a worsening budget balance and current account balance, which shows a positive relationship (*twin deficits).* The twin deficit hypothesis suggests that when the government increases its deficit through tax reduction, private disposable income increases and domestic residents turn to use extra portion of disposable income to consume more and as expected some of the extra cash will be spent on imports. Thus, the Keynesian model suggests that a widening fiscal deficit induce a widening current account deficit (Merza and Aliwan, 2012).

A well-known study on twin deficits by Monacelli and Perotti (2010), examined the effects of fiscal policy, in particular, government spending shocks on the CPI real exchange rate and the trade balance and their co-movement with gross domestic product and consumption by the private sector in the United States, Canada, the United Kingdom and Australia. The data is taken from the National Income Accounts covering the period 1980:1 to 2006:4 on quarterly basis. They employed vector autoregression (VAR) models to do estimates. The methodology is illustrated using bivariate a example. Thus, the reduced form VAR is,

$$X_t = A(L)X_{t-1} + U_t.$$

$X_t \equiv [g_t \quad y_t\ ]'$ is an vector and g_t and y_t are the log of real government spending, and the log of real GDP, respectively, both in per capita terms. A(L) is a polynomial of order 4 and $U_t \equiv [u_t^g \quad u_t^y\ ]'$ is the vector of reduced form residuals. The term u_t^g and u_t^y can be described as shocks to government spending and output, respectively. The authors used a bivariate equation for illustration purposes only. Otherwise they had seven-variable VAR model; government spending, net taxes, real GDP, private consumption, real effective exchange rate, traded goods real exchange rate (all in logarithm form and/or per capita terms) and net exports of goods and

services as a percentage of GDP. This empirical methodology is the modification of the method used by Blanchard and Perotti (2002) and Perotti (2007).

Monacelli and Perotti's results indicate that increasing government expenditure worsens the trade deficit. These results support the traditional "twin deficits" hypothesis, contrary to the results produced by Kim and Roubini (2008) and Corsetti and Muller (2006) whose results produce "twin divergence". There are many empirical studies that establish the existence of twin deficits such as Alskwani (2000) and Vyshnyak (2000).

Kim and Roubini (2008) examined the effects of fiscal deficit shocks on the current account and the real exchange rate in the United States. Their results stand in marked contrast to those of other researchers. They used quarterly data from the period 1973:1 to 2004:1 during the floating exchange rate regime. They also employed VAR models to identify fiscal shocks. The basic model includes five variables; logged real GDP, government budget (% of GDP), current account (% GDP), the real interest rate (3-month) and the logged real exchange rate. The results reveal that a rise in government spending increases output over time and the real interest rate also rises. Surprisingly, the positive government budget deficit shocks improved the current account in the short run and the relationship between these two variables is insignificant in the long-run. Based on the results, Kim and Roubini (2008) assert that when in the presence of an output shock, it must be expected that there will be a "twin divergence". This analysis further shows that increase in private savings and fall in investment contributed in the improvement of the current account. Notably, these results are in stark contrast of theoretical view.

Corsetti and Muller (2006) also employed a structural VAR to assess four economies, namely the US, the UK, Canada and Australia. They used two specifications: specification one identifies shocks to government spending and specification two directly identifies shocks to the government budget. The first specification is given by:

$$X_t = [\, g, y, bb, \pi, r, p, nx \,]'$$

X_t is a vector that contains all the variables in specification one. There are seven variables included in this specification: government spending (g) and output (y) both expressed as log of real per capita terms, the primary budget balance (bb) and the trade balance (nx) both measured

as the percentage of GDP, inflation (π), the long-term nominal interest rate (r), the log of terms of trade (p). The second specification is given by:

$$X_t = [y, bb, \pi, r, p, ca,]'.$$

Specification two is similar with the only difference being the inclusion of the current account (ca) measured as a percentage of GDP and the exclusion of the government spending (g). Corsetti and Muller (2006), uses structural VAR model to further analyse the two specifications and to examine the twin deficits hypothesis. This model is written as follows:

$$A_0 X_t = \sum_{i=1}^{4} A_i X_{t-i} + \varepsilon_t.$$

Where; A_0 is the coefficient matrix that indicate interrelations among the variables in, X_t. The two specifications of VAR presented above were estimated recursively by OLS.

Corsetti and Muller's main empirical finding was that the twin deficit is more likely to occur if the economy is relatively open and fiscal expansion shocks are persistent. They revealed that the effects of fiscal policy shocks on the current account are limited in the US and Australia, which are less open economies and have less persistent government spending compared to the more open Canada and the UK. For Canada and the UK expansionary fiscal policy resulted in an improved current account. Therefore, the degree of an openness of the economy has an influence on the relationship between the fiscal and current account balances. Hence, Monacelli and Perotti (2010) argues that this study shows an element of twin divergence. Studies such as Bussiere *et al* (2005) and Merza and Aliwan (2012) also provide evidence of twin divergence in small but relatively open economies.

These contradictions in the empirical literature might be due to different specifications and identification methods used by the authors. The Monacelli and Perotti (2010) paper argues that the Kim and Roubini (2008) findings are influenced by the methodology they used to trace fiscal shocks and they believe this methodology has several shortfalls, although they did not specify them. Kim and Roubini (2008) estimated the responses to a budget deficit shock normalized to 1 per cent of GDP and Monacelli and Perotti claims that when they estimate using the same specification used by Kim and Roubini they find a positive effect of the fiscal deficit on the current account balance. Therefore the key difference with the results is that widening budget deficit induces a positive trade balance. Monacelli and Perotti (2010) gives two reasons for this,

Kim and Roubini (2008) measures the government budget as a percentage of GDP and they ignore the fact that GDP has automatic effects on the budget deficit. So far, the empirical evidence still shows a lack of a strong relationship between the government budget deficit and the current account, thus studies are inconclusive about the causal relation between the two balances (Merza and Aliwan, 2012.

The other main variable is the real exchange rate. In the US an improved government budget surplus (fiscal contraction) during the period of 1990s was believed to be accompanied by real exchange rate appreciation. Although between the period 2002 and 2004 when the government budget deficit tended to further worsen (fiscal expansion), the real exchange rate depreciated (Kim and Roubini, 2008). Kim and Roubini (2008) impulse response function suggest that increase in fiscal deficit results in a real exchange rate depreciation. The reason for persistent RER depreciation is that in a large economy like US, a rise in government spending results in a higher real interest rate, logically private consumption will fall. In a model where the demand for money is assumed to be determined by private consumption the nominal exchange rate will depreciate leading to the same effect on the real exchange rate due to price rigidity. Thus, the nominal exchange rate was found as the main contributor of real exchange rate depreciation.

In contrast, Benetrix and Lane (2013) estimate the impact of fiscal shocks on the real exchange rate for OECD countries that have been in monetary union since 1999. They used annual time-series data from 1970 to 2008. They also employed a VAR model. Their empirical results show that as the government spends more the real exchange rate appreciates for the European Monetary Union group of countries and asserts that shocks to public investment induces larger real exchange rate appreciation. Shocks to wage spending also lead to persistent appreciation (Benetrix and Lane, 2013). Thus, they concluded that the impact of shocks to government varies with the type of government spending and shocks to public investment (Benetrix and Lane, 2013).

In addition, if the expansionary fiscal policy results in a rise in output and price, due to induced excess demand for goods, consequently demand for money will increase (Penati, 1983 and Yanik, 2006). In response, the nominal and real exchange rate will decrease (that is, appreciate) to clear the money market (Penati, 1983). Furthermore, an increasing government budget deficit

will tend to appreciate the exchange rate if government expenditure falls predominantly on traded goods (Penati, 1983).

The above discussion shows that the relationship between fiscal policy and the real exchange rate is also inconclusive. Thus, Benetrix and Lane (2009) in their study *"the impact of fiscal shocks on the Irish economy"* show that the impact of budget deficit shocks critically depend on the nature of the fiscal innovation. In addition, structural features such as asset substitutability, public debt and net external position contribute to the variation of fiscal policy effects on the real exchange rate and the current account, Sachs and Wyplosz, (1984).

2.6 Related work for South Africa

This section briefly considers some of the studies of fiscal policy in the South African economy. None of the studies adopts the exact approach followed in this dissertation. Mabugu *et al.* (2013) uses an intertemporal computable general equilibrium (CGE) model to investigate the consequences of expansionary fiscal policy aimed at accelerating economic growth in South Africa. The results provide evidence that an expansionary fiscal policy would translate into increased debt to GDP ratio and consequently widen the budget deficit. These results further show that increased government spending through tax increase would have negative short-run impact on economic variables, supporting "Ricardian equivalence".

Ocran (2010) conducted a similar study using a seven-variable structural VAR based on the Blanchard-Quah decomposition identification scheme and employs quarterly data. The key variables examined are: the government budget deficit, the interest rate and real GDP. The results show that impulse responses appear to be insignificant to the budget deficit, in particular in the long-run, whilst real GDP responds positively only in the short-run and the interest rate responds negatively and temporarily (both variables are insignificant in longer horizons) to shocks from budget deficit. These results suggest that fiscal policy instruments have varied effects on output and the interest rate and they are quite similar to the results presented by Kim and Roubini (2008).

In addition, Jooste *et al*. (2013), analyses the effects of aggregate government spending and taxes on output in South Africa using three models, namely Dynamic Stochastic General Equilibrium (DSGE), Structural Vector Error Correction Model (SVECM) and Time-Varying Parameter-VAR. Jooste *et al.* (2013) also provides evidence that output responds positively to shocks from

budget defcit in the short-run and appears insignificant over the long-run. Increase in taxes decreases GDP in the short-run but insignificant over longer horizons.

In all three studies reviewed above none is looking at the open economy. Therefore further empirical research is necessary in order to make progress in understanding the effects of fiscal policy. Looking at the relationship between the government budget deficit shocks, the current account and the real exchange rate is an effort of this study to broaden our knowledge of the fiscal policy effects.

2.7 Summary

The chapter has reviewed both the theoretical and empirical literature of the relationship between the government budget deficit, the current account and the real exchange rate. The Keynesian proposition argues that there is positive relationship between budget deficit and current account deficit. The Ricardian equivalence argument suggests that the two deficits are not correlated at all.

Many studies such as Kim and Roubini, (2008) and Corsetti and Muller, (2006) empirically studied that fiscal expansion (or government budget deficit shock) result to improved current account and depreciate the real exchange rate in the United States. These results are in stark contrast with the theoretical point of view, that a fiscal expansion should induce the current account deficit (Monacelli and Perotti, 2010). The current literature extensively covers only developed countries, in particular the United States. The VAR model is the most commonly used econometric technique for analysis in examining the relationships of this nature and will also be employed in this dissertation.

Chapter 3

Data and Research Methods

3.1 Introduction

This chapter of the study shows how the research is conducted in an attempt to respond to the research question. Firstly, section 3.2 sets out the empirical model. Secondly, section 3.3 provides description of data sources and a concise description of variables used to study the specific interrelations among variables of interest. Lastly, section 3.4 displays descriptive statistics, raw data plots and unit root test.

3.2 Empirical Model

3.2.1 Vector Autoregressive (VAR)

A Vector autoregression (VAR) models are widely used in the literature to study the dynamic interdependence between macroeconomic variables and numerous studies have employed this model to analyse fiscal policy dynamics (Blanchard and Perotti, 2002, Perotti, 2007 and Giordano *et a.l* 2007).

The method used in this study is similar to the approach presented by Fatas and Mihov (2001) and Favero (2002) and depends on a Choleski ordering to identify fiscal shocks. According to Favero (2002) and Harris and Sollis (2003), this approach ensures that there is a strict causal ordering in the contemporaneous relationships between the endogenous variables, with the most endogenous variable (i.e the one affected most by others) ordered last in the model. Sims (1980) pioneered this approach which was primarily intended to analyse the impact of (structural) shocks in the model. Although there may be little or no justifications for these imposed restrictions in economic terms and the only way to justify them is considering economic theory. Furthermore, different orderings of the variables in the "vector" will produce different orthogonalized impulse responses. Thus it is difficult to interpret these responses in economic terms. Another problem with Sims' approach is that it often ignores the long-run structural relationships in the model by not converting the VAR to a VCEM (Harris and Sollis, 2003). Thus, the structural VAR approach (i.e structural factorization) extends the Sims' approach by using economic theory to identify the restrictions.

Similar studies such as Corsetti and Muller (2006) employed the SVAR model to test the "twin deficit" hypothesis between the fiscal deficit and current account deficit in OECD countries. They used two specifications: specification one identifies shocks to government spending and specification two directly identifies shocks to the government budget (as already described in chapter two). In both specifications they allowed for linear and quadratic trends as well as for quarterly dummies in each equation. Both specifications of VAR were estimated recursively by OLS. Monacelli and Perotti (2010) employed a reduced form VAR to identify fiscal shocks to examine the joint response of private consumption, the trade balance and the real exchange rate. However, their benchmark VAR specification included seven variables. They both provided evidence of co-movement between budget deficit, current account deficit and real exchange rate appreciation, thus supporting the theoretical view which states that expansionary fiscal policy induces a widening current account and a real exchange rate appreciation.

Kim and Roubini (2008) employed both recursive and non-recursive VAR and provided evidence of "twin divergence". These findings were supported by studies such as Bussiere *et al* (2005), Merza and Aliwan (2012) and Benetrix and Lane (2013. These authors argued that expansionary fiscal policy induces improved current account and real exchange rate depreciation (refer to Chapter 2 for more details). The inconclusiveness of the empirical literature and application of different methodologies suggest that further research is required. Hence, this study examines the relationship of these variables in the South African context based on both literature and economic theory.

Thus, similar to Perotti (2002) and Kim and Roubini (2008), the benchmark specification of the current study uses a five variable VAR model: the government budget (GOV), the current account (CUR) (both measured as a percentage of GDP), the real GDP (LRGDP), the real effective exchange rate (LREER) (both log-transformed) and the 3-month real interest rate (RIR). VAR models allow for linear interdependence among variables although model identification does not depend on a certain theoretical model. It is important to note that in a VAR model there is no dependent variable, each variables is written as a linear function of its past values and the past values of all other variables plus an error term (Kennedy, 2003).

The VAR model assumes that the South African economy can be described as follows:

$$AY_t = \gamma_0 + \gamma_1 Y_{t-1} + \gamma_2 Y_{t-2} + \cdots + \gamma_p Y_{t-p} + Be_t. \quad (3.1)$$

A is an $(n \times n)$ matrix describing contemporaneous relations among the variables; Y_t is an $(n \times 1)$ vector of endogenous variables. That is, all variables will be gathered into a single vector (Y_t) as follows (see Appendix C);

$$Y_t = [LRGDP_t, GOV_t, CUR_t, RIR_t, LREER_t]' \ . \quad (3.2)$$

(γ_0) represent the vector of constants, γ_1 is matrix of coefficients of lagged endogenous variables (Blanchard and Perotti, 2002, Perotti, 2002 and Enders, 2004). e_t are error terms uncorrelated with their own lagged values or orthogonal white-noise structural disturbances (Blanchard and Perotti, 2002). The error term coefficient (B) is an $(n \times n)$ matrix whose non-zero off-diagonal elements allow for direct effects of some shocks on other variables. Since, equation (3.1) cannot be estimated, is transformed into a reduced form VAR of order p, Enders (2004) suggesst a pre-multiplication of equation (3.1) by A^{-1} ;

$$Y_t = A^{-1}\gamma_0 + A^{-1}\gamma_1 Y_{t-1} + A^{-1}\gamma_2 Y_{t-2} + \cdots + A^{-1}\gamma_p Y_{t-p} + A^{-1} Be_t \quad (3.3)$$

Equation (3.3) gives a reduced form VAR, as follows:

$$Y_t = \varphi_0 + \sum_{i=1}^{p} \varphi_i Y_{t-i} + \vartheta_t \quad (3.4)$$

If one can denote, this gives:

$$\varphi_i = A^{-1} \propto_i \qquad i = 0, 1, 2, \ldots., p$$

$$\vartheta_t = A^{-1} Be_t$$

$\vartheta_t = A^{-1} Be_t$ is a $(n \times 1)$ vector with zero mean and an identity variance-covariance matrix (Blanchard and Perotti, 2002). In addition, the terms; ϑ_t^{LRGDP}, ϑ_t^{GOV}, ϑ_t^{CUR}, ϑ_t^{LREER} and ϑ_t^{RIR} can be described as shocks to variables in question. Furthermore, these reduced form residuals are linear combination of three components, namely; automatic response of each variable (e.g output) to unexpected movements of other variable(s) (e.g the government budget deficit and the current account); systematic discretionary response of policymakers to innovations in the other endogenous variables (e.g real GDP) and lastly, the random discretionary shocks to fiscal policies (uncorrelated with all other structural shocks), which is more useful in estimating

impulse response functions. For the purpose of this dissertation, we will focus on the impulse responses.

Since the structural fiscal shocks are correlated with reduced form residuals the issue here is to restrict the system so as to recover various e_{it} and to preserve the assumed error structure concerning the independence of the various e_{it} shocks (Enders, 2004). To solve this identification problem, the reduced form VAR is estimated using OLS in order to retrieve structural economic shocks from the innovations of the reduced form by restricting the parameters of A and B matrices to be:

$$A\vartheta_t = Be_t \tag{3.5}$$

$E(\vartheta_t, \ \vartheta_t') = \sum$, is the constant variance-covariance matrix of reduced form VAR that can be obtained using OLS and $E(e_t, \ e_t') = 1$, that is, the orthogonality assumption of the structural innovations impose identifying restrictions on matrices (A) and (B) as presented below:

$$A\sum A' = BB' \tag{3.6}$$

A and B are both $(n \times n)$ matrices. This condition gives us a total of $2n^2$ unknown elements that can be identified. Since $\sum$ is symmetric, it only contains $(n^2 + n)/2$ independent elements (Enders, 2004). Thus, $n^2 + n/2$ restrictions are imposed in equation (3.5). Specifically, this study uses the standard approach that imposes a recursive structure of the VAR, with the ordering of variables given by equation (3.2). Intuitively, this approach assumes that expansionary fiscal policy (GOV) shocks have no immediate effect on output (LRGDP), unexpected current account (CUR) movements have no immediate effect on government budget, the real interest rate (RIR) shocks have no immediate effect on the current account and the real effective exchange rate (LREER) has no immediate effect on real interest rate.

In technical sense, this requires estimation of the reduced form VAR, then computing the Choleski factorization of the reduced form VAR covariance matrix. Since we have 5 variables, the approach suggests ten restrictions. Therefore the relation between the reduced form residuals and the structural shocks in equation (3.5) is given by the following scheme:

$$\begin{bmatrix} e_t^{lrgdp} \\ e_t^{gov} \\ e_t^{cur} \\ e_t^{rir} \\ e_t^{lreer} \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ b_{21} & 1 & 0 & 0 & 0 \\ b_{31} & b_{32} & 1 & 0 & 0 \\ b_{41} & b_{42} & b_{43} & 1 & 0 \\ b_{51} & b_{52} & b_{53} & b_{54} & 1 \end{bmatrix} = \begin{bmatrix} \vartheta_t^{lrgdp} \\ \vartheta_t^{gov} \\ \vartheta_t^{cur} \\ \vartheta_t^{rir} \\ \vartheta_t^{lreer} \end{bmatrix}$$

In the system above, the Choleski decomposition requires that all elements above the principal diagonal to be equal to zero (Enders, 2004). For instance,

$$b_{12} = b_{13} = b_{14} = b_{15} = 0$$
$$b_{23} = b_{24} = b_{25} = 0$$
$$b_{34} = b_{35} = 0$$
$$b_{45} = 0$$

There are other alternative approaches used to identify the fiscal shocks. For instance Sims (1986); Bernanke and Mihov (1998) and Sims and Zha (2006) have used structural factorization this approach requires an assumption of orthogonality between structural disturbances, e_t and imposing that macroeconomic variables do not contemporaneously react to economic activity. This approach has been criticized that such restrictions do not help in identifying long-run relationships among the variables in the model and it is unlikely that enough information would be available for identification based on theory (Harris and Sollis, 2003).

The "narrative approach" represented by Romer and Romer (1989), Ramey and Shapiro (1998) and Burnside *et al.* (2001). These studies detect the dummy variable effects capturing "Ramey and Shapiro" fiscal events such as public expenditure on the Korean and Vietnam war military expenditure and the Reagan era expansionary fiscal policy. If these episodes are purely exogenous and unanticipated, in examining their effects all is needed is a reduced form regression. However, it is possible that these fiscal episodes are not entirely unanticipated. Also, it is likely for different type or origin of fiscal shocks to occur at the same time, which therefore pollutes the process of identifying the fiscal shocks.

Mountford and Uhlig (2009) also present an approach that identifies fiscal shocks by restricting the signs on the impulse response functions. For instance, "revenue" shocks maybe identified by

imposing the restriction that tax revenue response increases while the public expenditure response does not. This method is best used when the fiscal shocks can be anticipated. For example, the estimated effects on, say, private sector consumption at time zero could be the behavior towards the shock to revenue in the next period. Controversy occurs when identifying revenue shocks via the condition that tax revenue and output do not covary positively in response to the shock and therefore the approach rules out by assumption a whole set of "non-Keynesian" output responses to fiscal shocks. Another shortcoming is that this method cannot track down the exact time the fiscal shock will occur.

The last approach developed by Blanchard and Perotti (2002) is akin to SVAR. This approach exploits decision lags in fiscal policy and institutional information about the elasticity of fiscal variables to economic activity. For instance in examining the dynamic effects of changes in government spending and taxes on output this approach take three steps to identify shocks; (i) Obtain institutional information about taxes, transfers and spending programs to construct elasticities of output of government purchases and of taxes minus transfers, (ii) these elasticities are used as estimates to construct the cyclically adjusted reduced-form tax and spending residuals and (iii) The remaining unknown coefficients are estimated through presenting results under two assumptions. The first assumption is that tax decisions come first (then equate government spending coefficient to zero) then estimate the tax coefficient; The second assumption is that government spending decisions come first (then equating the tax coefficient to zero) then estimate the spending coefficient. Perotti (2002) further extends this approach by considering interest rates and inflation. However, the process of obtaining institutional information and constructing elasticities is quite complex.

Nevertheless, in the current study once the recursive VAR model is estimated we can generate impulse response function on the basis of reduced from VAR and conduct Granger causality tests and carry out a variance decomposition, as explained below.

3.2.2 Impulse Response Functions

This study is also interested in assessing the impulse response functions (IRF) to see what happens to the other variables when we shock one variable and this relationship is analyzed using graphs. This technique clearly shows responses of each variable and therefore we can answer the question of how one variable is affected by the other (Gujarati and Porter, 2003). Let

us consider a bivariate case with one lag and constant term is suppressed. The structural equations are illustrated as follows:

$$Y_t = \beta_1 X_t + \gamma_{11} Y_{t-1} + \gamma_{12} X_{t-1} + \vartheta_{yt} \quad (3.7a)$$

$$X_t = \beta_2 Y_t + \gamma_{21} Y_{t-1} + \gamma_{22} X_{t-1} + \vartheta_{xt} \quad (3.7b)$$

In our application Y_t is the government budget deficit and X_t is the current account. ϑ_{yt} and ϑ_{xt} represent the error terms, respectively. The above structural equations are reduced in order to estimate the coefficients. Then the reduced form is as follows;

$$Y_t = \frac{\gamma_{11} + \beta_1\gamma_{21}}{1-\beta_1\beta_2} Y_{t-1} + \frac{\gamma_{12} + \beta_1\gamma_{22}}{1-\beta_1\beta_2} X_{t-1} + \frac{1}{1-\beta_1\beta_2}\vartheta_{yt} + \frac{\beta_1}{1-\beta_1\beta_2}\vartheta_{xt}$$

$$Y_t = d_{11} Y_{t-1} + d_{12} X_{t-1} + \vartheta_{1t} \quad (3.7c)$$

$$X_t = \frac{\gamma_{21} + \beta_2\gamma_{11}}{1-\beta_1\beta_2} Y_{t-1} + \frac{\gamma_{22} + \beta_2\gamma_{12}}{1-\beta_1\beta_2} X_{t-1} + \frac{\beta_2}{1-\beta_1\beta_2}\vartheta_{yt} + \frac{1}{1-\beta_1\beta_2}\vartheta_{xt}$$

$$X_t = d_{21} Y_{t-1} + d_{22} X_{t-1} + \vartheta_{2t} \quad (3.7d)$$

The values of the coefficients $\{d_{11}, d_{12}\ and\ d_{21}, d_{22}\}$ are known as multipliers and the time path of Y (budget deficit) and X (current account) following a shock is known as the impulse response function. It is likely that a variable initially rises by the full amount of the shock and then it gradually returns to the value before the shock, then such a shock is regarded as temporary. The IRF is interpreted as tracing how one variable (government budget balance) responds to shocks to another variable (current account).

3.2.3 Variance Decomposition

Again, in an attempt to respond to the research question, this study assesses how much variation in one variable is caused by another variable's error term, this is usually referred to as variance decomposition or forecasting error variance decomposition. The aim is to decompose the variance of each element of the variable in question into components due to each of the elements of error term and to do so for various horizons. This decomposition helps us to see how much variance of each element of the variable in question is due to the first error term, second error term and so on (Gujarati and Porter, 2003). Considering our bivariate example in equation (3.7a)

and (3.7b), the variance decomposition is interpreted as indicating the fraction or the variance of government budget balance that is due to real factors versus that due to nominal factors. Usually a table is used to analyze this kind of information. This technique clearly shows where the estimates are coming from and it has been widely used in the literature.

The advantages of VAR is that there is not much concern about which variables are endogenous and which are exogenous; all variables are endogenous. The estimation of the model is not sophisticated we apply the usual OLS method on each equation separately. In many cases it is better for forecasting unlike complex simultaneous-equation models. The shortcomings of the model are that it has no underlying theory for identification. The VAR technique is very sensitive to the number of lags, the more lags for each variables the lesser are the degrees of freedom and the fewer the lags the more likelihood of estimates biasness.

3.2.4 Granger Causality

This dissertation requires an assessment of whether these variables Granger cause each other and the nature of Granger causality if it is bi-directional (that is the variables have an impact on each other) or Un-idirectional (only one variable has an impact on the other) or Independent (they have no impact on each other) (Gujarati and Porter, 2003). In a simple setting the first variable is said to Granger cause the second if the forecast of the second variable improves when lagged values of the first variable are taken into account (Granger, 1969). Consider the following bivariate example suggested by Granger (1969) for illustration:

$$Y_t = \sum_{i=1}^{p} c_i X_{t-i} + \sum_{i=1}^{p} d_i Y_{t-i} + \vartheta_{yt} \quad (3.8a)$$

$$X_t = \sum_{i=1}^{p} e_i X_{t-i} + \sum_{i=1}^{p} f_i Y_{t-i} + \vartheta_{xt} \quad (3.8b)$$

The assumption is that X_t and Y_t are two stationary time series variables with zero means (e.g. X_t represent the current account and Y_t is the government budget deficit); ϑ_{yt} and ϑ_{xt} represent two uncorrelated error terms; p is assumed to be finite and shorter than the given series. The coefficients;c_i and f_i indicate if X_t and Y_t Granger cause each other. The null hypothesis suggests that there is no causal relationship between X_t and Y_t. This is illustrated as follows:

H_0: $c_i = 0$ i.e. (X_t does not Granger cause Y_t)

H_1: $c_i \neq 0$ i.e. (X_t does Granger cause Y_t)

If the null hypothesis (H_0) is rejected, the conclusion would be that there is evidence of Granger causality (H_1) (Granger, 1969).

3.2.5 Lag length selection criteria

Economic decisions have effects that do not occur instantaneously but they are distributed over future periods of time. A change in the current value of the variable could be a result of what occurred in previous periods and not necessarily only affecting itself but other economic variables as well. Thus, in economic analysis it is important to consider the past events. In the literature the significance of lags is laid upon, psychological factors (i.e uncertainty), technological reasons and institutional reasons. The matter of how far you look at the past is determined by the "model selection criteria". They are in the standard output of most computer packages and they are the standard tool for lag length selection criteria in a VAR. The idea is to choose the lag order p to minimize the loss of degrees of freedom (if too many lags) and biased estimates (if too few lags). The most commonly used model selection criteria are; the Akaike Information Criteria (AIC), the Schwarz Information Criteria (SIC) and the Hannan-Quinn Information Criteria (HQIC). Ideally, AIC, SIC and HAIC will be as small as possible. Therefore, the model to be chosen should be the one with the lowest value of information criteria test (refer to Appendix A).

3.3 Definition of Variables and Interpretation

3.3.1 Government budget deficit (GOV)

In this study the researcher uses an overall fiscal deficit (government expenditure including the interest payments) because the interest is on the fiscal policy. One would have preferred to use primary government budget balance, which is the government budget deficit excluding interest rate payments (Blanchard, 2000). Excluding interest payments appears to make sense if you are interested in modelling monetary policy, which directly affects the level of interest payments. Therefore primary budget balance makes very little sense for fiscal policymakers (Blanchard, 2000). The data is collected from the South African Reserve Bank website *(series name: SABTGDIQ Index)*

3.3.2 Current account (CUR)

The saving-investment identity is the key link between the current account and the government budget. The interpretation on impulse responses in not straight forward but keep this in mind, if the sign of the coefficient is negative on either of the two variables we will conclude that there is no co-movement but if otherwise (positive sign) we will conclude that there is positive relationship. In this study the current account is measured as a percentage of GDP. The data for the current account is collected through the South African Reserve Bank website *(series number: KBP5380K)*.

3.3.3 Real Exchange Rate (LREER)

The data on LREER is collected from the World Development Indicators *(series code: PX.RER.REER*). This study uses the CPI-based LREER which is calculated as a weighted geometric average of the level of consumer prices in the home country relative to that of its trading partners, expressed in a common currency (Cashin *et al*, 2004). According to Cashin *et al* (2004), the CPI-based LREER of country i is defined as follows:

$$LREER_i = \frac{P_i R_i}{exp \sum_{i=1}^{n} (W_{ij} \ln(P_j R_j)}$$

Where; i represent the country in question (i.e South Africa in this study); j is an index that runs from 1 to n over country i's trade partner countries; W_{ij} is the trade weight attached by country i to country j; P_i and P_j are the seasonally adjusted consumer price indices in countries i and j; R_i and R_j are the nominal exchange rates of country i's currency and countries j's currencies in US dollars. A decline (depreciation) in a country's real effective exchange rate index indicates a rise in its international competitiveness (Cashin *et al*, 2004). The LREER has been found by researchers such as Corsetti and Muller (2006) and Kim and Roubini (2008) to have a significant relationship with budget deficits.

3.3.4 Real Gross Domestic Product (LRGDP)

The real GDP is often referred to as GDP at constant-prices. The theoretical framework that links the relationship between fiscal policy and real GDP is built on elements of government revenue such as sales taxes and income taxes (Blanchard and Perotti, 2002, and Blanchard, 2000). Persistent increase in government spending accompanied by insufficient revenue leads to a

deficit in the budget and lower real GDP growth rates (Blanchard, 2000). LRGDP data is collected through the South African Reserve Bank website *(series name: SAGDOANN Index).*

3.3.5 Real interest rate (RIR)

The Fischer equation provides a more formal description of RIR. This equation states that the real interest rate is the difference between nominal interest rate and inflation. This is given by:

$$r = i - \pi$$

Where r is representing real interest rate, i is the nominal interest rate and π represent inflation. The RIR is translated to monetary policy actions that we would also like to control for. The RIR has been manually calculated by the researcher of this study as the difference between the repo rate and inflation. The data on repo rate *(series name: SARPRT Index)* and inflation *(series name: SACPIYOY Index)* was collected through the SARB website.

3.4 Data and Descriptive Statistics

3.4.1 Descriptive statistics of the raw data (GOV, CUR, LREER, LRGDP and RIR*)*

Table 3.1 presents the descriptive statistics of the five variables in question. Statistical description helps us to see what is going on in our raw data and help us to simplify large amounts of data in a sensible way.

Table 3.1: Results reported are in level form

Descriptive Statistics					
Variables	**Mean**	**Maximum**	**Minimum**	**Std. Dev**	**No. of Observations**
GOV	-3.058000	4.20000	-11.40000	3.176402	100
CUR	-1.752000	3.200000	-6.900000	2.534309	100
LREER	4.542198	4.712768	4.209507	0.116150	100
LRGDP	14.47640	14.83007	14.15436	0.223202	100
RIR	2.481037	2.646016	12.99255	-12.34013	100

"GOV" (% of GDP), "CUR" (% of GDP), "LREER" (logged), "LRGDP" (logged) and "RIR" (3-month)

Source: Own estimates, (1990Q1-2014Q4)

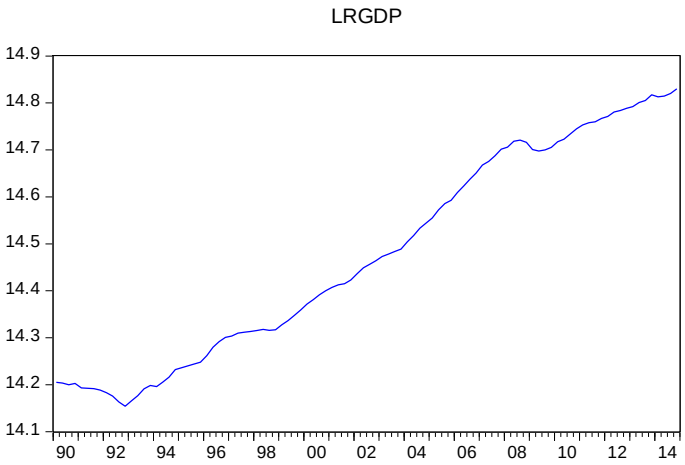
3.4.2 Raw data plots

Figure 1 below displays the evolution of government budget balance, the current account, the real exchange rate, the real GDP and the real interest rate overtime in South African economy. All these variable's plots show a linear positive relationship overtime. Except for the real interest

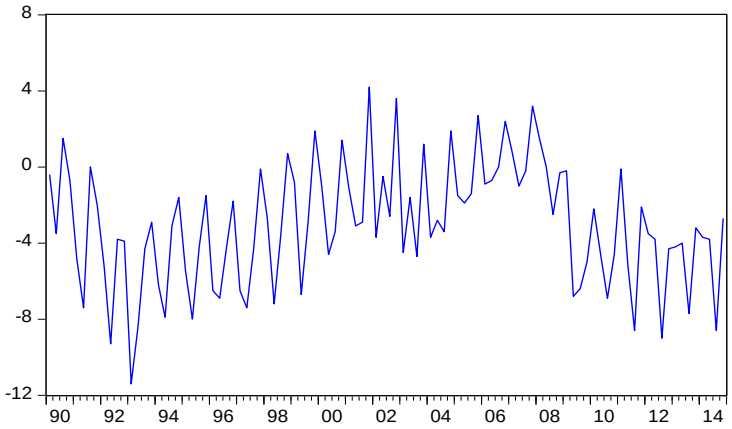
rate evolution that shows erratic movements and the logged values of real GDP trend behavior looks nonstationary which means its path overtime are unlikely to revert to the mean. The trend exhibited by these plots is not surprising since most time series economic data, rather macroeconomic variables grow overtime and so they do not have a fixed, (i.e stationary) mean (Kennedy, 2003). This suggests that the variables might have some form of long-run relationship or rather they revert to the same mean only in the long-run.

However, based on the graphical analysis (Fig.1) below, one cannot conclude with certainty on the behavior of the series; thus, formal tests are necessary in order to draw conclusions about the nature of the behavior of these variables over time. Therefore, it is also necessary to undertake tests such as unit root to check for stationarity since it is recommended that when using vector autoregressive model is better to have stationary variables to avoid spurious results. In the case where unit root test is undertaken using Augmented Dickey Fuller (ADF), Philip-Perron (PP) and Kwaitkowski-Phillip-Schmidt-Shin (KPSS) tests at level form gives us non-stationarity, the researcher considers first differencing the series which in most cases is likely to give stationary series. The tests are undertaken both on random walk with drift only and random walk with drift and trend in order to give substantial conclusion about the behavior of the series.

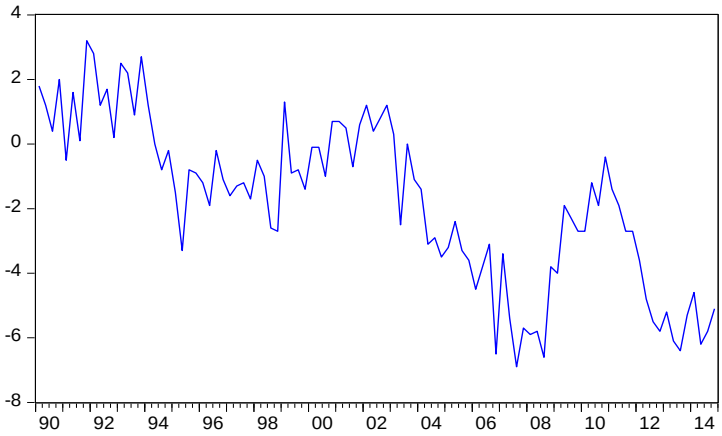
Figure 1: Evolution of variables at level



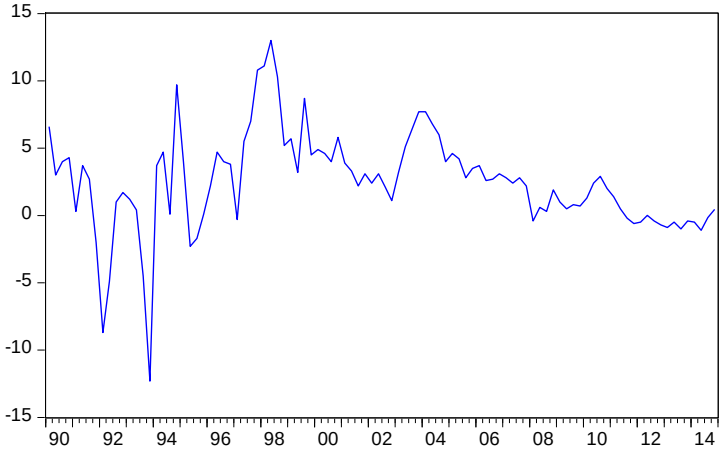
GOV (% OF GDP)

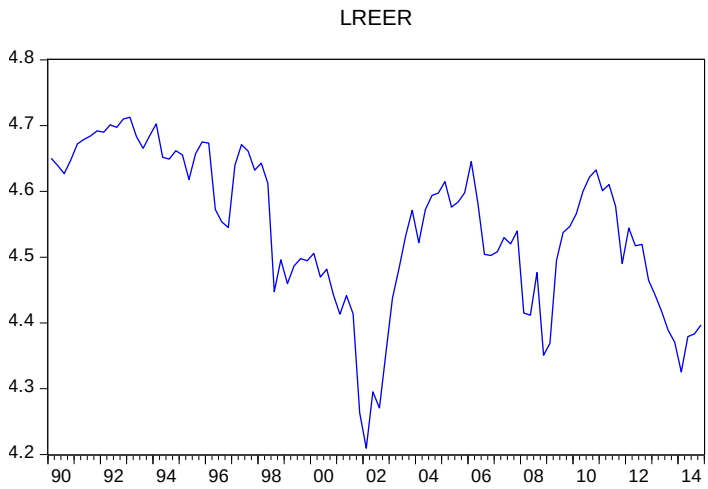


CUR(% OF GDP)



RIR





Sources: Own estimates, (1990Q1-2014Q4)

3.4.3 Stationarity and Unit Root test

Stationarity or non-stationarity can strongly influence the behavior and properties of the series in question. For example, the persistence of shocks will be infinite for nonstationary series. In economic literature it has been argued that economic variables such as the real exchange rate, the real GDP, the current account and the government budget balance follow a non-stationary process. That is, they are not mean reverting, hence testing for unit roots has become a pre-requisite for accurate, unbiased and consistent estimates (Kennedy, 2003). In testing the presence of unit roots in all variables, the researcher applied alternatively three standard tests: ADF, the PP and the KPSS tests.

(i) ADF test

ADF test comes after Dickey Fuller test or method (DF test) which is the pioneering work on testing for a unit root in time series that was done by Dickey and Fuller (Dickey and Fuller 1979, Fuller 1976). The DF method is only valid if ε_t are white noise, thus may create a problem of autocorrelation. Hence, to solve the autocorrelation problem, Dickey and Fuller developed a method or test called Augmented-Dickey Fuller Test by using *p* lags of the dependent variable. It is advisable that one has a sufficient number of lags in order to avoid serial correlation in the residuals (Lardic and Mignon, 2006).

In performing an ADF test, there are three forms of regressions to be considered. The researcher has a choice to include a constant only, a constant and a linear time trend or neither in the test regression (Hussain *et al*. 2009).

The model for ADF Test can be illustrated as follows:

$$\Delta y_t = \beta_0 + \varphi y_{t-1} + \propto_t + \sum_{i=1}^{m} \beta_1 \Delta y_{t-1} + \varepsilon_t$$

Where Δ is the difference operator. The main objective of the ADF Test is to test the null hypothesis that the series is non-stationary, that is, has a unit root ($\varphi = 1$) in:

$y_t = \varphi y_{t-1} + \varepsilon_t$ (*pure random walk model)*

Against the one-sided alternative φ<1. This hypothesis can be written as follows:

H_0*: series has unit root (null hypothesis)*

H_1*: series is stationary (alternative hypothesis)*

To reach a decision on this hypothesis, one has to consider the t-statistics, p-values and critical values. If the negative value of t-statistic is greater than the critical values at all levels of significance we do not reject the null hypothesis (H_0), alternatively if the p-value is greater than the critical values at all levels of significance (0.01, 0.05 and 0.1), we do not reject H_0. If the opposite occurs, we reject the null hypothesis and accept that the series is stationary. Many studies such as Giordano *et al.* (2007), Mohamed et al (2009), Ocran (2009) and Monacelli and Perotti (2010) have conducted unit root test on fiscal policy analysis. However, the ADF test does not have strong power, it is always vital to verify the decision by using two or more tests (Gujarati and Porter, 2003).

(ii) PP test

The Phillips-Perron test is a more comprehensive theory of unit root non-stationarity. The test is much similar to ADF test but they incorporate an automatic correction to the DF procedure to allow for autocorrelated residuals. The PP test ignores serial correlation in a given system. The PP test is given by:

$$\Delta y_t = \beta' D_t + \pi y_{t-1} + u_t$$

Where, u_t is $I(0)$ and may be heteroscedastic. The PP test correct for any serial correlation and heteroscedasticity in the error u_t of the test regression by directly modifying the test statistic $t_{\pi=0}$ and $T\hat{\pi}$. These modified statistics, denoted Z_t and Z_π, are given by:

$$Z_t = \left(\frac{\hat{\sigma}^2}{\hat{\lambda}^2}\right)^{1/2} . t_{\pi=0} - \frac{1}{2}\left(\frac{\hat{\lambda}^2 - \hat{\sigma}^2}{\hat{\lambda}^2}\right) . \left(\frac{T.SE(\hat{\pi})}{\hat{\sigma}^2}\right)$$

$$Z_\pi = T\hat{\pi} - \frac{1}{2}\frac{T^2.SE(\hat{\pi})}{\hat{\sigma}^2}(\hat{\lambda}^2 - \hat{\sigma}^2)$$

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

$$\sigma^2 = \lim_{T\to\infty} T^{-1} \sum_{t=1}^{T} E[u_t^2]$$

$$\lambda^2 = \lim_{T\to\infty} \sum_{t=1}^{T} E[T^{-1} S_T^2]$$

Where $S_T = \sum_{t=1}^{T} u_t$. The sample variance of the least squares residuals $\hat{u}_t$ is a consistent estimate of σ^2, and the Newey-WEST long-run variance estimate of u_t and using $\hat{u}_t$ is a consistent estimate of λ^2. This test usually give the same conclusions as the ADF test and the calculation of the test statistic is complex (Vogelvang, 2005). The Philipp-Perron Test is also criticized for low power, in particular if the process is stationary but with a root close to the non-stationary boundary (Volgelvang, 2005).

(iii) KPSS test

KPSS Test is undertaken to ensure a correct conclusion about the series and to avoid biasness from the other tests. The KPSS test was developed by Kwiatkowski *et al.* (1992). There is a difference in null hypothesis, the KPSS test assumes stationarity of the variables of interest and does not have a p-value.

According to Kwaitkowski *et al*. (1991) series can be decomposed into the sum of a deterministic trend, a random walk and a stationary error. Written as follows:

$$y_t = \propto_t + r_t + \varepsilon_t$$

Here, r_t is a random walk, given by: $r_t = r_{t-1} + \mu_t$. Where, μ_t are identically independently distributed, that is, are iid(0,σ_μ^2). The stationarity hypothesis is simply that the variance is zero (i.e, $\sigma_\mu^2 = 0$) and since ε_t is assumed to be stationary under the null hypothesis y_t is trend-stationary. Whilst under the assumption of no trend, y_t is simple stationary and $r_t = r_0$ for all t periods, whereas ε_t is defined as the residual from the regression of y on an intercept (that is, $e_t = y_t - \bar{y}$) and the rest of the construction of the test statistic in unaltered (Kwaitkowski *et al*, 1991). It is important to note that KPSS uses LM statistic for the stationarity hypothesis and interest is much on one-sided LM test than two-sided (Rogers, 1986). Consider a simple regression below to find the estimated stochastic component under the null hypothesis $\hat{e}_t$ is stationary;

$$y_t = \hat{\mu} + \hat{e}_t$$

That observation can be used to design a test: H_0: $\sigma_\mu^2 = 0$ against H_1: $\sigma_\mu^2 > 0$. The test statistic is given by:

$$KPSS = \frac{1}{T^2} . \frac{\sum_{t=1}^{T} S_t^2}{\hat{\sigma}_\infty^2}$$

Where, $S_t = \sum_{s=1}^{t} \hat{e}_s$ is a partial sum, $\hat{\sigma}_\infty^2$ is a HAC estimator of the variance of $\hat{e}_t$. This is an LM test for constant parameters against a Random Walk parameter.

Likewise, the KPSS compares the test statistic with the critical value on desired significance level. If the test statistic is higher than the critical value, the null hypothesis is rejected and when test statistic is lower than the critical value, the null hypothesis cannot be rejected.

Table 3.2: Unit Root test results at level and first difference (Random Walk with drift only)

Variables	Level Form				First difference		
	ADF	PP	KPSS		ADF	PP	KPSS
GOV	-2.099589	-7.000422***	0.205472		-4.283802***		0.205472
CUR	-1.181381	-2.328005	0.888373**		-10.31233***	16.97840***	
LRGDP	0.449373	0.775353	1.196988**		-4.884895***	4.830635***	
LREER	-1.977015	-2.086298	0.545028**		-9.494822***	-9.495389***	
RIR	-2.271598	-4.518411***	0.249909		-4.054741***		0.249909

(*), (**) and (***) denote rejection of the null hypothesis at 10%, 5% and 1%, respectively.

Source: Own estimates, (1990Q1-2014Q4)

Table 3.2 above displays the unit root test results in levels with each series containing only a drift term. The ADF test shows that all variables have unit root at all levels of significance (0.01, 0.05 and 0.10). However the PP test suggest otherwise on government budget and real interest rate. The KPSS test also rejects the null hypothesis at 5% level of significance on CUR, LRGDP and LREER [i.e. $I(0)$] It is then necessary to first difference all the variables except for those that are initially stationary. Table 3.2 further presents results after first differencing and all three tests, ADF, PP and KPSS tests show stationarity on all variables.

Table 3.3: Unit Root test results after first differencing (Random walk with drift and trend)

Variables	Level Form				First difference		
	ADF	PP	KPSS		ADF	PP	KPSS
GOV	-1.988462	7.017401***	0.174645		-3.992786		0.08134
CUR	-2.918697	4.551377***	0.051103**		-10.26527		
LRGDP	-3.16256*	-3.146451	0.163901			-4.935378	0.163901
LREER	-2.498661	-2.664553	0.118739**		-9.447875	-9.448476	
RIR	-2.344404	-4.530496***	0.201369		-4.079361		0.060074

(*), (**) and (***) denote rejection of the null hypothesis at 10%, 5% and 1%, respectively.

Source: Own estimates, (1990Q1-2014Q4)

Table (3.3) presents the unit root test results in levels with each variable containing both a drift and trend. The ADF test still shows that all variables have unit root except for the real GDP variable that appears stationary at 0.10 level of significance. Whilst the PP and KPSS tests still shows that real GDP has a unit root and the real exchange rate also has a unit root except for

government budget, current account and real interest rate that appear stationary. However, according to KPSS test government budget and real interest rate has unit root. These results require that all nonstationary variables be first differenced but $I(0)$ variables are omitted. Since the government budget balance (GOV), the current account (CUR), the real GDP, the real exchange rate (RER) and the real interest rate (RIR) have been found to be nonstationary at level form but appear to be stationary after first differencing, the conclusion is that the series are integrated of order one [i.e $I(1)$]. It might be necessary later on to examine whether these variables are co-integrated.

3.5 Summary

This chapter has described the methodology that will be employed in the research in addressing the research questions. To examine the interrelation between government budget deficit, current account and real exchange rate the study will assess Granger causality, impulse response function and variance decomposition. This section has also provided a full description of econometric technique that will be used to examine statistical properties of the data and description of the employed empirical model. The definition and relevance of variables has been provided. The sources of data have been identified and they are reliable and widely used in economic research. This chapter further provided a full description of raw data including the descriptive statistics to shed a light on relevant and reliable data. Furthermore, the data is checked for stationarity by testing for unit root for both random walk with drift only and random walk with drift and trend using ADF, the PP and KPSS tests.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents and discusses the empirical results on the reduced VAR model, $Y_t = \varphi_0 + \sum_{i=1}^{p} \varphi_i Y_{t-i} + \vartheta_t$, which follows Choleski ordering of variables and gathered into a single vector $Y_t = [LRGDP_t, GOV_t, CUR_t, RIR_t, LREER_t]'$. I have selected Hannan-Quinn Information Criteria (HQIC) which suggested four number of lags. The analysis has been conducted using Eviews statistical package. With regard to the impulse responses, there is one figure for each of the variables. I draw inferences from the interpretation of the results. I further distinguishes between the temporary (the short-run) and permanent (the long-run) one-time impulse response. The short-run effect would occur if a given shock generate a response path that reverts to the original value (or equilibrium), and it is referred to as long-run if the response path does not return to the equilibrium. Table 4.2 displays variance decomposition. Granger causality results for the main variables of interest are presented in Table 4.3 and additional supporting results are provided in Appendix B. This chapter first presents the basic results of the model to shed a light on the co-movements between the government budget deficit, the current account and the real exchange rate.

Table 4.1: Basic Correlations

	Basic correlation results	
	GOV correlation with Current account	**GOV correlation with Real exchange rate**
Government budget deficit (GOV)/GDP	-0.13	-0.29

Source: Own estimates, (1990Q1-2014Q4)

It seemed valuable to conduct basic correlations specifically on GOV since the focus is on the effects of fiscal deficit on the current account and the real exchange rate. The correlation between the government budget deficit and the current account appears weakly negative at (0.13). These results support the empirical evidence provided by studies such as Kim and Roubini (2008), arguing that the government budget deficit and the current account do not

automatically move in the same direction. This is not surprising, the raw data showed a “twin divergence” rather than “twin deficit” pattern over the whole sample period.

Furthermore, Table 4.1 reports a weak negative correlation between the government budget deficit and the real exchange rate at (-0.29). These results again suggest that government budget and real exchange rate do not necessarily move into the same direction. For instance, an expansionary fiscal policy can be accompanied by a depreciating real exchange rate.

It is well known that the government budget balance, in particular the revenue part, displays a pro-cyclical behavior while the traditional and modern theories of the current account predict counter-cyclical fluctuations in the presence of the output shocks. Hence, when identifying the government budget deficit shocks on the current account it is vital to control for the endogenous movements of the government budget balance and the current account to account for the effects of output shocks. Thus, the empirical model described in chapter three is designed to control for this endogenous nature of the budget balance and the current account as well as identifying exogenous components of the government budget balance. The framework described in the methodology chapter uses information on various macroeconomic variables, their interactions and their dynamic interrelations to spell out the exogenous part of the government budget deficit and to analyze the effects of government budget deficit shocks on the current account and the real exchange rate.

4.2 Impulse Response Functions

In Figures 4.1 to 4.5 deviation show impulse responses to Choleski one standard deviation shocks with one standard error bands over five years (i.e twenty quarters) in the basic VAR model. The red dotted bands show the level of significance. If they are both below or above the horizontal line, the results are significant but if split above and below the line, the results are insignificant. In addition, the horizontal axis measures the period and the vertical axis measures the impulse responses. As mentioned in the previous chapter the variables follow Cholesky ordering. On top of each graph the responding variable is written first followed by the shocked variable (e.g response of CUR to GOV, where; CUR=responding variable and GOV=shocked variable). In each square we have government budget deficit “GOV” (% of GDP), the current account (% of GDP)“CUR”, the log of real GDP “LRGDP”, the log of real effective exchange rate “REER” and the real interest rate (% point) “RIR”.

4.2.1: Responses to shocks in real GDP

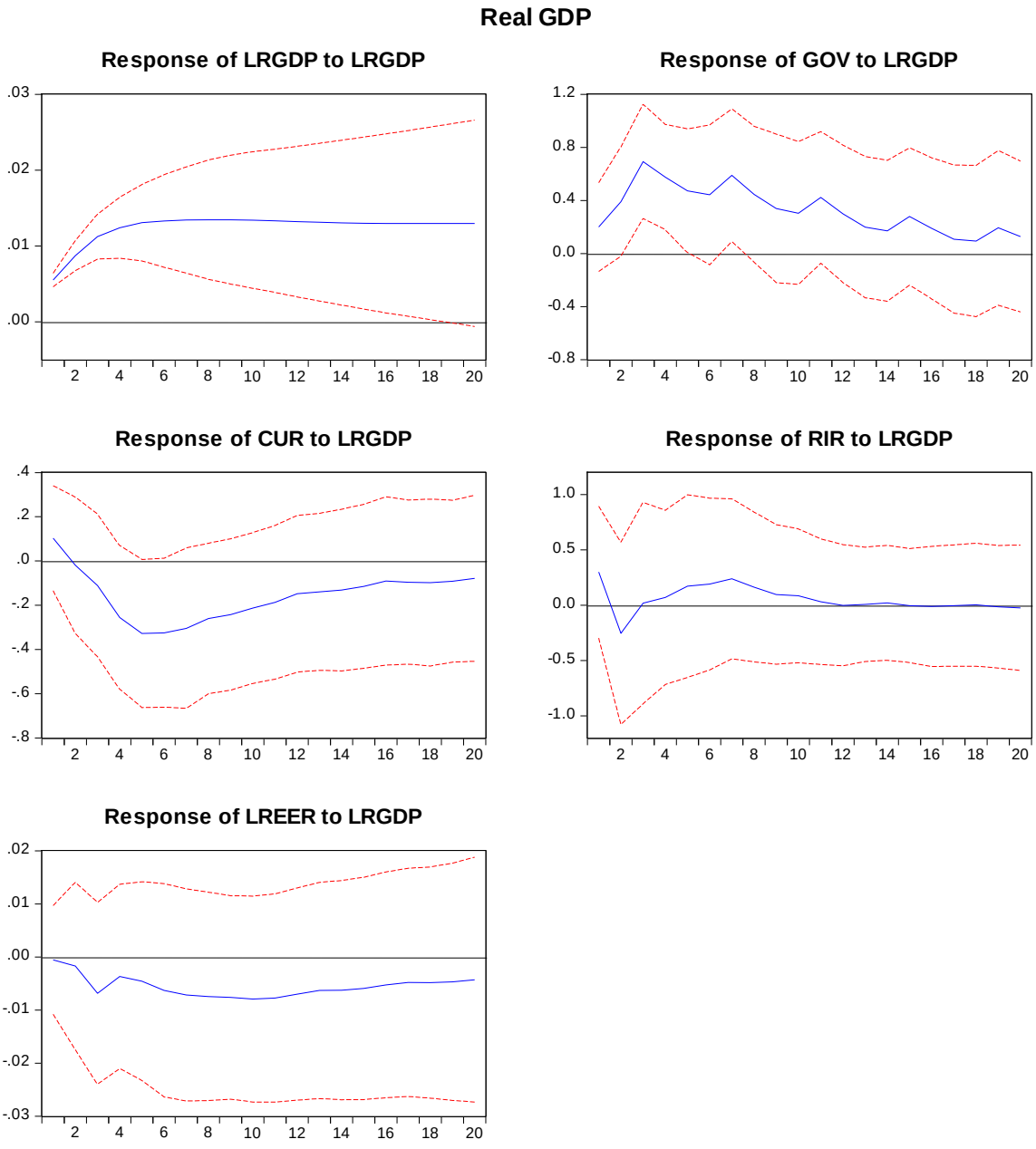
Figure 4.1 shows the response of endogenous variables to output shocks. Likewise, model 1 is a system that encompasses all the endogenous variables to real GDP shocks. Figure 1 shows that the effects of output shocks are negative and quite modest over the longer horizons. The impulse responses show that real GDP responds positively to its own shocks and this response appears to be quite modest after the sixth quarter. In the case of the response of government budget deficit, a relatively strong positive response is observed over the sample period.

These results suggest that in response to output shocks, the government budget deficit worsens (that is, increases) for several years. This fiscal balance response is inconsistent with economic theory and the automatic-stabilizer role of the government budget and the pro-cyclical behavior of the government budget balance, and is also inconsistent with the Kim and Roubini (2008) empirical findings. Notably, the government budget response has relatively high standard errors compared to other endogenous variables. This makes the results less reliable over the sample period.

On the other hand output shock has a negative impact on the current account. The response of the current account increases in intensity albeit negatively. These effects generate a counter-cyclical behavior of the current account as compatible with traditional theories and modern theories of the current account. The traditional theories suggest that an increase in domestic productivity growth consequently increases domestic aggregate income and demand. In a relatively small open economy like South Africa this increase in output induces an increase in the demand for imported products and thus, worsen the current account.

On the other hand, modern theories suggest that real GDP shock may be regarded as productivity shock. In the same vein, as in the former theory, a persistently positive output shock is likely to increase investment substantially as a result worsen the current account as suggested also by Mendoza (1991) and Backus *et al* (1992). Moreover, one would argue that although the standard error associated with the shock look relatively small, it increases overtime and thus make the predictions less reliable and accurate over time. Notably, these responses are significantly different from zero.

Figure 4.1: Response of endogenous variables to Real GDP



Source: Own estimates, (1990Q1-2014Q4)

Furthermore, the interest rate response is temporarily positive and completely dies out after reaching the equilibrium in the twelfth quarter (that is, three years). In the case of real exchange rate a negative response is observed. This suggests that an output shock appreciates the real exchange rate over the sample period accompanied by high response intensity and increasing standard errors. Intuitively, this supply shock raises South African income, that is, wealth but

some of the income will be spent imported products not necessarily due to small or insufficient domestic supply but tastes and preferences. Hence, the increase in domestic demand is likely to be less than the domestic supply. To restore equilibrium the relative price of South African goods must decrease, thus demand will rise and the rand might fall in real terms. These results are consistent with the results presented by Corsetti and Muller (2006) and Kim and Roubini (2008).

Overall the impulse responses suggest that output shocks are likely to generate a positive (i.e twin deficits) co-movement between the current account and government budget deficit, which is inconsistent with the results presented by Kim and Roubini (2008). Moreover, these results suggest that the model used in this study accounts to a large extent for the endogenous current account and government budget deficit fluctuations (in particular those induced by real GDP shocks). In addition, these results motivate the researcher's interest for examining the causal relations between the exogenous budget deficit shocks and the current account.

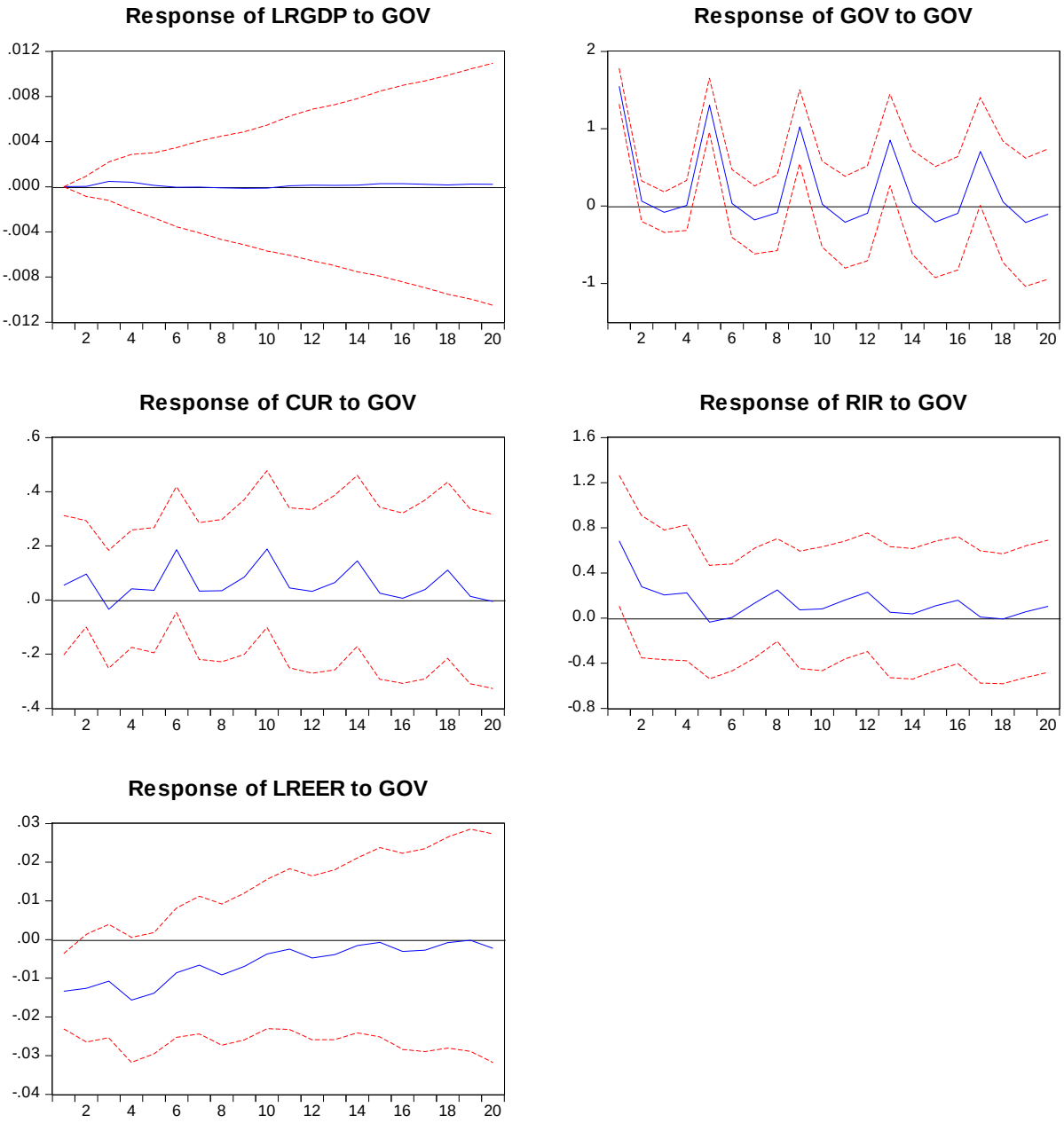
4.2.2: Responses to shocks in the Government budget deficit

Figure 4.2 show results of the main focus of this study. This dissertation is primarily looking at effects of expansionary fiscal policy shocks. In figure 4.2, real GDP does not respond immediately to a government budget deficit shock and depict a very weak positive response, approximately, 0.001 units of response to one unit of innovation. The output response reaches its equilibrium after four quarters and completely dies out by the sixth to the sixteenth quarter and bounce back positively by the twentieth quarter (i.e fifth year). Theoretically, it is surprising that the output response is so poor to the extent that one would barely notice the effect of government budget deficit.

These results support empirical evidence presented by studies based on the South African economy such as Ocran (2009). An expansionary fiscal policy result to an increase in aggregate demand and consequently expands domestic production following Keynesian theory. Therefore, the sluggish response of output might be due to production capacity that is not large enough to meet a high aggregate demand, whereas in the long-run the producers can expand production. In addition, the output response depict high level of uncertainty due to increasing standard errors overtime (also refer to Table 4.2).

Figure 4.2: Response of endogenous variables to government budget deficit shocks

Government Budget Deficit



Source: Own estimates, (1990Q1-2014Q4)

The impulse response function further shows that positive government budget deficit shock is accompanied by an improvement in the current account balance, depicting "twin divergence" behavior (negative relationship). This behavior is contrary to the traditional theoretical view, that an expansionary fiscal policy induces a worsening current account, the so called "twin deficit" behavior. In 1990s the European Union (EU) only allowed member states with no, rather small budget deficit to adopt the "euro" and for the EU community the government budget deficit

started to decline to approximately 4.5% of GDP but the current account did not change. The statistics showed that the main reason the current account was constant was a sharp decline in the private saving rate by about 4% of output, almost equivalent to an increase in the government savings and the investment rose slightly during this period. Conversely to the Ricardian equivalence, governments that lower their deficits (thereby increasing the government savings) will induce a decrease in the private savings, as happened in Europe in the late 1990s. In addition, Kim and Roubini's (2008), empirical results reveal that increases in private saving and declines in investment contributed in the current account improvement in response to expansionary fiscal policy shock. Hence, "twin divergence", prevailed.

In contrast studies such as Corsetti and Muller (2006) argue that a positive co-movement between the current account and expansionary fiscal deficits prevails in relatively more open economies compared to countries such as US and Australia which are relatively less open. Although, the above results follow the empirical evidence provided by Kim and Roubini (2008) based on the United States economy (being less open economy). Hence, the relationship between these two variables still seems inconclusive.

In the case of the real exchange rate, the response is negative over the sample period. However, looking at the real exchange rate path, it is likely to revert to its original value after the fifth year thus this negative effect can be viewed as temporary. These results suggest that government budget deficit shock appreciates (or decrease) the real exchange rate in the short-run, this is consistent with the theoretical view and findings of studies such as Devereux and Purvis (1990).

On the other hand, the response of the real interest rate is positive and temporary, which is also consistent with the theory. Intuitively, an expansionary fiscal policy leads to an increase in aggregate demand resulting to an increase in output. Note, as output increases, so does the demand for money, leading to an upward pressure on the real interest rate which leads to an appreciation of the real exchange rate in the short run. Corsetti and Muller (2006) posit that the response of the real exchange rate to government budget deficit might depend on the openness of the economy and persistence of the shock.

Therefore, it should not be surprising that, these results are contrary to the empirical evidence provided by studies such as Monacelli and Perotti (2006) who focused on OECD countries, Kim and Roubini (2008) based on the United States economy and Devereux (1995) posit that the

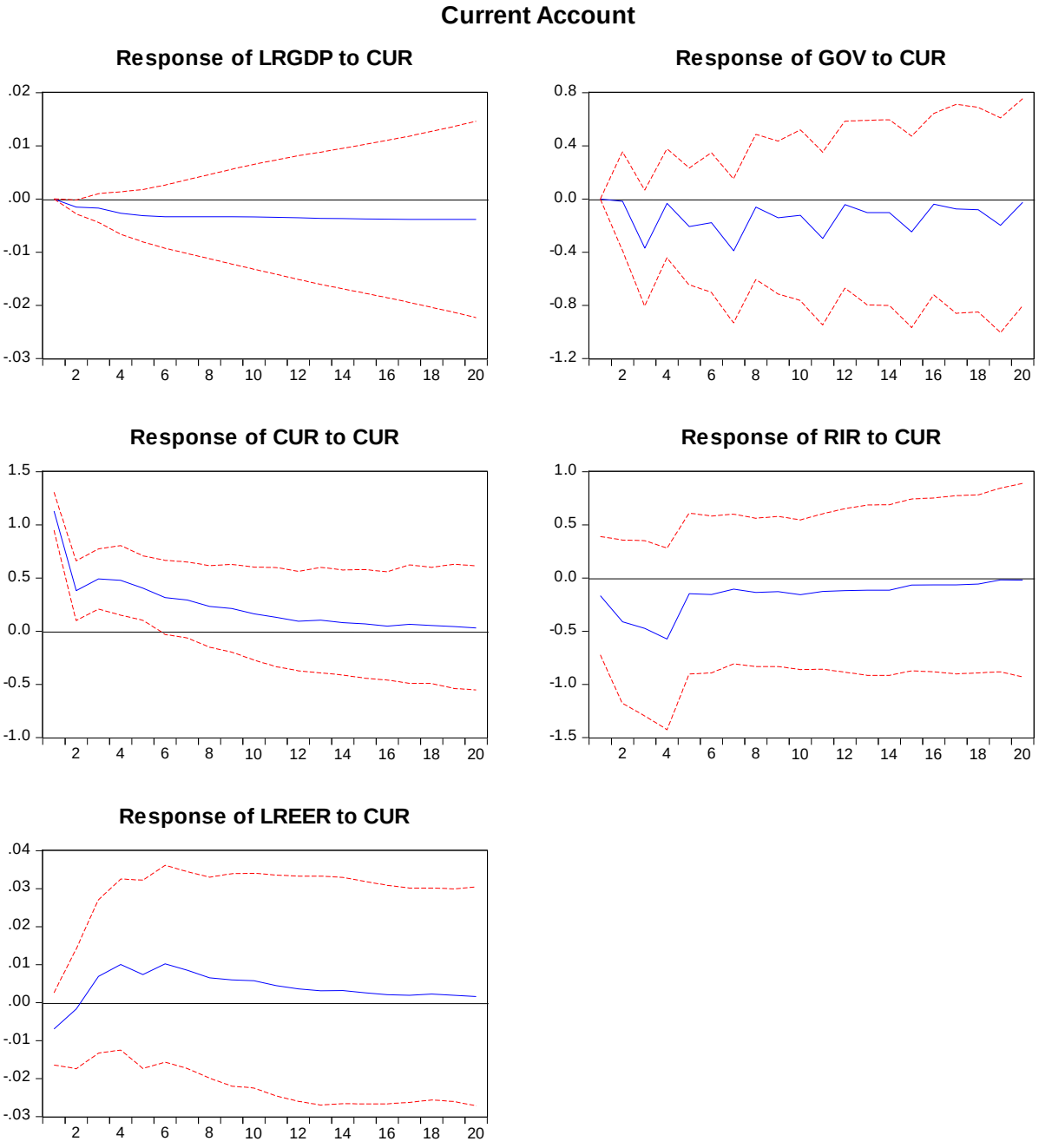
experience of many small economies appears to contract the traditional theory. In addition, recent empirical research confirms that there is a significant relationship between government budget deficit and the real interest rate but there is still a huge debate among macroeconomists on how much does budget deficit affect interest rate. The impulse response function shows that the impacts of shocks from government budget deficit itself are larger than impacts from non-government budget deficit shocks. It appears that government budget deficit demonstrate unstable response to own-shock and the intensity of the response is likely to die out in the long run.

4.2.3: Responses to shocks in the Current Account

In response to the current account shocks, real GDP is negative, quite close to its original value depicting a modest behavior over the sample period. These results are consistent with theory and the impulse responses presented earlier from output shocks (Fig 4.1). Recall that net exports (main component of the current account) does depend on the domestic output behavior, for instance an increase in output leads to a decrease in net exports (Blanchard, 2000). But a favorable balance in the current account indicates that exports exceed imports. This implies that domestic goods are relatively cheaper to foreign consumers and low product prices do not encourage supply (i.e productivity, recalling the law of supply) in the short run. Consequently, imports might decrease as well due to declining aggregate.

Furthermore, in response to current account shock, the government budget deficit increases albeit negatively and approaching its original value by the last quarter of the fifth year. Therefore, we can say that current account shock has a temporal negative effect on the government budget deficit, depicting the so called "twin divergence" in the short-run. As mentioned before, this behavior is inconsistent with the conventional view, in this case a favorable balance in the

Figure 4.3: Response of endogenous variables to current account shocks



Source: Own estimates, (1990Q1-2014Q4)

current account is accompanied by a negative balance in government budget. The current account shocks have a negative effect on the real interest rate and this effect looks temporal as the real interest rate is approaching its original value over the sample period. This is one of the

impulse responses that is not easy to explain clearly, so in this study real interest rate have been used as a proxy for monetary policy shocks.

On the other hand the real exchange rate responds positively to current account shocks and quite modest over the sample period. These results are not surprising at all as in theory an improvement in the current account is accompanied by a depreciation (i.e increase) in the real exchange rate. Intuitively, assuming demand for exports is relatively elastic, this would mean a fall in foreign price of exports, and thus increasing the value of exports, likely to be above the imports. Then the current account would improve accompanied by a depreciation in the real exchange rate. Therefore similar results are expected in the analysis of real exchange shocks on the current account.

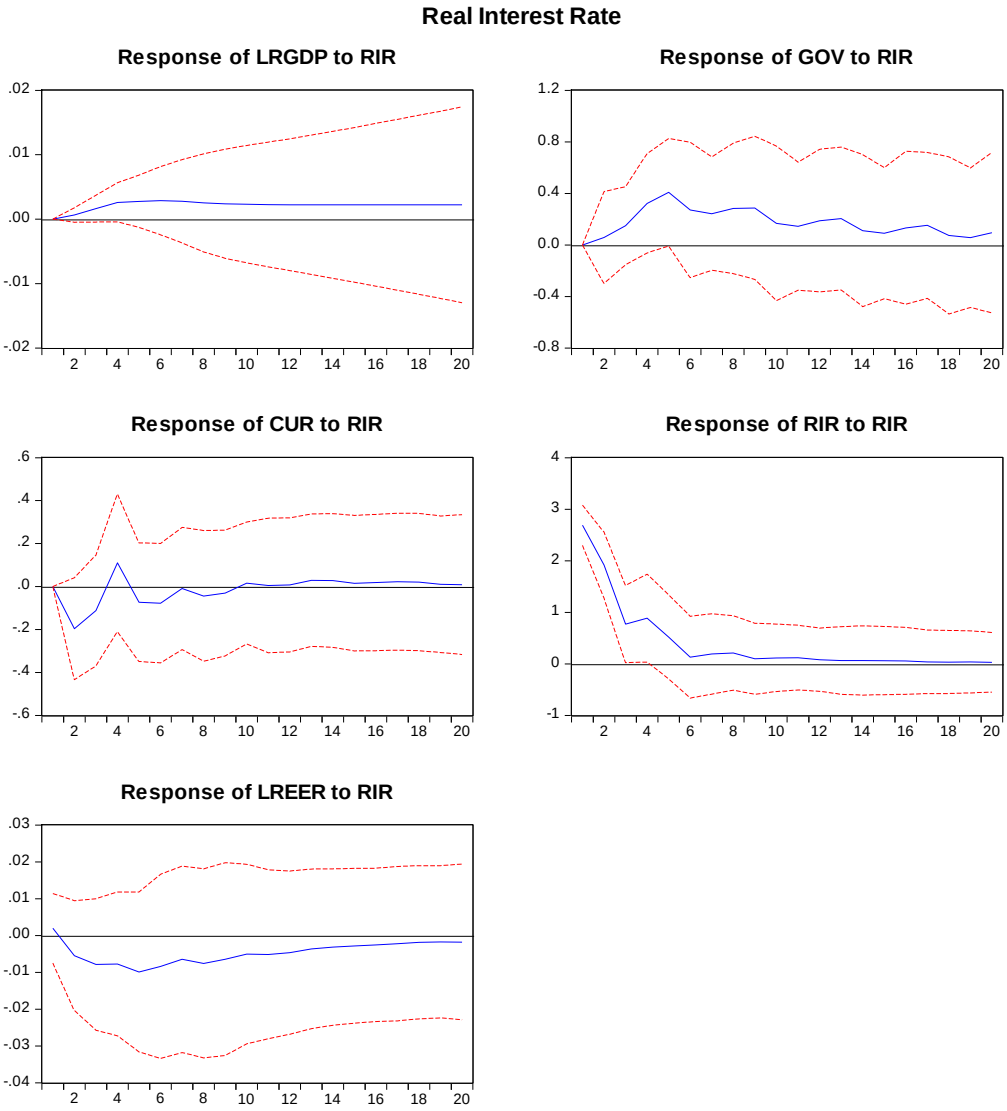
4.2.4: Responses to shocks in Real Interest Rate

As alluded to earlier it is difficult to clearly interpret other structural shocks such as the real interest rate. The real interest rate is more relevant to this study when used as proxy for monetary policy since the short-term real interest rate innovations are believed to be controlled by the monetary policy makers by adjusting the nominal interest rate from the current rate of inflation, as in sticky price models (Kim and Roubini, 2008).

Therefore an interpretation of impulse responses to real interest rate shocks may be that a contractionary monetary policy (that is, an increase in real interest rate) leads to a persistent increase in output, an increase in government budget deficit, a negative balance in the current account and real exchange rate appreciation. The real interest rate effects on output and current account are likely to be permanent as their path over the sample period does not seem to be approaching their original values, whilst effects on government budget deficit and real exchange rate we can say are temporary as they seem likely to revert to their original values.

The output response is the only variable that shows intensity over time and associated with high degree of uncertainty, as shown by high standard errors. However, other endogenous variables generated impulse responses accompanied by relatively high standard errors, declines substantially overtime.

Figure 4.4: Response of endogenous variables to real interest rate shocks



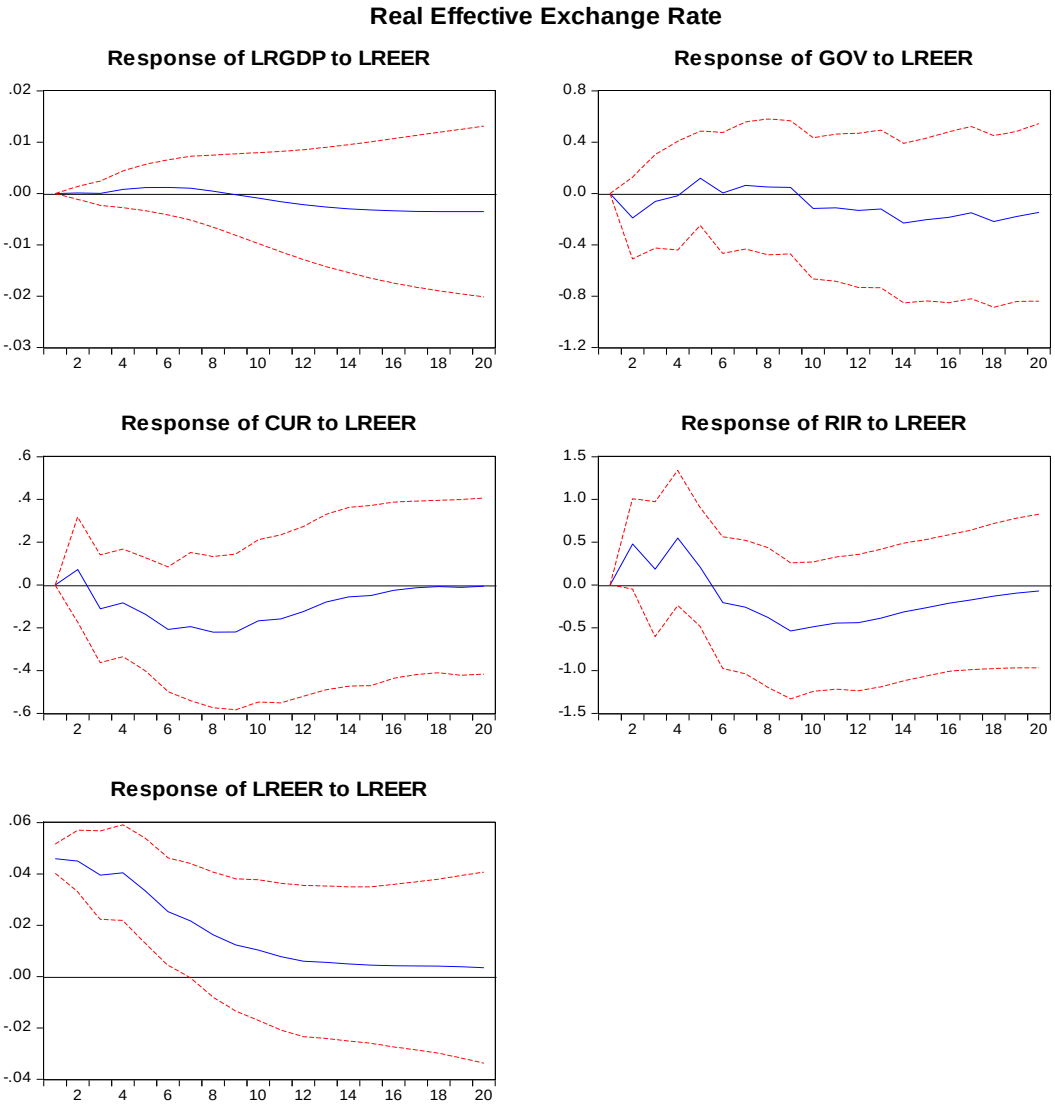
Source: Own estimates, 1990Q1—2014Q4

4.2. 5: Responses to shocks in Real Effective Exchange Rate

Innovations from the real exchange rate do not attract immediate response from real GDP. Indeed, there is a lag of almost a year after which a positive output response ensues but during the eighth quarter output is persistently negative. Furthermore, results show a modest response overtime and associated with an increase in standard errors thus reducing the reliability of output

response. Nevertheless, these results are consistent with the intuition demonstrated by the response of real exchange rate to output innovations in model one. In addition, this effect dies out by the sixth year, hence, we can assumes that the effect is temporary. The results show that real exchange rate shock is accompanied by a temporary negative government budget balance as the intensity of the response dies out by the fourth year. These results are quite consistent to the analysis we did on government budget deficit shocks (model 2) and theoretically these results are not surprising but contrary to empirical evidence provided by studies such as Kim and Roubini (2008).

Figure 5.5: Response of endogenous variables to real effective exchange rate shocks



Source: Own estimates, (1990Q1-2014Q4)

Also, by observation, the results are inconsistent with the current state of the government budget (deficit) in South Africa, which is accompanied by a depreciating exchange rate. On the other hand, the current account increases albeit negatively in response to real exchange rate shock and we observe this effect as temporary since its path is approaching the equilibrium level by the fifth year. Although, current account response positively for only about two to three quarters. The negative response of the current account is also consistent with the current account shock effects on the real exchanged rate analysed earlier.

Furthermore, we observe a positive effect of real exchange rate on real interest rate for only about three quarters, but thereafter the real interest rate responds negatively for several years. Notably, the intensity of the response dies out and return to equilibrium after the fourth year. Therefore, a real exchange rate shock has a negative and temporal effect on real interest rate. Own-shocks due to innovations from real exchange rate elicit a high positive response. This response is very close to the equilibrium level by the fifth year, giving an impression that it might return to its original value in successive years beyond the sample period. Thus, one may argue that real exchange rates have a negative temporary own-shock effects.

4.3 The Variance Decomposition

In an attempt to respond to the research question and draw further detailed inference from impulse responses in figures 4.1 to 5 above, this study assesses how much variation in one variable is caused by another variable's error term, this is referred to as variance decomposition. For the purpose, as an objective of this study the researcher only analysed the forecast error variance decomposition of the government budget deficit. The standard errors (S.E) are constructed by Monte Carlo integration with the Jeffrey's prior as in Doan (2004). There are four number of lags used as suggested by Hannin-Quinn Criterion (appendix A). Furthermore, there are two things to note, short-run and long-run, which are three quarters and twenty quarters in this study, respectively. In table 5 the first column present the forecast horizon.

The results presented in Table 4.2 provide clear evidence that on overall fluctuations of government budget deficit resulting from non-government budget deficit are far smaller than those from government budget deficit itself. For instance, in the short-run, that is quarter three, the shock to government budget deficit (GOV) account for 73.41 percent of the variation of the

Table 4.2: Variance decomposition of Government budget deficit (GOV)

Period	S.E.	LRGDP	GOV	CUR	RIR	LREER
1	0.005494	1.627829	98.37217	0.000000	0.000000	0.000000
		(2.87883)	(2.87883)	(0.00000)	(0.00000)	(0.00000)
2	0.010440	7.278792	91.19807	0.011028	0.124774	1.387336
		(5.75907)	(6.20505)	(1.55637)	(1.65514)	(2.12871)
3	0.015519	20.43524	73.40587	4.152619	0.776422	1.229849
		(7.35914)	(7.94090)	(4.33254)	(2.14427)	(1.97826)
4	0.020224	26.92291	64.81161	3.695707	3.476194	1.093583
		(8.91989)	(8.83765)	(4.22092)	(3.99702)	(2.59181)
5	0.024461	20.87482	70.08175	3.073635	5.036252	0.933539
		(8.82236)	(8.93940)	(3.29491)	(3.87714)	(1.75175)
6	0.028204	23.01834	66.67398	3.436209	5.983325	0.888142
		(10.1099)	(9.76109)	(4.01330)	(4.71506)	(2.22096)
7	0.031545	26.12431	61.30049	5.381577	6.326307	0.867308
		(11.0090)	(10.3392)	(5.23187)	(5.00600)	(2.47157)
8	0.034550	27.85985	58.86263	5.210411	7.200303	0.866810
		(11.7862)	(10.8864)	(5.39452)	(5.90634)	(2.85128)
9	0.037306	24.99697	62.49424	4.654586	7.092663	0.761539
		(11.7911)	(11.6371)	(5.32672)	(5.89622)	(2.97118)
10	0.039863	25.64714	61.40004	4.748785	7.296004	0.908030
		(12.1618)	(11.9281)	(5.78601)	(6.18465)	(3.27879)
11	0.042255	26.67247	59.49658	5.568118	7.249752	1.013072
		(12.2877)	(12.0453)	(6.31982)	(6.22236)	(3.51405)
12	0.044516	27.21160	58.58239	5.494635	7.522359	1.189015
		(12.4936)	(12.2658)	(6.51895)	(6.75084)	(3.93402)
13	0.046679	25.29352	61.02434	5.134635	7.308706	1.238802
		(12.2974)	(12.7986)	(6.67292)	(6.73154)	(4.25079)
14	0.048752	25.31301	60.38295	5.186439	7.352594	1.765013
		(12.2973)	(12.9066)	(7.02609)	(6.81850)	(5.00820)
15	0.050746	25.49967	59.42499	5.675878	7.264854	2.134612
		(12.1970)	(12.9176)	(7.32356)	(6.76253)	(5.58485)
16	0.052670	25.60253	58.94104	5.636411	7.367123	2.452900
		(12.2056)	(13.0541)	(7.47905)	(6.99450)	(6.05876)
17	0.054536	24.38272	60.48898	5.395887	7.197817	2.534591
		(11.9668)	(13.4911)	(7.69303)	(6.93118)	(6.20876)
18	0.056344	24.30360	60.11828	5.420208	7.200876	2.957040
		(11.8777)	(13.6093)	(7.94279)	(6.95799)	(6.63589)
19	0.058096	24.29700	59.66658	5.699956	7.127009	3.209458
		(11.7443)	(13.6393)	(8.11449)	(6.88934)	(6.87780)
20	0.059798	24.31541	59.45060	5.675851	7.169864	3.388278
		(11.7399)	(13.7543)	(8.19587)	(6.97895)	(7.05423)

Cholesky Ordering: LRGDP GOV CUR RIR LREER

Standard errors: Monte Carlo

Source: Own estimates, 1990Q1-2014Q4

fluctuations in GOV (i.e own shock), whereas the shocks to CUR and LREER cause 4.15 percent and 1.22 percent, respectively. Likewise, in the long-run, that is, 20 quarters (equivalent to 5 years) the results indicate that the impulse to GOV account for 59.45 percent variation of the

fluctuations on its own shock (i.e GOV). Whilst, impulses to CUR and LREER cause 5.70 percent and 7.13 percent variations, respectively and analogous application to LRGDP and RIR variables.

Notably, the contribution of government budget deficit to its own shock is becoming smaller and smaller over the longer horizons, suggesting that the exogenous part is likely to be less than a half of the total government budget deficit movements. In addition, real exchange rate and real interest rate shocks contribution are larger in the long run compared to the short run but for the current account shock there is not much of a change and this is consistent with IRF graphs above (4.2.4 and 4.2.5).

Table 4.2 further shows that the contribution of output shocks is becoming larger and more persistent over the sample period. These results suggest that the model used in this study takes into account the endogeneity of the government budget deficit, in particular the endogenous components of the fiscal balance with regards to output shocks. Therefore it is important to pay some attention to output shocks, hence, a detailed analysis is provided in the IRF (Fig. 4.1) above. In general, these results support the interest for examining Granger causality. Let us take a closer look at the persistent of the government budget deficit shocks as the predictions of the theoretical models do differ sometimes from the actual persistence of these shocks. More than 20% of the initial increase in the budget deficit dissipates in about three quarters (that is, in the short run). About 26% dissipates in eight to sixteen quarters and about 27% dissipates by the twentieth quarter. Therefore the budget deficit shocks seem to be persistent over the sample period.

4.4 Granger causality

Granger causality tests were conducted to assess whether these variables cause each other and the nature of causality if it is *bi-directional*, *uni-directional* or *independent*. This analysis is believed to provide detailed information about the direction of influence between the government budget deficit, the current account and the real exchange rate in order to contribute to the debate of these relationships in the current literature. In each case the null hypothesis states that independent variable under consideration "does not Granger-cause" the dependent variable in question (H_0). Table 4.3 below presents the Granger causality test results at the 5% level of

significance, with four distributed lags as suggested by the HQC selection criterion. The decision parameter is that if the p-value is less than 5% level of significance, then (H_0) is rejected in favor of (H_1). If p-value is greater than 5%, we do not reject the null hypothesis. For the purpose of this study only the variables of interest are summarized in Table 4.3, other variables are presented in Appendix B.

Table 4.3: Granger Causality

Granger Causality Test					
Null Hypothesis (H0)	**Chi-sq**	**df**	**p-value**	**Decision**	**direction of causality**
CUR does not granger cause GOV	2.535322	4	0.5383	Do not reject	Independent
GOV does not granger cause CUR	7.520188	4	0.1108	Do not reject	
LREER does not granger cause GOV	1.549481	4	0.3241	Do not reject	Independent
GOV does not granger cause LREER	3.327468	4	0.5046	Do not reject	
LREER does not granger cause CUR	3.430171	4	0.4886	Do not reject	Independent
CUR does not granger cause LREER	2.772473	4	0.5966	Do not reject	

5% level of significance, variables: "GOV" is the government budget deficit, "CUR" is the current account and "LREER" is the real exchange rate, "

Source: Own estimates, (1990Q1-2014Q4)

The results suggest that the current account does not Granger-cause the government budget deficit, since the p-value is (53.83%) which greater than 5% level of significance (Table 4.3). In other words, we do not reject the null hypothesis. Likewise, the government budget deficit does not Granger-cause the current account. Similar results are observed between the real exchange rate and the government budget deficit. Again, the results postulate a similar behavior for the current account and the real exchange rate. According to these results, all the three variables' coefficients are not statistically significant, rather different from zero in all three equations, in other words, they are *"independent"* of each other.

These results suggest that in South Africa the current account and the real exchange rate past values do not better predict future values of government budget deficit. Likewise, the government budget deficits' past values do not better predict future values of the current account and the real exchange rate. Interestingly, the results show that real exchange rate lagged values influence the future values of the real interest rate but not the other way round, depicting a "uni-directional" causality (Appendix B). This is consistent with the Mundell-Flemming model when the government expands public spending accompanied by floating exchange rate regime and

perfect capital mobility. Surprisingly, output Granger causes government budget deficit but not the reverse. On the other hand, output Granger causes the current account but not the other way round and this is consistent with the theoretical view. More generally, since the future cannot predict the past, causality analysis is vital for the objective of this research.

4.5 Summary

This chapter has focused on the analysis and discussion of empirical results in answering the main research question of whether the fiscal deficit affects the current account and the real exchange rate. The analysis has been based on impulse response functions, variance decomposition and Granger causality. It has been well justified why this particular analysis is necessary. The impulse response function results showed mixed results of the effects of output shocks and they look quite modest over the longer horizons (Fig. 4.1). These results further suggest that output shocks are more likely to generate a twin deficit between the current account and the government budget deficit. In addition, the variance decomposition has shown that the contribution of output shocks is becoming larger and persistent over the sample period (Table 4.2). Surprisingly, the results reveal that output Granger causes the government budget deficit but not the reverse (Appendix B).

Returning to the focus of this research, the impulse response function results show that the budget deficit improves the current account balance, depicting "twin divergence" which is contrary to Corsetti and Muller (2006), argument that twin deficits are likely to occur in relatively more open economies like South Africa. On the other hand the budget deficit has a negative effect on the real exchange rate (i.e an appreciation) in the short run and quite modest over the sample period as also approaching the original balance (Fig. 4.2). Although in all five IRF figures the responses appear to be not statistically different. These results might be surprising, rather not convincing when we observe an improvement in the current account and yet the real exchange rate appreciates. In trying to clarify these puzzling results, the researcher considers the J-curve (refer to chapter 2) which suggests that the market does not necessarily respond immediately to the changes in the foreign exchange market. For instance, most imports and export orders are placed several months in advance. In the short run, the net foreign assets, imports and exports behavior may reflect transaction decisions that were made on the basis of the old real exchange rate (Krugman and Obstfeld, 2003)

In addition, the results suggest that short-run shocks to the current account and the real exchange rate can cause 4.15 percent and 1.22 percent fluctuations in the government budget deficit, respectively. These magnitudes are smaller than government budget deficit fluctuations from own-shocks (Table 4.2). Similar results are observed in the long-run. The results further suggest that in South Africa the past values of the current account and the real exchange rate do not better predict the fluctuations of government budget deficit. Likewise, the budget deficit does not Granger cause the current account and the real exchange rate. Hence, according to the Granger causality results, the current account, the real exchange rate and the government budget deficit all appear "independent" of each other (refer to Table 4.3).

The real interest rate is relevant to this study when used as a proxy for monetary policy. We have observed the effects of real interest rate shocks and we can say that the contractionary monetary policy leads to a persistent increase in real GDP, an increase in the government budget deficit, a worsening of the current account and a real exchange rate appreciation. In addition, real interest rate shocks contribution on government budget deficit fluctuations are larger in the long run compared to short run, this is consistent with the impulse response function graph (refer to Table 4.2 and fig. 4.2). The results further depict a "uni-directional" causality between the real exchange rate and the real interest rate, following Mundell-Fleming model, (refer to Appendix B).

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This dissertation have examined the effects of government budget deficit shocks on the current account and the real exchange rate in South Africa using vector autoregressive models. The researcher controlled for endogeneity in order to identify the government budget deficit shocks, hence output shocks were also analysed. The analysis indicate that output is a very strong cyclical component on both the budget balance and the current account balance and it induced a negative correlation between the two variables over the business cycle, as the economic expansion tend to widen government budget deficit but improved the current account. In other words, the econometric results suggest that the fiscal deficit shocks improved the current account in the short run. Contrary to the conventional view that expansionary fiscal policy generating budget deficit also worsen the current account negative balance. Looking at the role of output on these results, the possible economic implication is that an improvement in the current account balance (driven basically by the trade balance surplus) encourages the government to increase expenditure causing the budget deficit to widen.

The results further show that fiscal shocks appreciated the real exchange rate in the short run and these results are consistent with economic theories (Blanchard, 2000). In addition, the J-curve seem to justify the simultaneous occurrence of improved current account and the real exchange rate appreciation. The empirical evidence presented here suggest that government budget deficit and the current account do no necessary move to the same direction, therefore, "twin divergence" is observed. According to Kim and Roubini (2008), a divergent movement of the fiscal balance and the current account is expected when there are cyclical shocks to output. It is worth to mention that the same results were found by Alkswani (2000) based on the Saudi economy as well as Merza and Alwani (2012) based on the Kuwait economy, thus we may conclude that the twin deficit hypothesis may not be applied to small economies.

It is imperative to note the difficulties encountered in analysing fiscal policy actions using VAR models. One of the major limitations of this study is unavailability of quarterly data on some of the variables such as real exchange rate and real interest rate. Therefore, the conversion of annual

and/ or monthly data to quarterly using E-views statistical package might have had huge influence on the results. Difficulties in obtaining relevant data for the current account components such as government net interest receipts have influenced the decision of keeping on hold the extended analysis on how and why the results show twin divergence in order to shed more light about these relationships. This calls for further analytical reconsideration of how fiscal policy affects the current account and the real exchange rate.

5.2 Recommendations

The key policy implication of the study is that the impact of fiscal policy deficit shocks on the current account and the real exchange rate is temporal and at best modest. In addition, something sensible can be said for a role of real output in shaping the relationship between the government budget deficit and the current account. It is also important to note that real exchange rate appreciation induced by the fiscal deficit, is inconsistent with the current exchange rate fluctuations in South Africa, which shows depreciation in the presence of continuous government budget deficit (on observation of the raw data). This dissertation contributes to the literature from a South African focused empirical effort, also given that it is a developing economy. Some fiscal authorities may find this paper valuable for policy stance that balances taxation, public expenditure and borrowing accompanied by sustainable economic growth.

I believe these relationships are some of key details that the fiscal policy makers should consider in decision making for prosperity of this great nation.

5.3 Suggestions for further research

This research was much constrained by time. The researcher would like to suggest a further detailed study on the relationship between the government budget deficit, the current account and the real exchange rate based on South African economy. Also in an attempt to broaden the knowledge on this phenomenon further analytical reconsideration of fiscal policy shocks in Sub-Saharan African to even Africa as a whole is needed since in the current literature most of the studies have covered the OECD countries. Further theoretical research that tries to match the empirical evidence of this research paper will be fruitful in order to further highlight the transmission mechanism. For instance, further investigation on why and how the expansionary

fiscal policy is accompanied by an improvement in the current account and real exchange rate appreciation in South Africa by analyzing the effects of the fiscal shocks on components of the current account and the real exchange rate and even further examine the cointergration.

Appendices

Appendix A: Lag Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: GOV CUR LRGDP LRER RIR
Exogenous variables: C
Date: 08/20/15 Time: 20:35
Sample: 1990Q1 2014Q4
Included observations: 92

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-557.9758	NA	0.142164	12.23861	12.37566	12.29392
1	-101.1166	854.1282	1.19e-05	2.850360	3.672682*	3.182256
2	-63.01720	67.08799	9.00e-06	2.565591	4.073182	3.174068
3	-42.68979	33.58442	1.01e-05	2.667169	4.860029	3.552226
4	29.37059	111.2236	3.71e-06*	1.644118	4.522246	2.805755*
5	52.75166	33.54675	3.99e-06	1.679312	5.242709	3.117529
6	75.96178	30.77863	4.40e-06	1.718222	5.966888	3.433020
7	95.55821	23.85652	5.38e-06	1.835691	6.769625	3.827069
8	130.3512	38.57485*	4.88e-06	1.622800*	7.242003	3.890758

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion

Source: Researcher's own estimates

Appendix B: Granger Causality

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 10/15/15 Time: 12:07
Sample: 1990Q1 2014Q4
Included observations: 96

Dependent variable: LRGDP

Excluded	Chi-sq	Df	Prob.
GOV	3.152892	4	0.5326
CUR	7.104161	4	0.1305

RIR	2.087537	4	0.7197
LREER	2.119094	4	0.7139
All	15.56293	16	0.4839

Dependent variable: GOV

Excluded	Chi-sq	Df	Prob.
LRGDP	33.76152	4	0.0000
CUR	2.535322	4	0.6383
RIR	4.659337	4	0.3241
LREER	1.549481	4	0.8178
All	57.05433	16	0.0000

Dependent variable: CUR

Excluded	Chi-sq	Df	Prob.
LRGDP	12.95981	4	0.0115
GOV	7.520188	4	0.1108
RIR	5.730040	4	0.2202
LREER	3.430171	4	0.4886
All	27.61315	16	0.0352

Dependent variable: RIR

Excluded	Chi-sq	Df	Prob.
LRGDP	4.586554	4	0.3324
GOV	3.390707	4	0.4947
CUR	2.658289	4	0.6165
LREER	10.02524	4	0.0400

All	17.59093	16	0.3484

Dependent variable: LREER

Excluded	Chi-sq	Df	Prob.
LRGDP	2.613848	4	0.6244
GOV	3.327468	4	0.5046
CUR	2.772473	4	0.5966
RIR	2.332898	4	0.6748
All	12.91051	16	0.6793

5%levelofsignificance

Source: Researcher's own estimates

Appendix C: Ordering of variables

Real GDP

Output is the most contemporaneously exogenous variable in the model. Kim and Roubini (2008) condition on the current Real GDP since government budget deficit is likely to be endogenously affected by the current level of economic activity within a quarter. In particular, elements of government revenue such as sales taxes and income taxes are very likely to depend on the current level of economic activity within a quarter. This assumption is supported by Blanchard and Perotti (2002). They found a non-zero effect of output on net taxes within a quarter.

Government budget deficit

Government budget deficit is also an exogenous variable in the model this study. Conditioning government budget on the current real GDP is essential to control the current endogenous reactions of the government budget deficit to current economic activity. While, not conditioning on other current variable is reasonable to identify exogenous or discretionary changes in the

government budget deficit since such changes are less likely to depend on other current variable because of the decision lags of fiscal policy.

Current account

The current account variable is ordered first, before the real interest rate and real exchange rate by assuming that the real sector variable. The current account is contemporaneously exogenous to the financial sector variables (i.e RIR and RER). Following Sims and Zha (2006), Kim (1999) and Kim and Roubini (2000).

Real interest rate

The real interest rate is contemporaneously exogenously related to monetary variable than real exchange rate. But, endogenously related to most of variables in the model.

Real exchange rate

In the literature the real exchange rate is assumed to be contemporaneously related to all variables in the model, since economic participants are forward-looking.

NB. All these variables will be gathered into a single vector (Y_t) as follows (see equation 3.2);

$$Y_t = [LRGDP_t, GOV_t, CUR_t, RIR_t, LREER_t]' \quad .$$

Appendix D: Ethical Clearance approval letter

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

02 November 2015

Ms Nwabisa Florence Ndzama (213565767)
School of Accounting, Economics & Finance
Westville Campus

Dear Ms Ndzama,

Protocol reference number: HSS/1612/015M
Project title: The effects of fiscal policy on the current account and real exchange rate in South Africa

Full Approval – No Risk / Exempt Application

In response to your application received on 28 October 2015, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted **FULL APPROVAL.**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....
Dr Shenuka Singh (Chair)

/ms

Cc Supervisor: Professor James Fairburn
Cc Academic Leader Research: Dr H Ngalawa
Cc School Administrator: Ms Seshni Naidoo

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REFERENCES

Alkswani, M. A (2000): "The Twin Deficits Phenomenon in Petroleum Economy: Evidence from Saudi Arabia ", *Economic Research Forum, Conference Paper, No. 072000001*

Backus, D. K., Kehoe, P. J., & Kydland, F. E. (1992): International real business cycles. *Journal of Political Economy*, pp.745-775

Balassa, B. (1964): The purchasing-power parity doctrine: a reappraisal. *The Journal of Political Economy*, pp.584-596

Balassa, B. (1988): Public Finance and Economic Development. *PPR Working Paper 31. World Bank, Washington, D.C.*

Barro, J.R. (1996): Determinants of Economic Growth: A Cross-Country Empirical Study, *NBER Working Papers 5698, National Bureau of Economic Research, Inc.*

Baxter, M. (1995): International trade and business cycles. *National Bureau of Economic Research.*

Blanchard, O. (2000): The Government Budget Constraint. *Macroeconomics, 2nd edition. Prentice Hall International, Inc. pp.* 518-522

Blanchard, O. and Perotti, R. (2002): An Empirical Characterization of the Dynamic Effects of changes in Government Spending and Taxes on Output. *Quarterly Journal of Economics, Vol.117 (4), pp.* 1329-1368

Blanchard, O. and Johnson, D.R. (2013): Macroeconomics. 6th edition. *Pearson Education Limited.*

Beetsma, R., Giuliodori, M. and Klaassen, F. (2008): 'The effects of public spending shocks on trade balances and budget deficits in the EU', *Journal of the European Economic Association, vol. 6(2–3), pp.* 414–423.

Benetrix, A., and Lane. P (2010): "Fiscal Shocks and the Real Exchange Rate." *Open Economies Review* 21 (3): 335–350

Bernanke, B.S., & Mihov, I. (1998): The liquidity effect and long-run neutrality. In *Carnegie-Rochester conference series on public policy*. Vol.49, pp.149-194. North-Holland.

Burnside, C, Eichenbaum, M & Jonas. F (2000), "Assessing the effects of fiscal shocks", *NBER Working Paper series, Working Paper 7459*

Burnside, C., Eichenbaum, M., & Rebelo, S. (2001): Hedging and financial fragility in fixed exchange rate regimes. *European Economic Review, 45*(7), pp.1151-1193.

Burnside, C, Eichenbaum, M & Jonas. F (2004): "Fiscal Shocks and Their Consequences," *Journal of Economic Theory 115,* pp. 89-117.

Bussiere, M., Fratzscher, M. & Muller, G. (2005): Productivity, budget deficit and the current account. *Working Paper series, no.509*

Cashin, P., Cespede, L.F & Sahay, R. (2004): Commodity currencies and the real exchange rate. *Journal of Development Economics, Vol 75,* pp.239-268

Corsetti, G & M¨uller G.J, (2006) "Twin deficits: squaring theory, evidence and common sense," *Economic Policy,* pp.599-638

Devereux, M.B & Purvis, D.D., (1990): Fiscal Policy and the real exchange rate. *European Economic Review, 34(6),* pp. 1201-1211

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American statistical association*, *74*(366a), pp.427-431.

Edelberg, W., Eichenbaum, M. & Fisher, J.D.M (1997): Understanding the Effects of a Shock to Government Purchases*, *Review of Economic Dynamics* **2**, 166]206 _1999.*
Article ID redy.1998.0036, available online at http:rrwww.idealibrary.com

Enders, W. (2004): Applied Time Series Econometrics. Second edition, pp.291-311

Engen, E. M., & Skinner, J. (1996). Taxation and economic growth). *National Bureau of Economic Research. (No. w5826)*

Erceg, C.J, Guerrieri, L & Gust, C, (2005): Expansionary Fiscal Shocks and the US Trade Deficit. *International Finance, vol.8, Issue 3,* pp.363-397

Fatás, A., & Mihov, I. (2001). The effects of fiscal policy on consumption and employment: theory and evidence, *Vol. 2760. Centre for Economic Policy Research.*

Favero, C.A. (2002). How do European Monetary and Fiscal Authorities Behave? *CEPR Discussion Paper No. 3426. Available at SSRN: http://ssrn.com/abstract=323361*

Fischer, S and William, E. (1990): The Economics of the Government Budget Constraint. *The World Bank Research Observer, Vol.5, No.2,* pp.127-142

Frankel, J.A. (1998): Obstacles to International Macroeconomic Policy Coordination *(No.w2505).NBER*

Fuller, W. A. (1976): Introduction to Statistical Time Series. *New York: Wiley.*

Giordano, R., Momigliano, S., Neri, S., & Perotti, R. (2007): The effects of fiscal policy in Italy: Evidence from a VAR model. *European Journal of Political Economy, Vol 23(3),* pp.707-733.

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

Gujarati, D. N. & Porter, D.C (2003): Basic Econometrics. *4th edition. McGraw Hill Irwin*.

Harrod, RF. (1933). A further note on decreasing costs. *The Economic Journal*, pp.337-341

Harris, R., & Sollis, R. (2003): Applied time series modelling and forecasting. *Wiley.*

Hayashi, F. (1985): Tests for liquidity constraints; a critical survey. *National Bureau of Economic Research.*

Hussain, A., Muhammad, S.D., Akram , K. and Lal, I., (2009): Effectiveness of Government Expenditure Crowding –In or Crowding-Out: Empirical Evidence in Case of Pakistan. *European Journal of Economics, Finance and Administrative Sciences,* (16)

Jaffari, B. (2006): Social development from infancy to adolescence: Longitudinal and concurrent fators in an adoption sample. *Development Psychology, Vol 42(6),* pp.1143-1153

Jooste, C., Liu, G.D & Naraidoo, R. (2013): Analysing the effects of fiscal policy shocks in the South African economy. *Economic Modelling, Vol 32,* pp.215-224

Kennedy, P. (2003): Time series econometrics. A guide to Econometrics. *Fifth edition. The MIT Press Cambridge, Massachusetts*. pp.320-357

Kim, S., and Roubini, S. (2008): "Twin Deficit or Twin Divergence? Fiscal Policy, Current Account, and Real Exchange Rate in the U.S." *Journal of International Economics* 74 (2*),* pp. 362–83.

Kopcke, R. W., Tootell, G. M., and Triest, R. K. (2006). Introduction: The macroeconomics of fiscal policy.

Koop, G. (2005): Analysis of Economic Data. Second edition. *Wiley*

Krugman, P.R and Obstfeld, M. (2003). International Economics: Theory and Policy, *6th edition. Addison-Wesle. Boston*

Kulkarni, Kishore and Erickson, E (2001). Twin Deficit Revisited: Evidence from India, Pakistan and Mexico.‖ *The Journal of Applied Business Research, Vol. 17, No. 2,* pp. 97-103.

Kwiatkowski, D., Phillips, P. C., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that economic time series have a unit root?. *Journal of econometrics, Vol54(1),* pp.159-178.

Lardic, S., & Mignon, V. (2006). The impact of oil prices on GDP in European countries: An empirical investigation based on asymmetric cointegration. *Energy policy, 34(18),* pp.3910-3915.

Lau. E & Baharumshah Z., (2004): On the Twin Deficits Hypothesis: Is Malaysia Different?‖ *Pertanika Journal of Social Sciences & Humanities, University of Putra Malaysia, Vol. 12, No. 2,* pp. 87-100.

Lipton, D. and Sachs, J. (1983): Accumulation and Growth in a two-country model. A simulation approach. *Journal of International Economics, 15(1),* pp.135-159.

Lütkepohl, H., & Reimers, H. E. (1992): Impulse response analysis of cointegrated systems. *Journal of economic dynamics and control*, *Vol16(1*), pp.53-78.

Mabugu, R., Robichaud, V., Maisonnave, H. & Chitiga, M. (2013): Impact of fiscal policy in an intertemporal CGE model for South Africa. *Economic Modelling, Vol.3 (1),* pp.775-782

MacDonald, R. (1996).:Panel unit root tests and real exchange rates. *Economics Letters*, *50*(1), pp.7-11.

MacDonad, R. and Marsh, I. (1999): Exchange Rate Modelling. *Kluwer Academic Publisher, Boston*

Mann, C.L (2002): Perspectives on the US current account deficit and sustainability. *Journal of Economic Perspectives,* pp.131-152

Mehdi, A. (2015): Effects of budget deficit on production, inflation and trade balance of Iran-Based on the synchronous equation's model. *Bulletin of the Georgian National academy of sciences, Vol.9, no.1*

Mehrara, M and Zamanzadeh, A (2011): Testing Twin Deficits Hypothesis in Iran. *Interdisciplinary Journal of Research in Business*, *Vol. 1, Issue. 9*, pp. 7- 11.

Mendoza, E. G. (1991): Real business cycles in a small open economy. *The American Economic Review*, pp.797-818.

Merza, A., Alawin, M & Ala' Bashayreh, J (2012): The Relationship between Current Account and Government Budget Balance: The Case of Kuwait
International Journal of Humanities and Social Science Vol. 2 No. 7; April 2012 168

Monacelli, T. & Perotti, R. (2010): "Fiscal Policy, the Real Exchange Rate, and Traded Goods." *Economic Journal 120 (544),* pp. 437–61.

Montiel, P.J. (2009). International Macroeconomics. *First edition. Wiley-Balckwell*.

Mountford, A & Uhlig, H, (2009): What are the effects of fiscal Policy Shocks? *Journal of Applied Econometrics, Vol. 24, Issue 6,* pp.960-992

Nickel, C and Vansteenkiste, Il. (2008): Fiscal Policies, the Current Account and Ricardian Equivalence,‖ *Working Paper Series, European Central Bank, No. 935, September. Available on line at: http://www.ecb.int/pub/pdf/scpwps/ecbwp935.pdf*

Obstfeld, M. and Rogoff, K. (1996). Foundations of International Macroeconomics. *Massachusetts Institute of Technology*.

Ocran, M.K (2009): Fiscal Policy and Economic Growth in South Africa. *Journal of Economic Studies, Vol 38 (5),* pp.604-618

Penati, A. (1983): Expansionary Fiscal Policy and the Exchange Rate: A Review *International Monetary Fund,Vol. 30, No. 3, pp. 542-569. Published by: on behalf of the Palgrave Macmillan Journals International Monetary Fund Stable URL:http://www.jstor.org/stable/3866725*

Perotti, R (2007): "In search of the transmission mechanism for fiscal policy," *manuscript, IGIER, Universit`a Bocconi. NBER Macroeconomics Annual*

Ratha, A. (2011): Twin Deficit or Distant Cousin? Evidence from India. *St. Cloud State University. Economics Faculty Working Paper. Department of Economics.*

Ravn, M & Uribe, M (2007): Explaining the effects of government spending shocks on consumption and the real exchange rate. *NBER Working Paper 13328 http://www.nber.org/papers/w13328*

Ravn, O.M & Mertens, K. (2010): Measuring the Impact of Fiscal Policy in the Face of Anticipation: A structural VAR Approach. *The Economic Journal, Vol.120, issue 544,* pp.393-413

Ravin, M.O., Schmitt-Grohe, S. & Uribe, M. (2012): Consumption, government spending and the real exchange rate. *Journal of Monetary Ecoonomics, Vol.59,* pp.215-234

Rauf, A & Khan, AQ, (2011): An empirical study to find the relationship between trade deficit and budget deficit in Pakistan. *Academic Research International, ISSN: 2223-9553, Vol.1(3),* pp.36-46

Ramey, V. A., & Shapiro, M. D. (1998). Costly capital reallocation and the effects of government spending. *In Carnegie-Rochester Conference Series on Public Policy, Vol. 48, pp. 145-194. North-Holland.*

Rogers, A.J., (1986): Modified Lagrange multiplier tests for problems with one-sided alternatives, *Journal of Econometrics 31*, pp.341-362.

Romer, C. D., & Romer, D. H. (1989). Does monetary policy matter? A new test in the spirit of Friedman and Schwartz. *In NBER Macroeconomics Annual, Vol. 4* , pp. 121-184. *MIT Press*.

Romer, D. (2011): The Ricardian Equivalence in Practice. Advanced Macroeconomics. *Fourth edition. University of California, Berkeley. Published by McGraw Hill,* pp.594-596

Sachs, J and Wypolsz, C (1984): Real Exchange Rate Effects of Fiscal Policy. *Working Paper No. 1255. NBER Working Paper Series*

Samuelson, PA. (1964): Theoretical notes on trade problems. *The Review of Economics and Statistics,* pp.145-154

Sims, C.A. (1980): Macroeconomics and Reality. Econometrica: *Journal of the Econometric Society,* pp.1-48

Sims, C. A. (1986). Are forecasting models usable for policy analysis?. *Federal Reserve Bank of Minneapolis Quarterly Review*, *10*(1), pp.2-16.

Sims, C. A., & Zha, T. (2006). Were there regime switches in US monetary policy?. *The American Economic Review*, pp.54-81.

Thomas, Lloyd and Abderrezak, Ali. (1988) "Anticipated Future Budget Deficits and the Term Structure of Interest Rates," *Southern Economic Journal*, Vol. 55 Issue 1, pp. 150-161.

Truman, E. M. (2008). Sovereign wealth funds: the need for greater transparency and accountability. *Peterson Institute for International Economics*.

Uhlig, H., & Mountford, A. (2002). What are the effects of fiscal policy shocks?. *Available at SSRN 306321*.

Vogelvang B (2005). Econometrics: Theory and applications with EViews. *First Edition, Prentice Hall.UK*, pp.14-16

Vyshnyak, O. (2000): Twin Deficits Hypothesis: The Case of Ukraine‖. *National University ―Kyiv - Mohyla Academy‖, MS thesis, Ukraine.*

www.resbank.co.za

Yanik, Y. (2006): The Twin Deficits Hypothesis: an Empirical Investigation,‖ *Middle East Technical University. MS thesis, Turkey.*

Yotsuzuka, T. (1987): Ricardian Equivalence in the presence of capital market imperfections. *Journal of Monetary Economics, 20(2),* pp.411-436