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The effectiveness of fiscal deficits in stimulating economic growth

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Abstract

This thesis applies a Structural Vector Auto Regression model to find the response of economic growth to fiscal deficits in South Africa. The results of this study help to assess the effectiveness of discretionary fiscal policy in stimulating economic growth in this economy. Our study finds a negligible response of economic growth to fiscal deficits, for both the short-run and long-run, implying that discretionary fiscal policy is not an effective economic stimulatory policy in South Africa. Based on the analyses of the impulse response functions and the forecast error variance decompositions, we believe this finding could have been caused by: weak automatic stabilisers; the leakage of fiscal deficits through increased imports and the appreciation of the real effective exchange rate - both of which lead to a trade deficit; the crowding-out of private investment; and finally, the *South African Reserve Bank's (SARB)* compliance with the inflation-targeting monetary policy which could have offset the fiscal stimulus. These causes have both theoretical and empirical support for the impotence of fiscal deficits on economic growth. The findings are efficient and reliable, as our model passed all the most important diagnostic tests.

Declaration

I, Stanford Cheelo Mujuta, hereby declare that this mini-thesis entitled *The effectiveness of fiscal deficits in stimulating economic growth* is my own work and that I have not previously submitted it, in part or in its entirety, at any university for a degree or examination. All sources that I have used have been indicated and acknowledged by means of referencing.

Date :_____

Signature:_____

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This paper marks the completion of my Master Degree in Economics at the University of the Western Cape. Although interesting, the writing has been a challenging process.

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CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

Economies, from time to time, go through periods of high growth, slow growth, no growth and recessions. The recurrence of such cycles is a characteristic feature of every functioning economy. The recent 2008 economic recession, which was associated with a significant decline in output and a rise in the unemployment rate of many economies, attests to the adverse effects which can arise when economic cycles are severe and prolonged. The need to avoid the persistence of such economic cycles and restoring economic growth and employment to full potential levels is the mantle of macroeconomic management. Such an undertaking is cardinal for purposes of improving long-term growth potential, or what Haghighi, Sameti & Isfahani (2012:40) describe as the supply side performance of the economy. This paper aims to investigate the effectiveness of discretionary fiscal policy as a tool for macroeconomic management in South Africa. The main interest is to find out if the use of fiscal deficits in South Africa is an effective stimulative measure when the economy is ailing.

The most recent scenario when the South African economy ailed is 2009, as a consequence of the 2008[1] global economic recession. Prior to that, another recession, albeit, not as severe as the 2008 one, hit this economy in 1992. Recessions differ in many ways such as, magnitude and causes. In the same way they differ in terms of their characteristics, the strategies used to respond to recessions also differ, as Romer (1991:1) points out how, during the Great Depression of the 1930s, monetary policy was favoured for economic recovery, while fiscal policy was relegated to a minor role. However, after World War II, policy focus by many economies favoured Keynesian fiscal activism as a way of economic management. The popularity of this policy strategy did not however, last forever. The stagflation[2] experiences that affected most economies in the 1970s exposed some pitfalls associated with the use of fiscal policy for macroeconomic management. Following that, the prominence of Keynesian fiscal activism dwindled.

The decline in the influence of fiscal activism around this time gave rise to the use of the market approach for macroeconomic management, as propagated by monetary economists. The shift in policy preference was instigated by those who argued that government fiscal discretionary approach

[1] The 2008 economic recession had its origin in the collapse of financial markets. The suffering of these markets is only comparable to the Great Depression of the 1930s (Hasset & Newmark, 2008:77).
[2] It refers to the concurrence of high inflation and high unemployment.

was misguided and, therefore, needed to be replaced by the invisible hand. Blinder (2001:107) points out that the heydays of monetary policy characterized a situation where nearly all economic stabilisation discussions were exclusively about monetary policy. Eichenbaum (1997:236) also argues that during this period countercyclical fiscal policy was neither desirable nor politically feasible.

In a recent turn of events, it is apparent that countercyclical discretionary fiscal policy was never abandoned for good. After a long period of it being side-lined in policy implementation because of the dominance of monetarism, many economies re-embraced it during the recent 2008 economic recession. It can be argued that fiscal activism is now politically feasible. Some commentators however, are still pessimistic about the effectiveness of fiscal policy in stimulating economic growth. They argue that fiscal stimuli tend to be ill-timed, poorly targeted and often of the wrong size. Hasset (2009:79), nonetheless, reassures that because of lessons learnt from past experiences many countries, following the 2008 recession, proposed properly designed and very high stimulus packages, never witnessed before, in order to jumpstart their ailing economies. In the US, for instance, Hasset (2009:77) points out that President Barrack Obama signed into law a stimulus package amounting to US$787 billion. Once again, there is a shift in policy preference, and the global economy has predominantly found itself again in the era of Keynesian fiscal economics.

1.2 RESEARCH QUESTION AND HYPOTHESES

Attainment of economic growth and stabilising it is at the centre of South Africa's and many other countries' macroeconomic agenda. For South Africa, economic growth plays a crucial role as a way to create the much needed growth in employment levels, which in turn contributes to the long-run growth prospects of the economy. Ultimately, the benefits of stable growth have the ability to contribute to the reduction of poverty and inequality, and the improvement of the living standards of people.

Stable economic growth, however, from time to time, is threated by economic events such as recessions, which often tend to strip it of its benefits. The most recent recession happened in the year 2008, and Steytler & Powel (2010:4) report that it led to South Africa's overall GDP for 2009 drop by 1.8 percent, with about one million jobs lost.

One of the economic measures often employed to smoothen economic growth, particularly during times of recessions is referred to as a fiscal deficit, a strategy that is at the centre of Keynesian demand-side economics. A fiscal deficit is a situation that describes the surplus of expenditure over

revenue (Dalyop 2010:161). Keynesians advocate for the use of this strategy, particularly during depressions and recessions, when the economy suffers from insufficiency of active demand. A fiscal deficit, according to the Keynesians, would increase demand for productive output, resulting in the reduction of the unemployment rate (Dalyop 2010:154). In other words, a fiscal deficit can move the economy out of a recession, thereby triggering economic growth.

This paper reports on the findings of a study on the economic stimulative effect of fiscal deficits in South Africa from 1991 to 2012. This can also be interpreted as finding out whether or not fiscal deficits are effective in stimulating the South African economy out of a recession. We do this by analysing the impulse response functions and the forecast error variance decomposition generated from a Structural Vector Auto-Regression (SVAR) model, which is discussed in more detail in chapter 3.

Our research question is as follows: What is the impact of fiscal deficits on South Africa's economy and what factors can be expected to explain it? We identify factors that are important in influencing the response of economic growth to changes in fiscal deficits and further explain the mechanisms through which they do so.

The null-hypothesis (H_0) we test states that: Fiscal deficits lead to a positive effect on economic growth. The alternative hypothesis (H_1), states that fiscal deficits have an effect on economic growth which is equal to or less than zero.

This study, as we discuss in chapter 2, is not the first to investigate the economic effect of fiscal deficits, even in the case of South Africa. Different results are found by different studies depending on factors, such as, the time horizon considered, the country studied, the economic characteristic of the economy being studied, among others. It is the aim of this study to contribute to the fiscal policy discourse by assessing the economic effect of fiscal deficits in South Africa, while taking account of other factors that are most important in influencing this relationship. Our results in chapter 4 show that fiscal deficits have a zero impact on economic growth. Because of that, we reject the null hypothesis which states that fiscal deficits have a positive impact on economic growth. Conversely, we do not reject the alternative hypothesis which states that the effect of fiscal deficits on economic growth is equal to or less than zero. Based on this finding, our conclusion is that fiscal deficits are not effective in stimulating economic growth in South Africa**.**

1.3 PURPOSE OF THE STUDY

The study is undertaken in order to analyse the response of economic growth to changes in fiscal deficits for the South African economy in the period 1991 to 2012. This analysis helps us to understand how GDP increases or decreases as a result of a fiscal stimulus, as well as how GDP can decline or rise as a result of contractionary fiscal policy. The logic of the effectiveness of fiscal deficits applies to any of the components of GDP, that is, consumption, investment and net exports in response to fiscal policy instruments (Gaber, 2010:6). Put differently, a fiscal shock, such as a change in government spending or a change in taxation, can be examined to assess how it impacts GDP variables, for example, imports, private consumption and private investment. We use impulse response functions and the forecast error variance decomposition, generated through a five endogenous variable SVAR model to derive conclusions about the effectiveness of fiscal deficits on South Africa's economy.

1.4 SIGNIFICANCE OF THE STUDY

Generally, most economists hold the view that situations do arise when monetary policy may not be useful in addressing economic problems. This often is the case during recessions, as interest rates tend to be trapped in the lower limit bound and cannot be used for economic stimulation purposes (Hasset & Hubbard, 2002: 1298). The alternative option is often the use of fiscal policy, which can be in the form of discretionary policy or the use of automatic stabilisers.

Discretionary fiscal policy, according to Dolls, Fuest & Peichl (2012:2) implies the deliberate actions by government through changes in government spending and/or taxes with the objective of stabilising economic cycles or reducing unemployment. The economic stimulative effect of this fiscal policy approach is what this paper investigates. On the other hand, automatic stabilisers can also be used as a fiscal policy strategy to achieve the objective of smoothening economic cycles. These however, do not involve explicit government intervention. By definition, automatic stabilisers, according to the European Central Bank (2002:33), refer to the reaction of the government budget to economic fluctuations in the absence of any government action". Automatic stabilisers are applied in the South African economy, albeit, to a minor degree (Swanepoel & Schoeman, 2003:817).

This study makes a contribution to the fiscal policy literature. As Fatas & Mihov (2009a:57) observe, the effect of fiscal policy on the economy is less studied compared to monetary policy. Perotti (2002:5) supports this observation, adding that the absences of high frequency data over sufficiently

long time periods as well as the presence of varied opinions about fiscal policy among economists contribute to the low number of studies on this subject. This study also adds to the few studies on fiscal policy in developing countries, and in particular South Africa. Most of the fiscal policy studies available are, according to Perotti (2002:7) and De Castro & Garrote (2012:9), based on the U.S. economy, even though an increasing number of them are also evident in the European Union.

Moreover, this study helps to ascertain the effectiveness of fiscal deficits in stimulating economic growth in South Africa, against the backdrop of the country's suggestion to employ a numeric target fiscal rule proposed in the 2011 Budget Review (Budget Review, 2011). It is worth noting that a fiscal rule implies that discretionary fiscal policy is ineffective in stimulating demand and that only automatic stabilisers should be relied upon to smooth out business cycles. The results from this study, hopefully, will contribute to the debate whether to abandon discretionary fiscal policy and pursue a fiscal rule or continue with it.

1.5 STRUCTURE OF THE PAPER

The paper has five chapters, with the introduction as chapter one. In chapter 2, we review theoretical and empirical literature about fiscal deficits. Next, in chapter 3, we discuss the methodology employed to ascertain the impact of fiscal deficits on economic growth. The discussion revolves around our usage of the SVAR model, whose first application to the study of fiscal policy is credited to Blanchard and Perotti (2002). Chapter 4 estimates and analyses the results generated from the SVAR model. Finally, chapter 5 provides a conclusion.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

There is more agreement among academicians and policy makers on how central banks can use monetary policy to respond to business cycles than is the case when it comes to the use of fiscal policy (Fatas & Mihov, 2009a:58). The impact of fiscal deficits on the economy is a subject that is highly contested in economics. On the one hand, there are those who argue that fiscal deficits have a positive impact on economic growth. To them, fiscal deficits are effective in stimulating economic growth. On the other hand, there are those who argue that the effect of fiscal deficits on the economy is often zero or negative. They are of the view that fiscal deficits are not effective in stimulating economic growth.

This chapter reviews the extensive debate around the issue of differing views on the effectiveness of fiscal deficits. It is organised as follows: A theoretical framework that gives perspectives of the new Keynesians, neoclassical and the Ricardian-equivalence theorists on fiscal deficits is given in section 2.2. A theoretical debate about the effectiveness of fiscal deficits in stimulating economic growth, mainly focusing on the new Keynesians and neoclassical economists, then follows in section 2.3. Included in this section is a theoretical debate of how the control variables in our model may influence the effectiveness of fiscal deficits on economic growth. Section 2.4 attempts to put to rest the theoretically contrasting views by discussing the empirical evidence on the economic effect of fiscal deficits. Because this paper uses a developing country as a case study, section 2.5 attempts to give empirical evidence of the economic effect of fiscal deficits in developing countries. The conclusion of the chapter is then drawn in section 2.6.

2.2 THEORETICAL FRAMEWORK

There are various theories for the analysis of the effect of fiscal deficits on the economy. Basically, each theory leads to unique conclusions about how fiscal deficits affect economic growth. This section focuses on three contentious ones, the new Keynesian, neoclassical and the Ricardian-equivalence approaches.

2.2.1 Keynesianism

The well-known book, *The General Theory of Employment, Interest and Money*, written by John Maynard Keynes, later Lord Keynes, in (1936) was the first to offer a theoretical framework for fiscal policy. This theory, also known as Keynesianism, emerged amidst a drastic rise in global unemployment levels, caused by the Great Depression of 1929. The unemployment rate at the time was above 20% and the output gap widened in economies around Europe and the U.S (Barro, 1997:5). When the economies were in this state, Keynes declared that governments should increase spending and cut taxes to boost their economies. Most fundamentally, Keynes saw GDP as being determined in the short-run by aggregate demand. Recession or depression was due to demand falling short of the existing productive capacity of the economy, and the remedy was to stimulate demand.

At this time, this was considered unorthodox since the prevailing view was that a market economy would recover on its own, automatically, without government action. Keynes, in contrast, argued that an economy could languish indefinitely with high unemployment, despite the presence of abundant productive capacity in the economy, if aggregate demand is inadequate. The Keynesian perspective is that when aggregate demand is insufficient, firms perform poorly and their profits decline through-out the economy. Declining profits induce firms to cut back production and to lay off workers. Rising unemployment and declining profits further depress demand, resulting in an endless cycle of absent aggregate demand (Fazzari, Ferri & Greenberg, 1998:527). Keynes further contended that monetary policy is powerless to boost the economy out of a depression because it depends on reducing interest rates, and in a depression interest rates are already close to zero, what is also referred to as the liquidity trap (Hasset & Hubbard, 2002:1298).

The way out of such an economic problem, according to Keynes, is to run a fiscal deficit. By increasing government spending, Keynesians argue that it would not only boost demand directly but would also set off a chain reaction of increased demand from workers and suppliers whose incomes had been increased by the government's expenditure (Saleh, 2003:6). Similarly, according to Saleh (2003:6), Keynesians believe that a tax cut would put more disposable income in the pockets of consumers, and that too would boost demand.

The basic Keynesian macroeconomic model reveals interesting economic results that can emerge from the application of the above strategies (fiscal deficits). One of the key results of this model is that changes in government spending or taxation are multiplied in their effect on the economy. Through the increase in government spending and reduction in taxes, national income initially will increase by the actual value of the deficit, and then generate second round effects through the Keynesian multiplier.

The idea of the Keynesian multiplier is that, an increase in government expenditure by R1 directly increases income by R1, then the multiplier effect results in national income increasing by more than R1. In other words, the increase in the fiscal deficit need not be an amount equivalent to the prevailing output gap, but rather, should be an amount which, through a secondary multiplier effect, is just enough to close the output gap. It also follows that the stimulation of national income and consumption which occurs should entail that investment also increases – 'investment accelerator' as some call it (Gaber, 2010:5). Eventually, the fiscal deficit boosts capacity utilisation and smoothens out the business cycle.

Keynesianism is premised on certain assumptions. They include, firstly, a possibility of excess production capacity and unemployed labour and, secondly, a significant proportion of the population is liquidity constrained (Dwivedi, 2010:362), (Grabowski & Shields 2000:2) and (Saleh, 2003:3). The first assumption suggests that there is capacity underutilisation and hence, a negative output gap[3] in the economy. The second assumption implies that individuals are thought to increase, immediately and significantly, their demand in response to a temporary reduction in taxes or increase in government spending.

When the economy is in a situation as assumed above, it is clearly operating below potential. For Keynesians, this is the situation that warrants the use of fiscal deficits in order to smooth out economic growth (Fatas & Mihov, 2009a:60).

2.2.2 Neoclassical theory

From the point of view of neoclassical theory, fiscal deficits mainly have a negative effect on economic growth. The seminal work by Diamond (1965), cited by Bernheim (1989:57), was the first case to put a neoclassical argument against budget deficits. Its conclusion was that fiscal deficits

[3] A negative output gap implies that the difference between potential (efficient) output and actual output is negative.

raise interest rates which in turn crowd-out private capital accumulation. Many other scholars have supported this neoclassical argument. These include Auerbach & Kotlikoff (1987) and Taylor (2009), among others.

The neoclassical argument represents the crowding-out effect that is postulated by the standard IS-LM analysis. This analysis contends that the expansion in output arising from a fiscal deficit will raise money demand. If the supply of money is fixed, interest rates will increase, and private investment (capital accumulation) will fall. In turn, this reduces output and tends to offset the Keynesian multiplier effect.

As with Keynesian theory, neoclassical theory is also guided by certain assumptions. It assumes that consumers are farsighted, rational, and can access perfect capital markets. With these assumptions, consumers are unlikely to increase their consumption as a result of increased government spending or reduction in taxes. For this reason, deficits cannot stimulate economic activity. Bernheim (1989:59) argues that by acknowledging these assumptions fiscal deficits display inimical effects on interest rates, private investment and consumption.

The remedy to smoothening out business cycles, according to neoclassical theory lies in allowing the invisible hand of the market to work freely, as opposed to allowing government intervention through fiscal deficits. Taylor (2009:550) and Bernheim (1989:57) point out that self-adjustment in prices and wages will enable the economy to restore optimal equilibrium. The theory argues that in the event that the economy deviates from equilibrium and creates a negative output gap, wages in the economy would quickly be forced to fall, thereby reducing the cost of production for suppliers. The reduction in the cost of production would lead to increased output, which would then close the output gap, without the involvement of government.

2.2.3 Ricardian-equivalence theory

The Ricardian-equivalence theory posits that regardless of how it is financed, a fiscal deficit would have no impact on private consumption or income (Dalyop 2010:162). In other words, a fiscal deficit does not spur consumption growth, and thus, does not have an expansionary effect on output. This is because when a deficit is implemented, individuals increase their current savings in expectation of increased tax burdens in the future (Corden, 1991:7). The conclusion of the Ricardian-equivalence is that a fiscal deficit will not generate a positive effect on economic growth.

This school of thought is only applicable under extreme assumptions. The assumptions include the following:

1) The government budget constraint is internalised by consumers who are indifferent to the sources of government finance;
2) Capital markets are perfect, that is, the interest rate for borrowers and lenders should be the same;
3) There are no distortions in taxes.

Basically, under this theory, it is believed that there are generational inter-linkages bound by generosity, so much so that the current generation is concerned about the plight and welfare of future generations (Bernheim, 1989:56). On account of having unrealistic assumptions, many economists dismiss the Ricardian-equivalence approach. See Buiter (2010), Blinder (2004), Arestis & Sawyer (2003) and Hemming, Kell & Mahfouz (2002). For instance, in an empirical study, Blinder (2004:21) finds that consumption strongly responds to current cash income compared to future tax changes. He argues that this revelation invalidates the Ricardian-equivalence argument that consumers are not liquidity constrained (Blinder, 2004:21). Because many economists dismiss this theory, we focus mainly on the theoretical debates between the new Keynesian and the neoclassical theorists.

2.3 RELATED THEORETICAL DEBATES

2.3.1 Ideological arguments of fiscal deficits

It is perhaps essential to start the debate about fiscal deficits between Keynesians and neoclassical economists by indicating that this debate is closely aligned with ideological arguments around the role of the state in the economy (Fatas & Mihov, 2009a:59). John Maynard Keynes made a key contribution in this regard by arguing that leaving an economy to run itself can cause it to collapse and remain in a lethargic state. It is for this reason that Keynesians contend that the neoclassical suggestion that the economy should correct itself through wage and price adjustments is unlikely to work, but rather that government's help is needed. Fatas & Mihov (2009a:60) argue that Keynesians claim that wages and prices tend to be sticky when they should be falling, and, if the economy is left to correct itself after collapsing, it would be a recipe for prolonging and deepening the downfall.

Neoclassical economists, on the other hand, insist that state intervention results in the misallocation of resources in the economy and always fails. State intervention presupposes that government

policy makers are knowledgeable about how to run the economy. This assumption is based on shaky grounds because government may undertake actions so that they can be seen by electorates to be working and satisfying vested interest groups in the process. Fatas & Mihov (2009a:59) mention that state intervention is criticised on the basis that, often, expenditure programmes are crafted to satisfy narrow political priorities, rather than broader macroeconomic needs. Because of that, they suggest that the economy is better off correcting itself.

By extension, neoclassical economists criticise fiscal deficits with the argument that they expand public programmes such that they stress tax payers and limit the free operation of the market (Fatas & Mihov, 2009a:60). They further argue that fiscal deficits, which are financed through domestic debt, only entail a transfer of resources from the private to the public sector. According to them, none of this is desirable, since, it is the private sector that can create more jobs and promote economic growth (Dalyop, 2010:162). The notion that the free market system moves faster and better than the rigid hand of government is crucial in the neoclassical line of thinking.

Those opposed to the neoclassical economics standpoint argue that increased stimulus packages are necessary to restore a balanced form of capitalism by increasing public expenditure, and investing in areas important for economic growth and social welfare (Kuttner, 2009:1).

2.3.2 The crowding-out argument

It was highlighted in section 2.2 that Keynesians propagate the notion that fiscal deficits translate into growth of national income with a positive multiplier effect. The merit of this multiplier effect is that it helps to re-establish output to its full potential. However, criticism against this claim has been crafted by neoclassical economists. They contend that the Keynesian claim ignores the secondary effects of fiscal policy. When government undertakes a fiscal deficit, its source of finance is the credit market, through borrowing. If the money supply is fixed, borrowing by government reduces funds (savings) available in the financial markets and that may raise interest rates. Interest rates that are high may lead to crowding-out of private investment and consumer spending (Arestis & Sawyer, 2003:9). Thus, the efficacy of a fiscal deficit in stimulating growth is offset to a certain extent by the effect of crowding-out.

The above argument clearly raises the important issue of the interplay between fiscal and monetary policies. It would obviously be wrong to analyse the effects of fiscal policy on the economy in isolation from the interrelationship it has with monetary policy. Davig & Leeper (2011:212) point out that most researchers find that “separating monetary and fiscal policies overlooks policy interactions that are important for determining equilibrium”. (See also Ilzetzki, Mendoza & Vegh, 2010:3). We

acknowledge this caution and have included the short-term real interest rate variable in the model to analyse how monetary policy interacts with fiscal policy.

The inclusion of this variable helps us to achieve the following objectives: firstly, study the crowding-out effect argument propagated by the neoclassical economists. Secondly, find out the influence of the real short-term interest rate on the effectiveness of fiscal stimuli in South Africa considering that the South African Reserve Bank (SARB) follows an inflation-targeting[4] monetary policy framework through a Taylor-type interest rate rule. This means that the SARB adjusts the short-term interest rate in response to deviations of GDP and inflation from their steady-state levels (Jooste, Liu Naraidoo, 2012:7). In this case, the active role of monetary policy to maintain a certain desired level of inflation or output through changes in the interest rate might offset the stimulative effect of fiscal policy (Perotti, 2002:5). For this reason, Spilimbergo et al (2009:3) and Christiano, Eichenbaum & Rebelo (2009:79) have concluded that fiscal policy is a failure under inflation-targeting monetary policy. We are interested in ascertaining the extent to which this conclusion is correct in the South African context.

It is necessary to caution however, that Keynesians do not dispel the possibility that fiscal deficits may lead to a rise in interest rates and thus, crowding out private investment. They argue that the interest rates may rise when the economy is operating above potential output because in that state monetary authorities would want to prevent the over-heating of the economy (Fatas & Mihov 2009a: 59). Fiscal policy is effective during recessions (when output is below potential) which coincide with the time when interest rates are trapped in the lower limit bound and are likely to be unresponsive to the pressure imposed by increased fiscal deficits. During this time, the dampening effect of increasing interest rates on private spending is minimised. Christiano et al (2009:79) argue that for this reason, Keynesians recommend the implementation of fiscal deficits during times of recessions.

2.3.3 Fiscal deficits and exchange rate regimes

The discussion on the interaction of monetary policy and fiscal policy also spills over to the type of exchange rate regime pursued by the monetary authorities. A number of scholars have argued that the effectiveness of fiscal policy in stimulating economic growth depends on the exchange rate regime employed and the mobility of capital in the economy. See among others, Spilimbergo et al (2009:3) and Ilzetzki et al (2010:7). Most of these scholars argue for the potency of fiscal policy in fixed exchange rate regimes, as capital mobility increases. According to Boussard, De Castro & Salto

[4] South Africa has been following inflation-targeting since February 2000 (Van der Merwe, 2004:1).

(2012:4), “fixed exchange rate regimes magnify the fiscal multiplier in the presence of capital mobility because of the monetary accommodation necessary to keep the exchange rate at parity”. See also Jooste et al (2012:15).

South Africa has passed through a number of exchange rate regimes. Table 2.1 below shows the types of exchange rate regimes that South Africa has been through since 1985. It shows that different exchange rate regimes have been used since then. Although they come in different mixes, Van der Merwe (2004:2) argues that exchange rate regimes usually fall within the two extreme regimes, namely fixed and floating exchange rates. From Table 2.1, we follow Ilzetzki et al (2010:11) by classifying periods of dual exchange rate regime (Managed float commercial Rand and free float financial Rand) under fixed exchange rate regime. Everything else is then considered to fall under flexible exchange rate regime. From table 2.1, the only period considered to have had a flexible exchange rate regime is from the first quarter of 1995 onwards. Gupta (2012:2) states that South Africa changed to a flexible exchange rate regime in 1995. We are interested in assessing how this variable influences the potency of fiscal policy in South Africa by entering it as a dummy variable in our SVAR model.

Table 2.1 Episodes of exchange rate regimes in South Africa

Episode	**Date**	**Exchange rate regime**
I	1985Q3-1995Q1	*Dual exchange rate regime: Managed float commercial and free float financial rand*
Ii	1995Q1-2000Q1	*Unitary exchange rate: Managed float rand*
Iii	2000Q1-Present	*Unitary exchange rate: Free floating rand with inflation-targeting monetary policy framework.*

Source: De kock Commission (1985)

2.3.4 Fiscal deficits and the real exchange rate

The real exchange rate is another important monetary policy variable which cannot be overlooked when investigating the impact of fiscal policy on the economy. This is because this variable helps us

to examine the country's external competitive position after a fiscal shock has occurred. Theoretically, according to De Castro & Garrote (2012:9), fiscal deficits lead to the real appreciation of the exchange rate. Studies by Froot & Rogoff (1991:280) and De Gregorio, Giovannini, & Wolf (1994:1230), in line with theoretical predictions, find that increased government consumption leads to the long-run appreciation of the real effective exchange rate. Beetsma, Giuliodori & Klaassen (2008:415), recognise that government spending shocks do not only lead to the real appreciation of the exchange rate but also heighten the budget deficits and lead to negative trade balances. Saleh (2003:1) adds to this argument by highlighting the Mundell-Fleming framework, which posits that an increase in the budget deficit would induce upward pressure on interest rates, causing capital inflows and an appreciation of the exchange rate, thereby leading to an increase in the current account deficit. This culminates in the "twin-deficits hypothesis" where fiscal shocks lead to increased fiscal deficits, as well as a trade deficit. See De Castro & Garrote (2012:9) and Saleh (2003:1).

2.3.5 Fiscal deficits and economic openness

The other contentious debate around the effectiveness of fiscal deficits is on how it is influenced by the degree of economic openness to trade. Leeper, Traum & Walker (2011:15) point out that "in open economies, increases in government spending result in a substitution away from domestically produced products towards imported products." See also Boussard, et al (2012:4) and Spilimbergo et al (2009:3). Dalyop (2010:161) points out that, in open economies, increased government expenditure does not only lead to increased demand for foreign goods, but foreign assets, as well. This arises because of the excess money supply that results from the debt instruments drawn on the central bank (Dalyop, 2010:161). It also leads to domestic absorption[5] and thus, import expansion resulting in a current account deficit (Corsetti & Mueller, 2012:61). For this reason, Spilimbergo et al (2009:3) argue that more open economies have a higher propensity for imports and in such economies fiscal deficits are less effective compared to closed or partially open economies. In chapter 4, we investigate the impact of South Africa's degree of openness to trade on the effectiveness of fiscal deficits.

Keynesians are, however, aware of the negative impact that fiscal deficits could have on the external sector, and thus, on economic growth. In fact, the arguments presented above are according to Saleh (2003:13), in line with the conventional Keynesian economics view which contends that the effectiveness of fiscal deficits may be adversely affected the more open an economy is. They

[5] Government spending is usually biased towards domestic goods and services. This makes domestic products scarcer, thereby pushing up the relative price compared to imported products. As a result, a real appreciation of the domestic currency ensures leading the economy into a trade deficit (Frenkel & Razin, 1996:130).

contend that the above arguments are possible if the additional liquidity largely leads to an increase in the level of imports compared to domestic output (Dalyop, 2010:161). For this reason, they suggest that the domestic economy should be able to absorb the additional liquidity through the expansion of output, as this would make fiscal deficits more stimulative (Dalyop, 2010:161).

2.3.6 Fiscal deficits and savings

Another concern that neoclassical economists have with fiscal deficits is that they reduce savings in the economy. They contend that this reduction could have long-term economic repercussions. Their contention is that total savings in a country comprise individual, corporation and government savings. With low savings, as a result of fiscal deficits, a country will either reduce its investment in new plant and equipment or increase borrowing from abroad. Both measures lead to unpleasant consequences in the long-run. Lower levels of investment will result in lower capital stock and a reduction in a country's ability to produce output in the future. Increased foreign debt entails that the domestic economy is obliged to transfer a large portion of its economic gains to foreign economies at the expense of the domestic economy (Chowdhury, 2004:488).

Keynesians, on the other hand, shield themselves from the above criticism by arguing that fiscal deficits would not necessarily lead to the draining of savings from the economy. Eisner (1989:89) argues that the rise in aggregate demand that comes with fiscal deficits would improve profits on private investments, thus, leading to increased investment levels, given any rate of interest. Therefore, fiscal deficits may actually increase savings and investment, in spite of the fact that they may increase interest rates.

2.3.7 Supply-side vs. Demand-side economic measures

Anti-Keynesians have also criticised fiscal deficits on the basis that they go against the principle of supply-side economics. This view is supported by Brunner (1982:844-845) who asserts that the key factor in driving economic growth is not consumer spending but production. To the supply-side economists, it is backward to focus on consumer spending because consumption is an offshoot of production. They argue that pursuing prosperity through consumer spending might bring an appearance of prosperity, when in actual fact the opposite is the case. Ultimately, economic growth is a function of the supply of factors of production[6] and not demand. To Bernheim (1989:71), focusing on raising aggregate demand using deficits only fuels inflation and not growth.

[6] This refers to factors of production such as labour, capital and technology.

Keynesians defend themselves against the above criticism by arguing that a recession is a consequence of inadequate aggregate demand, as pointed out in section 2.2.1. In order to counter this situation, aggregate demand must be stimulated through the increase in spending and cutting down of tax, which essentially entails applying a fiscal deficit. This boosts consumer spending, business investment and output (Fatas & Mihov 2009a:67). Feldstein (2009:557) also points out that the lifting power of government spending is required to stimulate consumer demand and business spending. In the absence of such a measure, Keynesians believe an economic recession would be longer and more severe.

2.3.8 Fiscal deficits on consumer and business confidence

The other contested issue between the two schools of thought is the extent to which deficits can boost consumer confidence. Keynesians argue that stimulus spending boosts consumer confidence by showing, at least, a notion that the economy will run normally. Dalyop (2010:162) points out that a fiscal deficit stimulates the economy in the short-run by making households feel wealthier, resulting in increased private and public consumption spending. Aggregate demand increases lead to improved economic activity. This leads to the stimulation of savings and capital formation. Consequently, consumers and businesses are motivated to increase their purchases more than they otherwise would. This, as a result, has a positive impact on the economy.

The above argument is refuted by neoclassical economists. Balcerowicz & Rzonca (2008:1) argue that proposed stimulus bills prompt consumers and businesses to hold negative views about the economy, which might undermine their confidence. As a result, consumers choose to save the money spent by government, instead of spending it. This results in economic aggregate demand, capital formation and economic activity not increasing, as suggested by the Keynesians.

2.3.9 Fiscal deficits and public debt

Finally, the disagreement between these two schools of thought revolves around the topic of debt. Neoclassical economists argue that fiscal deficits damage the economy through increased future debt obligations (Seidman & Lewis, 2009:204). The commitment by government to service the debt in future puts a heavy tax weight on future tax payers.

However, Keynesians justify increasing debt during a recession on account that it will lead to boosting growth, thereby, generating an increase in revenue, which can be used to repay the acquired debt. Feldstein (2009:558) acknowledges that at the end of a recession, each economy's debt to GDP ratio rises. Following the increase in the debt to GDP ratio, Feldstein (2009:558) argues

that policies can be developed, such as gradually cutting down government expenditure so as to move to a fiscal surplus position and limit the debt burden.

2.4 RELATED LITERATURE ON EMPIRICAL EVIDENCE

Taking the theoretical debate presented above into consideration, the correct position about the effectiveness of fiscal deficits, however, can only be confirmed through empirical evidence. It is the objective of this section to discuss the empirical evidence pertaining to the effectiveness of fiscal deficits generated by different types of fiscal shocks. It focuses on the evidence for tax shocks, spending shocks, short-run and long-run effects of fiscal deficits, as well as evidence of the impact of fiscal deficits in developing countries, and South Africa in particular.

2.4.1 Tax shocks

To stimulate consumption and investment, and, hence, economic growth, government may implement tax rebates (tax cuts) as a fiscal measure. In practice, evidence about the effect of tax changes on economic growth (GDP) is mixed. We define the tax shock, according to Riera-Crichton, Vegh & Vuletin (2012:2) as the response of output to a change in taxes.

Following the 2001 economic recession, Johnson, Souleles & Parker (2006:1591) use survey data on consumer expenditure in the U.S to investigate the impact of tax rebates on consumer expenditure. They establish that tax rebates increase consumer spending on non-durable goods. Agarwal, Liu & Souleles (2007:3) investigate tax cuts in the U.S, following the 2001 recession, and discover that individuals, first, channel the money brought by the tax cut towards reducing the debt on their credit card, after which, they increase their purchase of goods. This counters the proposition of the Ricardian-equivalence theorists, discussed in section 2.2.3, who argue that individuals do not respond to tax cuts by increasing their current purchases. Romer & Romer (2007:20) find that a 1 per cent tax cut results in about 3 per cent increase in GDP, in a time frame of about two years. The above findings indicate that, to a large degree, tax cuts have a positive effect on GDP.

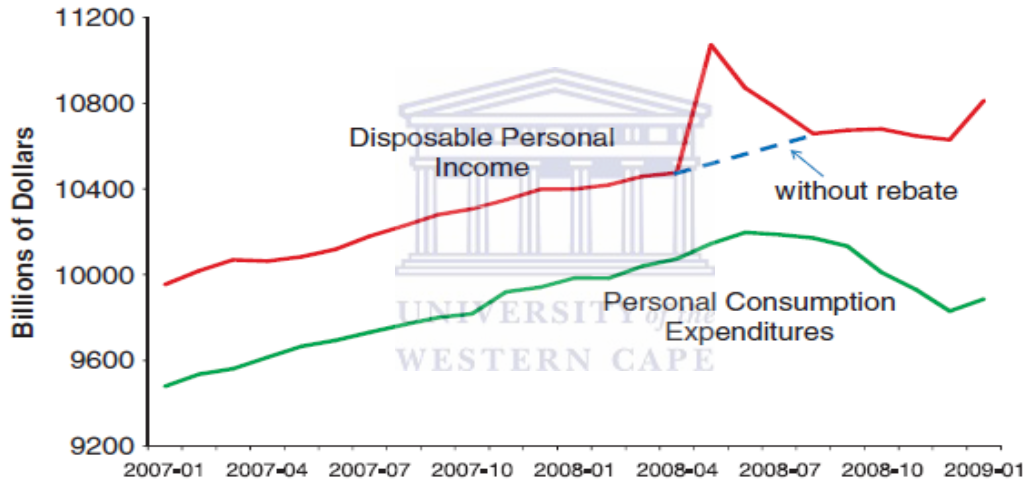
From the point of view of business investment, some of the empirical evidence suggests that tax cuts produce significant positive economic effects. Using the Standard Hall-Jergenson User Cost Model[7], Hasset & Hubbard (2002:1330) find empirical evidence that tax rebates in U.S. significantly impact positively on investment. House & Shapiro (2008:744) investigate the response of business

[7]This model measures changes in the incentive to invest as a result of various forms of investment tax credits.

investment to tax provisions in U.S. and find that investment increases mostly in equipment with long time duration.

Not everyone agrees that tax cuts are effective in stimulating consumption and business spending, however. Shapiro & Slemrod (2009:377), following the recent 2008 recession, undertook a survey which reveals that only 20% of respondents in U.S planned to increase their consumption spending as a result of stimulus tax rebates. Taylor (2009:551) presents data showing that tax rebates announced for the U.S economy in 2008 increase the disposable personal income but have a negative impact on personal consumption expenditure. This finding is presented in Figure 2.1, shown below.

Figure 2.1 Response of Consumption to the 2008 stimulus



Source: *Taylor (2009).*

This finding is in line with the permanent income theory in which consumers respond marginally to temporary income increases. In other words, the evidence produced here shows that tax-cuts have a negative effect on personal consumption expenditure and thus, cannot stimulate economic growth.

On the question of business investment, Auerbach & Kotlikoff (1987:49) conduct policy simulations based on the impact of temporary reductions in income tax on private capital accumulation. Their conclusion is that these tax cuts have little or perverse short-run effects on private investment. For instance, they find that temporary reduction in income tax rates for a period of five years would increase savings by roughly 20 per cent in the first year. However, in the new steady state, per capita capital would fall by 7.5 per cent (Auerbach & Kotlikoff, 1987:52-53). This suggests that tax-cuts have little positive impact on business investment.

2.4.2 Government spending shocks

The government spending shock, according to Spilimbergo et al (2009:3) measures the change in output resulting from a change in government spending. Keynesian textbooks predict a positive effect on economic output arising from government expenditure. Findings from simulations run by the Organisation for Economic Co-operation and Development (OECD) on three economies[8] find the economic effect, arising from government spending, which is significantly positive (Fatas & Mihov, 2009a:66). Barrell, Becker, Byrne, Gottshalk, Hurst & Welsum (2004:899) find a strong positive impact of government spending in the German economy. Benazic (2006:883) finds that increasing government expenditure in Croatia leads to an increase in GDP.

Anti-Keynesians reject the above claims. Barro (1981:1109) differentiates the impact of increases in military and non-military government expenditure on aggregate output in the U.S. He establishes that increasing military spending leads to a small positive change in economic growth. On the question of non-military spending by government, he finds that it has a negative impact on output. Barro (1981:1109) argues that when government expenditure is too high, it crowds-out investment and negatively affects exports.

In direct response to the above critic, Fatas & Mihov (2009a:63) argue that Barro's (1981:1109) findings are based on military spending shocks in the aftermath of the Great Depression (1943-44), the period in which output was already above potential, that is, unemployment rate was very low. In this case, government spending is likely to generate a close to zero effect on economic growth. When Fatas & Mihov (2009a:63) use Barro's (1981:1109) neoclassical methodology to estimate the effect of spending for the year 1941, when output was below potential, they find a positive effect, and when they try it for the year 1940, the positive effect is even larger. This to them is confirmation that fiscal policy is effective in stimulating economic growth.

Furthermore, Ramey & Shapiro (1999:176) dispel the Keynesian view in their investigation of fiscal deficits in the U.S. arising from an increase in government spending during wars. Their finding is in line with the neoclassical prediction that defence spending shocks have no positive effect on wages and consumption. However, their finding can be questioned on the basis that it does not mention what the impact would be on economic growth due to government spending in time of peace.

[8] An interlink model was used which coordinated three economies- U.S., the Euro area and Japan - to determine the multiplier effects.

2.4.3 Short-term and long-run effects of fiscal deficits

Many studies have explored the short-run and/or the long-run effects of expansionary fiscal policy. The findings differ. Blanchard & Perotti (2002), Mountford & Uhlig (2002) and Perotti (2005) find that short-run shocks to government expenditure in the U.S. lift consumption, real wage and GDP, in line with Keynesianism. On the other hand, Hemming, Kell & Mahfouz (2002:23) find that the short-run effect of government expenditure on output is quite close to zero.

In terms of the long-run impact of fiscal deficits on economic growth, most of the literature finds a negative result. See Grier & Tullock (1989); Alesina, Ardagna, Perotti & Schiantarelli (1999), Grossman (1990) and Fatas & Mihov (2001b). The only study we were able to come across with a positive long-run fiscal policy effect is by Li (2010:20) on the Chinese economy.

Other studies give mixed findings regarding the short-run and long-run effects of fiscal deficits. Edelberg, Eichenbaum & Fisher (1999:176) establish that in the short-run, government expenditure has a positive impact. However, beyond a year, this impact continuously falls. Barro & Redlick (2009:43), using a neoclassical model, argue that the short-run effect of higher government expenditure can be positive, but the long-run impact is likely to be very close to zero. Ilzetzki et al (2010:15) study government consumption spending and find a negative impact in the short term, while for the medium and long-run, they differ considerably depending on the economic characteristics[9].

2.4.4 Effectiveness of deficit induced fiscal policies in Developed Countries

As stated in section 1.4, studies on the effectiveness of fiscal deficits in developed countries have been more extensive, as compared to developing economies. Just as in the other cases we discussed above, the economic impact of fiscal deficits in developed countries is varied. Johnson et al (2006:1591), Agarwal et al (2007:3) and Romer & Romer (2007:20) find a positive response of consumption spending arising from tax cut shocks in U.S. Furthermore, Hasset & Hubbard (2002:1330) and House & Shapiro (2008:744) find that tax cuts have a positive effect on U.S. investment.

On the contrary, Shapiro & Slemrod (2009:377) and Taylor (2009:551) establish that tax cuts have a negative effect on consumption spending, while Aurbach & Kotlikoff (1987:49) conclude that tax cuts have a negative impact on private investment.

[9] Spilimbergo et al (2009:3), Fatas & Mihov (2009a:63) argue that different economic characteristics such as whether a country is pursuing inflation targeting monetary policy, is in the expansionary phase, is closed to foreign trade, and so forth, will have an effect on the potency of fiscal deficits.

From the point of view of government spending shocks, a study done on the U.S., the Euro area and Japan, reports positive effects of spending on GDP. Barrel et al (2004:899) find a positive response of GDP to government spending in German. On the other hand, Barro (1981:1109) and Ramey & Shapiro (1999:176) conclude that government spending has a negative effect on GDP.

The above analysis establishes a view that fiscal policy may be effective in stimulating economic growth in some cases and may prove impotent in others. Following the argument by Spilimbergo et al (2009:3), this is due to the fact that the effectiveness of fiscal deficits differs depending on various economic characteristics, which among some include, the monetary policy regime being pursued, degree of economic openness and the size of the fiscal deficit. This could explain why, in our analysis of developed countries, fiscal policy has both positive and negative economic effects. The same kind of reasoning, to some extent, applies to developing countries as we illustrate in the next section.

2.5 FISCAL POLICY IN DEVELOPING COUNTRIES

This section is included to highlight the point that economic policies affect countries of different economic strength differently. So often, when economic policies are suggested at a global level, it is assumed that their impact will be the same across all economies. This section takes note of the fact that there are differences in social, institutional and economic characteristics between developed and developing economies. With South Africa being a developing country, the conclusions made about fiscal policy in developed countries might not apply here. This section therefore, provides empirical evidence on the effectiveness of fiscal deficits in stimulating economic growth in developing countries.

2.4.5 2.5.1 Effectiveness of deficit induced fiscal policies in developing Countries

Generally, developing countries have been dependent on fiscal deficits to accelerate growth (Chowdhury, 2004:3). This is because most of them are incapable of mobilising enough resources to trigger growth. Additionally, developing countries face uncertainty with respect to foreign investment and capital flows (Chowdhury, 2004:3). Fiscal deficits, therefore, become an important economic strategy for engineering economic growth.

Empirical evidence about the effectiveness of fiscal deficits on developing economies is mixed. The study by Ilzetzki et al (2010) uses a Vector Auto Regression (VAR) model to compare the impact of fiscal deficits between twenty developed and twenty five developing/emerging nations. Their finding is that, in developing/emerging nations, the response of output to increases in government

consumption spending is smaller on impact and considerably less persistent than in high income countries (Ilzetzki et al. 2010:2). Dalyop (2010:168) concludes that fiscal deficits have an insignificant impact on the Nigerian economy.

Other studies strongly support the implementation of fiscal deficits in developing countries. Chowdhury (2004:4) studies the output impact of fiscal deficits on five developing countries from South Asia[10] and concludes that developing economies need more fiscal deficits than less, because deficits neither crowd-out investment nor have a perceptible impact on exchange-rates. Vera (2009:612) dismisses the simplistic conclusions of neoclassical economics which disregards the institutional differences between developed and developing economies, and shows evidence which supports the fact that deficits crowd-in public and private investment. Adam & Bevan (2006:53) find that for developing economies, which are not in their steady state, there is a range over which deficit financing may be growth-enhancing. Anh, Nhat & Thang (2010:770) study the fiscal stimulus exercised by the Vietnam government, amounting to 8.3% of GDP. They find that growth increases from 3.1% in the first quarter of 2009 to 7.7% in the fourth quarter of the same year, and from 4.4% in the second quarter of 2009 to 5.2% in the third quarter of the same year (Anh et al. 2010:770).

The foregoing findings provide great theoretical insight in terms of Keynesian modelling between developed and developing economies. Some of the features of orthodox Keynesian economics seem not to apply in the context of developing economies. As evidenced above, contrary to views of some ardent Keynesians like Eisner (1989:74) who admit that fiscal deficits do tend to crowd-out investment, to a large extent, the impact of fiscal deficits on investment and economic growth in developing countries is positive. Ilzetzki et al (2010:2) add to this argument, as they find that government investment spending has a positive and great fiscal effect in developing countries and an insignificant one in developed countries. This, thus, invites for a Keynesian theoretical framework which is centred on developing economies' institutional and economic characteristics, as opposed to the orthodox Keynesian framework. As shown above, such a framework enables us to establish that, in the presence of productive capacity, given structural deficiency in aggregate demand, a fiscal deficit can have positive effects, especially if it results in infrastructure spending or any other forms of investment spending. Following this, this study investigates the effectiveness of fiscal deficits in South Africa from a developing country Keynesian perspective.

[10] The countries are: Bangladesh, India, Pakistan, Nepal and Sri Lanka.

2.5.2 Fiscal Policy in South Africa

Post-apartheid South Africa is renowned for having experienced the most remarkable level of economic stability, recording the longest business cycle in the country's history (Du Plessis, Smit & Sturzenegger 2008:3). Aron & Muellbauer (2005:134-138) have pointed to the fact that this period was associated with lower and stable inflation, lower and stable real interest rates, steady GDP growth, and stable fiscal deficits and debt. Du Plessis et al (2008:3) allude to the fact that the remarkable economic improvements can also be attributed to the smooth political transition that took place after South Africa conducted its first democratic elections in 1994, which culminated in less uncertainty for investors.

This remarkable growth was, however, thwarted by the event of the 2008 recession which negatively affected economic growth around the globe. South Africa was not spared. According to Steytler & Powel (2010:4) South Africa experienced a 1.8 percent overall drop in GDP in 2009 due to this recession, with about one million people losing jobs. With monetary policy ineffective due to the liquidity trap, as discussed in section 2.2.1, Keynesian discretionary fiscal policy was one of the main options available to uplift the ailing economy. According to the United Nations Environment Programme (UNEP) (2009:8), South Africa released a stimulus package amounting to US$ 7.5 billion to be spent over the period 2009 to 2011, in response to the recession.

Prior to the discretionary policy exercised in 2008, Du Plessis et al (2008:7) point out that since 1996, the Minister of Finance, then Trevor Manuel, also made intentional announcements to implement discretionary fiscal policy in the years 1998, 2001 and 2007. However, before then, Calitz & Siebrits (2003:56) do mention that fiscal authorities in South Africa had not been keen on applying discretionary counter-cyclical fiscal policy since the late seventies. South Africa was not the only economy where discretionary fiscal policy was not popular after the 1970s. As mentioned in section 1.1, many economies abandoned discretionary fiscal policy in preference for the market approach due to the stagflation experiences of the 1970s (Blinder, 2001:107).

The empirical assessment of the performance of discretionary fiscal policy in South Africa is mixed. Ocran (2009:14) finds fiscal deficits to have an insignificant effect on economic growth, while government consumption and investment spending produce positive effects on output outcomes. Jooste et al (2012:1) find that increasing tax decreases GDP in the short- run, while the impact in the long-run is negligible. In terms of government spending in South Africa, Jooste et al (2012:1) find it to sometimes produce positive effects in the short-run, while the long-term impact is insignificant.

Our results in chapter 4 help us to make cross comparisons with the findings of Ocran (2009:14) and Jooste et al (2012:1).

2.6 CONCLUSION

The chapter has shown that there is neither a theoretical nor an empirical argument which is conclusive about the impact of fiscal deficits on economic growth, although, to a large degree, empirical evidence seems to suggest that fiscal deficits are effective in developing countries. This is because a range of factors such as assumptions used, the time horizon considered, and a country's economic policy characteristics, institutional and prevailing economic conditions have a great influence on the economic effect of fiscal deficits.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

Having reviewed the literature in the previous chapter, the current chapter offers a detailed discussion of the research methodology which is used to determine how effective fiscal deficits are in stimulating economic growth in South Africa. A research methodology is, according to Adams & Schvaneveldt (1991:16), "the application of scientific procedure towards acquiring answers to a wide variety of research questions. It provides tools for doing research as well as for obtaining useful information".

As mentioned earlier, the determination of the effect of fiscal deficits on economic growth requires the assessment of the impulse response functions and the forecast error variance decomposition. Doing so is the basis of the research design for this study. In the empirical analysis about the effect of fiscal deficits on economic growth, the paper uses standard macroeconomic time series data and a Structural Vector Auto Regression (SVAR) method. The application of this approach in fiscal policy was first done by Blanchard and Perotti (2002) in the U.S., and has in recent periods been the basis of many studies undertaken to investigate the economic impact of fiscal policy, as analysed in section 3.2 of this chapter.

The discussion of the research methodology is structured as follows: The literature on methodologies used to examine the economic effects of fiscal deficits is discussed in section 3.2, followed by section 3.3 which analyses the type and source of the time series data used in this study. Section 3.4 discusses the econometric techniques for the estimation of the economic effect of fiscal deficits. After that, section 3.5 concludes the chapter.

3.2 LITERATURE ON METHODOLOGIES

According to Boussard et al (2012:3), the technique used to study the effects of fiscal deficits on economic growth has a major influence on the effectiveness of fiscal deficits. Moreover, Kirchner (2011:4) argues that the effectiveness of fiscal deficits differs, even across studies that use similar techniques. This paper employs a VAR methodology, SVAR to be specific, to measure estimate the economic impact of fiscal deficits. The VAR has its origin in the works of Sims (1980) to avoid the

unpleasant identification restrictions of large-scale structural simultaneous econometric models. These models required one to make a priori distinctions between which variables are endogenous and which are exogenous (Kilian, 2011:1).

Sims (1980) believed that all variables should be treated the same, without any pre-existing assumptions about which variables are endogenous and exogenous. For this reason, he came up with the VARs, which assume that all variables within the model are endogenous. The VAR framework can accommodate any assumptions regarding endogeneity and causal effects. This, particularly, is useful for fiscal variables, since they often tend to be jointly determined thereby making it hard to assume a priori endogeinity and causality directions of the variables (Martin, 2010:4). However, if the need arises for the exogeneity of some variables, Luetkepohl (2011:2) argues that this may be imposed in VAR models based on statistical procedures. Dummies are an example of variables which may be imposed exogenously in statistical VAR models.

3.2.1 Types of VAR

VARs, according to Stock & Watson (2001:101) come in three forms. These are the reduced VAR, the recursive VAR and the structural VAR.

3.2.1.1 Reduced VAR

The reduced VAR expresses each variable as a linear function of its own past values, the past values of all other variables being considered, and a serially uncorrelated error term (Stock & Watson, 2001:102). The error terms become the shocks or innovations to the variables. It is referred to as reduced form because there are no contemporaneous variables that are included as explanatory variables on the right-hand side[11] of the equation. To estimate a reduced form VAR, no restrictions need to be imposed beforehand on the equation. In other words, the data is allowed to speak for itself. This, however, comes at a price because such a model is only good for forecasting and not for structural analysis and policy evaluation (Stock & Watson 2001: 106).

3.2.1.2 Recursive VAR

The recursive VAR, according to Stock & Watson (2001:103) expresses variables in terms of their lagged values, lagged values of other variables and contemporaneous values of regressors. A recursive VAR imposes restrictions so that the error term in each regression equation is not correlated with the error term in the past equation within the system (Kilian, 2011:3). The

[11] All the equations in the reduced form VAR have the same form since they share the same right-hand side variables.

restrictions in a recursive VAR may involve ordering variables in such a way that the most endogenous is ordered first, as Bjonness (2012:13) points out. The imposed restrictions on a recursive VAR is, however, criticised by Amarasekara (2008:6) who argues that these restrictions amount to impositions made, using arbitrary mechanical methods and not necessarily based on economic theory, as may be the case with a structural VAR.

3.2.1.3 Structural VARs

In structural VARs, according to Stock & Watson (2001:103), economic theory is used to derive causal relationships from contemporaneous correlations among the variables. Structural VARs are structural models which are drawn from the reduced form VAR of shocks to obtain an economic interpretative function of the impulse response (Ravnik & Zulic, 2011:30). Because they are drawn from the reduced form VAR, structural VAR models can forecast, undertake structural analysis and policy evaluation. Since this is the methodology we use, section 3.5 offers more discussion on how it is implemented in this study.

3.2.2 Advantages of VARs over large-scale simultaneous models

VARs are popular in estimations compared to models, such as large-scale structural econometric models. They are popular because they do not depend much on existing economic theory and they are less prone to demands of distinguishing between exogenous and endogenous variables (Kilian 2011:1). This is unlike large-scale structural models which Hakkio & Morris (1984:1) argue are bound on the basis of economic theory where variables which do not conform to economic theory are eliminated even if they are statistically significant. Sims (1980:2) points out that it is rare for economic theory to be sufficiently well defined. Because of that, exclusion restrictions of variables or exogeneity assumptions are likely to lead to the under-identification of a model. Hakkio & Morris (1984:1) point out that eliminating a variable based on theoretical explanations compromises the accuracy of the estimates. Hakkio & Morris (1984:1) contend that this is the major drawback of the large-scale structural models.

Furthermore, large-scale Keynesian-type simultaneous equation models are less attractive compared to VARs. As Kilian (2011:2) points out, they require the inclusion of hundreds of variables in the model which are '*incredible*'[12] to interpret. Typically, VARs contain less variables and equations (Bahovec & Erjavec, 2009: 16). In line with this argument, our study only uses five endogenous variables. Three advantages, compared to the large scale simultaneous equations, arise from the

[12] This is a term that Sims (1980:2) often used to describe the difficult faced in interpreting large-scale simultaneous equations.

compactness of the SVAR. Bahovec & Erjavec, (2009:16) list them as follows: one, they are easy to estimate; two, they avoid multicollinearity; and, three, they make it easier to interpret results and coefficients. In case of omission of an important variable in a VAR model, serially correlated error terms do reflect that (Bjonnes, 2012:14).

The use of VARs is more suitable in developing countries than the large-scale models. This is because developing countries lack developed markets and quality data that have meaningful links and clear distinction between the endogenous and exogenous variables. See Bernanke & Mihov (1995:4) and Kirchner (2011:6). As such, the SVAR model is suitable in the study of a developing economy like South Africa.

Many researchers use VARs, as they are easy to manage. Blanchard & Perotti (2002:1340) use the SVAR to analyse the effects of government spending and taxes on the post war U.S. economy. They use institutional information about tax and transfer systems to identify the automatic response of taxes and spending activities. Their results are in line with traditional macroeconomic theory, where increase in government spending has a positive effect, and increase in tax has a negative effect on the economy. A number of other scholars have used the SVAR methodology in the U.S. and have confirmed the results obtained by Blanchard & Perotti (2002). See among others Fatas & Mihov (2001b), Mountford & Uhlig (2002).

Giordano, Momigliano, Neri & Perotti (2008:76) use the SVAR to investigate the effect of fiscal policy in Italy. They find that a one per cent shock to government expenditure on goods and services raises private real GDP by 0.6 per cent after 3 quarters. However, after two years, this response reduces to zero.

Besides the U.S. and Europe, fiscal SVAR models have also been applied to other countries. Here is just a brief list of those papers: Perotti (2002), De Arcangelis and Lamartine (2003) for OECD countries in general; Lozano and Rodriquez (2008) for Colombia; Du Plessis, Smith and Struzenegger (2008), and Jooste et al (2012) on South Africa; and Ilzetzki et al (2010) on developed and developing countries. In all these papers, SVAR models are used for simulating fiscal shocks, but they partially differ in the variables they use. Their findings are mixed. Some find positive effects, while others find negative ones.

3.2.3 Criticisms of the VARs

The VARs are not without criticism, however. The results obtained from them are criticised for being sensitive to model specification, sample size and the choice of the lag length (Bjonness, 2012:13).

Suffice to indicate, however, that nowadays this is not such a problem. As Bjonness (2012:13) points out, there are several tests that can be employed to check for the robustness and the stability of a model.

Furthermore, some commentators have highlighted that VARs fall short because they do not offer information about the underlying structure of the economy but focus instead on the interrelationships of the economic variables (Hakkio & Morris, 1984:1). However, scholars like Amarasekara (2008:5) have played down this criticism, arguing that VARs are not designed to explain the structure of the economy but, rather, analyse the relationships between variables. Hakkio & Morris (1984:1) point out that "although VARs cannot make inferences about the structure of the economy, they can be used to estimate parameters of interest to policy makers".

3.2.4 The identification problem

The most important concern about SVARs, perhaps, is that they require "identification assumptions" in order for correlations to be interpreted in a causal manner. See Stock & Watson (2001:101) and Kilian (2011:1). Identification assumptions refer to how one arranges the variables in a system of equations in order to solve the causation and correlation problems (Stock & Watson, 2001:102). In other words, as Stock & Watson (2001:103) put it, identification requires that all causal links in the system are spelled out, such that only a specific causal link is identified. Beetsma & Giuliodori (2011:9) and Kilian (2011:1) have argued that identification requires knowledge of institutions, economic theory and other extraneous constraints on the model responses. This is not an easy exercise, since SVAR results are sensitive to identification assumptions. Ravnik & Zulic (2011:37) argue that small changes in the identification process can create large changes in the impulse responses and, thus, change the results of the SVAR model.

However, SVARs are important in this particular study because they allow us to impose identification about the error terms, so that we can look at individual shocks which are not correlated with other variable shocks. This is important because only if shocks are uncorrelated can we suspend some specific shocks and observe the impact of a particular shock of interest on another variable. In our case, it allows us, for instance, to suspend all other shocks, apart from the fiscal deficit variable shock, and observe how this shock affects real GDP.

In this paper, we use the recursive identification approach, suggested by Sims (1980:2). The recursive identification approach involves the use of the Cholesky decomposition method to separate structural shocks from reduced form shocks by making the error terms in the reduced form VAR uncorrelated, which is commonly referred to as *Orthogonalization.* This is done in order to

facilitate make the interpretation of the resulting impulse response functions. It is Orthogonalization that enables us to implement the idea of isolating fiscal deficit shocks, suspend other specific shocks and see how real GDP reacts.

Suffice to mention that there are several other methods that are used to identify equations in an SVAR model. Ravnik & Zulic (2011:28) cite the Structural Vector Error Correction model (SVEC) as one of them. Some scholars like Fatas & Mihov (2001:10) use the basic identification method of putting fiscal variables first, while the contemporaneous relationship of other variables is not specified. Kamps & Caldara (2008:28) compare various identification approaches and conclude that the Cholesky decomposition approach, with proper order of the variables in the model is one of the most appropriate methods of identifying variables.

3.3 DATA

The study uses quarterly macroeconomic time series data sets which span from 1991Q2 to 2012Q4. The first quarter in this study refers to the first three months of the Gregorian calendar, that is, January to March, and so on.

Quarterly data, as opposed to annual data are employed in this study. Quarterly data have several advantages in comparison to annual data. Firstly, it is necessary to note, as De Castro & Garrote (2012:10) point out, decisions on fiscal policy are taken throughout the year and are often based on information gathered on a monthly or quarterly basis. As a result, quarterly data are better placed to capture this rich dynamic pattern of the decision-making process than the aggregate yearly data, which often contain large contemporaneous effects that complicate the analysis and the interpretation of results. See also Martins (2010:13) and Splimbergo et al (2009:5). Ilzetzki et al (2010:8) confirm that annual data are not good at producing precise estimates.

Next, the use of quarterly data helps to minimise the likelihood of structural breaks and also increases the number of observations, or degrees of freedom. In South Africa, many structural breaks are eminent, due to several economic regime changes that have taken place. However, the use of quarterly data, as opposed to annual data helps to minimise the number of these structural breaks (Martins, 2010:14). On the other hand, many degrees of freedom realised from quarterly data are essential in enhancing the credibility of the estimates of a model. According to Martins (2010:14) the use of the VAR model normally results in the vanishing of degrees of freedom. The use

of quarterly rather than annual data, therefore, helps to minimise that loss of degrees of freedom by substantially increasing the sample size.

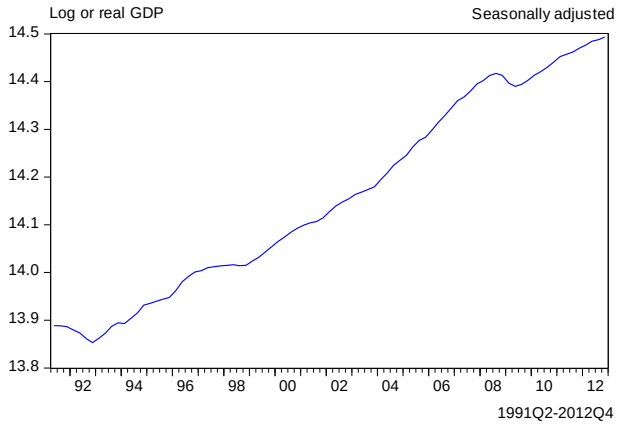
Finally, some studies have argued that since fiscal policy is susceptible to the problem of lags, annual data should be used to account for this challenge. It, however, should be pointed out that even if lags are present, it is unrealistic to assume that an entire year is required for the authorities to respond to output shocks. Ilzetzki et al (2010:8) argue that many countries, including developing countries responded with discretionary measures as early as the first quarter of 2009 to the economic fallout in the fourth quarter of 2008. As such, the approach to using quarterly data is substantiated.

Source and type of data

In terms of the sources of the data, we use a local source. All the data is obtained from the South African Reserve Bank (SARB, 2013). The SARB was chosen because it has a relatively long span of macroeconomic time series on South Africa and the data are consistent in terms of the units of measurement used. The data which we collected include:

a) The two key variables of the study. The first, also serving as our dependent variable, is the log of real GDP (*O*) measured at 2005 market prices. GDP refers to expenditure on domestically produced goods and services, or economic activity. This variable is obtained from the SARB, while already seasonally adjusted. Figure 3.1 below shows the evolution of the log of real GDP over the forecast horizon. The graph gives the idea that GDP is non-stationary, since it maintains an upward trend throughout the period, suggesting that the mean of GDP was perhaps changing. Discussion of the meaning of non-stationarity and how to address it is analysed in the next section.

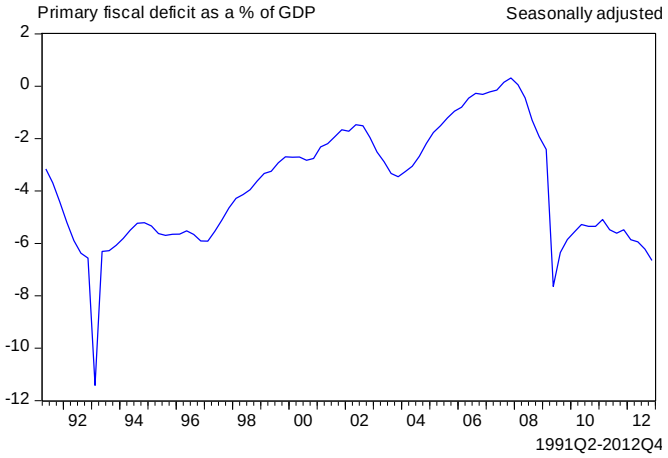
Figure 3.1



The second key variable, also serving as one of the explanatory variables, is the real primary fiscal deficit as a percentage of GDP (*F*), which is expressed in rates. As we defined it in chapter 1, a fiscal deficit refers to the surplus of government (public) expenditure over revenue (Dalyop, 2010:155). We use the primary deficit[13] as opposed to the conventional deficit because, as Tshiswaka-Kashalala (2006:3) points out, the conventional fiscal deficit may not properly represent discretionary fiscal policy because it contains interest rate payments, which are not a fiscal discretionary component of the fiscal deficit. On the other hand, the primary fiscal deficit does not include interest payments, thus, making it suitable to capture government's discretionary fiscal policy. We adjusted this variable for seasonality, using the TRAMO/SEAT ARIMA model[14] with programme package Eviews 7.0. Figure 3.2 below shows the pattern of the real primary fiscal deficit as a percentage of GDP for the time frame of consideration. The graph shows that this variable is also not stationary.

[13] We subtracted interest payments from the conventional fiscal deficit in order to arrive at the primary fiscal deficit.
[14] These seasonal adjustment technics were developed by Victor Gomez and Augustin Maravall, and are officially used by the Bank of Spain (Maravall, 2006). Their main advantage over other popular technics like the X-12 ARIMA used by the FED of the US is that they can handle missing as well as non-positive figures.

Figure 3.2

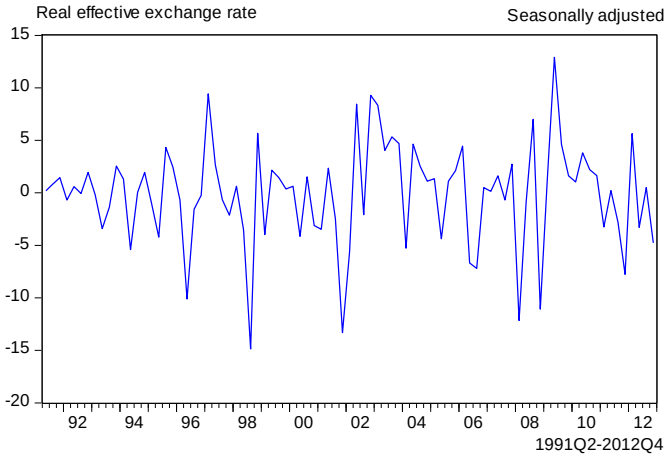


b) Apart from the above variables, there are other factors that are very important in determining the effectiveness of fiscal deficits. The mechanism through which they influence the effectiveness of fiscal deficits was discussed in the previous chapter. We, therefore, have to use these factors for controlling purposes in our analysis of the results in chapter 4. The first of these control factors is the real exchange rate, for which we use the real effective exchange- rate[15] (*X*) because it captures the relative strength of the domestic currency against other currencies better than the ordinary exchange-rate. This is a critical variable. As argued in the literature review, there is a link between fiscal deficits and the monetary aspect of exchange rates. Fiscal deficits may theoretically lead to an appreciation of the real exchange-rate (Dalyop 2010:161). This could have a negative impact on the external competitiveness of the economy, thereby offsetting the positive economic effect of fiscal deficits.

This variable is in rates and we seasonally adjusted it using the TRAMO-SEATS ARIMA model with programme package Eviews 7.0. Figure 3.3 below shows the evolution of the real effective exchange rate in South Africa from 1991 to 2012. The plot of this graph looks quite stationary. However, a more objective way of ascertaining whether this series is stationary is used in chapter 4.

[15] The real effective exchange-rate measures the strength of the Rand against a weighted average strength of 15 of South Africa's major international trading economies.

Figure 3.3



c) Moreover, it was also discussed in chapter 2 that the effect of fiscal deficits differs, depending on the exchange rate regime used in a given economy. As Spilimbergo et al (2009:3), Ilzetzki et al (2010:11) among others argue fiscal policy is more effective in fixed exchange rate regimes compared to floating exchange rate regimes. The paper creates a dummy called *dumreg* to compare the impact of exchange rate regimes on the effectiveness of fiscal policy. In this dummy, *dumreg* = 0 represents periods (quarters) of fixed exchange rate regime, while *dumreg* = 1 represents periods (quarters) of floating exchange-rate regime. Table 2.1 in the previous chapter showed a compilation of episodes of exchange-rate regimes that South Africa has passed through. It shows that from the time horizon of our consideration, it was only from 1991Q2 to 1994Q4 that South Africa was considered to be in a fixed exchange rate regime. This means that from 1995Q1 to 2012Q4, the floating exchange rate was used in the economy. We verify in chapter 4 whether or not the dominance of the floating exchange-rate in South Africa over our forecast horizon does significantly hamper the effectiveness of fiscal deficits, as many scholars suggest.

d) The next variable we include is trade as a percentage of GDP (*T*) in real terms. This measures the degree of openness of the economy. Openness of an economy, as discussed in chapter 2, has a critical influence on how fiscal deficits perform. Spilimbergo et al (2009:3) point out that the more open an economy is, the more likely fiscal deficits will be impotent. Theoretically, an open economy will result in the channelling of the income received from fiscal expenditure towards imports, thereby offsetting the current account

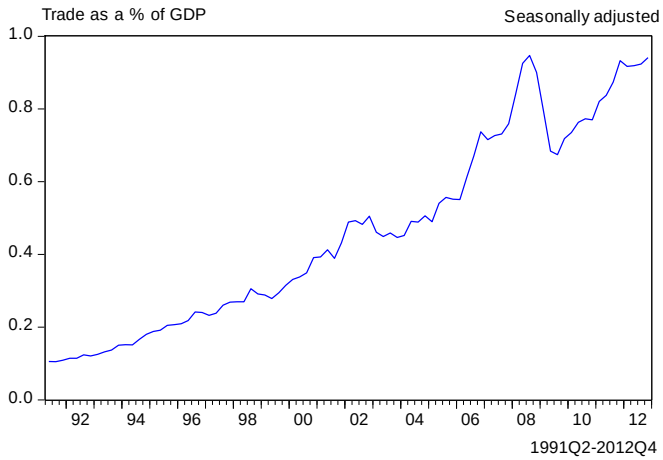
and GDP. With South Africa being a small open economy, we wait to verify in Chapter 4 if her openness to trade has an impact on the effectiveness of fiscal deficits.

Trade as a percentage of GDP is measured as exports plus imports as a proportion of GDP[16] (Dalyop, 2010:155). In other words, it measures the trade share of an economy. The higher the percentage of trade as a share of GDP, the more open the economy is. This type of approach to measuring the degree of openness of an economy, according to David (2007:9) is quite popular because it relies on the use of data for determination purposes, which data are normally readily available. In addition this approach makes it easy to make comparisons across studies of how economies are open (David, 2007:9).

We have expressed the variable, trade as a percentage of GDP, in rates. The series, which we used to calculate for this variable, were obtained from the SARB, already seasonally adjusted. Figure 3.4 below shows the plot of this variable over our time period of consideration. The graph exhibits non-stationarity tendencies for this variable, as the mean seems not to be constant.

[16] This can be calculated using either current or constant prices (David 2007:9). In our case, we used real values.

Figure 3.4

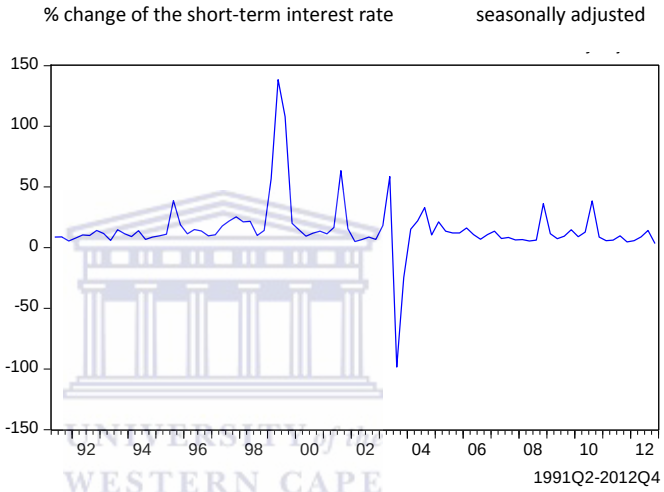


e) The base rate *(B)*, or the interest rate policy of the central bank, is another important monetary policy variable that could have an influence on the effectiveness of fiscal deficits. We argued in chapter 2 that both the neoclassical economists and New Keynesians admit that fiscal deficits may raise interest rates. From the rise in interest rates, the neoclassical economists contend that this would automatically have a dampening effect on private investment and may have an adverse effect on fiscal deficits. On the other hand, the new Keynesians argue that interest rates may rise, but fiscal deficits would still spur investment given any level of interest rate.

Moreover, we discussed in chapter 2 that the SARB follows a Taylor-type interest rate rule to implement its inflation-targeting monetary policy. The need to maintain inflation within the target range, using the short-term interest rate, may have offsetting effects on the effectiveness of fiscal deficits. For instance, if the rise in GDP arising from the increase in fiscal deficits mounts upward pressure on prices in the economy, the SARB may raise interest rates to cushion the rising prices and maintain them within the target range. This rise in interest rates may dampen investments and offset the stimulative effect of fiscal deficits. The inclusion of the interest rate variable in our model, therefore, helps us to evaluate the conclusion by Spilimbergo et al (2009:3) and Christiano et al (2009:17) that fiscal policy under inflation-targeting monetary policy is a failure.

We use the central bank repurchase rate (repo rate) to proxy the short-term interest rate policy of the central bank. The repurchase rate was introduced by the SARB in 1999, but prior to that, the bank rate was used to proxy the central bank interest policy rate (Dube & Zhou, 2003:197). We seasonally adjusted this variable using the TRAMO-SEATS ARIMA model with program package Eviews 7.0. Figure 3.5 below shows the trend of the repo rate since 1991. The variable seems to be stationary.

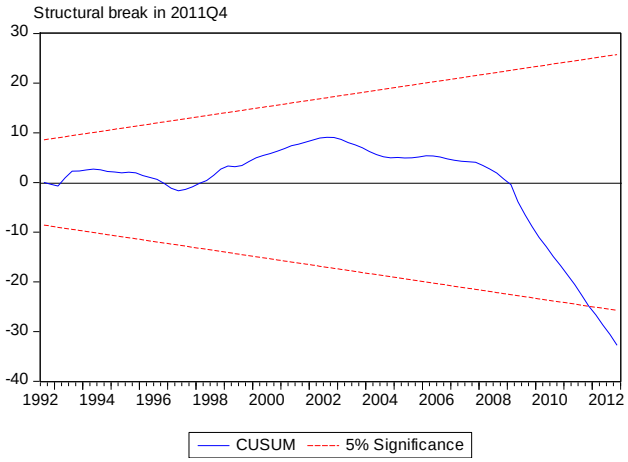
Figure 3.5



f) Finally, the paper creates a dummy variable *(dum11)*[17] to represent a structural break which took place in 2011Q4. We discovered this structural break after undertaking a stability diagnostic test of the residuals in the equation using program package Eviews 7.0. In this diagnosis, we rejected at 5% level the Chow Breakpoint test null hypothesis stating that there was no structural break in the fourth quarter of 2011. Adding structural break dummies in a VAR model when structural breaks are observed in the data improves the specification and stability of the model. Figure 3.6 shows a graph depicting the structural break that took place in 2011Q4 when the test statistic broke out of the 5% interval.

[17] Dum11 takes values of 0 from 1991Q2 to 2011Q4, and values of 1 from 2012Q1 to 2012Q4.

Figure 3.6



3.4 ECONOMETRIC TOOLS

As mentioned earlier, this study uses time series data. A time series is defined by Gourieroux & Monfort (1997:1) as "the sequence of observations on one variable". The data in these series may be available, for example, once a year or once a quarter. They come from repeated observations, corresponding to different dates.

3.4.1 Challenges to time series data and solutions

Time series data are a problem to use in research activities. The problem is that they often tend to have unit roots. Unit root is a term that implies that the data is non-stationary. A non-stationary series has a mean or variance, or both, that vary over time (Gujarati, 2003: 797). Gujarati (2003:797) contends that using such data would require that each set of time series data should be for a particular episode and, as such, it is not possible to generalise it to other periods. Using such time series in regressions produces results that appear to be true, when actually they are false. It so happens that a regression involving two non-stationary variables would produce a high adjusted R-Squared[18] when actually no relationship exists (Gujarati, 2003:797). Not taking action to make the data stationary can lead, therefore, to false results. Moreover, the VAR model that we use in this

[18] The adjusted R-squared is used to determine the fitness of a model. The higher it is, the better fitted a model is.

study requires, in the first place, that all the data used are stationary, or else the results would be invalid.

The graphical analysis made in section 3.4 already highlights that most of the time series used in this study are suspected to be non-stationary because they have sustained trends and random walk movements with drifts. However, a more objective way of assessing whether unit roots are present, and how to address them, is required. A number of methods are used to detect unit roots. One of them is the Augmented Dickey-Fuller test (ADF), named after its discoverers (Cheung & Lai 1995: 177). The ADF is based on random walk movements in time series and the fact that random walks have unit roots. It assumes that the explained variable (Y) follows an auto-regressive (AR) process of order p, that is, $\mathrm{AR(p)}$ and adds *p* lagged differenced terms of the Y time series to the right hand side of the regression. The null hypothesis of the ADF test states that unit roots are present in the time series. The alternative hypothesis, on the other hand, states that there are no unit roots in the time series. The ADF, according to Cheung & Lai (1995:177) is effective and is easy to apply and, for that reason, we find it appropriate to use in this study. Another technique available for detecting unit roots is the Phillips-Perron test (1988). However, for reasons we have already indicated, we use the ADF in this study.

3.4.1.1 Differencing

There are a number of methods used to address unit roots in time series data in order to make them stationary. Differencing is one of the easiest ways. Differencing[19] refers to the series of changes of a time series from one period to the next. The number of differencing operations that it takes to make the series stationary is known as the order of integration (Gujarati, 1995: 719). It is denoted as I(*d*). If it takes one differencing operation to make a series stationary, that operation would be expressed as I(*1*). By convention if *d*=0, the resulting I(*0*) expression entails that the time series is stationary. Differencing operation can be done using the ADF.

Though it is an easy way of addressing unit roots, differencing has disadvantages. A number of researchers have condemned it, arguing that it may result in the loss of important data. In addition, a model that only includes (lagged) differenced variables assumes that the impact of the independent variables on the dependent variable never last longer than one time period

[19] If Y_t denotes the value of the time series *Y* at period *t*, then the first difference of *Y* at period t is equal to $Y_t - Y_{t-1}$

(Mukherjee, White and Wuyts, 1998:407). This may not be correct. Moreover, Mukherjee et al. (1998:407) point out that using a regression with differenced variables yields no information on the long-run equilibrium relationship between the variables of consideration. As such, differenced variables are often thought of as representing only the short-run relationship.

3.4.1.2 Cointegration

Because of the inadequacy of the differencing method, this study employs the cointegration technique. The concept of cointegration was popularised by Robert Engle and Clive Granger in 1987. Their analysis was based on the argument that if two or more time series of the same order of integration, say I(*1*), are linearly combined and produce I(*0*) residuals, it means that those variables are cointegrating in the long run. Such variables can also be said to form an equilibrium relationship in the long-run. In other words, variables are cointegrated with one another if the residuals from the levels regression are stationary (Mukherjee et al, 1998: 399).

Testing if our model cointegrates is critical for our SVAR, as it determines whether or not our regressions are spurious. If our model cointegrates, it confirms that we are estimating a stationary model, and our regressions are not spurious.

Previously, cointegration analysis was predominantly undertaken for purposes of estimating "Restricted VAR models" or Vector Error Correction Models (VECM). This implies that unrestricted VARs, such as the one we use in this study, would not have to go through the process of cointegration tests. However, cointegration analysis, perhaps, is currently considered to be more important in unrestricted VAR analyses. As Baharumshah (2005:30) points out, "estimating the unrestricted VAR model for the cointegrated variables is a normal route taken by much of the literature". Furthermore, Ramaswamy & Slok (1998:380) argue that when variables are cointegrated it is better to apply an unrestrictive SVAR than a restricted one. This, Ramaswamy & Slok (1998:380) argue, "is because restricted VARs imply that the effect of a given shock is permanent, while that of an unrestricted VAR allows history to decide on whether the impact of a shock is permanent or not, which is desirable".

In line, therefore, with this literature, if we discover that our variables cointegrate, we will proceed with the estimation of an unrestricted SVAR model. There is need to mention however, that we will also run a VECM for the sole purpose of using it as a recommended method for determining

causality in multivariable models. We discuss the use of VECM in determining causality in section 3.5.5.1 below.

In this study, we use the Johansen approach to test for cointegration. This approach involves the application of standard multivariate calculations in the context of a Vector Auto-Regression (VAR) system. The Johansen approach allows for more than one cointegrating relation. In other words, it allows for the testing of cointegration in multivariate models (Mukherjee et al, 1998:399). This technique is, therefore, a suitable one for the multivariable model that we have in this study. The number of cointegrating vectors in our model can be up to 4, since we have 5 endogenous variables in the model. Moreover, we choose the Johansen approach, because of its ability to incorporate structural breaks and dummies in the tests for cointegration, as done by Thornton & Lusinyan (2009:864). This is important in our case because we have a structural break dummy and a dummy for the exchange rate regimes in our model.

Typically, the Johansen cointegration approach was designed to handle variables that are I(*1*) integrated. In our case, there is a possibility that we might also have variables which are I(*0*). However, Johansen (1991:1560) argues that there is still no problem with combining I*(0*) and I(*1*) variables when testing for cointegration. See also Harris (1995:80). This, he argues, is because, if some variables are I(*0*) instead of I(*1*), they will reveal themselves through cointegrating vectors whose space is spanned by the stationary variables in the model (Johansen, 1991: 1560).

The Johansen approach has two types of tests. These are the trace statistic and the maximum Eigenvalue statistic. Either one of the two tests or both can be used as a benchmark for deciding the number of cointegrating relationships in the model, as argued by Lutkepohl, Saikkonen, Trenkler (2001:305). However, they caution that the trace test has more power when handling more than one cointegrating relationship, while the Eigenvalue test is suitable for one cointegrating relationship (Lutkepohl et al, 2001:305).

The trace test is a joint test with a null hypothesis which states that the number of cointegrating relations is less or equal to *r*. The *r* is also called the 'rank' and it determines the number of cointegrating vectors. If *r* = 0, it means there is zero cointegration relations in the model. Its alternative hypothesis, on the other hand, is a general one which states that there are more than *r* cointegrating vectors (Johansen 1991: 1554).

In the maximum Eigenvalue test, separate tests on each Eigenvalue are conducted. Its null hypothesis states that there are *r* cointegrating relations. The alternative hypothesis, on the other hand, states that there are *r* + 1 cointegrating vectors (Johansen 1991: 1554).

3.4.1.3 Deterministic trend assumptions and lag length

The output of the Johansen approach cointegration tests is sensitive to the deterministic trend assumptions used for the time series and the lag order choice. A slight change in information on any of these, results in a change in the number of cointegrating vectors outputted. The Johansen cointegration system in E-views 7.0 asks for this information, and it is therefore important to input it correctly. From the preliminary investigation of our time series, based on graphical appearance, we observe that they have intercepts/constant, and a trend. Graphical appearance, as we discuss in chapter 4, is however, not an objective way of deciding the deterministic trend assumptions of the data. A more robust way of doing this is shown in the next chapter where, in the process of testing for unit roots, we also discover the correct and significant deterministic trend assumptions for our series. As for the lag order choice, we use the VAR lag order selection criteria in E-views 7.0. More discussion on lag choice selection follows in the next section.

3.4.2 The SVAR model for analysing deficits

There are different classes of SVAR models (E-views 7.0: 472). The one we use may broadly be written as:

- $\alpha u_t = \beta \varepsilon_t$ 1

In the above equation, u_t and ε_t are vectors of length *K*. u_t are the observed (or reduced form) residuals, while ε_t are the unobserved structural disturbances. The structural disturbances (ε_t) in the equation are orthonormal or uncorrelated with each other by assumption, that is, their variance-covariance matrix $\sum \varepsilon_t$ is diagonal. α *and* β are endogenous *K* x *K* matrices to be estimated. Following this broad analysis, the objective of this paper is to estimate this specific SVAR system:

- $\alpha Y_t = \sum_{k=1}^{K} C_k Y_{t-k} + \mathrm{m}_k X_{t-k} \beta u_t$.....2

In this system, Y_t is a cointegrated *K* variable vector, where *K* includes the following endogenous variables: the real primary fiscal deficit as a percentage of GDP *(F)*, real trade as a percentage of GDP *(T)*, real effective exchange rate *(X)*, log of real GDP *(O)*, and the short-term real interest rate or base rate *(B)*. *K* also includes X_t matrix of exogenous variables, which are: exchange rate regimes dummy

(dumreg) and the 2011 structural break *(dum11)*. A deterministic component may also be added as an exogenous variable. The process of testing for unit roots, which is done in the next chapter, aids to reveal the deterministic nature of our series.

In the same SVAR system above, *t* represents a quarter or three consecutive months in the Gregorian calendar. C_k, is a matrix of the own and cross-effect of the k^{th} lag of the variables on their current observations. The α matrix allows for the possibility of the contemporaneous relation contained in the vector Y_t of the variables. β is another component which we need to estimate in our structural VAR. Actually, the representation of this structural form is referred to in the literature as the $\alpha\beta$ model (Luetkepohl 2006: 364). The structural model can be said to be identified only if restrictions are imposed to α and β.

The recursive identification approach which we use restricts β to a *K* dimensional diagonal matrix. In other words, β is a diagonal matrix, implying that the vector $u_t[u_t^F, u_t^T, u_t^X, u_t^O, u_t^B]$ is an orthogonal vector corresponding to reduced-form residuals. Some literatures use an β identity matrix with a unit diagonal. However, the E-views 7.0 guideline: 472, argues that most of the literatures use a diagonal matrix where values that need to be estimated are assigned the label NA[20]. We thus, follow this argument by allowing our SVAR to estimate values for the diagonal matrix, as we show below on the matrix to the right:

$$\begin{Bmatrix} 1 & 0 & 0 & 0 & 0 \\ NA & 1 & 0 & 0 & 0 \\ NA & NA & 1 & 0 & 0 \\ NA & NA & NA & 1 & 0 \\ NA & NA & NA & NA & 1 \end{Bmatrix} \begin{bmatrix} u_t^F \\ u_t^T \\ u_t^X \\ u_t^O \\ u_t^B \end{bmatrix} = \begin{Bmatrix} NA & 0 & 0 & 0 & 0 \\ 0 & NA & 0 & 0 & 0 \\ 0 & 0 & NA & 0 & 0 \\ 0 & 0 & 0 & NA & 0 \\ 0 & 0 & 0 & 0 & NA \end{Bmatrix} \begin{bmatrix} \varepsilon_t^F \\ \varepsilon_t^T \\ \varepsilon_t^X \\ \varepsilon_t^O \\ \varepsilon_t^B \end{bmatrix}$$

On the other hand, we restrict α (the matrix to the left, above) to a lower triangular matrix with a unit diagonal. This implies that the variance-covariance matrix captured in $\sum u_t$ must be decomposed. The decomposition is derived from the Cholesky decomposition $\sum u_t = FF'$ by defining a diagonal matrix *P* which has the same main diagonal as *F*, and by specifying $\alpha^{-1} = FP^{-1}$ and $\sum \varepsilon_t = PP'$. This implies that the elements on the main diagonal of *P* and *F* are equal to the standard deviation of the respective structural innovation (Kamps & Caldara, 2008:13). What this essentially means is that, the βu_t in our SVAR system describes the relation between the structural disturbances (ε_t) and the reduced form disturbance (u_t).

[20] In e-views NA represents a value that is unrestricted or rather, needs to be estimated in the SVAR model. In the diagonal matrix system that we use, it means that we identify β by putting NA in a diagonal form.

3.4.2.1 The recursive causal chain for the SVAR model

The recursive identification approach which we use requires the imposition of a particular causal relationship, based on economic theory from the data (Kilian 2011:5). This implies that VARs are not completely atheoretic, since they require economic theory to be followed. In most cases, though, it is rare to find a fully developed theoretical model on which to base the causal chain. Kilian (2011:8) argues that in such cases "identification may be achieved by using extraneous information or by using selective insights from economic theory". Using this approach helps to make the causal chain relationship general and uncontentious.

We follow the Kilian (2011:8) suggestion, just mentioned above, and combine it with the basic identification procedure of Fatas & Mihov (2001b:10) and Blanchard & Perotti (2002) who order fiscal variables before output. We, thus, order our variables as follows: *fiscal deficit (F) — trade as a percentage of GDP (T) — real effective exchange-rates (X) — log of real GDP (O) — base rate (B).*

The implication of this causal order is that the fiscal deficit affects all the variables in the system at the same time in the first period. In the next period, any shock affects all the variables, all the variables have lags included in each other's equations. In other words, any shock can affect all the variables with a delay lag.

The equations below can be used to explain the recursive causal relationship identified above. It can be seen that the contemporaneous fiscal deficit is included as an explanatory variable in equations 4 to 7. Similarly, trade as a percentage of GDP is a contemporaneous explanatory variable in equations 5 to 7. The same pattern is applicable to the rest of the variables. Of course, the lag of one which we use below is just for demonstration purposes. The lag length could go beyond the length we have used. The Greek symbol ε represents the structural shocks to the models. By custom, the size of a shock is set equal to its standard deviation.

- $F_t = \alpha_0 + \alpha_1 F_{t-1} + \alpha_2 T_{t-1} + \alpha_3 X_{t-1} + \alpha_4 O_{t-1} + \alpha_5 B_{t-1} + \varepsilon_t^F$ 3

- $T_t = \beta_0 + \beta_1 F_t + \beta_2 F_{t-1} + \beta_3 T_{t-1} + \beta_4 X_{t-1} + \beta_5 O_{t-1} + \beta_6 B_{t-1} + \varepsilon_t^T$ 4

- $X_t = \delta_0 + \delta_1 F_t + \delta_2 T_t + \delta_3 F_{t-1} + \delta_4 T_{t-1} + \delta_5 X_{t-1} + \delta_6 O_{t-1} + \delta_7 B_{t-1} + \varepsilon_t^X$ 5

- $$O_t = \psi_0 + \psi_1 F_t + \psi_2 T_t + \psi_3 X_t + \psi_4 F_{t-1} + \psi_5 T_{t-1} + \psi_6 X_{t-1} + \psi_7 O_{t-1} + \psi_8 B_{t-1} + \varepsilon_t^O$$ 6

- $$B_t = \phi_0 + \phi_1 F_t + \delta_2 T_t + \phi_3 X_t + \phi_4 O + \phi_5 F_{t-1} + \phi_6 T_{t-1} + \phi_7 X_{t-1} + \phi_8 O_{t-1} + \phi_9 B_{t-1} + \varepsilon_t^B$$ 7

The ordering of these variables was guided by the following economic assumptions. The primary fiscal deficit as a percentage of GDP affects all the variables in the system in the same period because it appears as a contemporaneous explanatory variable for all of them, as shown above. This, as we argued in chapter 2, helps us to analyse whether fiscal deficits (1) are leaked out of the economy through increased imports, as captured by the increase in trade as a percentage of GDP; (2) lead to the appreciation of the real exchange rate, which may have negative consequences on net exports and GDP; (3) have a discretionary effect on GDP- this particular ordering rules out potentially important contemporaneous effects of automatic stabilizers on fiscal deficit, which can affect the impact of fiscal deficits on economic growth and; (4) lead to the increase in interest rates. An increase in interest rates, according to neoclassical economists crowds-out private investment and appreciates the real exchange-rate. Both of these may negatively affect the impact of fiscal deficits, as we discussed in chapter 2.

Trade as a percentage of GDP and real effective exchange-rate are ordered before real GDP so that we can analyse the net exports position of the economy after a fiscal shock has been subjected to them. As we discussed in the previous chapter, the appreciation of the real exchange-rate and the increase in imports for open economies may cause a negative trade balance, thereby minimising the fiscal multiplier.

Finally, we order the short-term real interest rate (base rate) last. We give two justifications for ordering this variable last. Firstly, based on the argument made in the previous chapter, the SARB pursues an inflation-targeting monetary policy, where interest rate changes are bound by the need to maintain inflation at the targeted level as GDP changes. This means that the obligation to fix inflation at a certain level may compel the SARB to change the interest rate in the direction that offsets the stimulative effect of the fiscal deficit. Secondly, the fiscal deficit, as we define it, represents the primary deficit, which excludes interest payments. We want to verify whether the fiscal deficit variable does not react to changes in the interest rate.

3.4.2.2 Estimation of the SVAR model

The matrix $\alpha^{-1}C_k$ and the coefficients α and β are what we aim to estimate. Estimation of VAR regressions is normally done using the Ordinary least squares (OLS). However, Luetkepohl (2011:8) points out that the OLS may be inefficient in cases where restrictions must be imposed on the parameters, such as what we do in this study. In view of that, we estimate our regression using the Generalised Least Squares (GLS). Luetkepohl (2011:8) argues that the GLS is beneficial when restrictions to parameters are imposed, and this estimator is consistent and asymptotically normal under general conditions. The GLS, thus, will provide us with the above estimates.

3.4.3 Lag length selection

Before estimation can be done, determination of the optimal lag length is always a prerequisite when dealing with VAR models. In our case, we combine statistical criteria and economic theory to determine the lag length. For the statistical criteria, we use the VAR lag choice selection criterion which is incorporated in the E-views 7.0 statistical package. We apply this criterion while cautious of the warning by Gujarati (2004: 733) that the more the lags that one adds to the model, the more the degrees of freedom get consumed. On the other hand, not including a lag at all in the model may be rejected on economic grounds, since it takes a quarter or more for fiscal policy to react (Bjonness 2012:15). We perform the lag selection procedure in the next chapter.

3.4.4 Residual diagnostic tests

Residual tests describe the distribution and characteristics of the residuals in the model. These tests are very important, for they determine the credibility of the conclusions drawn from a model. We follow the standard practice of testing the residuals for serial correlation, normality distribution and heteroskedasticity. In addition, we test for the stability of our SVAR, using the inverse roots of the AR characteristic polynomial.

3.4.4.1 Serial correlation

Serial correlation, also known as autocorrelation, is a serious problem in time series data. Serially correlated error terms underestimate the standard errors, thereby making the t-values overestimated. This renders the estimates biased. We use the Breusch-Godfrey serial correlation LM test to test for serial correlation. The null hypothesis for this test states that there is no serial correlation in the model.

3.4.4.2 Normality test

A normality test investigates whether the residuals in a model are normally distributed. Estimates derived from a model whose residuals are not normally distributed are invalid. We, therefore, have to undertake this test. We use the Jarque-Bera normality test to ascertain the distribution of the residuals in our model. The null hypothesis for this test states that the residuals are not normally distributed.

3.4.4.3 Heteroskedasticity

Heteroskedasticity means that residuals do not have a constant variance. This results in a model which has different probability distributions. Such a model cannot yield reliable estimates. We use the Breusch-Pagan-Godfrey test for heteroskedasticity to analyse heteroskedasticity in our model. The null hypothesis for this test states that the residuals have no heteroskedasticity.

3.4.4.4 Inverse Roots of AR Characteristic Polynomial

Finally, since we are running an SVAR model, it is also important that we test for the stability of our model. We use the technique called the "Inverse roots of AR characteristic polynomial" to ascertain the stability of our SVAR. In this test, if the Inverse roots of the AR polynomial have roots with modulus which are less than one and they lie within the unit circle, it means that the model is stable and the impulse response standard errors would be valid and the conclusions of the model would also be reliable.

3.4.5 SVAR Results

In analysing the results from our SVAR model, we follow the standard practice of reporting results from the Granger-causality tests, impulse responses and the forecast error variance decompositions. The E-views 7.0 package we use in this study, and many other econometrics packages, such as, TSP and RATS, can compute these statistics automatically. Stock & Watson (2001:104) argue that because VARs have complicated dynamics, reporting these statistics is more informative than using the regression coefficients or R^2 statistics.

3.4.5.1 Causality test

The concept of causality is attributed to Engle Granger (1969) who explained that if *X* Granger causes *Y*, then past values of *X* should contain information which helps to predict *Y*. This culminated in what is commonly known as the Granger causality test. However, the normal Granger –causality test is more suitable for bivariate equations. Lutkepohl (2006:76) points out that the normal Granger

causality test is not reliable in a VAR with more than two variables. A Granger causality test which is appropriate for handling more than two variables requires the use of the VECM. Maddala & Kim, (1998:297) argue that Granger causality for multivariate equations can be subdivided into long-run and short-run causality using the VECM. This can be done only after establishing that a cointegration relationship exists among the variables. Maddala & Kim (1998:297) argue that the long-run causality is determined by the error correction term. If the error term coefficient is statistically significant and has a negative sign, it indicates that long-run causality runs from the independent variables, jointly, to the dependent variable. The short-run causality, on the other hand, as argued by Maddala & Kim, (1998:298), is determined by a test of the joint significance of the lagged independent variables. The F-test or the Wald tests can be used in this case. We do these tests in the next chapter.

3.4.5.2 Impulse Response Functions (IRFs)

SVARs, like recursive VARs, are typically interpreted using Impulse Response Functions (IRFs). IRFs are used to trace out the time path of various innovations (shocks) that are in the SVAR system. Stock & Watson (2001:106) point out that "impulse responses trace out the response of current and future values of each of the variables to a one unit increase in the current value of one of the VAR errors, assuming that this error returns to zero in subsequent periods and that all other errors are equal to zero". IRFs can be achieved through expressing variables in the model in terms of shocks. We use IRFs to interpret results because using individual coefficients from an estimated SVAR is difficult (Bjonness, 2012:14).

3.4.5.3 Forecast Error Variance Decomposition (FEVD)

According to Stock & Watson (2001:106) "the Forecast Error Variance Decomposition (FEVD) is the percentage of the variance of the error made in forecasting a variable (say, GDP) due to a specific innovation (say, the error term in the fiscal deficit equation) at a given horizon (like two years)". Whereas the IRF trace the effect of an innovation to an endogenous variable on the variables in the VAR system, the FEVD gives information about the relative importance of each random shock or innovation to the variables in the VAR system. The IRF together with the FEVD constitute what is known as "Innovation accounting"

3.5 CONCLUSION

This chapter addressed the methodology that would be used to investigate the effectiveness of fiscal deficits in stimulating economic growth in South Africa. We argued that macroeconomic time series

data would be applied in an SVAR model in order for us to determine whether or not fiscal deficits have a stimulative effect on the South African economy. We analysed the source and type of time series data that are appropriate for our study. We examined problems associated with the use of time series data, and how to resolve them. The SVAR technique was discussed and we discovered that, despite the challenge of how to make “identification assumptions”, it is a better technique to use in investigating the economic effectiveness of fiscal policy. We also examined the diagnostic tests that would be used to assess the efficiency and validity of our estimates.

CHAPTER 4: EMPIRICAL RESULTS

4.1 INTRODUCTION

This chapter empirically investigates the impact of fiscal deficits on economic growth in South Africa. Specifically, it answers the questions raised in chapter 1: What is the effect of fiscal deficits on South Africa's economic growth and what factors are expected to explain it? The decision on whether fiscal deficits are an effective stimulatory policy in South Africa depends on the conclusions we draw from the following hypotheses: Fiscal deficits lead to a positive effect on economic growth, our null hypothesis (H_0). The alternative hypothesis (H_1), states that fiscal deficits have an effect on economic growth which is equal to or less than zero. If our results show an effect, which is statistically significantly positive, we should conclude that fiscal deficits are effective in stimulating economic growth in South Africa. Otherwise, the alternative hypothesis is accepted and we conclude that fiscal deficits are not effective in stimulating economic growth in South Africa.

As part of answering our research question, we also analyse factors that may explain the effectiveness of fiscal deficits on economic growth. For this reason, our model includes important variables for the analysis of the mechanism through which the economic impact of fiscal deficits may have been affected.

To determine the effectiveness of fiscal deficits, an SVAR model, which we re-write below from chapter three, is used. As stated, this model includes the real primary fiscal deficit as a percentage of GDP *(F)*, the real trade as a percentage of GDP *(T)*, the real effective exchange rate *(X)*, the log of real GDP *(O)* and the short-term real interest rate of the central bank *(B)*, as endogenous variables. It also includes exogenous variables: the exchange-rate regimes dummy *(dumreg)* and the 2011 structural break *(dum11)*.

- $\alpha Y_t = \sum_{k=1}^{K} C_k Y_{t-k} + \mathrm{m}_k X_{t-k}\, \beta u_t$

To answer our research question, we organise this chapter as follows: in order to address the problem of unit roots, which in chapter 3 were discussed as being a serious problem in time series data, we use section 4.2 to detect the presence of unit roots and address them. The ADF method is used to detect unit roots, while the Johansen cointegration technique is used to address them. Section 4.3 discusses the diagnostic tests of the residuals and the stability of the SVAR model which we use in this study. This is important because the validity and reliability of our estimates and

conclusions strongly depend on these tests. After satisfying that prerequisite, we estimate the SVAR in section 4.4. We use the standard procedure in VAR models of reporting the Granger causality test, the impulse response functions and the variance decomposition analysis. In all these reports, the short-run and long-run relationship outcomes are considered. Section 4.5 concludes chapter.

4.2 UNIT ROOT TESTS AND HOW TO ADDRESS THEM

4.2.1 Initial investigation of the data

Before undertaking a formal test for unit roots, Gujarati & Porter (2009:749) advise that a graphical analysis by visually plotting the time series should be done. They justify this by arguing that a graphical representation of the series provides a primary clue of the expected nature of the series with regard to the inclusion or not of a trend, constant/intercept term or both in the model. Our series are plotted in section 3.4 of chapter 3. Based on figures 3.1 to 3.5, the visual analysis of our series is as follows: The log of real GDP (Fig 3.1) has a constant term and maintains an upward time trend starting from the early 1990s. However, following the economic recession, it slightly declined in 2008 and then continued with the upward trend. On the other hand, the primary fiscal deficit as a percentage of GDP (Fig 3.2) has mainly been in the negative region, meaning that for most of the period, government expenditure (excluding expenditure on interest payments) was more than the revenue collected. The sharpest increases in the fiscal deficit were witnessed in the years 1993 and 2008. This time series has a constant term and shows random walk movement with time trend drifts in some periods, meaning that it is not stationary. The next time series, which is the real effective exchange-rate (Fig 3.3), is fairly stationary in the main, as its mean and variance seem to be constant throughout the period. Trade as a percentage of GDP, according to Fig 3.4, has a constant term and a time trend. This graph also shows that from the beginning of the sample period, the share of trade to GDP was increasing until 2008 when the economy was hit by a recession, making it decline and then rise again. Finally, the short-term real interest rate appears to have no constant term and is, fairly, stationary. However, a formal way of assessing if it is stationary is done below.

4.2.2 The ADF test for unit roots

The above analysis is not objective enough, as we cannot be sure about the stationarity or non-stationarity of the variables. A formal hypothesis testing approach for unit roots is required. The approach we use to test for unit roots as discussed in chapter 3 is the ADF, which has a null hypothesis, stating that unit roots are present in the series. This approach requires the use of trend

deterministic assumptions. Based on the visual graphical analysis made above, we apply the following trend deterministic assumptions, as specified in E views package 7.0, which we use, 'intercept term', 'intercept term and trend', and 'none'. Table 4.1 below shows results from the unit roots tests we have done for each of the five endogenous variables.

Table 4.1 Augmented Dickey-Fuller unit root test

	ADF Test		
Variables	**Level**	**1st Difference**	**Robust deterministic trends**
Fiscal deficit as % of GDP (F)	**-0.65**	**-11.69***	**None**
Trade as % of GDP (T)	**1.41**	**-5.56***	**None**
Effective Exchange rate (X)	**-8.96***	**-**	**None**
Real GDP (O)	**0.12**	**-4.06***	**Intercept**
Base rate (B)	**-6.20***	**-**	**Intercept**

Source: Author's compilation;

** Denotes that we reject the null-hypothesis at 5% level of significance. The Schwarz Information Criterion is used to determine the lag order*.

Table 4.1 shows that, except for the real effective exchange-rate and the base rate, all the other variables are non-stationary at level. The non-stationary variables all become stationary after the first difference. Contrary to the trend deterministic assumptions based on our visual graphical analysis, the ADF test reveals that our series predominantly exhibit the no constant/no trend, and constant deterministic assumptions. Because of this pattern, in all our VAR estimations we assume that there is no deterministic trend in our model and choose the option in E-views which states that there is 'no intercept or trend'.

4.2.3 Test for cointegration

We cannot run a model based on variables that are non-stationary. Doing so would produce spurious regressions. However, as we argued in chapter 3, if the series in the model, even if some are non-stationary, are able to form stationary residuals I(*0*) when they are regressed together, their regressions will not be spurious. This is because those series form a long-run equilibrium relationship, and they cointegrate, which is desirable. We use the Johansen cointegration test to ascertain if our model forms a long-run equilibrium relationship. Before we can apply the Johansen cointegration test, however, it is imperative that we determine the optimal lag length for our model, as the Johansen cointegration test is sensitive to the number of lags chosen.

Lag order choice

We use the lag length selection criteria to determine the optimal lag length for our model. As mentioned earlier, we use the option 'no intercept or trend' as our trend deterministic assumption in this test. Table 4.2 below shows our lag order choice outcome.

Table 4.2 VAR Lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-588.2858	NA	2.956052	15.27306	15.72295	15.45330
1	-181.1271	731.8548	0.000186	5.598155	6.797875*	6.078800
2	-134.4354	78.01663	0.000109	5.048996	6.998542	5.830044*
3	-106.6264	42.94548*	0.000104*	4.977883	7.677254	6.059334
4	-81.44483	35.70045	0.000108	4.973287*	8.422483	6.355140
5	-59.75784	28.00093	0.000127	5.057160	9.256182	6.739417
6	-41.11828	21.70683	0.000167	5.218184	10.16703	7.200844
7	-24.08847	17.67651	0.000240	5.419961	11.11863	7.703024
8	3.932467	25.53806	0.000278	5.343482	11.79198	7.926947

* 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

HQ: Hannan-Quinn information criterion

We choose the lag length of 4 based on the result suggested by the Akaike Information Criterion (AIC). We do this because this lag length is the generally accepted lag order choice in empirical fiscal policy studies. This can be verified in studies by Blanchard & Perotti (2002), Ilzetzk et al (2010) and Kamps & Caldara (2008). A smaller lag length, as suggested by other criteria, can be rejected on economic grounds. This is because, theoretically, it takes more than one quarter for the effects of fiscal policy to be registered in the economy.

4.2.4 Johansen cointegration approach

Having made a decision on the lag order choice and the trend deterministic assumptions, we can now investigate if our model forms a long-run equilibrium relationship using the Johansen cointegration approach. Suffice to mention that the unit root tests in table 4.1 reveal that our series

exhibit I(*0*) and I(*1*) variables. Typically, the Johansen cointegration approach was designed to handle variables that are integrated I(*1*). However, Johansen (1991: 1560) argues that there is still no problem with combining I*(0*) and I(*1*) variables when testing for cointegration. This, he argues, is because, if some variables are I(*0*) instead of I(*1*), they will reveal themselves through cointegrating vectors whose space is spanned by the stationary variables in the model (Johansen, 1991: 1560).

As we mentioned in chapter 3, the Johansen cointegration approach has two tests for cointegration. These are the Trace test and the Maximum Eigenvalue tests.

4.2.4.1 Trace test

Table 4.3 below shows the results from the trace test for cointegration.

Table 4.3 Trace test: Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.307877	74.70842	60.06141	0.0018
At most 1 *	0.266434	44.53317	40.17493	0.0171
At most 2	0.151509	19.12646	24.27596	0.1946
At most 3	0.059812	5.654240	12.32090	0.4794
At most 4	0.007252	0.596833	4.129906	0.5012

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

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

In this test, we reject the null hypothesis that there is no cointegrating vector in our model. This is because at this rank (number of cointegrating vectors) the trace statistic value of approximately 74.71 is greater than the 5% critical value of about 60.06. Next, the null-hypothesis that there is at most 1 cointegration relationship, is also rejected, because at this rank the trace statistic value of approximately 44.53 is greater than the 5% critical value of about 40.17. We, however, do not reject the null hypothesis which states that there are at most 2 cointegrating relations. This is because at this rank the trace statistic value of approximately 19.13 is less than the 5% critical value of about 24.28.

4.2.4.2 Maximum Eigenvalue test

Table 4.4 below shows the results from the maximum Eigenvalue cointegration test.

Table 4.4 Maximum Eigenvalue test: Lags interval (in first differences): 1 to 4

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.307877	30.17525	30.43961	0.0539
At most 1 *	0.266434	25.40671	24.15921	0.0338
At most 2	0.151509	13.47222	17.79730	0.1990
At most 3	0.059812	5.057407	11.22480	0.4692
At most 4	0.007252	0.596833	4.129906	0.5012

Max-eigenvalue test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

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

In this test, we do not reject the null hypothesis, that there are no cointegrating relations. This is because at this rank the maximum Eigen statistic of approximately 30.18 is less than the 5% critical value of about 30.44.

Based on the two Johansen cointegration tests, we have two conflicting numbers of cointegrating relations. The trace test gives us 2, while the maximum Eigenvalue test gives us 0. Literature advises that either of the two tests can be used as a benchmark to determine the number of cointegrating vectors in the model (Lutkepohl et al, 2001: 305). These researchers conclude, however, that the Trace test produces more robust findings than the Eigenvalue test. This is because the trace test has more power when analysing more than one cointegrating relations, while the eigenvalue test is suitable in analysing one cointegrating relationship (Lutkepohl et al, 2001:305).

Based on the above analysis, we conclude that 2 is the total number of cointegrating relations we have in our model. This is desirable as we now know that our model forms an equilibrium relationship in the long run, and that we can run a VECM to use for determining causality in our model without getting spurious regressions. The other interesting finding in this test is that we have discovered that I(*0*) and I(*1*) variables are able to give us cointegrating relations. This conforms to the argument by Johansen (1991:1560) that variables with different levels of integration may be cointegrated. See also Harris (1995:80).

4.3 RESIDUAL DIAGNOSTIC CHECKS

Before we show our estimated results, it is necessary to begin by analysing the residuals from our estimated SVAR model. This analysis determines whether the results which we show in the next section, are efficient and reliable. We undertake the following residual diagnostic tests: serial correlation based on the Breusch-Godfrey serial correlation test, normality based on the Jarque-Bera test, and heteroskedasticity based on the White heteroskedasticity test. The null hypotheses for these diagnostic tests are that there is no serial correlation, no normality and no heteroskedasticity, respectively. In addition, we undertake inverse roots of AR characteristic polynomial in order to analyse the stability of our VAR.

4.3.1 Test for serial correlation or Autocorrelation

Correlation of a variable with itself over successive time periods (serial correlation) is a normal problem faced in time series analysis. Serial correlation can lead to the underestimation of standard errors, thereby making t-values to be overestimated. Our VAR estimates are suspect if our model exhibits serial correlation. We also highlighted in chapter 3 that the presence of serial correlation in the residuals is one indication that there could be an omitted important variable. Table 4.5 below is the Breusch-Godfrey serial correlation test with the null hypothesis stating that there is no serial correlation in our model. The test shows a value of about 1.015 for the observed R-squared, which is statistically insignificant at 5% level. Based on this finding, we cannot reject the null hypothesis of no serial correlation in our model. In other words, there is no serial correlation between the residuals and we do not have an important omitted variable in our model.

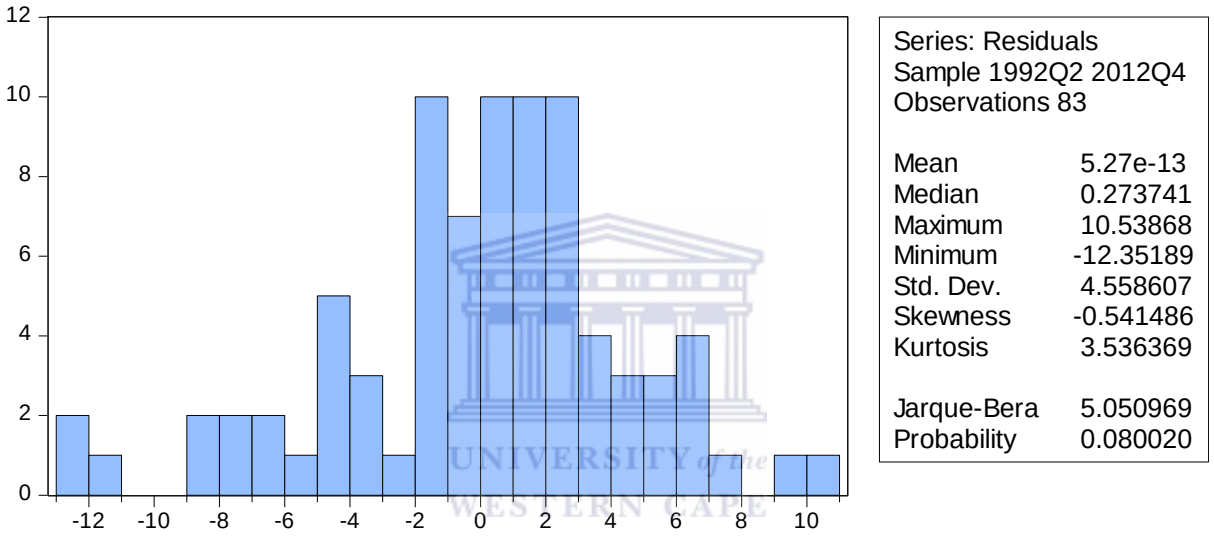
Table 4.5 Breusch-Godfrey Serial Correlation LM Test for our model

F-statistic	0.173335	Prob. F(4,56)	0.9512
Obs*R-squared	1.015060	Prob. Chi-Square(4)	0.9075

4.3.2 Normality test

We do the normality test to make sure that the estimated residuals are normal. A model with residuals that are not normally distributed cannot produce efficient estimates. Figure 4.1 below shows the Jarque-Bera test for normality, with a value of about 5.05, which is statistically insignificant at 5% level. Based on this test we do not reject the null hypothesis which states that the model is normal. In other words, the residuals in our model are normally distributed, and this is desirable in making our estimates efficient and unbiased.

Figure 4.1 Normality test



4.3.3 Heteroskedasticity test

Heteroskedasticity means that residuals do not have a constant variance. This results in a model having different probability distributions. We use the Breusch-Pagan-Godfrey test to test for heteroskedasticity. Based on the test in table 4.6, with an observed R-squared of about 17.95, which follows a Chi-square probability, we cannot reject at 5% level of significance the null hypothesis that our model has no heteroskedasticity. In other words, the residuals in our model are constant, and this is desirable in rendering our estimates efficient.

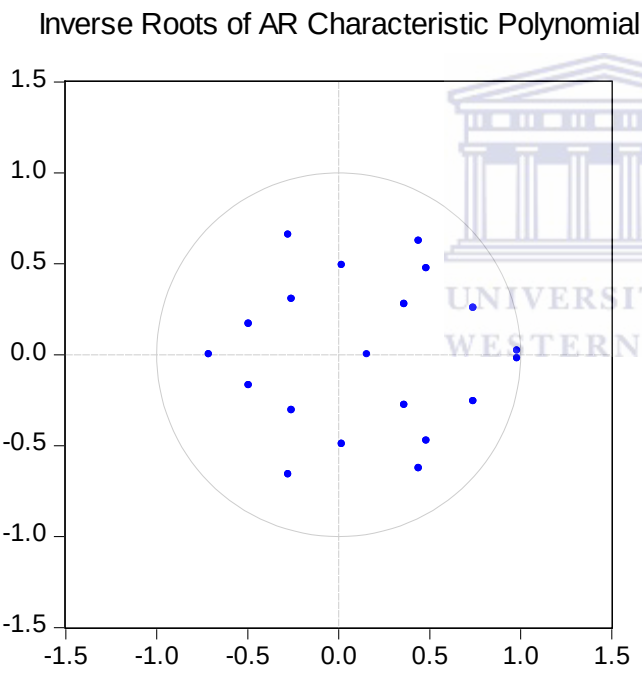
Table 4.6 Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.752450	Prob. F(22,60)	0.7669
Obs*R-squared	17.94779	Prob. Chi-Square(22)	0.7091
Scaled explained SS	11.89433	Prob. Chi-Square(22)	0.9595

4.3.4 Inverse Roots of AR Characteristic Polynomial

As we discussed in chapter 3, VAR models need to be tested for stability in order for their estimates to be credible. Figure 4.2 below shows that all the reported inverse roots of the AR polynomial have roots with modulus which are less than one and they lie within the unit circle. This indicates that our estimated VAR is stable and stationary. This is a very desirable result due to the fact that, if our VAR were not stable, results, such as the impulse response standard errors, would be invalid, thereby making the results and conclusions of our model unreliable.

Figure 4.2 Inverse roots of AR characteristic polynomial



4.4 EMPIRICAL RESULTS

We follow the standard practice in VAR analysis which requires us to report results on causality in the model, impulse responses and forecast error variance decomposition.

4.4.1 Causality

In this section, we are interested in finding out whether the independent variables are useful in predicting the values of our dependent variable, which is real GDP. These variables include: the real primary fiscal deficit as a percentage of GDP, real trade as a percentage of GDP, real effective exchange rate, real short-term interest rate, exchange-rate regimes dummy and the 2011 structural break. Of particular interest, is to find out whether this relationship exists in both the short-run and the long-run.

In chapter 3 we ascertained that the normal Granger causality test is not effective in multivariate models. As a result, we use the procedure suggested by Maddala & Kim (1998:297) of using the Vector Error Correction Model (VECM) to determine causality for the short-run and the long-run. To determine short-run causality, a Wald-coefficient restriction test is undertaken using the joint lagged coefficient values of the independent the variables derived from the VECM model (excluding the coefficient of the error correction term).

On the other hand, to determine long-run causality, the Error Correction Term (ECT) of the VECM model is used. If the ECT is statistically significant and its coefficient value is negative, it means that, in the long run, the independent variables can jointly predict the values of the dependent variable.

4.4.1.1 Short-run causality test

Table 4.7 below shows the results of the Wald-coefficient restriction test derived after running a VECM. The null hypothesis in this test states that the dependent variable (real GDP) is in the short-run not jointly caused by all the independent variables, c(77) to c(100). Based on the statistical significance at 5% of the Chi-square value of 271.9875, we reject the null hypothesis that the independent variables [c (77) to c (100)] jointly cannot cause a short-run change in the dependent variable. In other words, our independent variables, jointly, can cause a short-run change in real GDP. This is a desirable result.

Table 4.7 Wald-coefficient restriction test results

Wald Test:

Equation: Real GDP as caused by other variables

Test Statistic	Value	Df	Probability

F-statistic	11.33281	(24, 57)	0.0000
Chi-square	271.9875	24	0.0000

Null Hypothesis: C(77)=C(78)=C(79)=C(80)=C(81)=C(82)=
C(83)=C(84)=C(85)=C(86)=C(87)=C(88)=C(89)=C(90)=
C(91)=C(92)=C(93)=C(94)=C(95)=C(96)=C(97)=C(98)=
C(99)=C(100)=0

4.4.1.2 Long-run causality test

Table 4.8 below shows the regression involving real GDP as explained by the lagged coefficients of the other variables in our model. We obtained this regression from the VECM, which we ran. We are interested in coefficient 73, which corresponds to the Error Correction Term (ECT). As we stated earlier, this test is based on the statistical significance of the ECT. The null hypothesis for this test is that the independent variables jointly cause the dependent variable in the long run. In order for the ECT to be accepted as a determinant of long-run causality in the VECM model, its coefficient must have a negative sign. From table 4.5, the ECT coefficient of about -2.54 has a correct sign, which is desirable. However, this coefficient is not statistically significant at 5% level. Our conclusion therefore, is that in the long-run, there is no causality from the independent variables to the dependent variable.

Table 4.8 Vector Error Correction Model results for the ECT

Dependent Variable: D(real GDP)
Method: Least Squares
Date: 03/24/13 Time: 19:01
Sample (adjusted): 1992Q3 2012Q4
Included observations: 82 after adjustments
D(real GDP) = C(73)*(F(-1) - 4.75019623249*X(-1) - 1.04059138528*O(-1) +
0.780286327946*B(-1)) + C(74)*(T(-1) - 4.7261647684*X(-1) -
0.268526560153*O(-1) - 0.097226364125*B(-1)) + C(75)*D(F(-1)) +
C(76)*D(F(-2)) + C(77)*D(F(-3)) + C(78)*D(F(-4)) + C(79)*D(T(-1)) +
C(80)*D(T(-2)) + C(81)*D(T(-3)) + C(82)*D(T(-4)) + C(83)*D(X(-1)) +
C(84)*D(X(-2)) + C(85)*D(X(-3)) + C(86)*D(X(-4)) + C(87)*D(O(-1)) +
C(88)*D(O(-2)) + C(89)*D(O(-3)) + C(90)*D(O(-4)) + C(91)*D(B(-1)) +
C(92)*D(B(-2)) + C(93)*D(B(-3)) + C(94)*D(B(-4)) + C(95)*DUMREG +
C(96)*DUM11

	Coefficient	Std. Error	t-Statistic	Prob.

C(73) or Error Correction				
Term	-2.54E-05	5.54E-05	-0.458245	0.6485
C(74)	-2.53E-05	9.89E-05	-0.255391	0.7993
C(75)	0.000344	0.000750	0.458914	0.6480
C(76)	-0.000137	0.000844	-0.161919	0.8719
C(77)	0.000674	0.000852	0.790882	0.4322
C(78)	0.001640	0.000720	2.278041	0.0264
C(79)	-0.008392	0.029767	-0.281904	0.7790
C(80)	-0.034423	0.027967	-1.230848	0.2233
C(81)	0.000381	0.028127	0.013548	0.9892
C(82)	-0.018567	0.030466	-0.609419	0.5446
C(83)	-9.03E-05	0.000288	-0.313504	0.7550
C(84)	-0.000229	0.000251	-0.910946	0.3661
C(85)	6.88E-06	0.000211	0.032654	0.9741
C(86)	5.62E-05	0.000142	0.395632	0.6938
C(87)	0.842154	0.134229	6.273988	0.0000
C(88)	-0.173720	0.176822	-0.982457	0.3300
C(89)	0.028957	0.182892	0.158327	0.8747
C(90)	-0.045461	0.156101	-0.291229	0.7719
C(91)	1.70E-05	4.22E-05	0.402234	0.6890
C(92)	-6.46E-06	3.60E-05	-0.179152	0.8584
C(93)	1.34E-05	3.09E-05	0.434186	0.6658
C(94)	-9.24E-06	2.68E-05	-0.344705	0.7316
C(95)	0.003021	0.001533	1.970776	0.0535
C(96)	0.000217	0.002946	0.073579	0.9416

R-squared	0.527462	Mean dependent var	0.007558
Adjusted R-squared	0.340076	S.D. dependent var	0.006368
S.E. of regression	0.005173	Akaike info criterion	-7.451489
Sum squared resid	0.001552	Schwarz criterion	-6.747084
Log likelihood	329.5111	Hannan-Quinn criter.	-7.168681
Durbin-Watson stat	1.944941		

4.4.2 Impulse Response Functions (IRFs) analysis

SVAR models are easily interpreted with Impulse Response Functions (IRFs). We are interested in investigating the short-run and long-run IRFs. In line with Boussard et al (2012:5), we take the short-run to represent a time gap of one year (four quarters) from the time the fiscal shock first occurred, and the long-run as a period of three years (12 quarters) from the time the fiscal shock first took place.

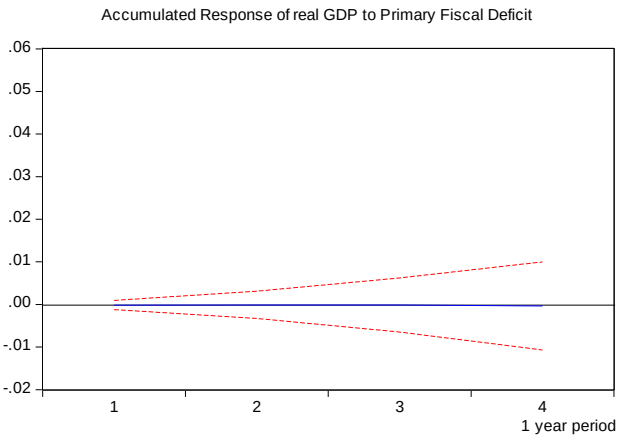
In our interpretation of the IRFs, we take the procedure of reporting responses, using the 'cumulative impulse response measure'. Hereafter, we refer to the cumulative impulse response measure as the 'cumulative response' or 'accumulated response'. The cumulative response analysis investigates the cumulative change in a variable, say real GDP over a given time horizon *N*, in response to cumulative changes in a variable like primary fiscal deficit over the same time horizon *N*.

Since the economic stimulative effect of fiscal deficits, depends not only on the increase in fiscal deficits but also on other variables, we restate that we included in our model other variables that are most important in influencing the effectiveness of fiscal deficits in stimulating economic growth. The mechanism through which those variables influence the potency of fiscal deficits is incorporated in our analysis of the IRF results.

4.4.2.1 Short and long- run cumulative response of real GDP to primary fiscal deficit

We begin our analysis by investigating the short-run IRF for the relationship between the key variables in our model. In this relationship, we analyse the response of real GDP to a one standard deviation positive shock in the primary fiscal deficit. Results based on the accumulated response measures in figure 4.3 below indicate that, in the short-run, the response of real GDP to a one standard deviation positive shock in the primary fiscal deficit is negligible or zero.

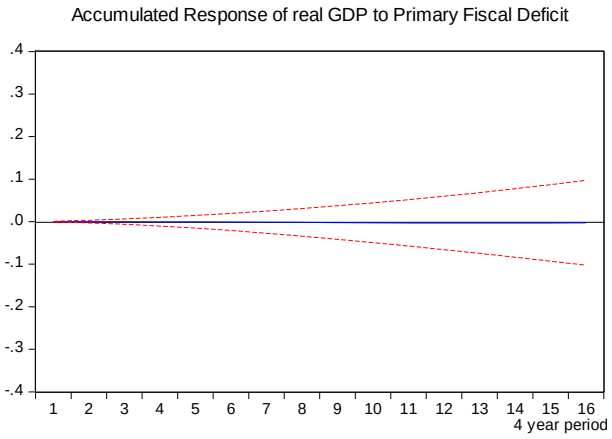
Figure 4.3 Short run response of real GDP to primary fiscal deficit



Since, in the above analysis, we find no significant change in real GDP to a change in the primary fiscal deficit, we can now state that there is a zero short-run response of real GDP to an increase in the primary fiscal deficit.

In the long-run, the IRF in figure 4.4 below shows that just as in the case of the short-run, the long-run response of real GDP to a one unit positive standard deviation shock in the primary fiscal deficit is almost zero.

Figure 4.4 Long-run response of real GDP to primary fiscal deficit



The results show that the response of real GDP to the primary fiscal deficit is negligible. We can now state that there is a zero long-run response of real GDP to an increase in the primary fiscal deficit.

Fiscal deficits lead to a positive effect on economic growth, our null hypothesis (H_0). The alternative hypothesis (H_1), states that a fiscal deficit has an effect on economic growth which is equal to or less than zero

These results provide an answer to our research hypotheses which, once again, state as follows: Fiscal deficits lead to a positive effect on economic growth in South Africa, as the null hypothesis; and fiscal deficits in South Africa have an effect on economic growth which is equal to or less than zero, as the alternative hypothesis.

Based on the above results, we reject the null hypothesis and conclude that fiscal deficits are not effective in stimulating both short-run and long-run economic growth in South Africa. This conclusion is quite similar to findings established by other related studies on South Africa. Jooste et al (2001:1), using the same methodology as ours, conclude that fiscal deficits in South Africa have a negative effect sometimes and positive one at other times. Our results fall between the Jooste et al (2001:1) findings. In terms of the long-run impact, our results are consistent with those of Jooste et al (2001:1) who also find a negligible effect. Ocran (2009:14) finds a negligible effect of fiscal deficits on economic growth. Clearly, these findings bring questions to the potency of discretionary fiscal policy in South Africa. We find the following factors to be credible in explaining the impotency of discretionary fiscal policy in South Africa:

4.4.2.2 Short and long-run cumulative response of primary fiscal deficit to real GDP

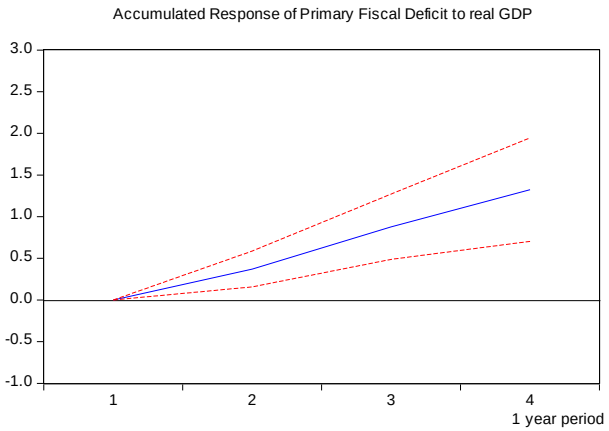
In this section, we analyse the state of automatic stabilisers in South Africa, and how it impacts the effectiveness of discretionary fiscal policy. The state of automatic stabilisers in our model is captured by the response of the primary fiscal deficit to a change in real GDP. Our interest is more in establishing whether automatic stabilisers in South Africa are strong.

Based on figure 4.5 below a one unit positive standard deviation shock in real GDP causes a rise in the primary fiscal deficit. This outcome portrays a scenario of small or weak automatic stabilisers in South Africa. If automatic stabilisers were strong, an increase in real GDP should have been associated with a fall in the primary fiscal deficit. Interestingly, our study is not the first one to make such a claim. Swanepoel & Schoeman (2003:566) find no significant evidence of automatic stabilisers in South Africa.

Suescun (2007:29) points out that, small fiscal automatic stabilisers tend not to be responsive to cyclical conditions and thus, have a weak anti-cyclical capacity to business fluctuations. Hoppner (2002:16) points out that, weak automatic stabilisers render discretionary fiscal policy ineffective in smoothening out business cycles. See also Swanepoel & Schoeman (2003:572). Discretionary fiscal policy works well when it is reinforced by automatic stabilisers. This is because, with strong automatic stabilisers, spending through transfer payments increases, while taxes automatically fall during economic downturns. This helps to stimulate the economy.

In view of the fact that our study finds weak short-run automatic stabilisers, we make the claim that this could explain why we obtained a zero response in economic growth to changes in fiscal deficits.

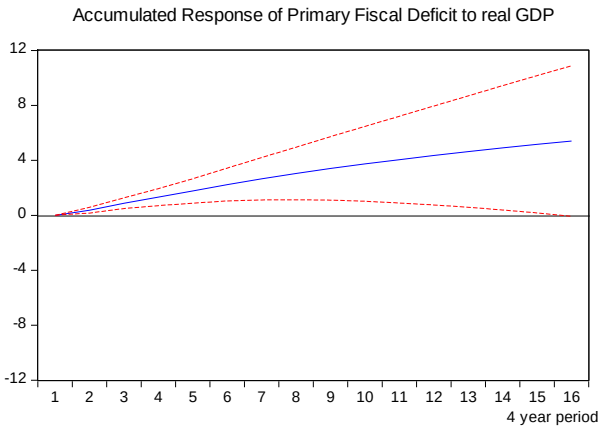
Figure 4.5 Short-run response of primary fiscal deficit to real GDP



In the long-run, we still find that automatic stabilisers are weak. Figure 4.6 below portrays weak long-run automatic stabilisers in South Africa. For the same reasons we gave above, we believe this

could explain why we obtained a zero long-run response of economic growth to changes in fiscal deficits.

Figure 4.6 Long-run response of primary fiscal deficit to real GDP



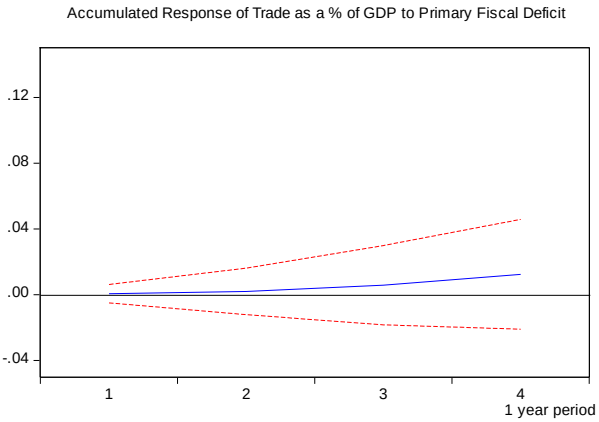
4.4.2.3 Short and long-run cumulative response of trade as a % of GDP to primary deficit

The next analysis refers to the extent to which the degree of openness to trade can offset the economic stimulative effect of fiscal deficits. We discussed in chapter 2 that more open economies render fiscal policy ineffective because fiscal stimuli may be leaked out of the economy through imports. See among others Spilimbergo et al (2009:2) and Ilzetzki et al (2010:6).

We use trade as a percentage of GDP to assess whether fiscal deficits are leaked out of the economy through increased imports. An increase in trade as a percentage of GDP due to a positive shock in the primary fiscal deficit indicates that the fiscal deficit is leaked out of the economy through imports. We are aware that trade as a percentage of GDP can increase due to an increase in exports, as well. However, we contend that, if trade as a percentage of GDP increases due to the rise in exports, this effect should lead to a positive impact on real GDP. Failure to do so makes us claim that the increase in trade as a percentage of GDP emanates from the rise in imports.

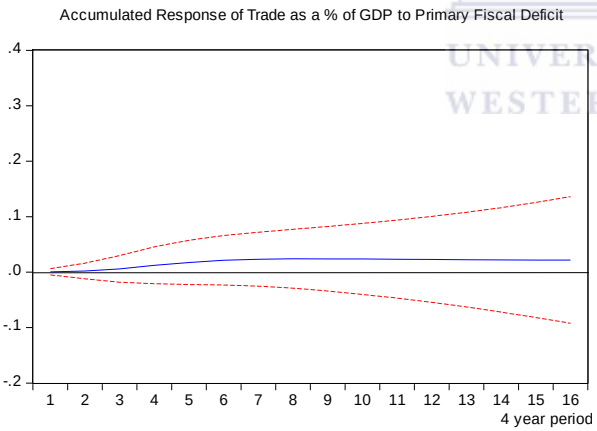
Figure 4.7 below shows the short-run response of trade as a percentage of GDP to a one unit positive standard deviation shock in the primary fiscal deficit. We find a positive IRF. We claim that this outcome is attributed to the leakage of the fiscal deficit through increased imports. Because of that, the economic stimulative effect of fiscal deficits was offset by leakages through increased imports. This possibly explains why we obtained a zero response of economic growth to changes in fiscal deficits.

Figure 4.7 Short-run response of trade as a % of GDP to primary fiscal deficit



In terms of the long-run relationship for these variables, figure 4.8 below reports a positive cumulative response. Based on this response result, we contend that the long-run economic stimulative effect of the primary fiscal deficit was offset by the leakages through increased imports. We believe that this could explain why we obtained a zero response of economic growth to changes in fiscal deficits.

Figure 4.8 Long-run response of trade as a % of GDP to primary fiscal deficit



4.4.2.4 Short and long-run cumulative response of the real interest rate to the primary deficit

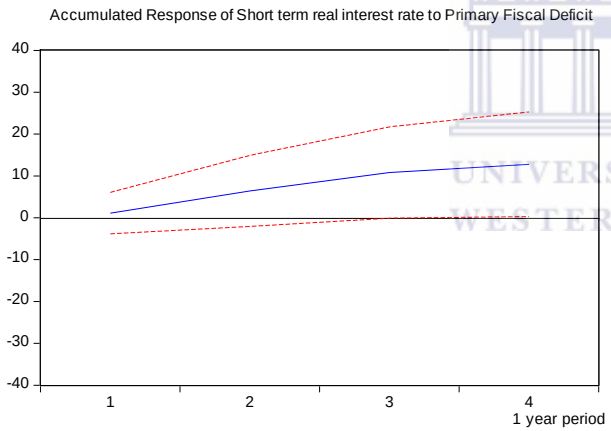
In this section, we assess whether fiscal deficits lead to the rise in interest rates. Perhaps, the most cogent argument against fiscal deficits, particularly by the neoclassical economists, is that they lead to an increase in interest rates which then dampen or crowd-out private investment. The crowding-out of private investment offsets the economic stimulative effect of fiscal deficits. Interestingly, the new Keynesians, like Eisner (1989:89), acknowledge that fiscal deficits do raise interest rates. However, to them, fiscal deficits are important for improving business confidence, such that,

regardless of the level of interest rate, private investment would still occur, guaranteeing an increase in GDP.

From the two schools of thought, figure 4.9 below helps to ascertain the claim which conforms to our empirical findings. From figure 4.9, a one unit short run positive standard deviation shock in the primary fiscal deficit leads to a positive change in the short-term real interest rate. So far, both schools of thought are correct in their predictions. However, we argue that the neoclassical prediction is consistent with our findings, that is, there is a rise in interest rates which is associated with a fall in real GDP. On the other hand, the new Keynesian prediction fails on the basis that the rise in the interest rate is, in our case, not associated with an increase in real GDP.

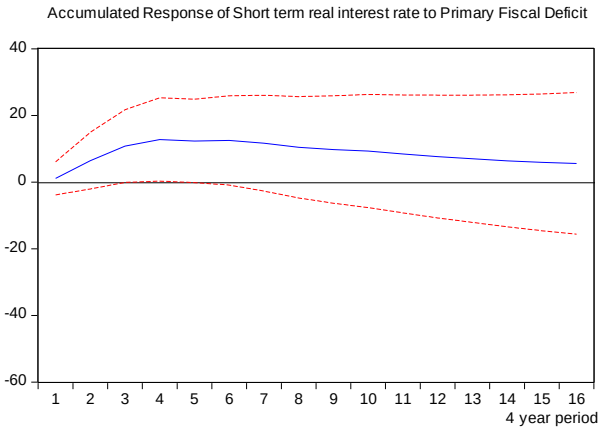
Our conclusion is that, the short-run economic stimulative effect of the primary fiscal deficit was offset by the dampening effect of the rise in interest rates on private investment. This could explain why we obtained a zero response of economic growth to changes in fiscal deficits.

Figure 4.9 Short-run response of the short-term real interest rate to primary fiscal deficit



In terms of the long-run relationship for these variables, figure 4.10 below shows an increase in the short-term real interest rate to a one unit positive standard deviation shock in the primary fiscal deficit. We conclude that the long-run economic stimulative effect of fiscal deficits was offset by the crowding-out of private investment. This could potentially explain why we found a long-run fiscal multiplier which is less than one.

Figure 4.10 Long-run response of short-term real interest rate to primary deficit

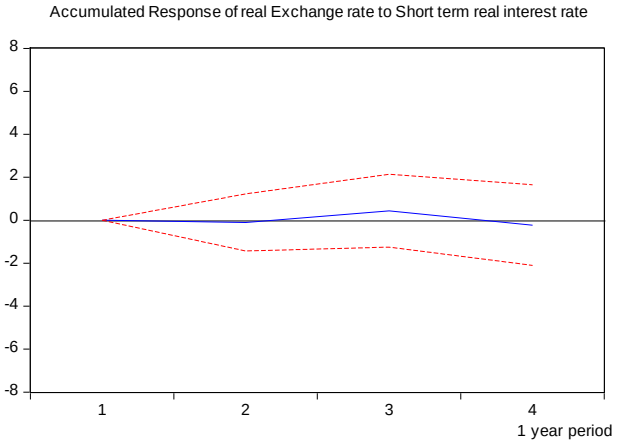


4.4.2.5 Short and long-run cumulative response of real effective exchange-rate to real interest rate

In this section, we make an analysis that fiscal deficits lead to the rise in interest rates. This rise in interest rates creates room for the appreciation of the real exchange-rate, which then causes a trade deficit, and hampers GDP. In chapter 2, we made reference to the Mundell-Fleming framework which posits that fiscal policy is ineffective in economies where capital is mobile. The justification for this argument was that fiscal deficits lead to the rise in interest rates, which we have already established in the section above. This rise in interest rates leads to increased capital inflows, which cause the real appreciation of the exchange rate. The appreciation of the real effective exchange-rate leads to a trade deficit, in addition to the fiscal deficit, ending in what is called the "twin deficit hypothesis" which we mentioned in chapter 2. These reactions offset the economic stimulative effect of fiscal deficits.

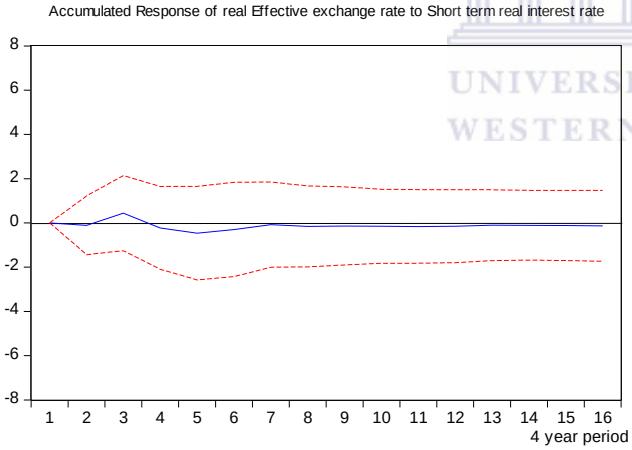
Focusing on the results from our SVAR, figure 4.11 below shows the response of the real effective exchange-rate to a one unit short run positive standard deviation shock to the short-term real interest rate. There is a noticeable amount of appreciation of the real effective exchange-rate, although not throughout the entire short-term period. This appreciation of the real effective exchange-rate could have led to a trade deficit, thereby offsetting the short-run economic stimulative effect of the fiscal deficit. Barro (1981:1109) reaches this same conclusion about the economic effect of fiscal policy. We, therefore, believe this could explain why we obtained a zero short-run fiscal impact of fiscal deficits on economic growth.

Figure 4.11 Short-run response of real effective exchange-rate to short-term real interest rate



As for the long-run relationship for these variables, figure 4.12 below shows that the change in the real effective exchange-rate, due to a one unit positive standard deviation shock, is almost negligible. We conclude that the relationship between these variables had a negligible effect on the long-run effect of fiscal deficits.

Figure 4.12 Long-run response of real effective exchange-rate to short-term real interest rate



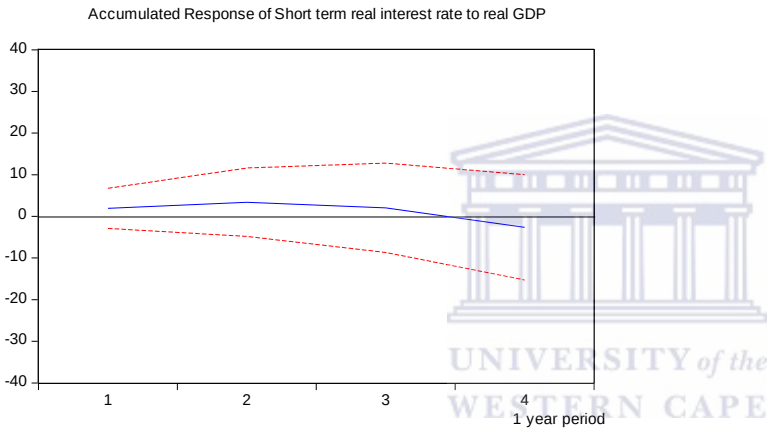
4.4.2.6 Short and long-run cumulative response of short-term real interest rate to real GDP

In this section, we are interested in assessing the impact of the monetary policy framework of inflation-targeting on the effectiveness of fiscal policy. Christiano et al (2009:80) and Spilimbergo et al (2009:3) argued that fiscal stimuli are a failure under inflation targeting monetary policy. This is because, under inflation-targeting, the monetary authorities adjust the short-term interest rate in response to deviations of GDP and inflation from their steady-state levels (Jooste et al, 2012:7). In this case, the active role of monetary policy to maintain a certain desired level of inflation or output through changes in the interest rate might offset the economic stimulative effect of fiscal deficits.

The SARB follows this approach. Because of that, we expect that an increase in real GDP should result in an increase in the short-term real interest rate in order for the SARB to maintain inflation and GDP in their steady state. In other words, we expect an offsetting effect of the economic stimulative effect of fiscal deficits through the raising of interest rates by the SARB.

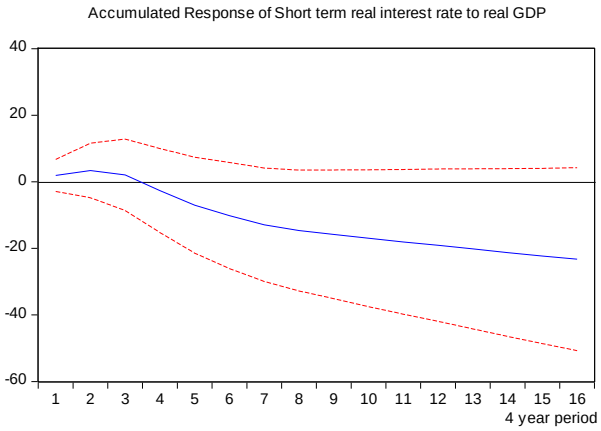
Figure 4.13 below, confirms the active role of the SARB. The short-term real interest rate rises due to a one unit positive standard deviation shock in real GDP. We argue that this active role of the SARB had an offsetting economic stimulative effect of the primary fiscal deficit. Thus, inflation-targeting monetary policy of the SARB could have contributed towards the ineffectiveness of fiscal deficits on economic growth.

Figure 4.13 Short-run response of the short-term real interest rate to real GDP



In the long-run, we find results which do not confirm our expectations, as can be seen in figure 4.14 below. We see a negative response of the short-term real interest rate to an increase in real GDP. This result reveals that the SARB was more interested in the continued stimulation of long-run economic growth. This could also explain why South Africa's inflation rate over the years has been bordering the upper limit of the targeted range.

Figure 4.14 Long-run response of short-term real interest rate to real GDP

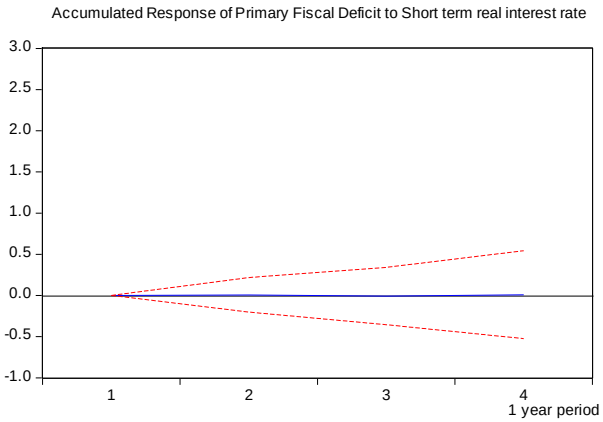


4.4.2.7 Short and long-run cumulative response of primary deficit to short-term real interest rate

In this section, we are interested in making one attempt of assessing the consistency of relationships in our model. We do so by analysing the response of the primary fiscal deficit to an increase in the short-term real interest. In chapter 3, we mentioned that one of the reasons we ordered the interest rate variable after the primary fiscal deficit variable was to assess whether the primary fiscal deficit can react to interest rate changes. Since the primary fiscal deficit excludes interest payments, if our estimates are consistent, it means that this variable should not react to changes in the short-term real interest rate.

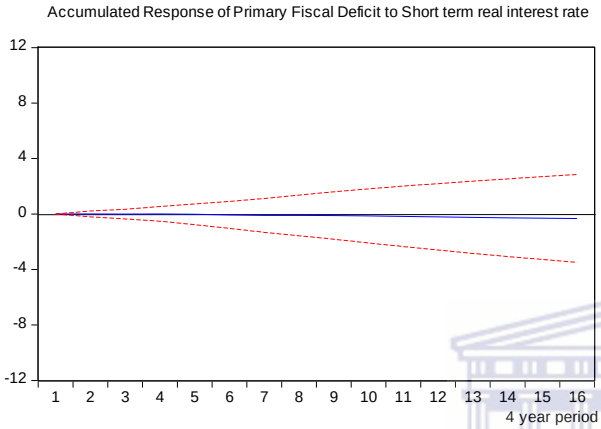
Figure 4.15 below demonstrates that the primary fiscal deficit has a negligible short-run response to a one unit positive standard deviation shock in the short-term real interest rate. This result is in accordance with what we expected. It is an indication of consistency in our model.

Figure 4.15 Short-run response of primary fiscal deficit to short-term real interest rate



In the long-run, figure 4.16 below shows a slight negative response of the primary fiscal deficit to a one unit positive standard deviation shock to the short-term real interest rate. This result is contrary to what we expected. However, undertaking an experiment of testing the consistency of the estimates from data series in the manner we do, comes at a risk. This is because national accounts data are never objective enough, and thus, will often fail the type of consistency test that we have just applied.

Figure 4.16 Long-run response of primary fiscal deficit to short-term real interest rate



4.4.3 Forecast Error Variance Decomposition (FEVD)

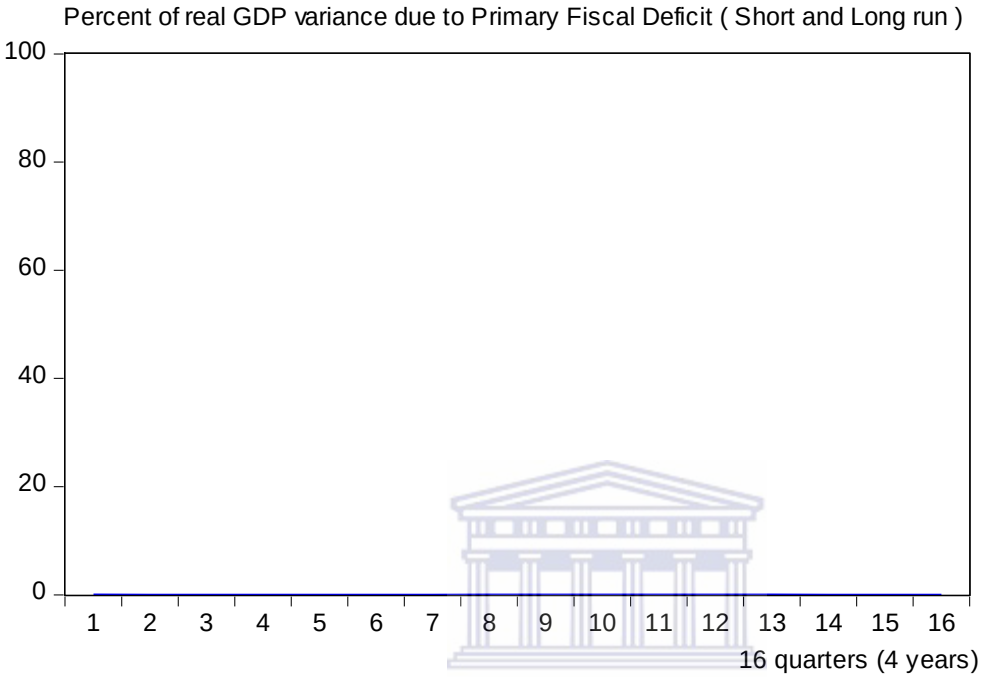
In consonance with the standard practice when showing findings for VAR models, we also report results from the Forecast Error Variance Decomposition (FEVD). Once again, this reports the strength of a given shock in explaining the changes that occur in another variable. This is necessary as it helps us to gauge the relevance of a given variable in influencing another variable. It also helps us to assess the consistency of the analyses we made under the IRFs. We report the short-run and long-run FEVD for each relationship using the same graph. As before, the short-run is a period up to 4 quarters (1 year), while the long-run is a period of 12 quarters (3 years) and beyond. A tabular FEVD is provided at the end of this section particularly to analyse the variables that had the greatest influence in offsetting the economic stimulative effect of fiscal deficits.

4.4.3.1 Short and long-run real GDP variance due to primary fiscal deficit

In this section, we are interested in finding out the extent to which the primary fiscal deficit can influence changes in real GDP. As can be seen in figure 4.17, the primary fiscal deficit has almost a 0% influence on real GDP, both in the short-run and long-run. This tallies well with the results which

we reported using the IRFs, where real GDP remained zero after an increase in the primary fiscal deficit. It is, therefore, correct for us to conclude that the primary fiscal deficit in South Africa has no stimulative effect on real GDP.

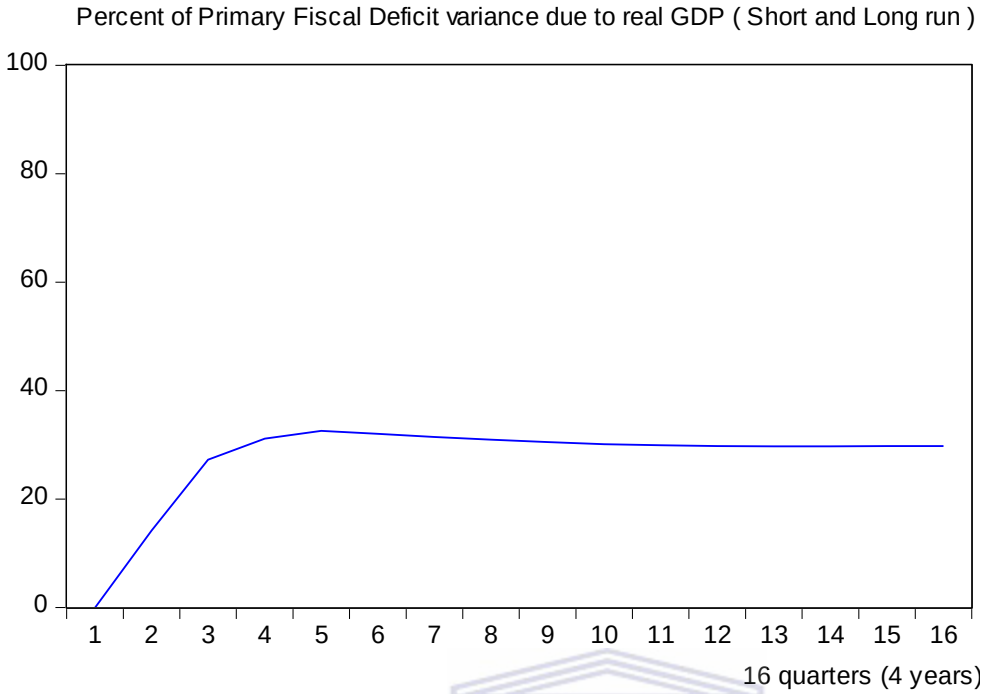
Figure 4.17 Real GDP variance due to primary fiscal deficit



4.4.3.2 Short and long-run primary fiscal deficit variance due to real GDP

According to figure 4.18 below, real GDP explains over 35% of variations taking place in the primary fiscal deficit. As we established when we analysed the IRFs, this variation relates to the increase in the primary fiscal deficit, which explains the case of very weak automatic stabilisers. As can be seen in the figure below, our results are almost in line with those of Swanepoel & Schoeman (2003:256) who find no evidence of the presence of automatic stabilisers in South Africa. Because of that, we once again, believe that weak automatic stabilisers could explain why we found a zero short-run and long-run response of economic growth to changes in fiscal deficits.

Figure 4.18 Primary fiscal deficit variance due to real GDP

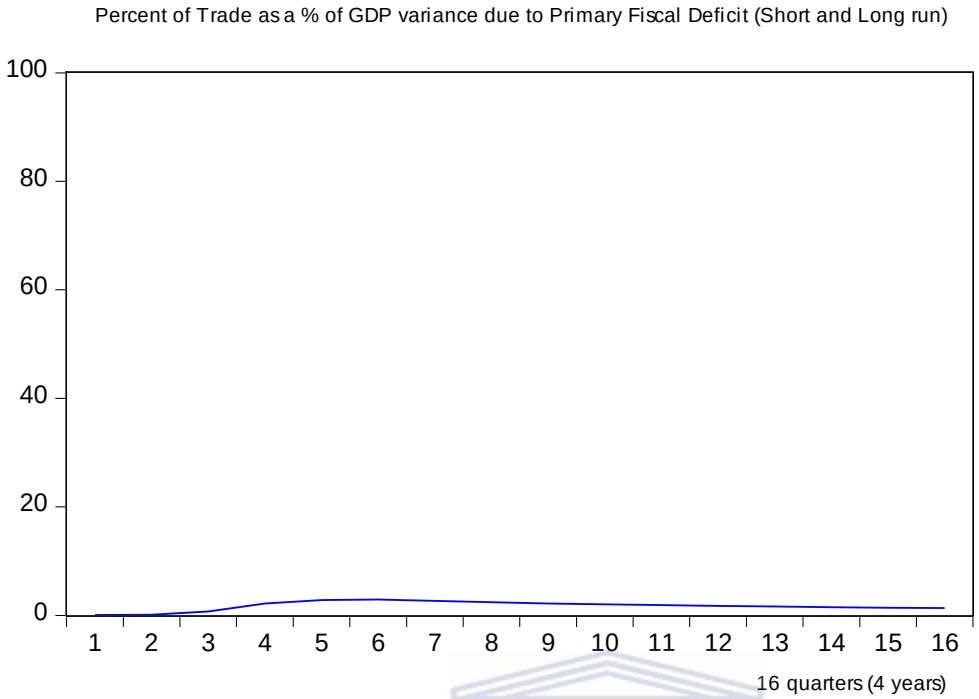


4.4.3.3 Short and long-run trade as a % of GDP variance due to primary fiscal deficit

In this section, we want to assess if the primary fiscal deficit has an influence in the increase in trade as a share of GDP. In our context, we have already established that the increase in trade as a percentage of GDP may have possibly been as a consequence of the primary fiscal deficit being leaked out through imports. In analysing the FEVD, we therefore look at the extent to which the primary fiscal deficit might have led to leakages through increased imports.

Figure 4.19 below shows a positive contribution of the primary fiscal deficit towards leakages through increased imports. This is in line with the analysis we made under the IRF analysis. Our conclusion is that, this outcome could explain why we found a zero short-run and long-run impact of fiscal deficits on economic growth.

Figure 4.19 Trade as a % of GDP variance due to primary fiscal deficit

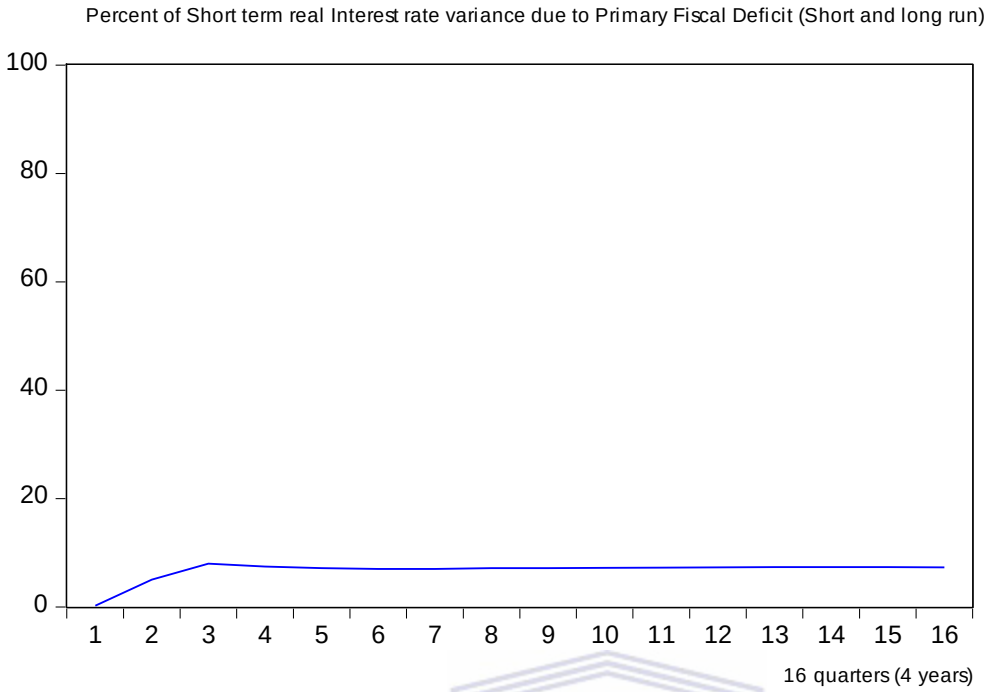


4.4.3.4 Short and long-run short term real interest rate variance due to primary fiscal deficit

In this section, we analyse the extent to which the primary fiscal deficit could explain the rise in interest rates, thereby, possibly causing what is commonly known as the crowding-out of private investment.

Figure 4.20 below shows that a shock in the primary fiscal deficit does contribute about 8% of the rise in the short-term real interest rate. Once again, this is consistent with our arguments under the IRF analysis that an increase in the primary fiscal deficit leads to a rise in the short-term real interest rate. Since our study finds a zero change in real GDP, we once again, claim that the economic stimulative effect of the primary fiscal deficit could have been offset by the dampening effect of the rise in the short-term real interest rate, both in the short-run and long-run.

Figure 4.20 Short-term real interest rate variance due to primary fiscal deficit

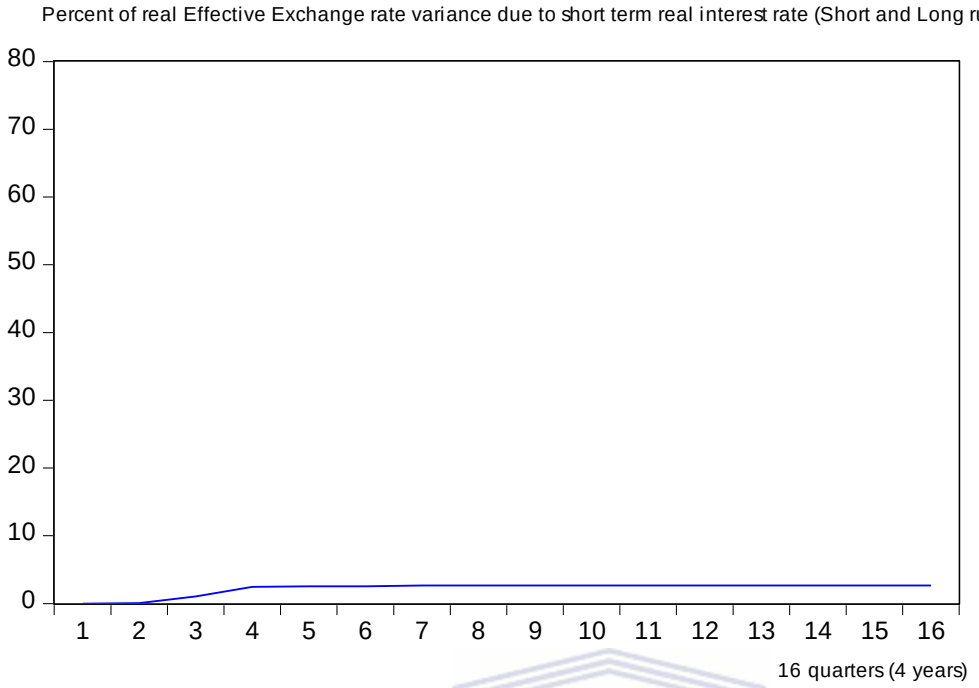


4.4.3.5 Short and long-run real effective exchange-rate variance due to real interest rate

In this section, we are interested in assessing the extent to which the short-term real interest rate could have influenced changes in the real effective exchange-rate. This assessment comes as a result of the Mundell-Fleming argument, made above, that fiscal deficits lead to a rise in interest rates. If capital is mobile in the economy, this could lead to an increase in capital inflows which then causes an appreciation of the real exchange-rate.

Figure 4.21 below, shows that a shock in the primary fiscal deficit has a positive contribution towards the appreciation of the real effective exchange-rate, both in the short-run and long-run. This is in line with our analysis under the IRFs where we established that an increase in the short-term real interest resulting from a fiscal stimulus would lead to the appreciation of the real effective exchange- rate. The appreciation of the real effective exchange-rate could have led to a trade deficit, thereby thwarting real GDP. As a result we are led to conclude that the economic stimulative effect of the fiscal deficit could have been offset by the increase in the trade deficit emanating from the appreciation of the real effective exchange-rate.

Figure 4.21 Real effective exchange rate variance due to short-term real interest rate

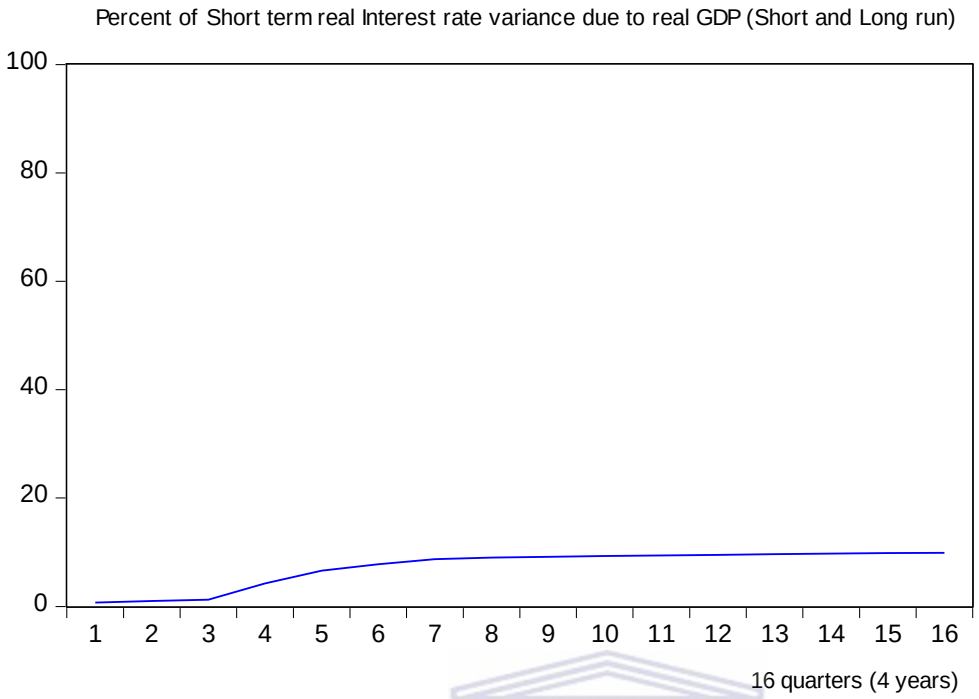


4.4.3.6 Short and long-run short-term real interest rate variance due to real GDP

Once again, South Africa pursues an inflation-targeting monetary policy. As we established earlier, the SARB adjusts the short-term real interest rate in response to deviations of real GDP and inflation from their steady state. In our case, we are interested in finding out the extent to which real GDP influences the SARB to change the short-term real interest rate.

From figure 4.22, we see that the percentage impact of real GDP on changes that take place in the short-term real interest rate is positive, both in the short-run and long-run. This implies that, real GDP contains information upon which the SARB bases its inflation-targeting monetary policy. As we mentioned earlier, the SARB reacts to this information by changing the short-term real interest rate, as can be seen in figure 4.22 below. We therefore conclude that the zero response of real GDP to changes in fiscal deficits we obtained could be attributed to the offsetting effects of the SARB's need to comply with the inflation-targeting monetary policy.

Figure 4.22 Short-term real interest rate variance due to real GDP

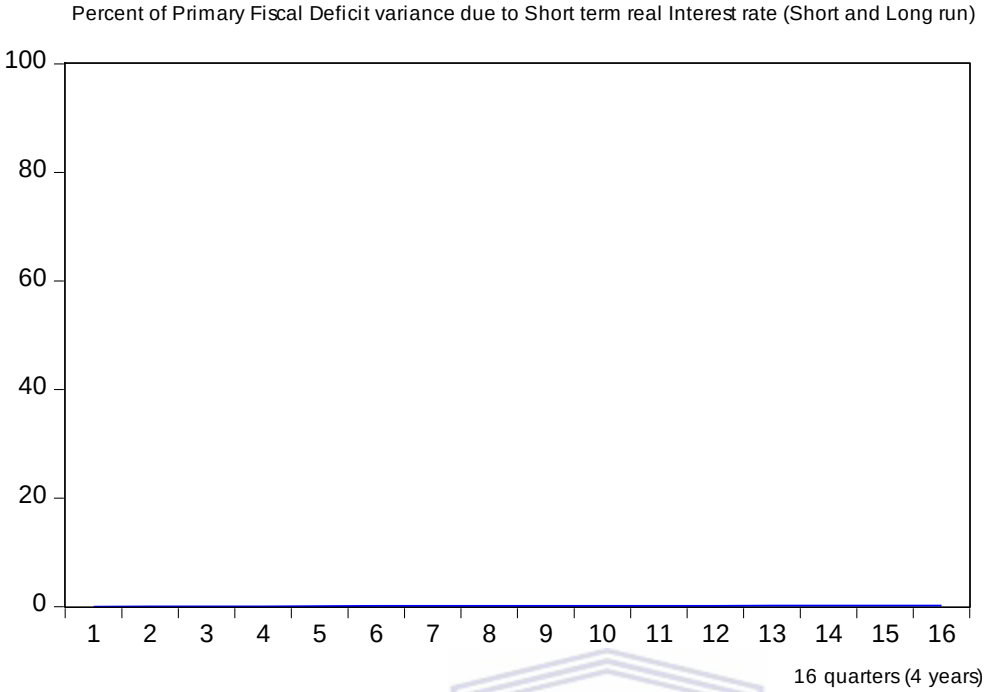


4.4.3.7 Short and long-run primary fiscal deficit variance due to short-term real interest rate

Finally, in this section, we attempt to assess the consistency of our estimates through gauging the extent to which the short-term real interest rate can influence the primary fiscal deficit. Since we calculate the primary fiscal deficit by subtracting interest payments, we expect that the short-term real interest rate should have a 0% influence on the primary fiscal deficit.

Figure 4.23 below shows exactly what we expected. This proves that our estimates between the primary fiscal deficit and the short-term real interest rate are consistent. In addition, our FEVD results help us to clarify the unclear findings we obtained under the IRF analysis where there was a slight response of the primary fiscal deficit to a change in the short-term real interest rate.

Figure 4.23 Primary fiscal deficit variance due to short-term real interest rate



4.4.3.8 Variance decomposition table for real GDP

In this segment, we are interested in finding out the variables which had the greatest influence in the variations of real GDP. The variables that had the greatest influence are taken to have had a dominant offsetting effect on the stimulative effort of the primary fiscal deficit. Table 4.6 below shows percentage contributions of each variable shock towards changes in real GDP at different forecast periods.

Table 4.9 Variance decomposition of real GDP:

Period	S.E.	Deficit	Trade as % GDP	Effective exchange rate	real GDP	Interest rate
1	0.004967	0.088613	5.225305	0.004531	94.68155	0.000000
2	0.009877	0.023607	2.631257	0.159388	97.16347	0.022281
3	0.014398	0.011601	1.238955	0.114694	98.62114	0.013608
4	0.018589	0.020282	2.451430	0.096163	97.41165	0.020473
5	0.022722	0.018786	5.839806	0.083378	94.03788	0.020152
6	0.026651	0.023880	9.252071	0.065732	90.63263	0.025688
7	0.030347	0.038119	11.95656	0.051668	87.92511	0.028544
8	0.033757	0.053688	13.88540	0.063217	85.96785	0.029839
9	0.036930	0.062067	15.29862	0.089850	84.52219	0.027279

10	0.039943	0.064886	16.41420	0.122034	83.37496	0.023916
11	0.042866	0.062052	17.35487	0.153523	82.40878	0.020767
12	0.045714	0.056842	18.13869	0.181079	81.60507	0.018320
13	0.048496	0.050990	18.78876	0.205007	80.93890	0.016345
14	0.051209	0.045743	19.33151	0.227530	80.38053	0.014683
15	0.053852	0.042291	19.80048	0.247265	79.89666	0.013299
16	0.056431	0.041540	20.22654	0.263539	79.45623	0.012147

In table 4.9 above, we notice that real GDP had the greatest short-run influence on itself, explaining about 97% of fluctuations in itself. It is followed by Trade as a percentage of GDP, with about 2% contribution. After that, the real effective exchange rate follows. The last ones are the short term real interest rate and the primary fiscal deficit.

In the long run, the influence of real GDP on itself declines, while the influence of trade as a percentage of GDP, real effective exchange-rate, primary fiscal deficit and short-term real interest rate increase, in that order.

We can claim, therefore, that the economic stimulative effect of fiscal deficits was offset by the influence of other variables. The influence of those variables can be ranked, starting with the strongest, as follows: trade as a percentage of GDP, which captures leakages through imports; real effective exchange-rate, which captures the trade dampening effect of the appreciation of the exchange-rate; fiscal deficit, and the short-term real interest rate, which captures the crowding out of private investment.

4.5 CONCLUSION

We undertook this chapter in order to test the research hypotheses: Fiscal deficits lead to a positive effect on economic growth, as our null hypothesis. The alternative hypothesis, on the other hand, stated that fiscal deficits have an effect on economic growth which is equal to or less than zero. We used macroeconomic time series data ranging from 1991 to 2012 to apply an SVAR model. We implemented all the necessary measures required to ensure that our series were made stationary and suitable for our SVAR model. Based on the IRF and FEVD analyses, we rejected the null hypothesis that fiscal deficits in South Africa lead to a positive effect on economic growth. We, therefore, establish that fiscal deficits in South Africa generate a zero short-run and long-run impact on economic growth, and conclude that they are not effective in stimulating economic growth. We

analysed the different factors that could have led to this outcome. Basically, these factors explain how the economic stimulative effect of fiscal deficits was offset. They include: weak automatic stabilisers, openness to trade, real appreciation of the exchange-rate, crowding-out of private investment, and the fact that the SARB pursues an inflation-targeting monetary policy. These findings are efficient and reliable, based on the success in the diagnostic checks we undertook, which included the residual diagnostic tests and model stability test. Our findings are not very different from those of similar studies on South Africa. Jooste et al (2012:1) find that the short-run fiscal deficit impact can be positive sometimes and other times negative. Our long-run fiscal multiplier is exactly as found by Jooste et al (2012:1) where real GDP does not respond to an increase in the primary fiscal deficit. Ocran (2009:14) finds that fiscal deficits have an insignificant impact on economic growth.

CHAPTER 5: CONCLUSION

This study set out to investigate the short-run and long-run effectiveness of fiscal deficits in stimulating South Africa's economic growth. Determination of whether fiscal deficits are effective was based on the analysis of the impulse response functions and the forecast error variance decomposition estimated through an SVAR model.

Before the model was estimated, a literature review in chapter 2 was provided. In this chapter, we discovered that there is no consensus among different schools of thought regarding the effectiveness of fiscal deficits in stimulating economic growth. Whereas the new Keynesians argue that fiscal deficits stimulate economic growth, the neoclassical and Ricardian theorists disagree. The disagreements filtered into our literature on empirical findings about the effectiveness of fiscal deficits in stimulating growth. We discovered that empirical evidence on the effectiveness of fiscal deficits is mixed, regardless of which fiscal shock one uses. It can be positive, negative or zero.

We then discussed the methodology to use in estimating the effect of fiscal deficits in chapter 3. We substantiated the selection of the SVAR system for the analysis of the results in our study. Basically, the SVAR is easier to analyse and provides better estimates for economies susceptible to poor quality data such as developing countries, compared to the large scale simultaneous models. In this chapter, we presented the types of time series data that would be used for analysis and discussed how to resolve the problem of unit roots which is normally a source of concern in these types of data. Arising from the argument that one of the most critical challenges of using SVAR models is how to apply identification assumptions, we showed how the recursive identification method suggested by Sims (1980) could help in addressing this challenge in our study.

In chapter 4, we applied all the econometric tools necessary to ensure that our series were satisfactory for use in estimating the SVAR. This implies that we chose the optimal lag length, used robust deterministic assumptions and ensured that our series were stationary. Our model passed all the residual diagnostic and stability tests, making our conclusions efficient and reliable. We reported our results using Impulse Response Functions (IRFs) and Forecast Error Variance Decomposition (FEVD). Our results showed that fiscal deficits have a zero impact on economic growth. This led us to the conclusion that fiscal deficits are not effective in stimulating economic growth in South Africa. This arose due to the fact that the stimulative effect of fiscal deficits was offset by the crowding-out effect, small automatic stabilisers, leakages through increased imports, appreciation of the Rand and the inflation-targeting policy rule of the SARB.

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