

Current Account Dynamics and Macroeconomic Policy

Thesis

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by

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Abstract

This thesis focuses on the growing current account imbalances in South Africa and how these imbalances are influenced by macroeconomic policy. These issues are dealt with in three related studies. Even though literature argues that fiscal policy may be more capable of attaining current account stability if supported by monetary policy measures, only a few studies actually address the potential of both monetary and fiscal policy to stabilise the current account (Herz and Hohberger, 2013). As a result, our first study establishes stylised facts about the interaction of fiscal policy and the external balance by analysing the fiscal determinants of the current account. The second study establishes stylised facts about the interaction of monetary policy and the external balance by analysing global and domestic monetary determinants of the current account. The third study considers the structure of the economy in South Africa in terms of the share of traded goods vis-à-vis non-traded goods in production and consumption. The study calibrates a Dynamic Stochastic General Equilibrium (DSGE) model that analyses the role of non-traded goods in the determination of the current account and exchange rate. These three studies help to develop an understanding of the current account in South Africa.

The first study analyses the impact of fiscal shocks on the current account and provides an understanding of how fiscal shocks shape current account developments. By so doing, the study establishes the usefulness of fiscal consolidation in managing current account deficits by determining whether the twin deficits approach to managing the external balance holds in South Africa. To achieve this objective, we estimate a series of Structural Vector Autoregressive (SVAR) models that analyse the effect of fiscal shocks on the current account. This helps in understanding how fiscal shocks shape current account developments, and establishes the usefulness of reduced fiscal expenditure in managing current account deficits by determining whether the twin deficits approach to managing the external balance holds. Upon determining the effect of fiscal shocks on the current account, and the effect of current account deficits on fiscal variables, we proceed to analyse the channels through which fiscal shocks are transmitted to the current account to understand how current account management policies can best be formulated. Our main contribution to the literature lies in providing a case study of South Africa, an emerging economy characterised by large current account deficits, macroeconomic volatility, a well-developed financial sector, and a dataset which has not been exploited to understand the external balance. A particularly interesting finding is that expansionary fiscal shocks improve the current account within a year through household savings and public investment, which is a departure from the twin deficits hypothesis.

The second study also estimates SVAR models to analyse the effect of global and domestic monetary shocks on the current account. This helps to understand how the change in global monetary conditions affects current account developments, and provides an understanding of how monetary policy can attain a stable current account position in South Africa. The study also goes further to analyse the channels through which monetary shocks are transmitted to the current account so as to determine the direct way in which the savings investment gap is affected by monetary policy. Using a case study of South Africa, the study contributes to literature by providing an understanding of the relationship between the current account and monetary policy in an emerging market, and provides insight on the possible risks that deficit countries face from global monetary policy changes, and the manner in which domestic monetary can alleviate these risks. Findings shows that the current account deficit is affected by both global and domestic monetary shocks, with an increase in US interest rates (normalisation of monetary policy) posing a risk of current account reversal in South Africa.

Finally, the third study addresses the issue of most general equilibrium models of the current account which focus on developed countries and assume that the evolution of the current account is caused by changes in the traded goods sector alone. By making this assumption, these models fail to account for the role of non-traded goods in the determination of the current account. This study contributes to literature by calibrating a Dynamic Stochastic General Equilibrium (DSGE) model to analyse the impact of non-traded goods on the current account and exchange rate. The model is calibrated to South Africa because of the country's relatively large non-traded goods sector and its possible influence on the current account. The usefulness and applicability of the model is examined by comparing model predictions in the third study to the stylised facts established in the second study. The results show that non-traded goods play a significant role in the determination of the current account, with half the variation in the current account explained by non-traded goods productivity shocks. This result provides an interesting departure from single sector models that find that the current account is mostly explained by risk premium shocks with a small role for other variables. The model provides a good fit to stylised facts, suggesting that the non-traded goods sector is vital for the evolution of the current account and exchange rate in South Africa.

The thesis concludes by discussing possible policy implications of these results, and ideas for further research.

Dedication

To my mother, Patricia Makanza

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List of Acronyms

AERC	African Economic Research Consortium
ADF	Augmented Dickey Fuller
AR	Autoregressive
CA	Current Account
CES	Constant Elasticity of Substitution
CPI	Consumer Price Index
CSAE	Centre for the Study of African Economies
DSGE	Dynamic Stochastic General Equilibrium
ESSA	Economic Society of South Africa
ERSA	Economic Research Southern Africa
EME	Emerging Market Economies
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
IRF	Impulse Response Function
IMF	International Monetary Fund
LIBOR	London Interbank Rate
NOEM	New Open Economy Macroeconomic
pp	Percentage Point
SARB	South African Reserve Bank
SVAR	Structural Vector Autoregressive
TOT	Terms of Trade
UIP	Uncovered Interest Parity
UK	United Kingdom
US	United States
USD	United States Dollar
VAR	Vector Autoregressive
VD	Variance Decomposition
YTD	Year to Date

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Chapter 1

Introduction

1.1 Introduction and Motivation

Global imbalances have received substantial attention over the years, with two prevalent views in literature on the importance of the current account for macroeconomic policy. One view argues that the current account balance is not important for policy, whilst the second view argues that the current account is certainly relevant for policy and has implications for the macroeconomy (see Corden, 1991; Obstfeld, 2012).

The first view postulates that the current account does not matter from a policy perspective as current account balances are temporary and self correcting, even though the elements that determine the current account and lead to imbalance are certainly important for policy. This view argues that current account imbalance simply reflects optimising decisions by households and firms, which are a direct result of the increased integratedness of global financial markets. This is because when countries share risk equally, forward looking and optimising households generate current account balances that are consistent with efficient resource allocation, provided the fiscal deficit is not excessive. Over time, as firms exhaust their most productive investment projects, households reduce consumption due to reduced wealth, and the current account balance adjusts or self corrects (Obstfeld, 2012). However, this view is based on the assumption that countries share risk equally (complete assets markets) which has been disputed in the literature (see Obstfeld and Rogoff, 1995b). Another weakness of this view is that it argues that the integratedness of global financial markets poses the risk of financial market instability and is a cause of concern, but the current account is not. However, we argue that surely, if systematic risk from financial markets is a cause of concern for economic stability, then the current account balance, which is a direct result of these capital flows should also be a cause of concern, as a sharp increase or decrease in

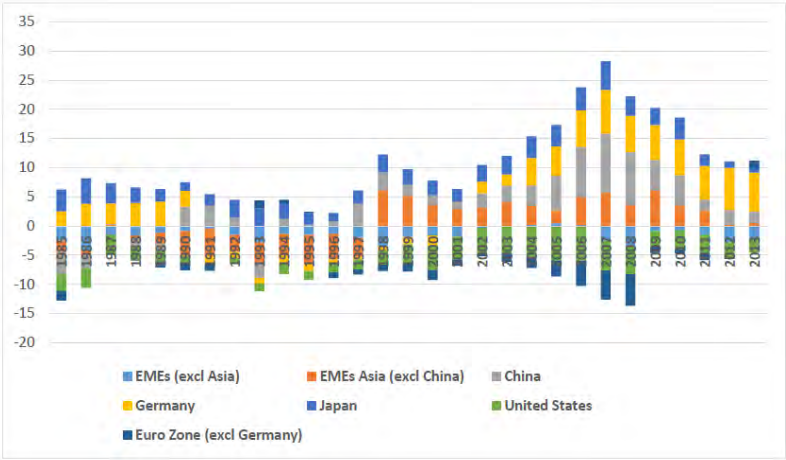
capital flows will deteriorate or improve the current account balance.

The second view on the other hand presents the argument that whilst current account imbalance may be justified by macroeconomic fundamentals, current account deficits cannot be sustained indefinitely, particularly when they are not consistent with macroeconomic fundamentals. This view posits that persistent and large current account imbalances are a symptom of related macroeconomic problems, and views the current account deficit as an accumulation of liabilities to the rest of the world. These liabilities are financed by flows into the capital account, and need to be repaid at a later date by borrowing further or depleting foreign exchange reserves. However, the depletion of foreign exchange reserves associated with financing the deficit could lead to a foreign exchange crisis and increase in external debt liabilities (see Hume and Sentance, 2009; Gourinchas and Obstfeld, 2011; Catao and Milesi-Ferretti, 2014). This view therefore suggests that current account deficits warrant policy intervention as they could have destabilising implications. The implications however vary depending on the source of current account imbalance. For example, whilst an investment driven current account may not be a problem as it reflects a productive and growing economy, a consumption driven current account deficit reduces the nation's ability to repay debts. Likewise, a deficit driven by an excess of imports over exports may reflect competitiveness problems, and a deficit caused by low savings rather than high investment may be a sign of weak fiscal policy or a consumption binge, and reflects a country living beyond its means (Obstfeld, 2012). Under these scenarios of undesirable current account deficits, consequences of the deficit could range from foreign exchange crisis to a sudden stop of capital flows as the country's liabilities increase. A sudden stop of capital flows may lead to an abrupt current account reversal, which could lead to an abrupt adjustment of relative prices, currency depreciation and an increase in the real value of foreign liabilities. As a result, current account management through appropriate actions is necessary to avoid these adverse effects.

Through out this thesis, we subscribe to the second view that the current account is highly relevant for economic stability due to the possible implications of current account deficits on the economy, and as such deficits which are not in line with macroeconomic fundamentals warrant close monitoring and policy intervention. The view we adopt is in line with other studies that address concerns about current account imbalances and argue that whilst justifiable by macroeconomic fundamentals, they are reflective of potential underlying financial instability (Obstfeld, 2012). Other studies go as far as to state explicitly that current account imbalances are one of the main causes of financial crises (see Milesi-Ferretti and Blanchard, 2009; Obstfeld and Rogoff, 2009; Caballero, Farhi and Gourinchas, 2006), and furthermore, pre-crisis external imbalances are often found to have strong predictive powers of post crisis macroeconomic outcomes and this has seen some policy measures taken towards the adjustment of current account imbalance (Lane and Milesi-Ferretti, 2014).

Prior to the 2008 financial crisis, current account imbalances were characterised by large deficits in the US, Greece, Ireland, Italy, Spain and Portugal among other deficit countries, whilst countries with large surpluses included China, Germany, Japan, emerging market Asia, and oil exporting countries (Lim, 2013). The 2008 global financial crisis adjusted current account imbalance, mostly as a result of weakened demand and low economic growth. To deal with the resulting problems of low economic growth and unemployment, countries adopted a mixture of fiscal and monetary policy measures, including quantitative easing, which is characterised by a reduction in interest rates, and has ultimately led to negative interest rates in real terms. However, a number of problems resulted from this adjustment. First, the adjustment of deficits in developed countries through weakened demand reduced consumption and savings levels, which ultimately led to reduced growth. Second, the move by some developed countries to resort to quantitative easing as a means of stimulating economic recovery has not been without consequence for the current account balances of emerging markets. Quantitative easing resulted in an inflow of capital to emerging markets with relatively higher interest rates, which caused a reallocation of current account deficits towards emerging markets.

Figure 1.1: Dispersion of Current Account Imbalances



Source: Authors compilations using data from TheWorldBank (2015)

Figure 1.1 shows that whilst global imbalances have narrowed, mostly due to the narrowing of the US current account deficit, emerging markets deficits have increased, and this increase is mostly attributed to the ease of financing current account deficits through the more integrated financial system (Herz and Hohberger, 2013). In addition, the quality of adjustment of global imbalances has been undesirable as it has been a result of weakened demand and low economic growth, with little role played by macroeconomic policy towards adjustment. This suggests weak efforts by macroeconomic policy to adequately address global imbalances, (Lim, 2013). IMF (2013a) suggests that more structural and exchange rate adjustments are required to adjust towards more sustainable current account balances, and this should be

aided by measures to boost consumption and investment in surplus countries, as well as increase savings and reduce fiscal expenditure in deficit countries.

The failure of macroeconomic policy to address the appropriate measures to take towards global imbalances is a result of a number of factors, particularly in emerging markets. First, several studies that provide guidance on how macroeconomic policy should tackle the adjustment of current account imbalances are cross country studies that either combine developed and developing countries in the data panel, or only look at developing countries (e.g. Ivrendi and Guloglu, 2010; Abbas, Bouhga-Hagbe, Fatás, Mauro and Velloso, 2011; Rafiq, 2010). The problem that arises from cross country studies of the current account is that the dynamics of the current account are influenced by country specific fundamentals. Since panel results are on a more general level, this implies they propose generalised policy implications which may not be applicable to individual countries, and may be difficult to tailor to a country's specific context. In addition, developed countries have different macroeconomic structures and experience different exogenous shocks compared to developing countries. This implies policy implications based on research on developed countries may not necessarily be relevant in developing and emerging markets. These factors motivate an analysis of how macroeconomic policy can best curtail current account imbalances in EMEs which are characterised by different macroeconomic structures and experience different economic shocks from developed countries. To avoid the problem of a generalised context, the thesis provides a country analysis of an emerging market to understand the interaction between the current account and macroeconomic policy in a representative emerging economy. Country analysis not only contributes to the scarce literature of current account dynamics in emerging markets, but also provides a platform for analysing the impact of macroeconomic policy on the current account in these economies, and how this differs from that of countries of different income levels.

Literature that explores the role of macroeconomic policy in countries of different income levels, and the implications for the current account covers various aspects. Various studies debate the role played by fiscal policy, and in particular, the role of expansionary fiscal policy in generating current account deficits (e.g. Bartolini and Lahiri, 2006; Corsetti and Muller, 2006; Kim and Roubini, 2008), with recent findings that this relationship is strongly influenced by the macroeconomic conditions of a country. Central to this literature is the argument that where business cycle fluctuations are persistent, current account deficits are driven by the endogeneity between output shocks and the fiscal balance. As such, whilst the Mundell Fleming twin deficits approach predicts positive correlation between the fiscal balance and the current account balance, accounting for macroeconomic fundamentals such as output shocks and cyclicalities of fiscal expenditure may unearth new interactions different between fiscal policy and the current account (see Kim and Roubini, 2008).

The above mentioned studies encompass the idea that central to the role of fiscal policy in current account determination is the influence of monetary policy. The objectives of fiscal policy and monetary policy can have conflicting outcomes, for example, whilst fiscal policy may take measures to narrow the current account deficit, contractionary monetary policy may counter this objective by attracting capital inflows that appreciate the currency, thereby financing the current account deficit. As a result, the usefulness of fiscal policy can be undermined unless corresponding efforts from monetary authorities are also taken into consideration, suggesting the need to understand the interaction between monetary policy and the current account as well. Bergin (2006), Ferrero, Gertler and Svensson (2008) and Lu (2012) contribute to this literature by discussing the usefulness of monetary policy for current account adjustment and sustainability, and their studies build on the literature of interactions between the current account and monetary policy (e.g. Kim, 2001a; Lane, 2001). However, analysing the role of monetary policy in current account stability has still largely focused on developed countries, and is yet to fully embody the evolving global monetary conditions which is an aftermath of the financial crisis.

Effects of the financial crisis on economies are fairly new areas in research which have not been fully explored, and the novelty of this problem has raised increasing difficulty in explaining current account imbalances and the failure of policy to address the imbalances. In determining the drivers of external imbalance, there is a need to take into account the structure of the economy under consideration to ensure that suggested solutions are within the context of the economy. Studies that use the structure of the economy to explain current account balances are mostly based on developed countries (e.g. Bergin, 2006; Lu, 2009), and by failing to model the characteristics of EMEs, these models fail to fully explore the usefulness of macroeconomic policy in managing the current account, and the actual drivers of the current account in emerging markets. One key characteristic that is particularly relevant for EMEs is the contribution of the traded and non-traded goods sectors to GDP, and the way in which this differs from developed countries. Whilst developed countries such as the UK and US are more open and characterised by higher levels of trade, EMEs are typically small open economies with a relatively large non-traded goods sector. Batini, Harrison and Millard (2003) argue that accounting for the role of the non traded sector facilitates in addressing questions that single sector models cannot address. This suggests that models that incorporate non-traded goods in the determination of the current account not only improve the predictive power of the model, but also improves the precision of forecasts on the role that monetary and fiscal policy can take in current account management.

The arguments discussed above explore the role played by fiscal and monetary policy in explaining and predicting the behaviour of the current account, and expand current account models to improve both the predictions of these models and the relevance of macroeconomic

policy in explaining the current account in EMEs. These arguments form the basis of the three broad objectives of the thesis which are explored in three chapters. The first objective is to understand the effect of fiscal policy on the current account, the second objective is to determine the impact of monetary policy on the current account, whilst the third objective is to analyse the role of non traded goods in the determination of the current account.

The first objective of the thesis forms chapter 2 and analyses how fiscal shocks shape current account developments. This chapter establishes the usefulness of fiscal consolidation in managing current account deficits by determining whether the twin deficits approach to current account deficits holds in South Africa. The chapter further analyses the channels through which fiscal shocks are transmitted to the current account in order to understand how current account management policies can best be formulated.

The need to analyse the interaction between fiscal policy and the current account is motivated by the lack of emerging market case studies in this field. Existing case studies, which are mostly on developed countries find inconsistent results on the current account-fiscal policy relationship. Some studies find that the traditional twin deficits hypothesis holds where a worsening of the fiscal deficit deteriorates the current account balance (e.g. Lau, Mansor and Puaah, 2010), whilst other studies find that if a country has procyclical fiscal policy and strong business cycle fluctuations, a characteristic of most EMEs, the relationship between the current account and fiscal policy may be influenced more by the strength of the business cycles as opposed to fiscal expenditure alone (Kim and Roubini, 2008). The studies indicate that the way fiscal policy interacts with the current account depends on the macroeconomic fundamentals of a country, and as such, fiscal policy measures towards current account deficits should be guided by evidence-based research.

In the chapter, we specifically analyses the effect of government budget deficits and government spending shocks on the current account to determine the effect of expansionary fiscal policy on the current account, and furthermore, analyse the channels through which fiscal shocks are transmitted to the current account to determine key aspects that fiscal policy should focus on for current account stability. To do this, we use a Structural Vector Autoregressive (SVAR) model which enables the imposition of theoretically founded restrictions on the current account-fiscal relationship. The chapter uses variance decompositions and impulse response functions to infer the effect of fiscal shocks on the current account, and uses current account components (savings, investment and consumption variables) to analyse the channels through which fiscal shocks are transmitted to the current account. The study concludes by noting that due to the endogeneity of the fiscal balance, fiscal shocks in fact improve the current account position in South Africa, a result which departs from the twin deficits hypothesis.

Due to the interaction of both fiscal and monetary policy in obtaining macroeconomic outcomes, attempts by fiscal policy to attain a stable current account position can be more effective if accompanied by supporting monetary policy measures. The need for joint efforts from both monetary and fiscal policy motivates us to analyse the impact of monetary policy on the current account, which forms the basis of chapter 3 of the thesis. Chapter 3 is motivated by the vulnerability of emerging markets to changes in global monetary policy which affects capital flows and consequently, current account deficits (e.g. Milesi-Ferretti and Blanchard, 2009; Claessens and Ghosh, 2013; Eichengreen and Gupta, 2014).

The third chapter not only addresses the issue surrounding the impact of unconventional monetary policy on the current account and how the change in global monetary conditions is likely to impact the current account balance, but also contributes to the inconclusive debate on the role of monetary policy in attaining a stable current account balance. The study specifically analyses the impact of global and domestic monetary policy shocks on the current account balance. Analysing the impact of global monetary shocks helps to evaluate the consequences of the changes in global monetary conditions on the current account balances of emerging markets, whilst analysing the impact of domestic monetary shocks provides insight of how monetary policy can attain a stable current account balance. In addition, the study also analyses the channels through which monetary shocks are transmitted to the current account. This helps in evaluating the way in which the savings-investment gap is shaped by monetary policy decisions, and narrows down policy options for current account management.

To achieve these objectives, the study also uses an SVAR model and imposes theoretically founded restrictions on the interaction between monetary policy and macroeconomic aggregates. Results from impulse response functions and variance decompositions show that domestic contractionary monetary policy particularly worsens the current account position, and normalisation of foreign monetary policy poses a risk of current account reversal if foreign interest rates become relatively higher than domestic interest rates. Since contractionary monetary policy in the domestic economy is used to keep inflation within the target band when inflation exceeds the target, this result suggests the need for complementarity between monetary and fiscal policy to achieve current account stability, since the pursuit of other objectives such as low inflation may not be in line with narrowing the current account deficit.

Chapters two and three are based on the intertemporal approach to the current account by Obstfeld and Rogoff (1995b), which predicts that the current account is an outcome of savings-investment decisions by utility maximising households who make consumption decisions in an intertemporal framework. The approach models the current account as an

outcome of fiscal policy decisions that affect savings and investment, making it an expansion of the Mundell Fleming twin deficits framework. In addition, the Intertemporal Approach models the current account as an outcome of monetary policy as well through the impact of exchange rates and interest rates on savings and investment decisions. Our use of this approach follows several studies that abstract from the Intertemporal Approach to the Current Account in analysing the impact of monetary and fiscal rules on the current account (e.g. Bergin, 2006; Lu, 2009; Kumhof and Laxton, 2013). Abstracting from the predictions of the Intertemporal Approach, chapters two and three establish stylised facts about the interaction of monetary policy, fiscal policy and the current account in South Africa. These stylised facts are used to examine the usefulness of a structural model that explains the behaviour of the external balance when non-traded goods are assumed to affect the outcome of the current account. Developing and testing this structural model forms the basis of the fourth chapter of this thesis.

To analyse the impact of non-traded goods on the current account, chapter four develops a Dynamic Stochastic General Equilibrium (DSGE) model that tests the notion that shocks to the non-traded goods sector have effects which in turn spillover to the current account and exchange rate. This chapter is motivated by developed country general equilibrium models that mostly assume that the current account is an outcome of traded goods (e.g. Bergin, 2006; Herz and Hohberger, 2013), and by so doing, these models overlook the sizeable non-traded goods sector in EMEs which in some instances, outweighs the traded goods sector. Modelling consumption as a non-separable function of both traded and non-traded goods implies that non-traded goods sector shocks may affect the current account through the intratemporal elasticity of substitution between traded and non-traded goods, and the share of non-traded goods that households consume. Chapter four investigates this hypothesis by developing a current account model that incorporates all the sectors (traded and non-traded) that contribute to the economy in EMEs. Inclusion of the non-traded goods sector is important as it facilitates in explaining aspects of the current account that single sector models cannot explain (Batini, Harrison and Millard, 2003), and shows how the current account is affected by substitutability between traded and non-traded goods.

To fully investigate the role of non-traded goods in the determination of the current account, the study develops a current account model based on a representative emerging market. The model is based on a small open economy with a representative utility maximising household that derives utility from consumption and disutility from labour. Traded good firms produce goods which are exported and domestically consumed, and non-traded good firms produce a good which is domestically consumed. The monetary authority regulates interest rates through a Taylor rule, with the objective of targeting inflation. The model is calibrated to South Africa, an emerging market with a relatively large non-traded goods sector, and is used

to analyse how productivity shocks from the non-traded goods sector affect the determination of the current account and exchange rate in comparison to those from the traded goods sector. The developed model is also used to analyse the effect of substitutability between traded and non-traded goods on the current account, and how the current account deficit is affected by the share of non-traded goods in the economy. To test the validity of the model, predictions on the effects of monetary shocks on the current account and macroeconomic variables from the calibrated model in chapter four are compared to the stylised facts established in the third chapter. The main findings show that productivity shocks, particularly from the non-traded goods sector in fact explain a large proportion of variation in the current account, which is a substantial difference from single sector models.

The three chapters use South Africa as a case study for the country level dynamics of the current account. South Africa provides an interesting case study because it has impressive availability of time series data which has not been exploited to fully understand the dynamics of the current account. South Africa also has a relatively well developed financial sector which provides a conducive environment for investment and attracts foreign capital inflows which have arguably been responsible for current account deficits due to reduced competitiveness (Smit, Grobler and Nel, 2014). The country has characteristics of both developing countries (relatively high unemployment and inequality), and emerging markets (relatively well developed financial and trade systems). This enables the thesis to cover the spectrum of these two income levels, making South Africa a unique case study. The relatively large current account deficit at the time of writing this thesis, was only superseded by Turkey among main EMEs, making South Africa an interesting case as it has one of the largest deficits and highly depreciated currencies among EMEs. In addition to these features, the monetary policy stance of the South African Reserve Bank (SARB) has also been a contributing factor to current account deficits. The use of interest rates as a tool in the inflation targeting framework, raises interest rates through contractionary monetary policy, which consequently affects the current account deficit by attracting capital inflows, suggesting that monetary policy also has an effect on the current account. In addition, despite the impact of both fiscal and monetary policy on the current account, and policy attempts to manage the current account deficit, South Africa's current account deficit remains high, which suggests that other fundamentals such as the structure of the economy may in fact have an effect on the deficit. This thesis poses the notion that the structure and decomposition of sectors in South Africa, and in particular the size of the non-traded goods sector affects trade dynamics and could possibly affect the current account position. Investigating this notion allows us to determine the relevance and contribution of non-traded goods in current account determination. It also allows us to contribute to the literature on current account dynamics in emerging markets, an important issue because of the vulnerability of these countries to exogenous shocks (Claessens and Ghosh, 2013).

Studies on the current account in South Africa have, to the best of our knowledge, only looked at the sustainability of the current account deficit and the possibility of current account reversals given the level of capital inflows (e.g. Kandiero, 2007; Smit, 2007; Smit, Grobler and Nel, 2014). In the thesis, we explore this gap and contribute to developing an understanding of how the current account is determined. We contribute to the literature by exploring the role of macroeconomic policy in attaining a sustainable current account balance at country level, particularly in countries that have developing and emerging market characteristics, and develop a model that explains the behaviour of the current account in South Africa and other EMEs, by incorporating the role of non-traded goods in current account determination. Overall, our findings suggest the need for both monetary and fiscal policy to stimulate household savings since this is the main channel through which the current account balance deteriorates. In addition, we find that current account models should cater for the structure of emerging markets by including non-traded goods in the model, as non-traded goods have a significant impact on the determination of the current account. Our findings contribute significantly to the literature on current account balances in emerging markets, an area that has not been fully exploited.

1.2 Organisation of the Thesis

Having discussed the main motivations and contributions of this thesis, the rest of the thesis is organised as follows; the study on the usefulness of fiscal consolidation in narrowing current account deficits, and the manner in which fiscal shocks are transmitted to the current account is presented in chapter two. Chapter three presents the impact of global and domestic monetary shocks on the current account, the usefulness of domestic monetary policy in attaining current account stability, and the manner in which monetary shock are transmitted to the current account. Chapter four evaluates the role of the non-traded goods sector in driving current account dynamics, and we test the usefulness of the model developed in this chapter by comparing model predictions to the stylised facts established in chapter three. Finally, chapter 5 concludes by summarising the findings of the three studies and discussing some ideas for further research.

Chapter 2

Fiscal Consolidation, Fiscal Policy Transmission, and Current Account Dynamics in South Africa

2.1 Introduction

There has been considerable debate over the importance of current account balances, with recent arguments that imbalances, while possibly justifiable by fundamentals, can also signal elevated macroeconomic and financial stresses and problems (Obstfeld, 2012). Despite these growing concerns, relatively little attention has been paid to studying what determines current account deficits and their dynamics in emerging market economies, particularly given that emerging markets may be prone to economic and financial sector instability due to the volatility of capital flows that finance current account deficits (Claessens and Ghosh, 2013). Understanding the determinants of current account deficits more generally can be valuable by providing insights into whether these deficits could be used as an early warning signal for potential macroeconomic instability that might warrant intervention. For example, while a short-run current account deficit may reflect heightened levels of consumption and investment, in the long-run it may not be sustainable, particularly if financed through borrowing.

Most of the existing empirical literature on current account dynamics has been based on cross country data sets, with the few case studies that exist being mainly for developed countries, despite the fact that the cross country studies tended to find that the factors that affect the current account differ between developed and developing countries (e.g. Calderón, Chong and Zanforlin, 2007; Chinn and Prasad, 2003). Recent studies find that depending on the nature of output shocks, components of the government budget balance, the structure of a particular

economy and a country's income level, the relationship between the current account and fiscal deficit may in fact be negatively correlated in an open economy (see Rafiq, 2010), as opposed to the theoretical expectations of the twin deficits hypothesis. This is because an open economy enables consumers to smooth consumption by lending and borrowing in international capital markets, and in so doing, attracts short term capital inflows to finance deficits. This suggests that it is important to try to understand the evolution of current account deficits and their determinants in countries of different income levels and openness, and this requires case study analysis to augment the cross country studies.

This chapter contributes to the literature by providing South Africa as a case study of an emerging economy. South Africa has developing country characteristics, relatively well developed industrial and financial sectors, a relatively high current account deficit in comparison to similar emerging markets, and impressive data availability, (IMF, 2013b). In the chapter, we investigate the interaction of fiscal policy with the external balance by determining the effect of fiscal aggregates on current account movements, and the channels through which fiscal shocks are transmitted to the current account. This allows the identification of policy options to influence the impact of fiscal policy on the evolution of the current account.

The next section discusses the approaches to defining the current account whilst analysing how fiscal deficits interact with current account deficits, and then reviews developments in the current account and fiscal policy literature. Section 2.3 then describes the experience of South Africa in terms of the evolution of fiscal policy and the current account. This is followed by an exposition of the chosen theoretical model in section 2.4. Section 2.5 discusses how the theoretical model leads to both the theoretical and empirical specifications of the model we will estimate, and how the model is identified. Section 2.6 discusses the data, while section 2.7 gives the estimation results, and finally, section 2.8 presents some conclusions.

2.2 Fiscal Determinants of the Current Account

It is possible to define the current account as the sum of the trade balance, income and transfers. This definition is the absorption approach which describes the balance of payments as the outcome of export and import activities, as well as the level of absorption and investment in an economy (Alexander (1952) and Johnson (2013) give a detailed discussion of this approach). This approach however does not account for the role of intertemporal decisions made by economic agents in their saving and investment behaviour, nor does it consider how these decisions affect the current account balance. Failure to take intertemporal decisions into account makes it difficult to analyse how current decisions impact future

current account imbalances. Accounting for intertemporal decisions brings into consideration the change in net foreign assets which describe how the current account is determined by the level of foreign capital in an economy, or the difference between national savings and domestic investment which can also be used to define the current account.

There are two dominant theoretical perspectives that arise from the interaction of the current account with the savings-investment relationship, both of which can be illustrated by manipulating the national income identity. These perspectives equate the current account (CA) to the savings-investment gap ($S - I$) when assuming a balanced budget, or to the government budget balance ($T - G$) when assuming savings and investment are equal (see equation 2.1)¹.

$$S - I = (G - T) + CA \implies CA = (S - I) + (T - G) \quad (2.1)$$

Focusing on the savings-investment gap is the basis of the Intertemporal Approach to the Current Account by Obstfeld and Rogoff (1995b). The Intertemporal Approach is built on the premise that expectations about productivity growth, government spending, current and future prices affect savings and investment decisions of residents of a nation, and has become the dominant theoretical approach within the literature (e.g. Obstfeld and Rogoff, 1995a; Bergin, 2006; Lu, 2012). This approach postulates a positive relationship between the current account deficit and government budget deficit, suggesting that an increase in government expenditure will lead to a deterioration of the current account balance towards a deficit. This is the basis of the twin deficits hypothesis which is one of the main theories that explains the relationship between fiscal policy and the external balance (Feldstein, 1983).

The twin deficits hypothesis posits that expansionary fiscal policy deteriorates the external position, implying that fiscal deficits worsen current account deficits. Following from equation 2.1, when savings equal investment, the current account can be equated to the fiscal balance such that

$$\text{if } S = I \implies CA = G - T \quad (2.2)$$

This implies a causal relationship between the current account balance and fiscal balance such that a fiscal surplus ($T > G$) would induce a current account surplus and a fiscal

¹*Proof:* $Y = C + I + G + NX$; but $Y - C - T = S$
 $\implies S = G - T + NX + I$
 $\implies CA(NX) = (S - I) + (T - G)$.
 $\implies CA = S - I$ if $(T - G) = 0$ or $CA = T - G$ if $(S - I) = 0$
 Y where is output, C is consumption, I is investment, G is government expenditure, NX are net exports, T are taxes, S are savings and CA is the current account balance.

deficit ($G > T$) would induce a current account deficit. The mechanism that explains this relationship stipulates that fiscal expansion, through an increase in fiscal expenditure or reduction in taxes can be financed through debt, which results in a decline in public savings, and increase in private sector disposable income, and the disposable income of households (Bartolini and Lahiri, 2006). Bartolini and Lahiri (2006) highlight two key relationships that arise in this Keynesian view of the twin deficits hypothesis. The first relationship is between fiscal policy and savings. This relationship determines how residents in the economy respond to changes in fiscal policy, as observed by the adjustment of savings and consumption patterns. The second relationship entails the response of the current account to changes in fiscal policy, which is key in examining the existence of the twin deficits hypothesis. This relationship entails that the government balance is an indicator of a country's fiscal stance and changes in fiscal policy affect private savings through the taxes and disposable income channel.

In the first relationship, a fiscal expansion accompanied by a tax cut and a concurrent increase in public debt increases disposable income, and hence increases private consumption and lowers savings. In the case of a tax reduction alone, the windfall gain in income from a tax reduction is used to increase consumption by a larger magnitude than the tax reduction, and results in a depletion of savings. In the case of fiscal expansion, increased fiscal expenditure is financed by increased borrowing domestically or abroad, which in turn finances the current account deficit through the inflow of foreign capital in an open economy. This influx of capital increases investment and worsens the savings investment gap, which consequently implies that fiscal expansion results in an expansion of the current account deficit. If international capital markets are relatively closed, residents will not be able to borrow from abroad, hence domestic borrowing will increase domestic interest rates, which crowds out domestic investment. This further reduces national savings and widens the current account deficit. This is the Keynesian view of the twin deficits hypothesis where the current account balance and fiscal balance are expected to be positively correlated (see Feldstein, 1983).

A key point of interest is that the predictions of the twin deficits hypothesis and the intertemporal approach to the current account are similar. With both theories, an increase in fiscal expenditure or worsening of the fiscal deficit results in a deterioration of the external deficit. However, even though this positive correlation between the current account deficit and fiscal deficit has been the dominant theoretical approach in literature, other approaches are suggested that result in an alternative relationship between the current account balance and the fiscal balance. These alternative theories include the Ricardian view of the current account (see Barro, 1989), and the twin divergence scenario put forward by Kim and Roubini (2008).

The Ricardian view departs from the twin deficits hypothesis and nullifies the relationship between the current account and fiscal balance. Under the Ricardian view, a tax cut will lead to an increase in government debt to finance fiscal expenditure. However, residents expect the government to eventually increase taxes to pay off the public debt, hence residents use the additional income from a tax cut to save in preparation for the future increase in taxes. As a result, consumption and the current account both remain unchanged because the increase in disposable income is offset by the increase in household savings (Barro, 1989).

A more recent phenomenon that has emerged in the literature is termed "twin divergence". This departs from the twin deficit and Ricardian view in that budget deficit shocks actually have the effect of improving the current account. Literature argues that this is as a result of comovements between the current account and fiscal balance being driven more by output shocks as opposed to fiscal shocks hence in this case, the current account deficit and fiscal deficit are expected to be negatively correlated. Kim and Roubini (2008) and Rafiq (2010) illustrate that the twin divergence scenario can be explained in new open economic macroeconomic models. Whereas the Ricardian View demonstrates that expansionary fiscal shocks have no effect on consumption and the current account, NOEM postulates that because of price stickiness, an increase in fiscal expenditure increases aggregate demand and hence output, at least in the short run. As consumers gradually smooth consumption, net output decreases and the current account improves. The divergence between the fiscal deficit and current account deficit is thus driven by the response of output to fiscal shocks, and how this response affects the current account.

Despite the various theoretical frameworks that explain how the current account balance and fiscal balance could possibly be related, most cross country empirical studies have traditionally been based on the twin deficits hypothesis. The majority of these studies find a strong link between budget deficits or public spending and the trade balance, implying that strengthening of the fiscal balance improves the current account position (twin deficits), with the association as strong in emerging economies as in advanced ones (e.g. Abbas, Bouhga-Hagbe, Fatás, Mauro and Velloso, 2011; Lau, Mansor and Pua, 2010; Beetsma, Giuliadori and Klaassen, 2008; Calderon, Chong and Loayza, 2002; Salvatore, 2006). For example, in analysing the external balance of the G7 countries, Salvatore (2006) finds strong evidence of a negative relationship between the fiscal budget and the current account deficit in the descriptive analysis. However, this negative correlation is disputed in regression analysis, with results concluding that the twin deficits hold for the G7 countries, and the impact of fiscal policy on the current account is lagged by at least a year, with the length of the lagged response varying across countries. In a group of Asian emerging markets, Lau, Mansor and Pua (2010) find evidence of a long run relationship between the current account deficit and budget deficit implying that fiscal discipline leads to current account improvement, but

the strength of this relationship varies across countries. Cross country studies use panel data methods but often suffer from a joint endogeneity problem (e.g. Calderon, Chong and Loayza, 2002; Calderón, Chong and Zانforlin, 2007). The studies also show evidence of heterogeneity as the interaction between fiscal policy and the current account differs across the countries in the panel. This implies the generalised results may not necessarily be applied to the context of individual countries, and supports the need for case studies to understand country level dynamics.

Some recent empirical work has begun to emerge in the literature which finds evidence of expansionary fiscal policy resulting in an improvement of the current account balance (twin divergence), particularly in higher income countries with more liberal financial systems, (e.g. Kim and Roubini, 2008; Muller, 2008; Rafiq, 2010). These studies are based on the open economy macroeconomics literature which controls for business cycle fluctuations and predicts that because of the endogenous response of the current account and budget balance to business cycles, comovements between the current account and fiscal balance are driven more by output shocks as opposed to fiscal shocks alone. For example, when fiscal expenditure is procyclical, a boom in output will lead to an increase in government spending, but however, the current account endogenously responds to the increased productivity which expands the export base, and the current account position improves, causing a negative correlation between the current account balance and fiscal balance. As a result, a scenario where an expansion of the fiscal deficit improves the current account position is likely to emerge when there are cyclical productivity shocks, and endogeneity of the budget deficit is taken into account (see Kim and Roubini, 2008). Such a result implies that fiscal consolidation, through a reduction in fiscal spending may fail to induce an improvement of the current account position. This notion goes against earlier results in line with the twin deficits hypothesis, and is evidence to the variation in the current account and fiscal policy relationship, depending on a country's income level and macroeconomic conditions such as the strength of the business cycle.

There are a few studies available that analyse the relationship between the current account / trade balance and fiscal policy in developing countries (e.g. Anoruo and Ramchander, 1998; Egwaikhide, 1999; Marinheiro, 2008). For example, Egwaikhide (1999) finds that a worsening of the fiscal deficit causes a deterioration of the trade balance in Nigeria, whilst Anoruo and Ramchander (1998) (in Egypt) and Marinheiro (2008) (in India, Indonesia, Korea, Malaysia and Philippines) find that causality actually runs from the external balance to government expenditure, with a deterioration of the trade balance causing an increase in fiscal expenditure. An important point to note about these studies however is that they are all prior to the 2008 financial crisis, implying they do not capture the dynamics between the current account and fiscal policy that may be a result of business cycle fluctuations brought

about by the financial crisis. In addition, most of the economies in these studies have now evolved to emerging markets, implying they have different macroeconomic conditions from the time these studies were conducted, and this warrants further investigation into the current account balances of EMEs. Further investigation not only to analyses the possible effects of business cycle fluctuations after the financial crisis, but updates the analysis to consider the relationship between the current account and fiscal policy when economies transition to emerging markets.

Various econometric techniques have been adopted in literature to determine the drivers of current account dynamics. The choice of technique is largely dependent on the questions the study seeks to answer, and the scope of the study in terms of the countries under investigation. Cross country studies that use panel data suffer from a joint endogeneity and simultaneity bias problem due to unobserved country specific effects. They control for this by employing GMM and the Sargan and Arellano-Bond specification tests (e.g. Calderon, Chong and Loayza, 2002; Calderón, Chong and Zanforlin, 2007). However, in as much as panel data methods explain current account determinants and control for fixed effects in the sample, they cannot determine the direction and magnitude of the effects of shocks to those determinants at different time horizons, hence to analyse the impact of shocks, some cross country studies adopt the use of panel VARs. Such studies include Abbas, Bouhga-Hagbe, Fatás, Mauro and Velloso (2011), Lau, Mansor and Pua (2010) and Lau, Baharumshah and Khalid (2006). However, although these studies explain the transmission of shocks between the current account and determinants, the results are generalised for the panel of countries examined, and this masks country level dynamics.

A different strand of literature uses New Open Economy Models (NOEM) to analyse the impact of macroeconomic policy changes on the current account at country level (e.g. Tervala, 2012; Kumhof and Laxton, 2013; Bergin, 2006; Lane and Milesi-Ferretti, 2002). These studies are able to analyse the impact of fiscal expansions and monetary variables on the current account by focusing the analysis to a country specific level. Apart from their ability to focus on country specific analysis, an added benefit is that NOEMs provide a framework for modelling country specific aspects such as household behaviour (Ricardian or Keynesian), and the monetary and fiscal rules adopted by policy makers. These models are also attractive because they provide a framework for monetary policy to affect real variables by incorporating nominal rigidities such as price stickiness in the model. However, NOEMs do have some shortfalls. Because of their complexity, much of the work based on these models has been theoretical, with little empirical advancement.

Of the empirical studies available, literature finds that when analysing the country level links between current account dynamics and fiscal aggregates, NOEMs models do not out-

perform structural vector autoregressive models (SVARs). An example of this is Bergin (2006) who uses a new open economy model to predict the behaviour of the current account and exchange rate. By comparing the predictions of his model to those of other SVAR models (e.g. Faust and Rogers, 2003; Eichenbaum and Evans, 1995), Bergin (2006) finds that the unrestricted VAR is a weaker fit due to a large set of unrestricted parameters, but the VAR model's prediction of the exchange rate and current account are still superior to NOEM. Kim and Lee (2008a) also concur with this view and demonstrate that the dynamic responses of variables in a VAR model are consistent with theoretical predictions when the identification restrictions are derived from a NOEM framework.

Consequently, based on the relatively superior performance of SVARs over panel data models and NOEMs, and the ability of SVAR models to isolate the exogenous component of business cycles and fiscal shocks through the choice of contemporaneous identification restrictions, this study proceeds to use a structural VAR model to analyse fiscal determinants of the current account in South Africa, an emerging market that exhibits pro-cyclical fiscal policy. Structural Vector Autoregressive Models (SVARs) have become a common feature in analysing current account and fiscal dynamics at a country specific level (e.g. Lee and Chinn, 2006; Hoffmann, 2003; Kano, 2008; Kim and Roubini, 2008; Corsetti and Muller, 2006) because of their ability to control for endogeneity together with the imposition of theoretical restrictions in the identification of the model. Recent empirical studies that analyse country specific current account dynamics utilise SVARs and identification restrictions which assist in the identification of global, country specific permanent and country specific transitory shocks. SVARs are attractive and appropriate for our analysis for a number of reasons which include their ability to incorporate theoretical assumptions which can be used in the identification of the model. These theoretically founded restrictions also deal with the problem of overparameterisation that is common in unrestricted VAR models cited in Bergin (2006). Furthermore, SVAR models control for the endogenous component of shocks and isolating their exogenous component, a feature which is useful in determining if the relationship between the fiscal and external balance is driven by the endogeneity of these variables (see Kim and Roubini, 2008). In addition, a common problem with reduced form VAR models is that, although serially uncorrelated, the error terms of the variables are likely to be mutually correlated if the variables themselves are correlated due to the contemporaneous relationships between variables. Structural VARs ensure identification by being explicit about the contemporaneous relationships between variables (see Corsetti and Muller, 2006). Specifying these contemporaneous relationships helps to identify the model by constructing the error terms such that the residuals in each equation is uncorrelated with the residuals in preceding equations.

These empirical advancements highlight the importance of identifying output shocks and

business cycle fluctuations in shaping the relationship between the external balance and fiscal policy, but surprisingly there is a lack of investigation into this relationship in emerging markets given the contribution of output shocks. Studies that analyse the current account in South Africa have so far only focused on the likelihood of sudden stops and sustainability of the deficits, for example, Frankel, Smit and Sturzenegger (2008) and Kandiero (2007) argue that South Africa's current account position is a result of investment goods and strong consumer related products with a sudden stop of capital flows being unlikely, whilst Searle and Touna-Mama (2010) and Smit (2007) conclude that the current account deficit in South Africa is sustainable and is cushioned by the level of capital flows and reserves. This lack of investigation into current account determinants, and South Africa's susceptibility to business cycle fluctuations (see Du Plessis, 2006) motivate the use of South Africa as a case study for this analysis. In addition to business cycle fluctuations, Du Plessis, Smit and Sturzenegger (2007), Burger and Jimmy (2006) and Thornton (2007) provide evidence of pro-cyclical government expenditure in South Africa with government expenditure increasing in times of economic boom, and reducing in times of economic downturn, which according to Kim and Roubini (2008) may lead to a divergence between the fiscal and current account deficits.

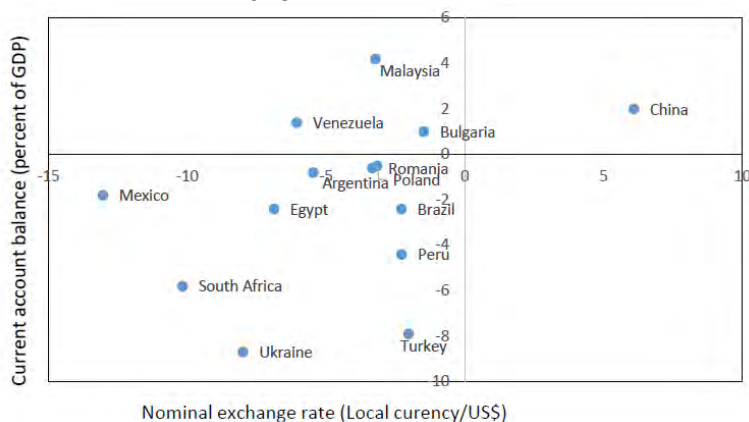
Given the lack of research on the underlying drivers of current account dynamics in emerging markets, this study contributes to the ongoing debate on current account dynamics and fiscal policy interaction by analysing drivers of current account dynamics in South Africa, an area which has been overlooked in literature, and the study has implications for the design of fiscal policy targeted at managing the external balances. In the next section, we move to discuss the macroeconomic developments in terms of fiscal policy innovations and current account dynamics in South Africa, and demonstrate why South Africa provides an appropriate case study for analysing the relationship between the current account and fiscal policy.

2.3 Current Account and Fiscal Developments in South Africa

South Africa has experienced persistent current account and fiscal deficits for over two decades, with several fiscal policy measures made in an attempt to manage the current account balance. The current account had an average deficit of 0.94% of GDP between 1985 and 2012 (SARB, 2014). Deficits are characterised by increasing capital flows, low investment, reduced savings and exchange rate depreciation, with the rand depreciating by approximately 23% since the beginning of 2012, and being the most volatile amongst EME currencies (IMF, 2013b). These factors, together with declining commodity prices contributed to the widening of current account deficits, with a deficit of 6.3% in 2012 which

was only superseded by Ukraine and Turkey amongst other EMEs (see figure 2.1).

Figure 2.1: Current Account Balance and Nominal Exchange Rate Changes: South Africa vs Selected EMEs as at December 2013



Source: Authors compilations using data from TheWorldBank (2015)

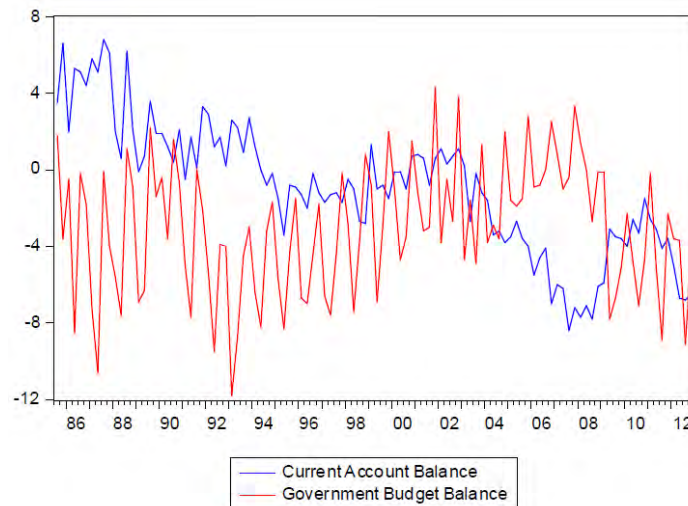
At present, South Africa’s fiscal position is currently weaker than other EMEs, with high levels of government debt averaging about 42% of GDP in 2012. Government budget deficits are mostly structural in nature, with the wage bill accounting for about 30% of spending. Public sector borrowing is 4 times the level it was in 2008 and about 60% of the borrowing requirements are financed by non-residents through short term capital flows. Household savings are also low with a household debt burden averaging about 76% of disposable income in 2012 (SARB, 2014). This accumulation of debt, particularly government debt, reflects the stance of fiscal policy, and the decline in gross domestic savings has contributed to the decline of the savings investment gap, and consequently a deterioration of the current account balance.

South Africa’s fiscal policy has evolved through three distinct phases since the end of apartheid. The first phase from 1994 to 2000 viewed the current account deficit as a constraint to economic growth and advocated for macroeconomic stability through reduced fiscal deficits which were also meant to reduce current account deficits. Fiscal policy between 2001 and 2006 was more targeted toward macroeconomic reform and aimed at increasing public spending to increase growth. The current account deficit was expected to widen in this period as public infrastructure investment increased in support of the growth initiative. From 2007, fiscal policy has been in support of more balanced growth through increasing both private and public investment (Jibao, Schoeman and Naraidoo, 2012).

Policy perspectives on current account imbalances in South Africa have so far been based on the twin deficits approach which postulates that a fiscal expansion causes an increase

in interest rates, that causes an increase in capital inflows when capital mobility is high, and appreciation of the domestic currency, thereby causing a current account deficit. The deficits exhibited in South Africa's external balance are reflective of a country living beyond its means, and in addition, the government budget balance and current account balance appear to diverge in the sample period under study 1985:Q3-2012:Q4 (see figure 2.2).

Figure 2.2: Current Account Balance and Government Budget Balance (% of GDP)



Source : Author's compilations using data from SARB (2014)

This contradiction of theoretical views raises the question of how fiscal policy and the external balance interact in South Africa, and motivates for a rigorous investigation into the interaction between the current account and fiscal aggregates. To investigate this interaction, there is need to determine the fiscal variables that should be included in the model together with the current account, and the priori expectations of the current account-fiscal relationship based on the Intertemporal Approach to the current account.

2.4 Theoretical Framework

As our focus is on how fiscal shocks are transmitted to current account components which include private and public investment, as well as public and private savings, we use the savings-investment gap to define the current account and abstract from the Intertemporal Approach to the current account by Obstfeld and Rogoff (1995b).

The Intertemporal Approach to the current account assumes that consumers in a small open economy are able to smooth consumption against country specific shocks by lending and borrowing in international capital markets. The approach is built on the premise of a small open economy that produces a single composite good, with the economy budget constraint

given by equation 2.3.

$$\sum_{s=t}^{\infty} R_{t,s}(C_s + G_s + I_s) \leq (1 + r_t)A_t + \sum_{s=t}^{\infty} R_{t,s}Y_s \quad \text{where} \quad \lim_{s \rightarrow \infty} R_{t,s}A_{s+1} \geq 0 \quad (2.3)$$

where $R_{t,s}$ is defined as

$$R_{t,s} = \frac{1}{\prod_{v=t+1}^s (1 + r_v)}$$

The budget constraint shows that the present value of the nation's expenditure must be less than or equal to the present value of net foreign assets plus the present value of domestic production as shown in equation 2.3, where $R_{t,s}$ is the discount factor for consumption at date s , C , G and I are consumption, government spending and investment, and Y is output. In addition, there is only one traded asset for simplicity, a consumption indexed bond A_t that pays a net interest of r_t . The current account in period t is defined by the accumulation of net foreign assets as

$$CA_t = A_{t+1} - A_t = rA_t + Y_t - C_t - G_t - I_t \quad (2.4)$$

In this case, CA is the current account and A_{t+1} is the country's stock of net foreign assets at the end of period t . This accumulation of net foreign assets reflects savings and investment decisions of residents in capital markets. The current account identity is derived by assuming a representative consumer that maximises utility (equation 2.5) subject to the consumer budget constraint (equation 2.6).

$$U_t = \sum_{s=t}^{\infty} \beta^{s-t} U(C_s) \quad (2.5)$$

$$\sum_{s=t}^{\infty} R_{t,s}C_s = (1 + r_t)(V_t + B_t) + \sum_{s=t}^{\infty} R_{t,s}(W_sL_s - T_s) \quad (2.6)$$

The consumer's budget constraint reflects that households own firms and V_t are firm profits, while B_t shows the households' stock of interest bearing assets. Maximising 2.5 subject to 2.6 gives the optimal consumption path given by

$$u'(c_t) = \beta(1 + r_{t+1})u'(c_{t+1}) \quad (2.7)$$

By assuming an isoelastic utility function we denote utility as below; where $\sigma > 0$ is the elasticity of substitution.

$$U(C) = \frac{C^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}} \quad (2.8)$$

This implies that the optimal consumption path in equation 2.7 now takes the form

$$c_{t+1} = \beta^\sigma(1 + r_{t+1})^\sigma c_t \quad (2.9)$$

The consumption path must follow the economy's intertemporal constraint such that equation 2.10² holds. Using equation 2.9 to substitute for C_s in equation 2.3, the economy's consumption at date t is given by

$$C_t = \frac{(1 + r_t)A_t + \sum_{s=t}^{\infty} R_{t,s}(Y_s - G_s - I_s)}{\sum_{s=t}^{\infty} R_{t,s}(\beta^{s-t}/R_{t,s})^\sigma} \quad (2.10)$$

After further manipulation of equations 2.3 and 2.10, Obstfeld and Rogoff (1995b) show that the current account in period t is given by the fundamental current account equation below which shows the dynamics resulting in a current account surplus or deficit.

$$CA_t = (r_t - \tilde{r}_t)A_t + (Y_t - \tilde{Y}_t) - (G_t - \tilde{G}_t) - (I_t - \tilde{I}_t) + \left[1 - \frac{1}{(\beta/\tilde{R})^\sigma} \right] (\tilde{r}_t A_t + \tilde{Y}_t - \tilde{G}_t - \tilde{I}_t) \quad (2.11)$$

Equation 2.11 characterises the current account as a function of net assets, interest rates, income, government spending and investment. The current account is thus measured by the deviation of these variables from their permanent level, where \tilde{X}_t is the permanent level of variable X at date t as shown in equation 2.12, (see Obstfeld and Rogoff (1995b) for a detailed discussion).

$$\tilde{X}_t \equiv \frac{\sum_{s=t}^{\infty} R_{t,s} X_s}{\sum_{s=t}^{\infty} R_{t,s}} \quad (2.12)$$

Using equation 2.11, we can derive the theoretically expected relationship between government expenditure (G_t) which reflects fiscal policy, and output (Y_t) which reflects movements in the business cycle. Domestic output above its permanent level ($Y_t - \tilde{Y}_t$) stimulates a

²See appendix for the derivation of equation 2.10

current account surplus due to consumption smoothing, implying that an expansion of the business cycle should lead to an improvement in the current account position. This is deduced from the positive relationship between the current account and the output gap ($Y_t - \tilde{Y}_t$). On the other hand, high government spending above its permanent level ($G_t - \tilde{G}_t$) reduces the current account balance, i.e. moves the current account towards a deficit. This is because the burden of increased expenditure may be transferred to the private sector and households through an increase in taxes, hence households increase foreign borrowing to smooth consumption and this widens the current account deficit.

We focus on the government expenditure and output variables as these are the two main variables identified in literature to be responsible for explaining the relationship between the current account and fiscal policy (see Rafiq, 2010; Kim and Roubini, 2008). As a result, based on the fundamental current account equation and the need to analyse the interaction between the current account and fiscal policy, this study uses the current account deficit, which includes components of fiscal expenditure to analyse the response of the external balance to shocks. Gross domestic product is used to account for the cyclicity of output shocks and the government budget deficit is used to proxy fiscal policy. We use the budget deficit since the hypothesis of twin deficits, which is our focus, entails a positive correlation between the current account balance and fiscal balance. In addition, we use the total fiscal deficit which includes the primary deficit (expenditure minus taxes) and interest payment on debt. Our choice to use the total fiscal deficit is shaped by equation 2.11 which shows that defining the current account as the change in net foreign assets implies the current account is a function of output, fiscal expenditure, investment, and the interest from net foreign assets $(r_t - \tilde{r}_t)A_t$. This shows that net interest payments are essential for shaping current account dynamics, and we account for the variable by capturing it in the total fiscal deficit. This is essential for an economy like South Africa with a large volume of capital inflows that have played a role in driving current account deficits (Smit, Grobler and Nel, 2014).

The theoretical model outlined above implies that the current account is determined by GDP and fiscal variables, but suggests no clear empirical specification. In the empirical literature, it has become common to allow the most general specification to be estimated using a structural VAR approach, which takes an unrestricted VAR and uses economic theory to provide identifying restrictions. Due to the atheoretical nature of VAR models, we use equation 2.11 as a guide in our variable selection, to deduce priori expectations, and to impose identifying restrictions. Imposing restrictions on the coefficients from theory improves the precision of estimates and reduces the forecast error variance by recovering structural innovations from the residuals (see Kim and Roubini, 2000; Christiano, Eichenbaum and Evans, 1999). The convenience of the fundamental current account equation (2.11) is that it shows a direct link between the intertemporal approach to the current account and the

twin deficit hypothesis through a negative correlation between the current account balance and the fiscal balance when government spending is above its permanent level (see equations 2.2), such that increasing fiscal expenditure worsens the current account deficit.

This mechanism of the twin deficit hypothesis, coupled with the arguments in literature that business cycle fluctuations play an important role in the determination of the current account (e.g. Rafiq, 2010; Kim and Roubini, 2008) enable us to reduce equation 2.11 to a specification where the current account is explained by a fiscal variable and output. This reduced form specification is supported by empirical studies that find that in analysing the relationship between the current account and fiscal policy, the minimum variables required are the current account and fiscal balance (e.g. Ganchev, Stavrova and Tsenkov, 2012; Marinheiro, 2008; Kouassi, Mougoue and Kymn, 2004). These studies demonstrate the minimum variables needed in analysing causality between the current account and fiscal policy are the current account balance and a fiscal variable, and this the basis of the identification strategy we adopt using a lower order VAR model.

2.5 The Model

2.5.1 Theoretical Specification

To implement the identification strategy, we follow the model by Kim and Roubini (2008), who argue that the VAR model is more useful in controlling for the endogenous component of shocks and isolating their exogenous component. A key difference from Kim and Roubini (2008) is that we reduce our model to a trivariate VAR to suit the specific objectives of this study of investigating the existence of a twin deficit relationship in South Africa, and analysing and how fiscal shocks are transmitted to current account components. We note that Kim and Roubini (2008) use a 5 variable VAR in their baseline model as their study aims to not only investigate the effects of fiscal policy, but also the effect of the real exchange rate on the current account. In contrast, we are concerned with the effects of fiscal policy and the transmission of fiscal shocks. Our focus on fiscal shocks alone motivates us to reduce our baseline model to a three variable system.

Reducing the model to a trivariate VAR helps us to specifically focus on fiscal shocks, which are our focus, and output shocks which are in key driving the relationship between the current account balance and fiscal balance. It also enables us to attain stable VARs. The use of lower order VARs is common in literature with several studies only focusing on the variables that are essential for the specific relationship under investigation. These studies include

Nason and Rogers (2002) who use a bivariate VAR to analyse the relationship between the current account and investment, and Bachman (1992) who uses bivariate VARs to analyse determinants of the current account. Bachman (1992) justifies the choice of a bivariate VAR by explaining that the aim of the study is to empirically determine variables that explain the current account, rather than investigate the interrelationships between explanatory variables. In the same spirit, Kano (2008) uses a trivariate VAR to analyse the response of the current account to country specific and transitory shocks, and argues that the trivariate VAR is more useful in the validation of several assumptions of open economy macroeconomic models as it has a minimum of arbitrariness. These country specific studies on current account dynamics tend to rely on small scale VARs since lower order VARs are found to capture the dynamic relationships more adequately than larger scale VARs (e.g. Kano, 2008; Hoffmann, 2003; Chinn and Prasad, 2003). In addition, Lee and Chinn (2006) argue that while larger scale VARs offer a set of multiple explanatory variables, they fail to identify statistically significant impulse response functions and provide less persuasive conclusions. Given these arguments in favour of lower order VAR models, we proceed to use a trivariate VAR in the baseline model, and expect the model to still give unbiased results as several studies demonstrate the feasibility of lower order VARs.

We present the model by describing the economy using a structural form equation given below;

$$G(L)Y_t = e_t \tag{2.13}$$

In this specification, $G(L)$ is a matrix polynomial in the lag operator L . Y_t is an $n \times 1$ data vector, e_t is an $n \times 1$ vector of serially uncorrelated error terms with variance Λ . This structural model is developed from a reduced form VAR that takes the form

$$Y_t = B(L)Y_t + u_t \quad \text{where } \text{var}(u_t) = \Sigma \tag{2.14}$$

A non-recursive structure that places theoretically founded restrictions on the coefficients is used to recover the structural parameters in equation 2.13 from the estimated parameters in equation 2.14. To recover the structural parameters, we assume G_0 to be a matrix with the contemporaneous coefficients in structural form, while $G^0(L)$ is a coefficient matrix in $G(L)$ without the contemporaneous coefficients such that

$$G(L) = G_0 + G^0(L) \tag{2.15}$$

This implies that $B(L)$ becomes the relationship between the structural and reduced form equations (2.13 and 2.14) such that

$$B(L) = -G_0^{-1}G^0(L) \quad (2.16)$$

Consequently, the structural and reduced form residuals are related by

$$e_t = G_0 u_t \quad (2.17)$$

$$\text{where } \Sigma = G_0^{-1} \Lambda G_0^{-1} \quad (2.18)$$

The right hand side of equation 2.18 has $n(n+1)$ free parameters to be estimated. To achieve identification, we normalise n diagonal elements of G_0 to 1s, and we impose at least $\frac{n(n+1)}{2}$ contemporaneous restrictions on G_0 . Consequently, G_0 can either be triangular, using a Cholesky decomposition, or can be non-recursive using a generalised structural VAR approach.

2.5.2 Econometric Specification and Identification

We convert the theoretical specification of the model to an empirical specification by reverting to the three key variables that are relevant for the analysis based on the fundamental current account equation (equation 2.11). As a result, the vector data Y_t in equation 2.13 is given by $\{LGDP; GOV; CAD\}$, where $LGDP$ is the log of gross domestic product, GOV is the fiscal variable, and CAD is the current account deficit. An illustration of the empirical specification of equation 2.13 is made using the three endogenous variables in the baseline model where $GOV1$ is the government budget deficit. The specification of the VAR is as in equations 2.19 - 2.21.

$$LGDP_t = \alpha_1 + \sum_{i=1}^m \beta_{1i} LGDP_{t-i} + \sum_{i=1}^m \gamma_{1i} GOV1_{t-i} + \sum_{i=1}^m \delta_{1i} CAD_{t-i} + \varepsilon_{1t} \quad (2.19)$$

$$GOV1_t = \alpha_2 + \sum_{i=1}^m \beta_{2i} LGDP_{t-i} + \sum_{i=1}^m \gamma_{2i} GOV1_{t-i} + \sum_{i=1}^m \delta_{2i} CAD_{t-i} + \varepsilon_{2t} \quad (2.20)$$

$$CAD_t = \alpha_3 + \sum_{i=1}^m \beta_{3i} LGDP_{t-i} + \sum_{i=1}^m \gamma_{3i} GOV1_{t-i} + \sum_{i=1}^m \delta_{3i} CAD_{t-i} + \varepsilon_{3t} \quad (2.21)$$

where $E(\varepsilon_{it}) = 0$; $E(\varepsilon_{it}\varepsilon'_{it}) = I$; and $E(\varepsilon_{it}\varepsilon'_{is}) = 0 \quad \forall t \neq s$

We estimate 3 different baseline specifications that analyse the impact of fiscal policy on the current account, before investigating how these shocks are transmitted to current account components. The first specification identifies government budget deficit shocks, the second identifies fiscal expenditure shocks, and the third identifies fiscal consumption shocks. Whilst the government budget deficit is used to proxy fiscal shocks, government spending shocks are also used as robustness checks and these different specifications help in determining which fiscal shock is more responsible for movements in the current account. As a result, the vector Y_t under each specification is denoted below;

$$\text{Specification 1:} \quad Y_t = \{LGDP; GOV1; CAD\}' \quad (2.22)$$

$$\text{Specification 2:} \quad Y_t = \{GOV2; LGDP; CAD\}' \quad (2.23)$$

$$\text{Specification 3:} \quad Y_t = \{GOV3; LGDP; CAD\}' \quad (2.24)$$

where $GOV1$ is the government budget deficit, $GOV2$ is government expenditure, and $GOV3$ is government consumption.

To identify government budget deficit shocks, it is assumed that the budget balance responds contemporaneously to changes in output, but not to changes in other variables in the model, whilst changes in the budget balance affect output only after one quarter. This identifies a fiscal innovation to the deficit and follows Kim and Roubini (2008) and Corsetti and Muller (2006). It implies that real GDP is ordered first as it is not likely to contemporaneously respond to other variables in the system. The government balance is ordered after real GDP because components of government revenue may be affected by the current level of economic activity. Other studies such as Blanchard and Perotti (2002) and Rafiq (2010) concur with this view of ordering the government balance after real GDP. Kim and Roubini (2008) argue that conditioning on current real GDP gives room to control for the current endogenous reaction of the government primary deficit to current activity. In addition, not conditioning on other variables gives room for identifying the exogenous changes in the government deficit, since such changes are less likely to depend on other variables due to the decision lag of fiscal policy. The current account is ordered third after real GDP and the government budget balance because of the assumption that real output growth is pre-determined with respect to the current account. The restrictions for specification 1 are illustrated in equation 2.25 below;

$$\begin{bmatrix} \Delta LGDP_t \\ \Delta GOV1_t \\ \Delta CAD_t \end{bmatrix} = \begin{bmatrix} B_{11}(L) & 0 & 0 \\ B_{21}(L) & B_{22}(L) & 0 \\ B_{31}(L) & B_{32}(L) & B_{33}(L) \end{bmatrix} \begin{bmatrix} u_{lg\ dp,t} \\ u_{gov1,t} \\ u_{cad,t} \end{bmatrix} \quad (2.25)$$

We recover the structural parameters in the system where $\varepsilon_{lg\ dp,t}$, $\varepsilon_{gov1,t}$, and $\varepsilon_{cad,t}$ are the structural disturbances. This lower triangular just identified system forms the basis of the identifying restrictions used in this specifications 2 and 3.

$$\begin{bmatrix} u_{lg\ dp,t} \\ u_{gov1,t} \\ u_{cad,t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ G_{21}(L) & 1 & 0 \\ G_{31}(L) & G_{32}(L) & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{lg\ dp,t} \\ \varepsilon_{gov1,t} \\ \varepsilon_{cad,t} \end{bmatrix} \quad (2.26)$$

When government spending shocks are used in place of the fiscal deficit, the identification strategy assumes that government spending does not contemporaneously respond to changes in other variables, whilst other variables are contemporaneously affected by government spending shocks. This identification scheme follows Blanchard and Perotti (2002) and Kim and Roubini (2008), and it implies that government spending is assumed to be exogenous to other non government variables in the system, hence it is ordered first.

2.6 Data

After setting up this model, we apply it to South Africa using quarterly data from the third quarter of 1985 to the last quarter of 2012. The starting point of 1985:Q3 corresponds with the start of the dual exchange rate regime in South Africa, so the sample covers two exchange rate regimes, the dual and the free float. A dummy variable is included to cater for the switch to a free floating exchange rate/financial liberalisation at the end of the first quarter of 1995, with 1 indicating the floating exchange rate from 1995:Q2 to 2012:Q4, and zero otherwise. Seasonal dummy variables are also included, together with a dummy variable that controls for the effects of the financial crisis on output. All data are obtained from the South African Reserve Bank (SARB, 2014).

The current account deficit (*CAD*) is measured as the ratio of the current account balance to GDP in percentage terms. Values greater than zero indicate a deficit and those less than zero, a surplus. This conversion is for ease of interpretation since South Africa's current account balance has an average deficit for the period under study. The government budget balance (*GOV1*) is used to analyse the effect of fiscal policy on the current account through budget

deficit shocks. The variable measures the government deficit or surplus as a percentage of GDP. Measuring both the current account balance and the fiscal balance as a percentage of GDP is standard in the literature and enables interpretation of the results in terms of a "current account deficit" and "fiscal deficit" (e.g. Rafiq, 2010; Kim and Roubini, 2008; Marinheiro, 2008; Bartolini and Lahiri, 2006; Corsetti and Muller, 2006). As in the case of the current account balance, the fiscal balance is converted such that values greater than zero are a deficit whilst those less than zero are a surplus. This conversion is also for ease of interpretation with results interpreted in terms of a government budget deficit. Real gross domestic product (LGDP) is measured by gross domestic product at 2010 constant prices. This variable is included to analyse the impact of output shocks/ business cycle fluctuations and is measured in logs. Measuring this variable in logs is also common in the literature (e.g. Kim and Roubini, 2008; Corsetti and Muller, 2006). Output controls for variations in business cycles and endogeneity of the fiscal and external balance.

Government expenditure as a ratio of GDP (GOV2), and government consumption as a ratio of GDP (GOV3) are used to generate government spending shocks. The difference between these two variables is that government consumption includes expenditure on goods and services only whilst government expenditure includes all expenditure on goods, services, investment and transfers. Alternative fiscal measures used to test robustness in the literature range from public consumption (e.g. Bartolini and Lahiri, 2006; Marinheiro, 2008), government surplus (e.g. Calderon, Chong and Loayza, 2002) and government spending (Kim and Roubini, 2008). However, because South Africa's fiscal position has mostly been in deficit, this study uses government spending variables to reflect a fiscal deficit generated through excess expenditure.

Current account components used to analyse the transmission of fiscal shocks are the trade balance as a percentage of GDP (TBAL), which is used to analyse how fiscal shocks are transmitted to trade activities, the ratio of household savings to disposable income (HSAV), net savings by the general government as a percentage of GDP (GSAV) and gross investment by the general government (GINV) are used to analyse the transmission of fiscal shocks via the savings and investment behaviour of the government and private agents. Lastly the ratio of final household consumption to GDP (HCONS) is used in order to infer household behaviour in response to fiscal shocks and how this response transmits to the current account.

To generate the results, we proceed by estimating the trivariate VAR models in specifications 1-3, and compare these models to determine robustness of the impact of fiscal policy on the current account. We then pick the most appropriate model and use it to infer how fiscal shocks are transmitted to current account components. To investigate the transmission of fiscal shocks, we add one current account component to the trivariate VAR, making it a four

variable VAR, and analyse how fiscal shocks are transmitted to that component. Following Kim and Roubini (2008), we repeat this process with the various current account components, and contrast the results to see which components are most affected.

2.7 Results

2.7.1 Effect of Fiscal Shocks on the Current Account

Given that the main objective of this paper is to analyse the relationship between the current account balance and the fiscal balance, the model examines the effect of fiscal deficit shocks on the current account, with fiscal deficit shocks generated through the government budget balance. The descriptive statistics (table 2.1) show a maximum current account deficit of 6.8% of GDP and a maximum fiscal deficit of 11.8% of GDP for the period under review. Whilst the current account has had an average deficit of 0.94% of GDP, the fiscal balance has also had an average deficit of 3.06% of GDP. This average deficit explains the choice to focus on the impact of the government budget deficit on the current account, and motivates the study to analyse the impact of government spending shocks on the current account as the fiscal balance is driven by increases in government spending. We also observe maximum government expenditure and government consumption of 33.7% and 20.7% of GDP respectively. The differential between government expenditure and government consumption is reflective of higher values for the government expenditure variable which includes investment and transfers, components which are not part of government consumption. This suggests that both investment and transfers may have a significant role in driving fiscal spending.

Table 2.1: Descriptive Statistics

	MEAN	STD. DEV	MIN	MAX
CA Def	0.9373	3.4403	-8.4	6.8
Gov Def	-3.0627	3.4095	-4.3	11.8
Gov Exp	25.9400	2.5842	19.9	33.7
Gov Cons	18.8327	0.8591	16.1	20.7
LGDP	14.0958	0.2189	13.091	14.4931

The correlation coefficients in table 2.2 show the government budget deficit and current account deficit are negatively correlated, implying that budget deficit shocks may lead to a current account improvement, which is indicative of a divergence of the two deficits. Output shocks may worsen the current account deficit based on the positive correlation between the two variables. This indicates the possibility of a current account deficit generated by business cycle fluctuations. The correlation coefficient between output and the current account is high (0.8363), however, because comovements between the current account and fiscal balance

Table 2.2: Correlation Coefficients

	CA Def	LGDP	Gov Def		CA Def	LGDP	Gov Def
CA Def	1.0000			Hhld Sav	-0.7665	-0.7713	0.2992
LGDP	0.8363*	1.0000		Gvt Sav	-0.0388	-0.1544	-0.6653
Gov Def	-0.1551	-0.1793		Gvt Inv	-0.0845	0.0381	-0.1208
Gvt Exp	0.1347	0.1097		Hhld Cons	0.4247	0.1488	-0.0748
Gvt Cons	0.2876	0.4587					
TBal	-0.9771*	-0.8135*	0.0999				

Note: Results reported are limited only to the variables that interact in the models.

Table 2.3: Stationarity Tests using ADF Method and Phillips-Perron Method

ADF

	Levels		1st Difference	
	Intercept	Intercept + Trend	Intercept	Intercept + Trend
LGDP	0.9962	0.5698	0.0001	0.0002
CA Def	0.7400	0.0942	0.0000	0.0000
Gov Def	0.2749	0.7458	0.0000	0.0001
Gvt Exp	0.8753	0.9857	0.0000	0.0000
Gvt Cons	0.1326	0.1327	0.0000	0.0000

PHILLIPS-PERRON

	Levels		1st Difference	
	Intercept	Intercept + Trend	Intercept	Intercept + Trend
LGDP	0.9980	0.7748	0.0001	0.0001
CAD	0.2613	0.0000	0.0000	0.0000
Gov Def	0.0000	0.0000	-	-
Gvt Exp	0.0000	0.0000	-	-
Gvt Cons	0.1864	0.1537	0.0000	0.0000

Note: H_0 - Series has a unit root.

Table records P-values of each test

could potentially be explained by output shocks (see Kim and Roubini, 2008), so real GDP is kept in the model. The same argument explains the high correlation between the trade balance and output.

Results from stationarity tests, using the Augmented Dickey-Fuller (ADF) method, showed that all variables have unit roots³. The Phillips Perron method however confirms these results, with the exception of the government deficit and government expenditure. The discrepancy between the ADF test results and PP test results for the government deficit and government expenditure can be attributed to the shortcomings of unit root tests. These tests are often criticised for having weak power, which makes it difficult to differentiate between

³Given that the variables are integrated of order 1, the Johansen Cointegration test is conducted and the results show that the variables are not cointegrated.

Table 2.4: Stationarity Tests on Detrended Variables

	Time trend		HP Filtered Cycle	
	ADF	PP	ADF	PP
LGDP	0.7018	0.6140	0.0038	0.0421
CAD	0.7400	0.2613	0.0000	0.0000
Gov Def	0.3045	0.0000	0.0002	0.0000
Gov Exp	0.4178	0.6319	0.0001	0.0000
Gov Cons	0.6854	0.5583	0.0000	0.0000

Note: Tests conducted with intercept
Table records P-values of each test

a difference and trend stationary process. As a way of overcoming this shortfall, we also test for deterministic and stochastic trends in the data to determine if the series are trend stationary. To test for a deterministic trend, we regress the variable of interest on a time trend, and test stationarity of the residuals that result. The results for this test are reported under the column "time trend" in table 2.4. Next, we use the Hodrick-Prescott (HP) filter to extract the stochastic trend from the data, and test for stationarity of the resulting detrended cyclical series. These results are reported under the column "HP Filtered Cycle" in table 2.4. The findings show the existence of a stochastic trend, and the variables are stationary when we use the detrended series. Consequently, we proceed to estimate the SVAR models in equations 2.22-2.24. These models help in analysing the impact of fiscal shocks on the current account, and we compare inferences of the difference stationary model to inferences of the HP filtered series before analysing the transmission of monetary shocks to current account components. We use impulse response functions and variance decompositions to facilitate the analysis, where the impulse response functions show the effects of a shock to one endogenous variable on the other variables in the system⁴.

When estimating VAR models, selecting the appropriate lag length is important as it has a bearing on the results. We find the appropriate lag length using the Likelihood Ratio (LR) test, the Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC) and the Hannan-Quinn Information Criterion (HQ). Ng and Perron (2005) and Liew (2004) demonstrate that the lag length is affected by sample size, with the AIC, and FP performing better when the sample size is less than 60. In general, the SC and HQ tend to pick smaller lag lengths whilst the AIC over estimates. This shows the need to use all 5 criteria for consistency in choosing the most suitable lag length. Table 2.5 reports the lag length selection criteria for the baseline specifications used to analyse the impact of fiscal shocks on the current account.

In proceeding with the analysis, our choice of models is between the difference stationary

⁴Model specifications are in table 2.12 in the appendix.

Table 2.5: Lag Length Selection

Model	Lag Length	LR	FPE	AIC	SC	HQ
<i>LGDP; Gov Bal; CAD</i>	3	87.1690	0.0002*	0.0037*	1.0912*	0.4440*
<i>Gov Exp; LGDP; CAD</i>	3	59.2861	0.0001*	-0.6827*	0.4047*	-0.2425*
<i>Gvt Cons; LGDP; CAD</i>	2	28.0325*	1.31e-05*	-2.7351*	-1.8807	-2.3891*

*indicates optimal lag order selected by the criterion

model based on the results from the ADF tests, and the trend stationary model, based on the HP filtered series which show that the model has a stochastic trend. We run the first specification of the model $\{LGDP; GOV1; CAD\}$ using both the differenced and detrended models, and compare the stability and diagnostics of these two models. The results from these tests demonstrate that whilst both models are stable, residuals from the detrended model are not multivariate normal and are serially correlated, whilst residuals from the differenced model are multivariate normal and serially uncorrelated (see table 2.6). This motivates us to proceed with the difference stationary model which retains the trend in the variables.

Table 2.6: Model Selection: Differenced vs Detrended Model

	White (cross)	Normality	LM
Differenced Model	0.2973	0.1416	0.2459
Detrended Model	0.2420	0.0691	0.0113

White test:	H_0 no heteroscedasticity / no misspecification
Normality test:	H_0 residuals are multivariate normal
LM test:	H_0 no serial correlation

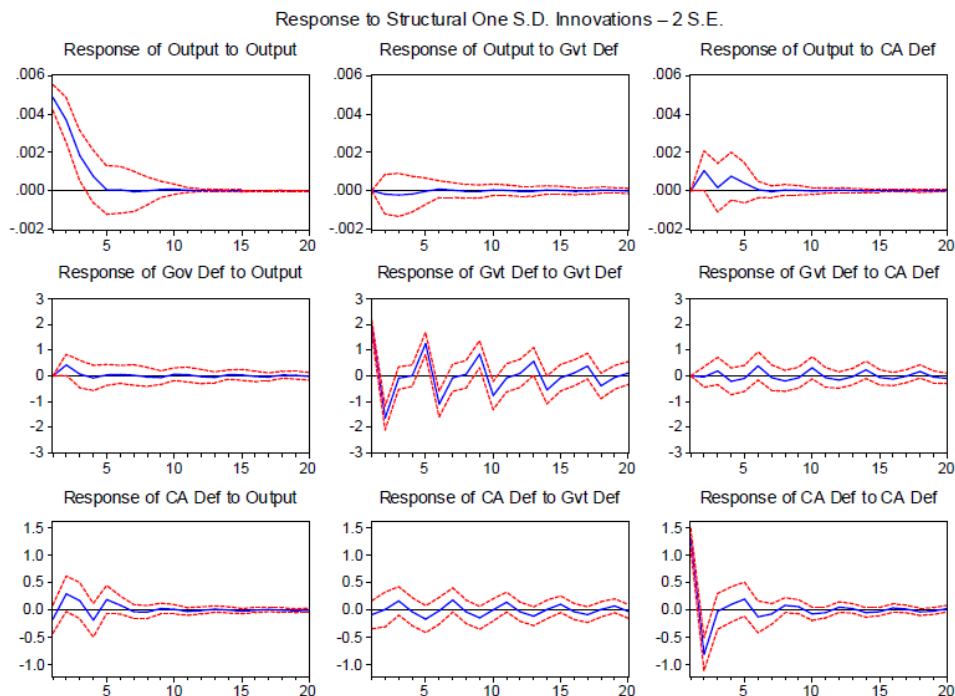
Equation 2.27 reports the estimated structural parameters for the VAR system in the differenced model for this just identified system. These coefficients show that an increase in output reduces the fiscal deficit whilst it increases the current account deficit, which could be through an increased import requirement. An increase in the fiscal deficit worsens the current account deficit, This is indicative of a positive relationship between the two deficit, and we explore this further in later sections using impulse response functions and variance decompositions.

$$\begin{bmatrix} 1 & 0 & 0 \\ -0.5266 & 1 & 0 \\ 34.8918 & 0.02216 & 1 \end{bmatrix} \begin{bmatrix} \lg dp \\ gov1 \\ cad \end{bmatrix} = \mathbf{G}(\mathbf{L}) \begin{bmatrix} \lg dp \\ gov1 \\ cad \end{bmatrix} + \begin{bmatrix} e_{\lg dp} \\ e_{gov1} \\ e_{cad} \end{bmatrix} \quad (2.27)$$

After identifying and selecting the appropriate model, we move to analyse the effects of fiscal shocks on the current account. Figure 2.3 shows the response of the variables to shocks, with row 1 column 1 showing the response of output to a percentage change in itself (own shock), column 2 shows the effect of a government deficit shock and column 3, the effect of current

account deficit shock. Row 2 shows the responses for the government budget deficit and row 3 shows current account deficit responses.

Figure 2.3: Impulse Response Functions - Government Budget Deficit



Clearly, a government budget deficit shock has very little impact on output, with only as much as a 0.001 percentage point (pp)⁵ increase which dies out within a year. The effect of a positive shock to the current account deficit (worsening of the current account deficit) on output is also small. A fiscal deficit shock also has a very small and insignificant impact on output, that is, output reduces by 0.001pp in period 2. Row 2, column 1 shows that a positive output shock worsens the fiscal deficit by 0.4pp in the second quarter, but this deterioration is short lived and is eroded by the third quarter, dying out after 12 quarters. The deterioration of the fiscal balance when there is a boom is indicative of procyclical fiscal policy. There is a slightly effect of the current account deficit shock on fiscal deficits, with the government budget deficit increasing by 0.3pp in the first quarter and eventually declines, though the decline is still evident at the end of the period.

It is also interesting to note that the impact of a current account deficit shock on the fiscal deficit was initially positive, suggesting that whilst fiscal expansion improves the current account position, a positive shock to the current account deficit worsens the fiscal deficit instead before it improves. This provides further evidence against the twin deficits hypothesis as the direction of effect between fiscal deficits and current account deficits should be two way for the twin deficits hypothesis to hold, i.e. an increase in the fiscal deficit should worsen the

⁵For illustrative purposes, a 0.1 percentage point increase entails an increase from 6% to 6.1%.

current account deficit and simultaneously, an increase in the current account deficit should worsen the fiscal deficit. Lau, Mansor and Pua (2010) find similar results for Malaysia, Thailand and the Philippines, where fiscal expansion improves the current account position. This could be explained by government's need to expand the fiscal deficit through increased borrowing to finance the current account deficit when it widens. They also find evidence of causality running from the current account deficit to the fiscal deficit only in Indonesia and Korea, with only Philippines showing bidirectional causality. This is supporting evidence of the need for case studies for such an analysis as the twin deficits hypothesis appears to fail in some emerging markets.

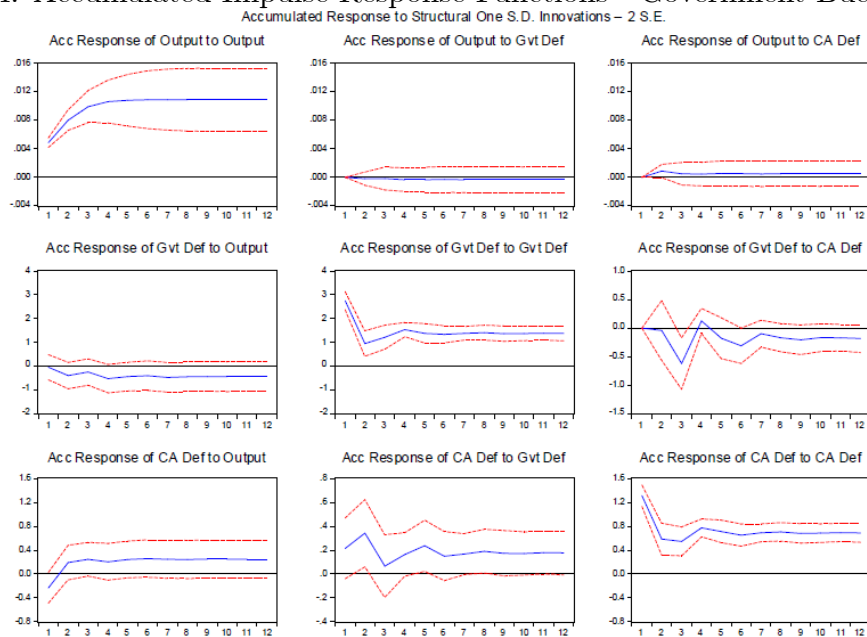
In the analysis above, we place focus on the response of variables to shocks on impact. However, we acknowledge that the IRFs are mostly insignificant and oscillate around zero. As a result, we use the accumulated impulse responses to analyse if the observed relationships hold over an accumulated horizon⁶. These results are reported in figure 2.4 and show that the fiscal balance improves in response to a government budget deficit shock by 0.62 percentage points. This result is significant in the third quarter. In addition to this, a positive shock to the government budget deficit leads to a deterioration of the current account deficit by 0.34 percentage points in the second quarter. The deterioration of the current account in response to fiscal expansion is significant in the second and fifth quarters. The significance of these accumulated impulse responses, even though it holds for a short period, shows that there is a diverging relationship between the current account and fiscal balance in South Africa.

The impulse response function results in the above discussion provide the total effect of the shocks (random innovations), but it is useful to know the contribution made by each of the variables in the VAR and this is provided by the variance decomposition results in Table 2.7. The first block in this table shows the decomposition of the total response of output to shocks, with columns 1, 2 and 3 showing the contribution of output, the fiscal deficit and the current account deficit to the variation of GDP to shocks. Block 2 decomposes the total response of the fiscal deficit, and block 3 the total response of the current account deficit to shocks.

From the variance decompositions, column 2 of the first block shows that the government budget deficit shocks have a very small effect on output, with a contribution of less than 1%, even at longer horizons and the contribution of the current account deficit shock to variations in output is also small (only 2% of the variation in output is accounted for by the current account in the first quarter and less using a longer horizon). Of Interest though is

⁶The accumulated impulse responses show the impact of the prior impulse responses, but over a cumulative horizon. This implies that significance of the accumulated IRFs only applies to the accumulated impact of the shock.

Figure 2.4: Accumulated Impulse Response Functions - Government Budget Deficit



the finding that growth (output) seems to be more affected by the current account deficit as opposed to the fiscal shocks, showing the importance of managing the current account balance for macroeconomic stability.

Whilst the current account accounts for 2.65% of the variation in the fiscal balance (second block, column 3) in the first quarter, the importance of the current account in explaining fiscal shocks increases to 7.2% at longer horizons. This demonstrates the importance of fiscal shocks in determining the external balance because of their persistence (see figure 2.3, row 2 column 3). Output shocks only account for at most 2.96% of the variation in the fiscal balance after 4 quarters (second block column 1), showing that the fiscal balance is more affected by shocks to the current account than by output shocks in this case.

Decomposition of the current account (block 3) shows that whilst the current account is largely affected by own shocks which have a contribution of 96.94% in the first quarter, this contribution falls at longer horizons to 87% as the impact of government budget deficit shocks on the current account comes into play (block 3 column 3). The contribution of the fiscal deficit increases from 3.02% in the first quarter to almost 10% after 12 quarters, indicating that fiscal policy has a stronger impact on current account dynamics at longer horizons. This is in line with the results found in figure 3 (row 3, column 2) which confirm that the current account is largely affected by expansionary fiscal shocks which improve the external deficit. The importance of fiscal shocks in current account dynamics suggests that measures to manage the current account through reduced fiscal expenditures may not achieve the desired results predicted by the twin deficits hypothesis. This implies fiscal expenditure reduction

Table 2.7: Structural Variance Decomposition
Period

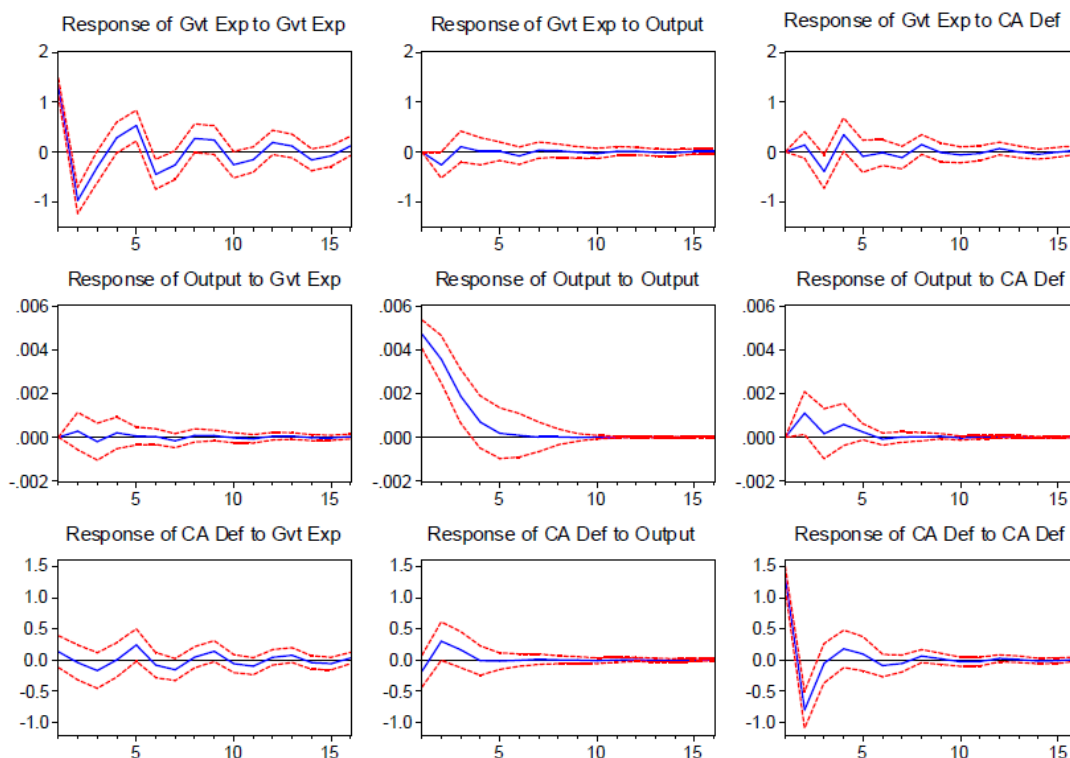
VD of Output	Output	Gvt Def	CA Def
1	97.9702	0.0906	2.0022
4	98.0577	0.0979	1.8444
12	98.0878	0.1105	1.8017
30	98.0840	0.0039	1.8021
VD of Gvt Def	Output	Gvt Def	CA Def
1	0.0541	97.2916	2.6543
4	2.9630	92.2443	4.7928
12	2.4706	90.7934	6.7360
30	2.4179	90.3579	7.2243
VD of CA Def	Output	Gvt Def	CA Def
1	0.0316	3.0235	96.9489
4	2.5626	4.9370	92.5004
12	2.5302	8.6723	88.7974
30	2.5277	9.8898	87.5829

may inadvertently result in a worsening of the current account deficit if not approached with caution. This result departs from the twin deficits hypothesis and is in support of other studies that find similar results and attribute the divergence of the two deficits to the endogeneity of the fiscal and external balances (e.g. Kim and Roubini, 2008; Rafiq, 2010). The endogeneity of the fiscal and external deficits is shown by the contribution of output shocks to the variation in these deficits, which is at most 2.9% and 2.6% for the fiscal and current account deficit respectively. These figures are however small, showing little evidence of endogeneity, and are in line with an insignificant impulse response function, so the result will be revisited in the following section using government spending shocks to analyse if there in fact is any evidence of endogeneity.

In the part that follows, government spending shocks are used as alternative specifications of the fiscal variable to test whether the negative relationship between fiscal expansion and the current account deficit continues to hold. The study generates government spending shocks through government expenditure (GOV2) and government consumption (GOV3). Spending shocks are preferred since the notion that procyclical fiscal spending improves the current account balance (twin divergence) entails that the main drivers of current account dynamics are output fluctuations and government spending. The impulse response functions are in figures 2.5 and 2.6, where the fiscal shock is denoted by shock 1, whilst shocks 2 and 3 are GDP and current account shocks respectively. Row 1 shows the response of the government spending variable (government expenditure in figure 2.5 and government consumption in figure 2.6), row 2 shows the response of GDP, row 3 the response of the current account deficit. Columns 1, 2 and 3 show shocks to government spending, output and the current account deficit respectively.

Figure 2.5: Impulse Response Functions - Government Expenditure

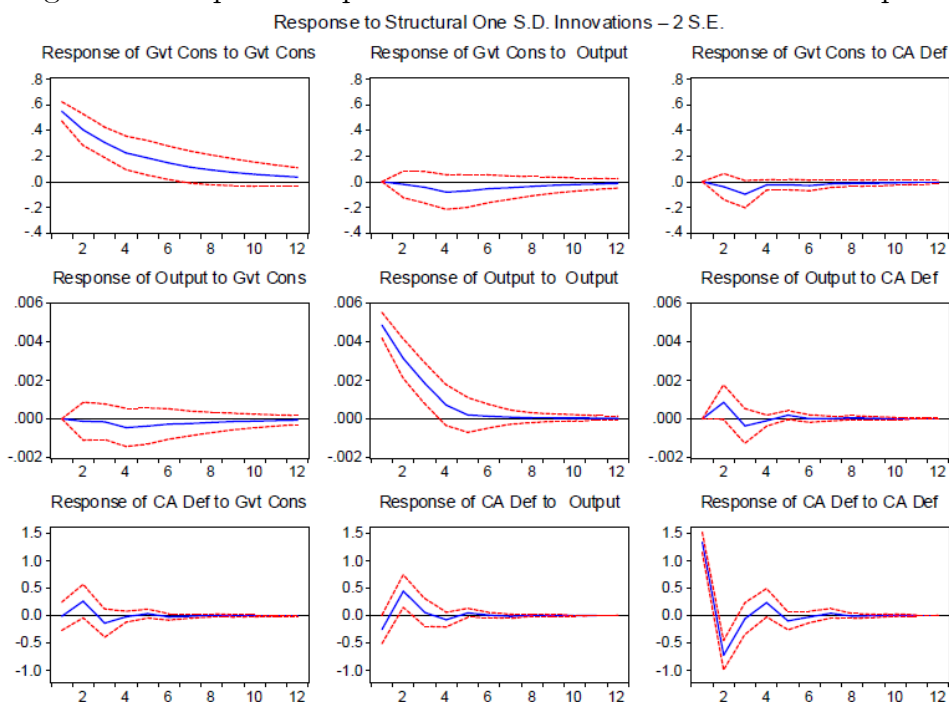
Response to Structural One S.D. Innovations – 2 S.E.



In response to an expansionary government expenditure shock (see figure 2.5), the current account improves with a peak improvement of 0.23pp in period 3 (see row 3 column 1). This improvement outweighs the small initial decline in period 2 and is very similar to the results found with a fiscal deficit shock both in the direction of the response and in magnitude. Like in the case of the government budget deficit and government expenditure, a shock to government consumption also generates an improvement in the current account balance. The current account improves by about 0.13pp in the first three quarters (see figure 2.6, row 3 column 1). The impact of government consumption shocks on the current account is smaller than government expenditure and government budget deficit shocks, and is also short lived, dying out after about 10 quarters⁷. We also examine the accumulated impulse response functions for the model using government expenditure, and they confirm these findings as well as support the predictions of the model that used the government budget balance. These results are in figure 2.10. Specifically we find that a positive shock to the current account deficit reduces government expenditure by 0.39 percentage points, and this result is significant in the third quarter. On the other hand however, a positive shock to government expenditure improves the current account balance by 0.28 percentage points, and the result is significant in the second quarter. This shows that regardless of how the fiscal variable is specified, an expansionary fiscal shock leads to an improvement of the current

⁷The data shows a very high correlation between the log of real government consumption and GDP (0.96), hence to avoid multicollinearity, the ratio of government consumption to GDP is used.

Figure 2.6: Impulse Response Functions - Government Consumption



account position, implying that the twin deficits hypothesis which informs policy formulation in South Africa fails to hold in an empirical analysis since our results are robust in predicting that fiscal expansion improves the current account. Using the variance decompositions, we move to analyse if this result is driven by the endogeneity of fiscal policy.

Tables 2.8 and 2.9 show the variance decomposition of the variables when a government expenditure shock and government consumption shock are respectively used in the model. In both instances, output is largely explained by shocks to government spending which have a contribution of about 20% for government expenditure and 25% for government consumption, implying fiscal expenditure shocks account for a quarter of the variation in output, whilst output shocks account for as much as 27% of the variation in fiscal expenditure (table 2.8, block 1 column 2). This suggests that the divergence between the current account and fiscal deficits displayed in figure 2.5 can be explained by the endogeneity of the fiscal balance which is evidenced by output shocks explaining a significant portion of the variation in government expenditure. We however take this result with caution because even though the direction of response of the IRFs indicates that increasing output reduces government expenditure, the IRFs are not significant for this result. The current account in this case is slightly more affected by budget deficit shocks (9.89% in period 30 in figure 2.3) than it is by government spending shocks (5.66% in period 30 in figure 2.5). Despite this, the effect of fiscal shocks on the current account still matters and increases at longer horizons, suggesting that output shocks generate diverging movements between the current account balance and the government balance.

Table 2.8: Structural Variance Decomposition - Government Expenditure
Period

VD of Gvt Exp	Gvt Exp	Output	CA Def
1	78.3213	21.5778	0.1009
4	61.9141	27.7545	10.3315
12	62.5471	27.7493	9.7036
30	62.5559	27.7623	9.6819
VD of Output	Gvt Exp	Output	CA Def
1	20.6377	76.0861	3.2762
4	20.3922	77.1754	2.4324
12	20.4337	77.0950	2.4713
30	20.4403	77.0863	2.4734
VD of CA Def	Gvt Exp	Output	CA Def
1	0.0070	0.2018	99.7912
2	0.2007	1.2636	98.5357
12	5.2138	2.4815	92.3047
30	5.6595	2.6833	91.6572

Two particularly interesting results arise from this analysis which are summarised in table 2.10. The first column summarises the impact of fiscal shocks on the current account, the second column summarises the variation in the current account deficit explained by fiscal shocks in the variance decomposition, and the third column explains the percentage of variation in the current account explained by output shocks. The figures in this table are obtained from the preceding discussion on impulse response functions and variance decompositions. First, expansionary fiscal shocks reduce current account deficits with all 3 specifications of the fiscal variable, and fiscal variables account for as much as 10% of the variation in the current account. This could be explained by the endogeneity of fiscal expenditure which is shown by the proportion of output shocks that explain the fiscal variable. Similar findings on endogeneity are found in Kim and Roubini (2008), and comparison of these results shows that endogeneity of fiscal expenditure is much stronger in the United States, a developed country than in South Africa, an emerging market, which conforms to expectations since developed countries have stronger business cycle effects. More endogeneity is found in the fiscal spending variables as the fiscal balance also contains revenue aspects. The second interesting result is the variation in the magnitude of the current account response between government expenditure and government consumption which shows that government expenditure shocks improve the current account more than government consumption shocks. This suggests that components of government expenditure such as investment which are not included in the government consumption variable may be responsible for the transmission of fiscal shocks to the current account. As such, there is need to empirically determine the channels through which fiscal shocks are transmitted to the current account to determine the best response fiscal policy could take to manage the external balance.

Table 2.9: Structural Variance Decomposition - Government Consumption
Period

VD of Gvt Cons	Gvt Cons	Output	CA Def
1	80.5450	18.9219	0.5331
4	75.1101	22.3924	2.4975
10	74.8452	22.3088	2.846
VD of D(LGDP)	Gvt Cons	Output	CA Def
1	24.4785	75.3098	0.2117
4	24.6778	73.5642	1.7580
10	24.6593	73.5718	1.7689
VD of CA Def	Gvt Cons	Output	CA Def
1	0.8888	4.5197	94.5915
4	1.2845	12.4054	86.3102
10	1.3743	12.7048	85.9209

Table 2.10: Summary of Current Account Deficit Response to Expansionary Fiscal Shocks

	IRF of CA Def	VD of CA Def	Endogeneity
Gov Def	0.2pp increase	9.8%	2.96%
Gov Exp	0.23pp increase	5.65%	27.76%
Gov Cons	0.13pp increase	1.37%	22.39%

2.7.2 Transmission of Fiscal Shocks to the Current Account

To analyse the channels through which fiscal shocks are transmitted to the current account, the components of the current account that we use include private and public savings and investments components, and the trade balance. Household consumption is used to infer household behaviour in response to fiscal policy, and how such behaviour filters to the current account. Since the focus of the study is on the divergence between the fiscal and current account deficits, the study reverts to using the original model with government budget deficit shocks for this analysis, with a current account component added to this model.

To identify the expanded models, we maintain the same assumptions as before, that is, we assume that the fiscal balance responds contemporaneously to changes in output, but not to changes in other variables in the system whilst changes in the fiscal balance affect output only after 1 quarter. We additionally assume that current account components are contemporaneously affected by GDP, but GDP only responds to current account components with a lag. These restrictions are illustrated below.

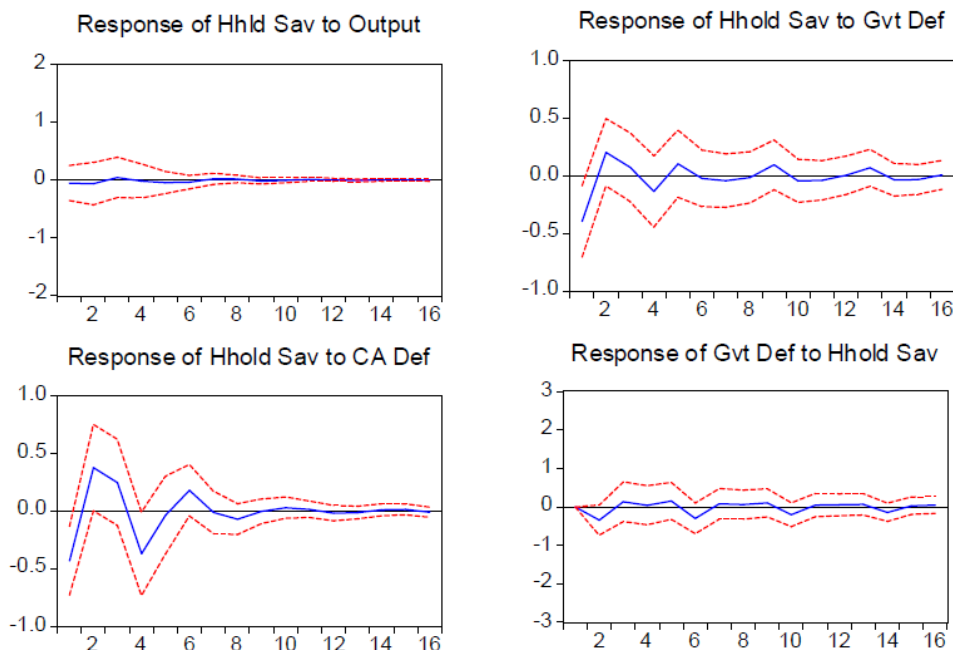
Impulse responses showing the transmission of fiscal shocks to household savings are shown in figure 2.7, and the rest are shown in the appendix.

Table 2.11: Identification Restrictions for Expanded Models

$$\left\{ \begin{array}{cccc} 1 & 0 & 0 & 0 \\ g_{21} & 1 & 0 & 0 \\ g_{31} & g_{32} & 1 & 0 \\ g_{41} & g_{42} & g_{43} & 1 \end{array} \right\}$$

**overidentifying restrictions are valid*

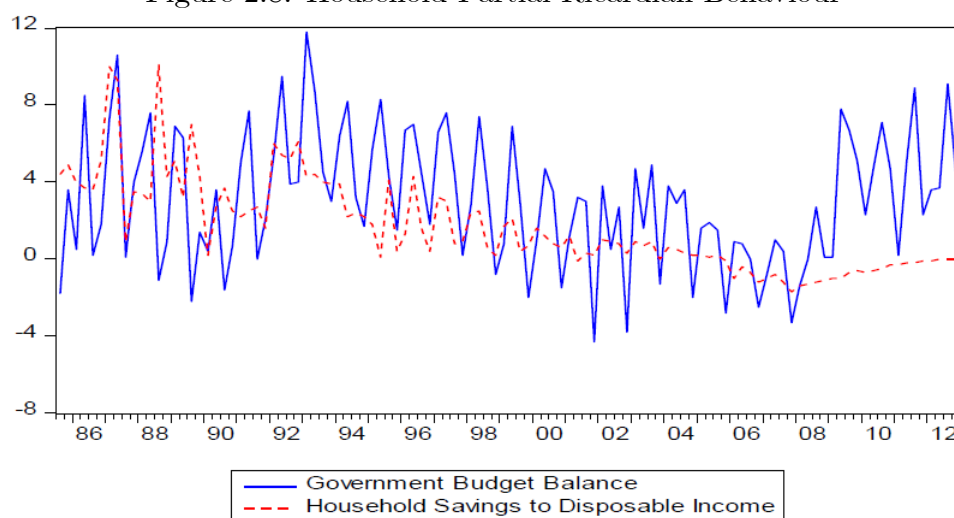
Figure 2.7: Transmission of Fiscal Shocks to Household Savings
Response to Structural One S.D. Innovations – 2 S.E.



In response to a government budget deficit shock, the trade balance improves by 0.08pp in the first period, with a maximum impact of 0.27pp in period 3 (see figure 2.12). The shock is persistent and dies out after 7 years and the result is very similar to the effect on the overall current account. Both household savings and government investment are significantly impacted by government budget deficit shocks. A shock to the government budget deficit increases the proportion of household savings to disposable income by 0.71pp in period 1 whilst household consumption falls by 0.03pp. This suggests that households behave in a partial Ricardian manner by saving in anticipation of a future tax increase when there is an expansionary fiscal deficit shock, and offset this increase in savings by a slight reduction in consumption. The Ricardian behaviour displayed by households is also shown in the data where household savings are highest when the government runs large deficits, and household savings fall when the fiscal deficit is reduced (see figure 2.8).

Whilst household savings increase, net savings by the government fall by 0.77pp in period 1, with a persistent decline suggesting that government savings take time to recover from a budget deficit shock. A shock to the government budget deficit reduces private investment by

Figure 2.8: Household Partial Ricardian Behaviour



Source: Author's compilations using data from SARB (2014)

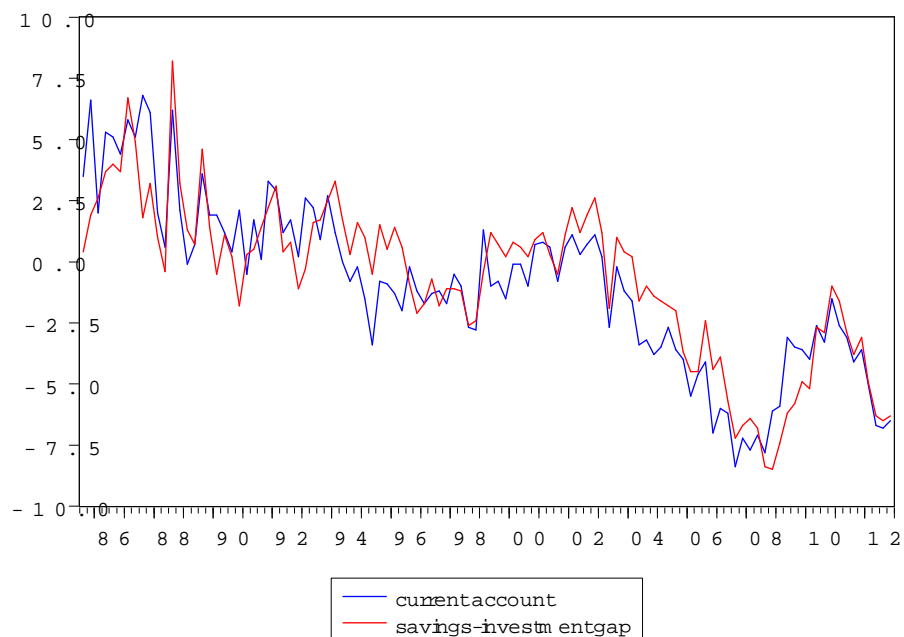
0.07pp in period 1, with a long run effect that dies out after about 50 quarters, hence crowding out private investment. Government investment on the other hand increases by about 0.05pp in the first period, with the impact of the shock lasting for almost 40 periods. The substantial increase in household savings following an expansionary fiscal shock thus has the overall effect of improving the savings investment gap and reducing household consumption by as much as 0.06pp. This is evident from the increase in savings and crowding out of private investment following an expansionary fiscal shock, which reflects the savings-investment gap. We can further infer that the narrowing of the savings-investment gap resembles an improvement of the current account balance as theoretically expected. This is demonstrated in figure 2.9 which shows that the savings investment gap and the current account balance do in fact trend together⁸.

In addition, the fall in gross investment shows that private investment is significantly crowded out by a fiscal shock, suggesting that government investment should be productive, for example, investment in infrastructure to attain maximum benefits. Lastly, the results stress the need for the correct policy formulation in terms of the fiscal approach to managing current account deficits as the effects of the fiscal policy on current account components are quite persistent, and deviate from the theoretical expectations of the twin deficits hypothesis. lastly, we also analyse the impact of fiscal shocks on the trade balance and find that an expansionary fiscal shock improves the trade balance by about 0.2pp, a result which is consistent with the impact of fiscal shocks on the current account.

Finally, to make viable inferences from these results, it is important for the VAR models to be stable since instability renders the standard errors and impulse response functions

⁸Figure 2.9 is obtained from the author's compilations using data from SARB, 2014.

Figure 2.9: Current Account Balance and Savings Investment Gap



invalid. Results for these diagnostic tests are reported in table 3.15. The LM test tests for serial correlation, and the results show that there is no serial correlation at the 1% and 5% levels of significance. This is important as it implies that we can rely on the significance of our estimates as they are precise and efficient. Serial correlation may indicate coefficients as significant when they are not. The normality tests indicate that the residuals are multivariate normal, and this implies that the estimates are efficient and the standard errors are unbiased, indicating that they reflect the true values. The White’s test suggests that the two models are homoscedastic, indicating that we can rely of the standard errors for accurate inferences. The results in the appendix also show that the roots lie inside the unit circle, and this shows that the VAR system is stable. Results from these diagnostic tests show that the model is econometrically sound and the results can be relied on for policy inference.

Table 2.12: Diagnostic Tests

Model	Specification	LM	Normality	White
1	Output, Gov Def, CA Def	0.3800	0.3092	0.0740
2	Gov Exp, Output, CA Def	0.5792	0.1677	0.1827
3	Gov Cons, Output, CA Def	0.0662	0.5407	0.0134

LM test- H_0 : No serial correlation
 Normality test- H_0 : Residuals are multivariate normal
 White test- H_0 : No heteroscedasticity

We also test robustness of these results to alternative identification schemes described in equation 2.13. In the trivariate VAR, we make an alteration to the way we identify the

fiscal deficit. Because the fiscal balance has mostly been in deficit, it suggests that fiscal expenditure has had a more dominant effect on the budget balance than fiscal revenue. As a result, we assume that the budget balance is not contemporaneously affected by output. We however still order the government balance second because of the revenue component in the variable, but restrict its contemporaneous response to output to zero. We carry the same restrictions over to the expanded model, but instead assume that current account components do not affect the other variables in the system contemporaneously, but are themselves contemporaneously affected by other variables in the system.

Using these alternative restrictions, we find that the diverging movement between the current account deficit and fiscal deficit still holds. This leads us to conclude that the results are robust to identification and specification, and are not significantly affected by the choice of identifying restrictions used.

Table 2.13: Alternative Identification Restrictions

$\left\{ \begin{array}{ccc} 1 & 0 & 0 \\ 0 & 1 & 0 \\ g_{31} & g_{32} & 1 \end{array} \right\}$
$\left\{ \begin{array}{cccc} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ g_{31} & g_{32} & 1 & 0 \\ g_{41} & g_{42} & g_{43} & 1 \end{array} \right\}$

Note: Overidentifying restrictions are not rejected in each case.
The first set of restrictions is used in the baseline model.
The second set of restrictions is used with current account components.

2.8 Conclusion

The debate on global current account imbalances continues to develop, with growing interest in the macroeconomic instability and widening current account deficits faced by emerging markets. The approach generally taken to reduce current account deficits in South Africa entails the reduction of fiscal deficits in line with the Mundell-Fleming twin deficits hypothesis. However, it is well established in literature that the current account behaves differently to macroeconomic circumstances in countries of different income levels, so approaches to managing external imbalances and fiscal deficits should be tailored to a country's macroeconomic conditions. Despite this, there is still a lack of investigation into drivers of current account dynamics in emerging markets. The lack of focus in this area of study raises the need to analyse current account determinants, together with the impact of macroeconomic

policy on current account dynamics in emerging markets so as to determine how external imbalances can best be managed.

We use a Structural Vector Autoregressive model (SVAR) to analyse the effect of fiscal shocks on the current account and the usefulness of fiscal consolidation in managing current account deficits. Our main objective is to understand how fiscal shocks shape current account developments and establish whether the twin deficits approach to managing the external balance holds in middle income countries. We further analyse the channels through which fiscal shocks are transmitted to the current account so as to understand how current account management policies should be formulated. South Africa is used as a case study because it is an emerging market characterised by large current account deficits and macroeconomic volatility due to business cycle fluctuations. In addition, South Africa provides a rich time series data set which has not been exploited to understand the external balance.

The main findings show that expansionary fiscal spending shocks improve the current account, whilst current account deficit shocks worsen the fiscal position. This is a novel result which provides stylised facts on the interaction of fiscal policy and the current account in South Africa. In addition, the transmission of fiscal shocks to the current account is primarily through an increase in household savings and decline in household consumption in response to an expansionary fiscal shock, with government investment crowding out private investment. These results contradict the twin deficits hypothesis which has tended to inform policy and provide new insights on the relationship between the external balance and fiscal policy in South Africa. Similar findings have been found in developed countries (e.g. Kim and Roubini, 2008; Rafiq, 2010), though the magnitude of the results is smaller in emerging markets, given that they have slightly weaker business cycles than developed countries. The results suggest that fiscal consolidation may not be effective in reducing current account deficits since a boom increases export capacity whilst stimulating government spending as well. We however take this result with some caution as it is only significant over short periods. Our findings also suggest that there is a need for incentives to boost household savings so as to improve the saving-investment position as household saving is more responsive to fiscal shocks than government saving. Such coordinated policies would be helpful in generating a more manageable external position which is in line with macroeconomic fundamentals.

These findings provide a novel perspective of how fiscal policy affects the current account in South Africa, and in light of these results, further research should investigate the optimal fiscal policy that generates a sustainable current account position, and could explore the revenue side of fiscal policy and its implications for the current account.

2.A Appendix to Chapter 2

2.A.1 Derivation of Equation 2.10

Given

$$\sum_{s=t}^{\infty} \mathbf{R}_{t,s}(\mathbf{C}_s + \mathbf{G}_s + \mathbf{I}_s) \leq (\mathbf{1} + \mathbf{r}_t)\mathbf{A}_t + \sum_{s=t}^{\infty} \mathbf{R}_{t,s} \mathbf{Y}_s \quad \text{where} \quad \lim_{s \rightarrow \infty} \mathbf{R}_{t,s} \mathbf{A}_{s+1} \geq \mathbf{0} \quad (\text{a2.3})$$

and

$$\mathbf{c}_{t+1} = \beta^\sigma (\mathbf{1} + \mathbf{r}_{t+1})^\sigma \mathbf{c}_t \quad (\text{a2.9})$$

we use a2.9 to eliminate $s > t$ from a2.3, and this gives us the function for \mathbf{c}_t

$$\sum_{s=t}^{\infty} \mathbf{R}_{t,s} \beta^\sigma (\mathbf{1} + \mathbf{r}_{t+1})^\sigma \mathbf{c}_t \leq (\mathbf{1} + \mathbf{r}_t)\mathbf{A}_t + \sum_{s=t}^{\infty} \mathbf{R}_{t,s} (\mathbf{Y}_s - \mathbf{G}_s - \mathbf{I}_s)$$

$$\mathbf{c}_t = \frac{(\mathbf{1} + \mathbf{r}_{t+1})\mathbf{A}_t + \sum_{s=t}^{\infty} \mathbf{R}_{t,s} (\mathbf{Y}_s - \mathbf{G}_s - \mathbf{I}_s)}{\sum_{s=t}^{\infty} \mathbf{R}_{t,s} (\beta^\sigma (\mathbf{1} + \mathbf{r}_{t+1})^\sigma)}$$

but

$$\mathbf{R}_{t,s} = \frac{1}{\prod_{v=t+1}^s (1 + r_v)} \implies \mathbf{R}_{t,s} = \frac{1}{(1 + r_{t+1})} \implies 1 + r_{t+1} = \frac{1}{\mathbf{R}_{t,s}}$$

$$\implies \mathbf{c}_t = \frac{(\mathbf{1} + \mathbf{r}_{t+1})\mathbf{A}_t + \sum_{s=t}^{\infty} \mathbf{R}_{t,s} (\mathbf{Y}_s - \mathbf{G}_s - \mathbf{I}_s)}{\sum_{s=t}^{\infty} \mathbf{R}_{t,s} \left(\frac{\beta^{s-t}}{\mathbf{R}_{t,s}} \right)^\sigma} \quad (\text{a2.10})$$

2.A.2 Additional Results

Figure 2.10: Accumulated Impulse Response Functions - Government Expenditure

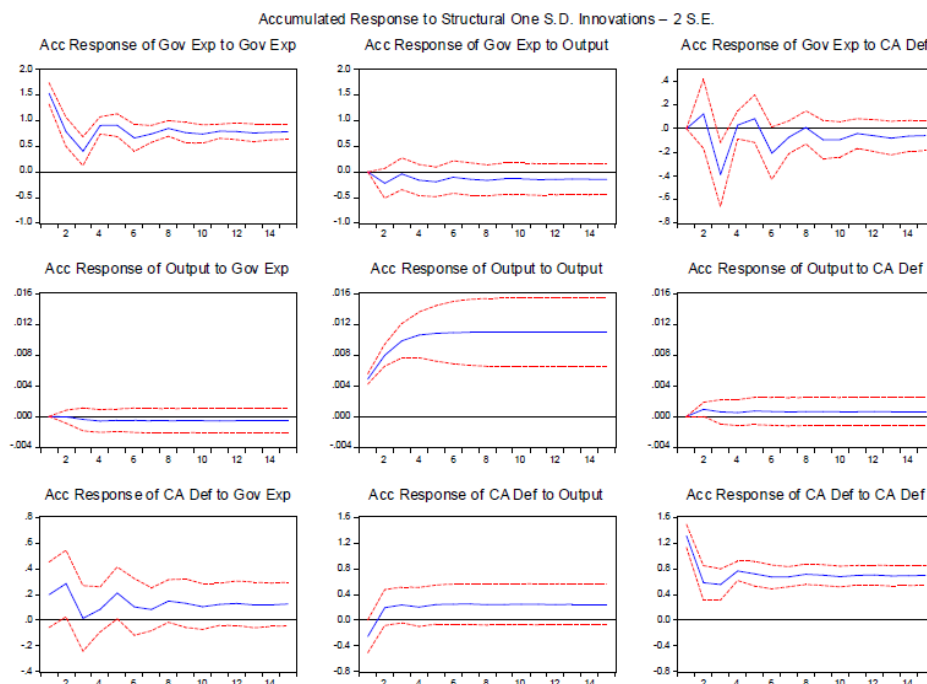


Figure 2.11: Transmission of Fiscal Shocks to Household Consumption
Response to Structural One S.D. Innovations - 2 S.E.

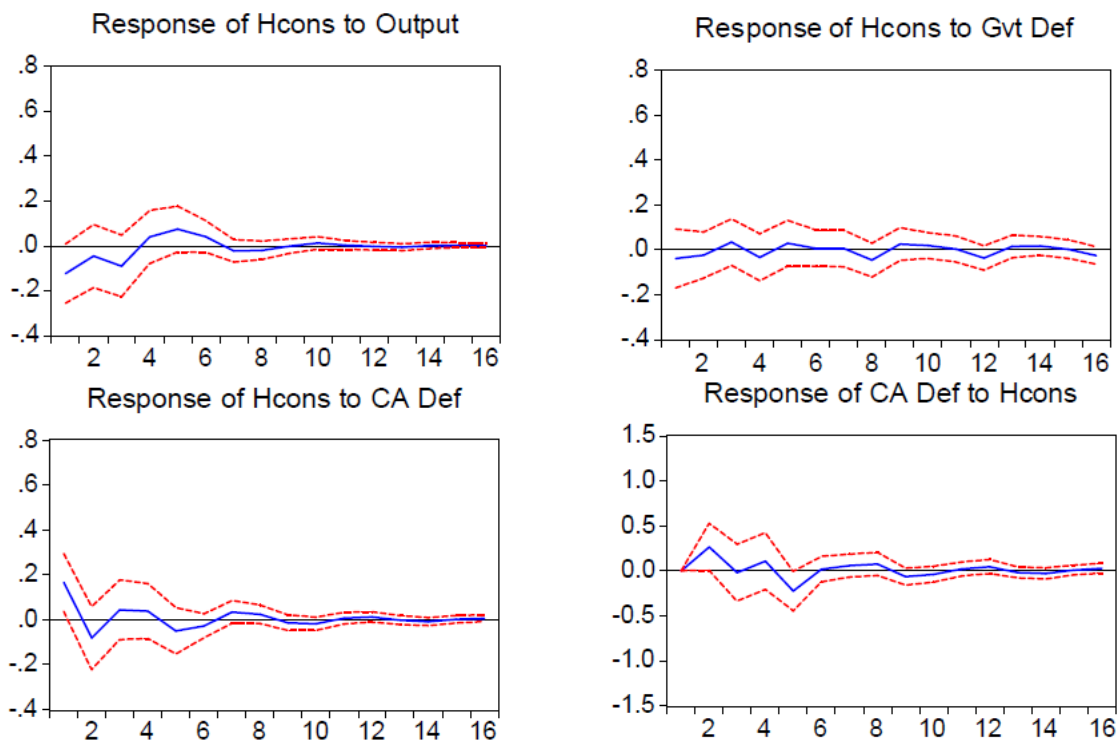


Figure 2.12: Transmission of Fiscal Shocks to the Trade Balance
 Response to Structural One S.D. Innovations – 2 S.E.

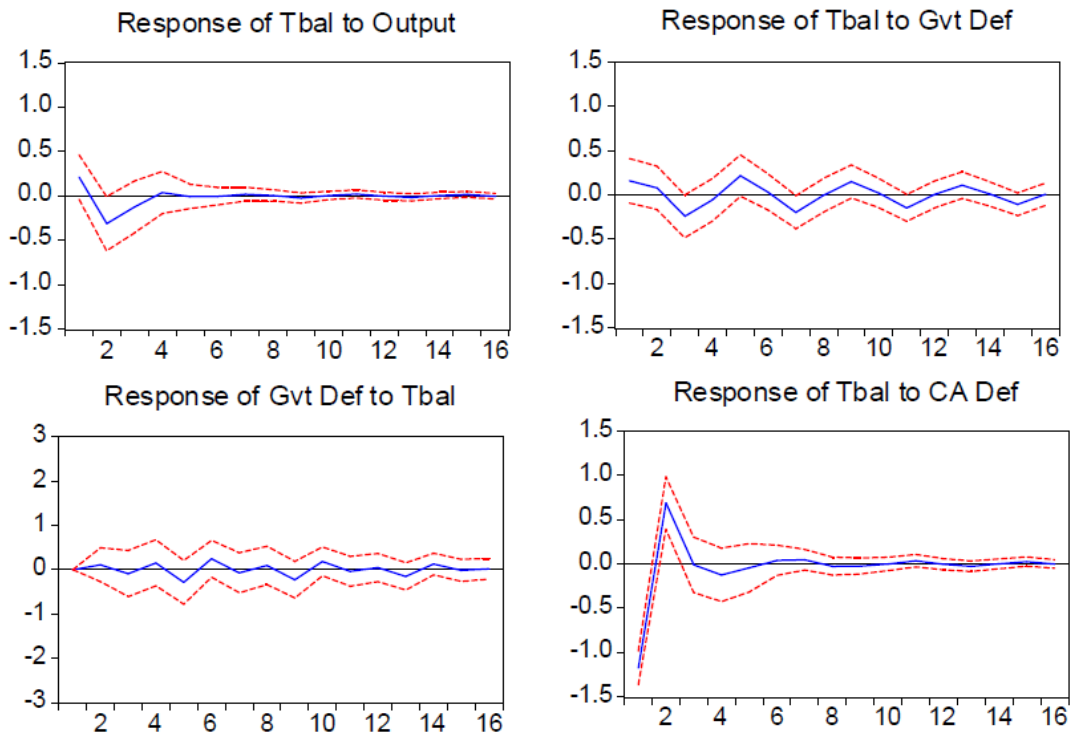
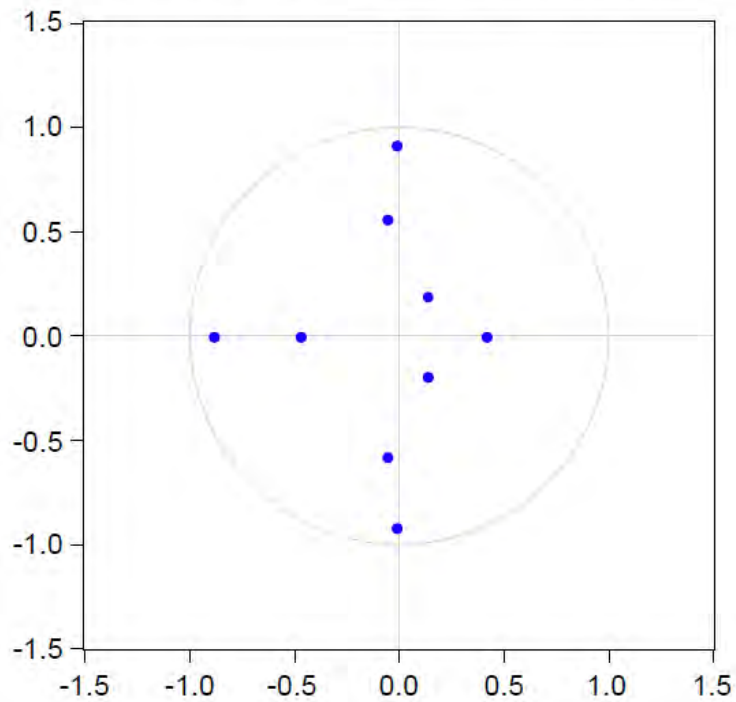


Figure 2.13: Stability of the VAR

Inverse Roots of AR Characteristic Polynomial



Chapter 3

Current Account Dynamics and Monetary Policy Transmission in South Africa

3.1 Introduction

External imbalances continue to get attention in international macroeconomics, particularly following the 2008 global financial crisis which increased the vulnerability of emerging markets to global shocks (e.g. Obstfeld and Rogoff, 2009; Milesi-Ferretti and Blanchard, 2009; Caballero, Farhi and Gourinchas, 2006). More recently, the changes in global monetary policy, particularly quantitative easing and the move towards the normalisation of the United States monetary policy as part of the adjustment after the financial crisis, have raised concern about the macroeconomic stability of emerging market economies (EMEs) and their ability to adjust to macroeconomic shocks. This is more so in countries with relatively large current account deficits since these countries are prone to economic and financial sector instability caused by the volatility of capital flows that finance current account deficits (Claessens and Ghosh, 2013). The gradual increase in global interest rates poses a risk of a decline or stop in capital flows to EMEs, putting deficit countries at the risk of a sharp reversal of current account deficits, which could have adverse consequences for growth. This risk is higher in EMEs due to increased volatility of capital flows and the exchange rate, with countries that allowed their currencies to appreciate, and current account deficits to widen before tapering being the ones likely to suffer the largest impact (Eichengreen and Gupta, 2014). This change in global monetary conditions has renewed interest among researchers about whether current account deficits in EMEs are sustainable, and raises questions about how current account deficits in these countries are affected by global monetary conditions, and the extent

to which domestic monetary policy can be used to insulate the effects of exogenous shocks and achieve stable adjustment of the current account.

There are several existing studies that analyse the interaction between the current account and monetary policy variables such as the exchange rate and interest rate (e.g. Abbas, Bouhga-Hagbe, Fatás, Mauro and Velloso, 2011; Lau, Baharumshah and Khalid, 2006). Most of these studies are based on cross country data sets, but because panel results are generalised, literature tends to find conflicting results on the interaction of the current account with macroeconomic aggregates particularly in countries of different income levels (see Calderón, Chong and Zanforlin, 2007; Chinn and Prasad, 2003). The inconsistency in results suggests there is need for case studies that analyse the relationship between the current account and macroeconomic policy at a country specific level. The case studies that do exist however mostly focus on developed countries and either attempt to determine whether monetary policy intervention has any gains for current account sustainability (e.g. Lu, 2009; Lu, 2012), or try to determine the best monetary rule that can be implemented for smooth current account adjustment (e.g. Herz and Hohberger, 2013; Di Giorgio and Nistico, 2013; Ferrero, Gertler and Svensson, 2008). In as much as an optimal monetary rule for current account stability is important, it is worth noting that these studies lack a clear understanding of the implications of monetary policy for the current account as they neglect the initial step of empirically narrowing down the monetary determinants of the current account before incorporating such determinants in a model that tries to explain the evolution of the current account with regards to monetary policy. Although other studies such as Kim and Roubini (2008) and Lane (2001) address this gap by analysing the effect of monetary shocks on current account fluctuations, these studies are based on developed countries and may not necessarily have policy relevance for lower income countries due to the varying behavioural patterns of the current account in countries of different income levels (see Calderón, Chong and Zanforlin, 2007; Chinn and Prasad, 2003).

The need to understand how the current account is influenced by monetary conditions, coupled with the lack of understanding of the monetary determinants of the current account in emerging markets motivate us to investigate the role of monetary policy in the stabilisation of the external balance. In addition, literature has not fully explored the implications of the changes in global monetary policy on the current account balances of emerging markets. By analysing the interaction of the current account and monetary policy, this chapter determines the effect of global and domestic monetary shocks on current account movements so as to identify current account determinants and provide a better understanding of the relationship between the current account and monetary variables. In addition to addressing the issue of the exposure and risks faced by EMEs to global monetary conditions, we also analyse the channels through which monetary shocks are transmitted to the current account.

Understanding the transmission mechanism of monetary policy to the current account facilitates in the identification of monetary policy options for improving the savings-investment gap in high deficit countries. We contribute to literature in two ways in this chapter. First, we contribute to the literature on monetary policy and the current account by analysing the effect of global monetary policy on the current account in emerging markets. This is an aspect that has been overlooked despite the changes in global monetary conditions which necessitate such an analysis. The second contribution is in providing a case study of South Africa, an emerging economy, that has developing country characteristics, a highly depreciated currency and a widening current account deficit which has been affected by global monetary conditions in comparison to similar emerging markets. South Africa also provides an impressive availability of time series data that has not been used extensively to analyse the dynamics of the current account (IMF, 2013b), and our study covers this gap.

In the next section, we discuss the approach used to define the current account in relation to monetary policy, and review developments in the current account and monetary policy literature. After reviewing recent developments in the current account literature, we move to describe the evolution of monetary policy in South Africa in section 3.3, and analyse how this has impacted the external balance. This is followed by a description of the chosen theoretical model in section 3.4. Section 3.5 discusses how the theoretical model leads to both the theoretical and empirical specifications of the model we will estimate, and how the model is identified. Section 3.6 discusses the data, while section 3.7 gives the estimation results, and finally, section 3.8 presents some conclusions.

3.2 Monetary Determinants of the Current Account

The current account can be described using alternate views such as the absorption approach, which describes the relationship between the current account and the levels of income and expenditure, the twin deficit approach which describes the relationship between the current account and fiscal balance, or the net foreign assets approach which describes the current account as the outcome of trade in goods, services and financial assets. Theories that explain the relationship between the current account and monetary policy stem from the monetary approach to the balance of payments (see Johnson, 1972; Frenkel, 2013). This approach explains changes in the country's external position to be a result of changes in the demand and supply of domestic currency, the creation of domestic credit and changes in domestic real income (Frenkel, 2013). By assuming a fixed exchange rate, the monetary approach theorises that a balance of payments surplus or deficit is a result of disparities between money demand and money supply. However, one of the main criticisms of the monetary

approach is that the fixed exchange rate assumption is one that most present day economies have departed from. This implies that by assuming balance of payments disequilibrium is a result of monetary flows, the theory fails to deal with the demand for assets which are denominated in different currencies, and are affected by fluctuating exchange rates when traded internationally (Rabin and Yeager, 1982).

To address these weaknesses, approaches to understanding the current account have evolved over time and consider the balance of payments as a consequence of international trade in goods, services and assets, which all affect the behaviour of consumption and income, not just the movement of money. This concept is encompassed in Obstfeld and Rogoff (1995b)'s Intertemporal Approach to the Current Account which identifies changes in the real economy that are responsible for balance of payments disequilibrium, making the balance of payments an outcome of trade in goods and services between countries. The Intertemporal Approach demonstrates that countries are able to smooth consumption against specific shocks by lending and borrowing in international capital markets, and consequently, the current account is determined by domestic and foreign interest rates in the lending and borrowing process, and the prevailing exchange rate in the trade of assets. This notion regards the current account as a monetary phenomenon explained by interest rates and exchange rates, and suggests that monetary policy may have implications for current account management.

Some empirical works study the relationship between monetary aggregates and the trade balance and focus on analysing whether the J-Curve exists for developed countries, i.e., whether depreciation of the exchange rate worsens the trade balance in the short run but improves it in the long run. An example of such an analysis is provided by Ivrendi and Guloglu (2010) who analyse the relationship between monetary policy shocks, the exchange rate and the trade balance in Australia, New Zealand, Canada, Sweden and UK, and find that in all countries except the UK, a contractionary monetary policy shock improves the trade balance, with no evidence of the J-Curve effect in any country. The findings demonstrate the importance of interest rates and monetary policy decisions in the determination of the current account, and are in line with similar findings by Prasad and Gable (1998). The analysis on the impact of monetary variables, and particularly the exchange rate, can be extended to an analysis of the current account, not just the trade balance, so as to examine the impact of monetary shocks on the current account (e.g Lee and Chinn, 2006). Lee and Chinn (2006) find that permanent monetary shocks have very small and insignificant effects on the current account, with models that differentiate between tradeables and non-tradeables potentially performing better than models that do not differentiate. Contrary to these studies that disprove the J-Curve hypothesis though, several other studies find the J-Curve to still hold in some developed countries, and show that the trade balance, and in some instances the current account, first deteriorates after a depreciation, before improving (e.g Koray and

McMillin, 1999; Lane, 2001; Nadenichek, 2006). The lack of consensus on exchange rate effects is due to a number of factors which include the characteristics and macroeconomic fundamentals of a country, the conduct of monetary policy and the implications of monetary policy for the exchange rate, and the improper identification of monetary policy shocks which may result in puzzles (see Kim and Roubini, 2000).

The issue of properly identifying monetary policy shocks is explored in Kim (2001a) and Kim (2001b) who argue that monetary shocks are better identified in an open economy when the ability to differentiate between money demand and money supply shocks is demonstrated and structural contemporaneous restrictions are imposed. Both studies analyse the impact of monetary policy on the trade balance or current account and macroeconomic aggregates and find that expansionary monetary policy worsens the United States trade balance before it improves after a year. Kim (2001b) focuses on the trade balance in the US, whilst Kim (2001a) focuses on the effect of monetary shocks on the trade balance in France, Italy and the UK. An interesting finding from these studies is the importance of world interest rates in the determination of the trade balance, and the transmission of monetary shocks through spillover effects from the foreign to the domestic economy. These studies highlight the significant impact that foreign monetary policy may have on the current account balance, and motivate an analysis of the impact of global monetary policy on the current account balances in emerging markets, since macroeconomic fundamentals are affected differently by economic shocks, depending on the income level of a country. Despite emerging markets facing a greater risk from changes in global monetary policy, the studies that so far exist have tended to focus on developed countries, with little attention paid to the consequences of unconventional monetary policy¹ for developing countries.

An exception to the lack of studies on developing countries is the study by Ncube and Ndou (2013) who analyse the link between monetary policy, the exchange rate and the trade balance in South Africa. The authors investigate whether expansionary monetary policy shocks affect South Africa's trade balance through an expenditure switching effect or an income absorption effect. An expenditure switching effect occurs when contractionary monetary policy results in higher interest rates, which increase capital inflows and appreciate the nominal exchange rate. This implies that imports become cheaper and exports become relatively more expensive. As a result, by increasing the amount of imports and reducing the amount of exports, the trade balance deteriorates. Consequently, the monetary channels through which the trade balance can be affected are the exchange rate and interest rate shocks under the expenditure switching effect. On the other hand, an income absorption effect occurs when contractionary monetary policy reduces real GDP, thereby reducing imports

¹Unconventional monetary policy refers to monetary policy is used to stimulate economic growth following a crisis, e.g., quantitative easing.

and improving the trade balance (see Ncube and Ndou, 2013; Kim, 2001a). This also implies that through the rate of consumption in the economy, interest rate shocks also affect the trade balance.

Whilst Ncube and Ndou (2013) analyse how the exchange rate affects the trade balance, focus on the trade balance alone precludes an analysis of how savings and investment components are affected by monetary policy, and how monetary policy affects the overall external balance. This aspect is relevant because savings and investment components are crucial for determination of the current account in South Africa, particularly given the volatility of capital flows which is affected by monetary policy. We extend Ncube and Ndou (2013)'s study in several ways. First, we extend the analysis to the current account by analysing how monetary shocks affect the current account and analyse which monetary shocks are more important for determination of the current account. We also go further to analyse the channels through which monetary shocks are transmitted to the current account, and such an analysis facilitates with the appropriate monetary policy design for current account stability. Lastly, we examine role of global monetary conditions in shaping current account developments. This is essential for small open economies like South Africa which are affected by exogenous shocks and the change in global monetary conditions, and contributes to the literature on the consequences of quantitative easing and normalisation prospects for emerging markets.

The studies in the preceding discussion use various estimation methods to determine the effects of monetary shocks on the current account. These methods range from panel data methods for cross country studies, to new open economy macroeconomic (NOEM) models. In as much as panel data methods explain current account determinants for a general set of economies, and are able to control for endogeneity and simultaneity bias by employing GMM and the Sargan and Arellano-Bond specification tests (e.g. Calderon, Chong and Loayza, 2002; Calderón, Chong and Zanforlin, 2007), the results are generalised for the group of countries examined and this masks country level dynamics as discussed in chapter 2, (e.g. Lau, Baharumshah and Khalid, 2006; Kim and Lee, 2008b; Abbas, Bouhga-Hagbe, Fatás, Mauro and Velloso, 2011).

Due to the need to uncover the underlying relationship between the current account and macroeconomic variables at a country level, the relationship between the current account and the exchange rate also tends to be modelled in new open economy macroeconomic (NOEM) models such as in Bergin (2006), Cavallo and Ghironi (2002) and Lane and Milesi-Ferretti (2002). These studies develop macroeconomic models that explain the relationship between the current account or net foreign assets and the exchange rate, and show that deviations from uncovered interest parity (UIP) are strongly related to shifts in the current account,

and in some instances, explain current account movements more than they explain the exchange rate. Whilst new open economy models (NOEM) focus the analysis to country level studies that predict the exchange rate and the current account, these models are normally outperformed by Structural VAR (SVAR) models (see Bergin, 2006). Consequently, most empirical studies that analyse country specific current account dynamics use SVAR models (see Hoffmann, 2003; Corsetti and Muller, 2006; Lee and Chinn, 2006; Kano, 2008; Kim and Roubini, 2008). The prominent use of SVAR models in analysing macroeconomic determinants of country level current account balances, and their general outperformance of NOEMs motivates the application of SVAR models in this chapter². The SVAR models are used to analyse the effect of global and monetary shocks on the current account, and the results are tested for robustness using different variable specifications and identifying restrictions.

The estimation is applied to a case study of South Africa, a developing country with a relatively high current account deficit and an inflation targeting monetary policy framework, which affects the current account through the variation in the interest rate as a monetary policy tool. Given the sparse research on the relationship between monetary policy and the current account, particularly in emerging markets which are likely to be negatively impacted by the change in global monetary conditions, we contribute to the literature on the effects of monetary policy for current account dynamics in developing countries. The chapter has implications for the design of macroeconomic policy targeted at managing external imbalance, and provides insight into the possible risks of normalisation of foreign monetary policy, and consequences of domestic monetary policy for the current account. To understand the nature of domestic monetary policy, we move to analyse monetary policy developments in South Africa, and their relation to changes in the current account balance.

3.3 Current Account and Monetary Policy Developments in South Africa

South Africa's persistent current account deficit has arguably been a result of domestic interest rates which are relatively higher than global averages and attract capital flows that finance the deficit (Smit, Grobler and Nel, 2014). In line with relatively high interest rates, high exchange rate volatility has also resulted in fluctuations of imports and exports, and has resulted in an unstable current account position. This variation in exchange rates and interest rates for the period covered in this study (1985 - 2012) has been a result of the

²Chapter 2 provides a detailed discussion of the attractive features of SVARs that motivate their use in the study, as well as the performance of SVARs in comparison to other methods in current account studies. This discussion carries over to Chapter 3.

various monetary regimes which have consequently affected the current account position and trade outcomes.

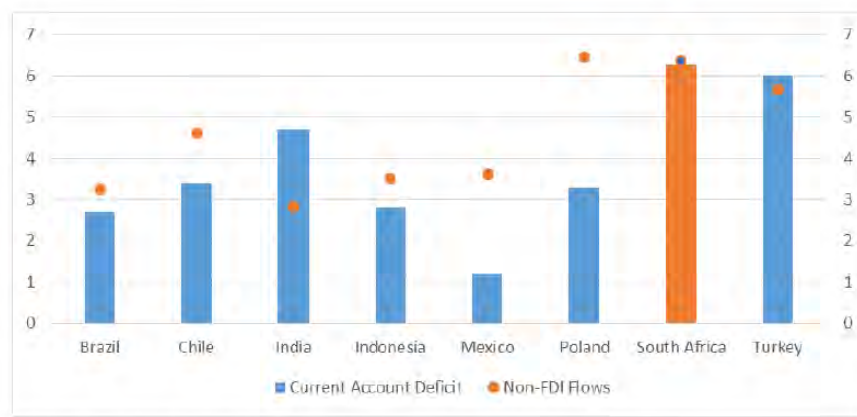
The first phase of monetary policy for the period reviewed in this study involved a system of flexible money supply targeting from 1986, and used the discount rate to influence short term interest rate changes. Money targeting was mostly influenced by the De Kock Commission which aimed to review exchange rate and monetary policy in a bid to regulate the financial market (see Aron and Muellbauer, 2002). In line with the recommendations of the De Kock Commission, which encouraged implementation of more market oriented monetary and fiscal policy, and the dual exchange rate system which came into effect, the SARB introduced monetary targeting which was in place until 1998. This ran concurrently with the debt standstill from 1985 to 1989. The end of the debt standstill resulted in a recovery of economic growth and a large outflow of capital, which resulted in exchange rate depreciation, and a current account surplus from increased export competitiveness for the most period until 1994 (see Aziakpono and Wilson, 2015). The increased capital flows consequently made money targeting more challenging, and as a result, the SARB developed an approach which combined money supply guidelines with a set of indicators for various economic aggregates such as the exchange rate, output gap, balance of payments, and fiscal stance (Aron and Muellbauer, 2002).

The end of apartheid in 1994 ushered in financial liberalisation which resulted in increased openness of the capital account due to the liberalisation of exchange controls and unification of the dual exchange rates. This increased the inflow of foreign capital, resulting in a deficit of the current account financed by capital inflow. As the changes in money supply became less reliable indicators of underlying inflation, money targeting was abandoned, with inflation targeting being adopted in February 2000. Under inflation targeting, the primary objective of the SARB is price stability, with secondary objectives of financial stability and economic growth. However, one main pitfall of inflation targeting is that it reduces flexibility when dealing with exogenous shocks (see Ncube and Ndou, 2013), which motivates the need to analyse the response of the current account to various shocks under the inflation targeting framework, and determine the best response to monetary shocks for a sustainable current account position.

A major implication of the change in monetary regimes is the influx of short term capital flows due to interest rate variations, particularly with contractionary monetary policy under inflation targeting. High interest rates attract foreign capital flows, which in turn finance the current account deficits, especially when domestic interest rates are considerably higher than world interest rates. In South Africa, relatively high interest rates have increased short term capital flows at the expense of foreign direct investment (FDI), with FDI being 44%

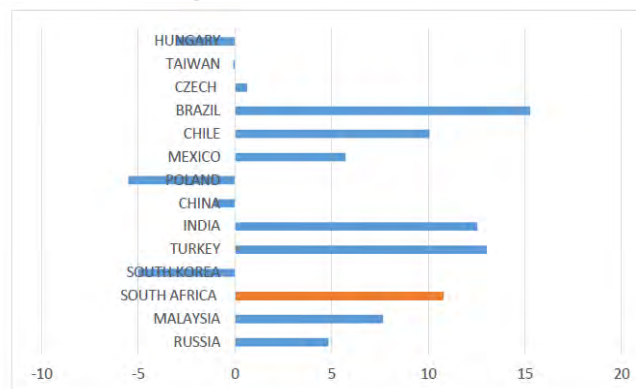
lower in the first half of 2012 compared to the same period in 2011 (GrantThorton, 2012). This has resulted in a current account deficit that is heavily financed by volatile short term capital (see figure 3.1), posing a greater risk of current account reversal in the event of an outflow of capital. Apart from the consequences of high interest rates on the current account, the fluctuation of the exchange rate has also had an impact on the country's export competitiveness, and in addition to a current account deficit of 6.4 % of GDP in the third quarter of 2013 (SARB, 2014) and increased inflow of short term capital, the rand has been one of the most volatile currencies amongst major emerging markets (see figure 3.2).

Figure 3.1: Reliance on Non-FDI Flows to Finance the Current Account Deficit (in % of GDP, 2012)



Source: Author's compilations using data from IMF (2015)

Figure 3.2: Exchange Rate Depreciation in Selected EMEs: May-December 2013



Source: Author's compilations using data from TheWorldBank (2015)

The effect of variations in the interest rate and exchange rate implies that monetary policy has considerable consequences for the current account, and raises the need to understand how the current account is affected by monetary shocks. This is useful in determining whether monetary policy can be used for current account management, and helps weigh implications of global monetary conditions on the current account in South Africa. The analysis also helps to determine how advisors should best respond to exogenous shocks in

the inflation targeting framework in order to attain a sustainable current account balance. Before the analysis is carried out however, it is essential to describe the theoretical framework that guides our selection of monetary variables that determine the current account. This framework is discussed in the section that follows.

3.4 Theoretical Framework

The framework used in this paper describes the theoretical link between the current account and monetary policy, and closely follows the Intertemporal Approach to the Current Account by Obstfeld and Rogoff (1995b) described in Chapter 2. The approach is built on the premise that expectations about productivity growth, exchange rates, relative interest rates and other macroeconomic aggregates affect savings and investment decisions. Since the current account in the intertemporal approach is the result of savings and investment decisions made by the residents of a nation, we focus on the factors that affect the savings investment relationship, and the impact of monetary variables on this relationship.

The Intertemporal Approach to the Current Account is based on the assumption of a small open economy that produces a single composite good and has a representative household, with the current account measured by the accumulation of net foreign assets A_{t+1} . In the following equations, we maintain the notation established in chapter 2, i.e., r_t is the net interest rate, A_t is a consumption indexed bond, $R_{t,s}$ the discount factor for consumption at date s , C, G, I and Y are consumption, government spending, investment and output respectively. CA_t remains the current account, \tilde{r}_t is the permanent level of variable r_t , and σ is the elasticity of substitution which is greater than zero. In this model, there is only one traded asset in the economy, a consumption indexed bond that pays a net interest of r_t and has a discount factor at date s given by $R_{t,s}$, and households maximise utility (equation 3.1) subject to the intertemporal budget constraint (equation 3.2).

$$\mathbf{U}(\mathbf{C}) = \frac{C^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}} \quad (3.1)$$

$$(1+r_t)A_t = \sum_{s=t}^{\infty} R_{t,s}(C_s + G_s + I_s + Y_s) + \lim_{s \rightarrow \infty} R_{t,s}A_{s+1} \quad (3.2)$$

We derive optimal consumption and substitute this into the budget constraint such that we derive optimal consumption at date t given by equation 3.3

$$\mathbf{C}_t = \frac{(1 + r_t)A_t + \sum_{s=t}^{\infty} R_{t,s}(Y_s - G_s - I_s)}{\sum_{s=t}^{\infty} R_{t,s}(\beta^{s-t}/R_{t,s})^\sigma} \quad (3.3)$$

To derive the current account identity from equation we use equations 3.3 and 3.2 to demonstrate the current account becomes a function of the interest rate on the accumulation of net assets, income, government spending and investment. The current account is measured by the deviation of these variables from their permanent level \tilde{X}_t , and as a result, the current account in period t is given by equation 3.4.

$$CA_t = (r_t - \tilde{r}_t)A_t + (Y_t - \tilde{Y}_t) - (G_t - \tilde{G}_t) - (I_t - \tilde{I}_t) + \left[1 - \frac{1}{(\beta/\tilde{R})^\sigma} \right] (\tilde{r}_t A_t + \tilde{Y}_t - \tilde{G}_t - \tilde{I}_t) \quad (3.4)$$

The Fundamental Current Account Equation³ (equation 3.4) holds a number of inferences about monetary policy and the determination of the current account. First, the approach suggests that the exchange rate, though not explicitly modelled in the framework, affects the current account through the trade in assets between the domestic and foreign economies. This is reflected in the net foreign assets A_{t+1} . The relationship between the real effective exchange rate and the current account can be two way. First, an increase in the real effective exchange rate (depreciation) increases the purchasing power of domestic residents, thereby increasing real consumption expenditure on both domestic and foreign goods, and the relative value of assets held by the residents. This reduces the rate of savings and increases the marginal propensity to consume, whilst at the same time increasing export competitiveness. The effect of depreciation on the current account deficit depends on whether the increase in the marginal propensity to consume (which worsens the current account) is stronger than the increased export competitiveness (which improves the current account). However, due to the need to smooth consumption, after a depreciation, residents normally opt to increase investment abroad as opposed to consumption, leading to a current account improvement (Kim and Roubini, 2008). On the other hand, an appreciation of the real exchange rate reduces export competitiveness and makes imports cheaper, worsening the current account deficit.

Equation 3.4 also suggests that global shocks do not affect current account dynamics since all countries are affected and adjust in a similar manner, thus only domestic variables feature in the equation. However, the difference between domestic and foreign interest rates affects the rate of capital flow, so this study posits the notion that foreign monetary shocks do in fact affect the current account. This notion is investigated by analysing the response of the current account to foreign interest rates, and facilitates in determining how the current account

³A more detailed description of the Intertemporal Approach is provided in Chapter 2.

position is affected by the changes in global monetary policy. This follows similar studies (e.g. Kim, 2001a; Kim, 2001b) that assume that the current account and its components are affected by shocks from both domestic and global monetary policy.

The interest rate is also used as an indicator of monetary policy stance in this study, since it is the SARB's policy tool of choice in the inflation targeting framework (SARB, 2014). When analysing the direct impact of domestic interest rates on the savings-investment gap, there are two channels through which the interest rate affects private savings; i.e., the substitution effect and the income effect. Under the substitution effect, an increase in the real interest rate acts as an incentive to increase private savings and reduce consumption, which reduces the current account deficit as the savings-investment gap narrows. Alternatively, an increase in the real interest rate appreciates the exchange rate and increases imports if demand is relatively elastic, implying the current account deficit widens (Simmons, 1997). Consequently, if the effect on imports is larger, the current account deficit widens, and if the substitution effect is greater, the current account position improves. By analysing the channels through which monetary shocks are transmitted to the current account, this study will determine which of these two effects hold for South African consumers.

The theoretical relationships between the variables discussed above narrow down the monetary variables that affect the current account to the interest rate and exchange rate, and paves way for analysing the impact of monetary aggregates on the current account. We use monetary shocks generated through the real effective exchange rate and the REPO rate to proxy domestic monetary shocks, and the US interest rate to proxy global monetary shocks. However, even though the theoretical model outlined above implies that the current account is determined by GDP and monetary variables, it suggests no clear empirical specification of the model. It has become common to circumvent this problem in empirical literature by allowing the most general specification of the current account to be estimated using a VAR approach as the variables that explain the current account are endogenous. Theoretical restrictions are used to improve the precision of estimates and reduce the forecast error variance in the model identification (e.g. Kim and Roubini, 2000; Christiano, Eichenbaum and Evans, 1999). However, to adequately capture monetary shocks, we draw from an ISLM framework where the economy is characterised by a goods market and money market. Drawing from this framework is useful for dealing with the monetary puzzles in literature that often arise when the response of variables to monetary shocks contradicts theoretical expectations due to weaknesses in the identification scheme (see Kim and Roubini, 2000).

3.5 The Model

3.5.1 Theoretical Specification

To implement the empirical specification, we follow the model by Kim and Roubini (2008), but limit our focus to the effects of monetary shocks on the current account and their transmission to current account components. Our identification scheme is also closely in line with Kim (2001b) who extend the closed economy identification of monetary policy to an open economy. We use VAR models to isolate the exogenous component of shocks, with the economy described by the structural equation below;

$$G(L)y_t = e_t \quad (3.5)$$

We focus on the effects of both foreign and domestic monetary shocks on the current account, and as a result, we use a 5 variable VAR in this chapter where y_t in equation 3.5, is the $n \times 1$ data vector given by US interest rates that proxy foreign monetary policy, output to capture business cycle fluctuations, the current account deficit, domestic interest rates in South Africa, and the exchange rate. $G(L)$ is the matrix polynomial in the lag operator, and e_t is a vector of serially uncorrelated structural disturbances. The structural model is based on the reduced form model below

$$y_t = B(L)y_t + u_t \quad \text{where } \text{var}(u_t) = \Sigma \quad (3.6)$$

We recover structural parameters by assuming two matrices G_0 with contemporaneous coefficients and $G^0(L)$ without contemporaneous coefficients in structural form such that

$$G(L) = G_0 + G^0(L) \quad (3.7)$$

This establishes a relationship between the structural and reduced form residuals given by

$$e_t = G_0 U_t \quad \text{where } \Sigma = G_0^{-1} \Lambda G_0^{-1} \quad (3.8)$$

As in chapter 2, we use theoretically founded restrictions on the contemporaneous coefficients to recover structural parameters by normalising n diagonal elements to 1s in G_0 and imposing at least $\frac{n(n+1)}{2}$ contemporaneous restrictions on the matrix of contemporaneous coefficients. We then use these restrictions to apply a generalised structural VAR approach to the model.

3.5.2 Econometric Specification and Identification

To recover structural parameters from the reduced form equation, we use the theoretical model described above to formulate the empirical specification of the 5-variable VAR. Our choice of monetary variables that affect the current account is based on the fundamental current account equation (equation 3.4) and its implications for monetary variables on the current account. We illustrate the empirical specification of the model where *usrate* is the US interest rate, *lgdp* is output, *cad* is the current account deficit, *repo* is the domestic interest rate, and *reer* is the real effective exchange rate⁴. The specification of the model is given below.

$$\begin{aligned}
usrate_t &= \alpha_1 + \sum_{i=1}^m \beta_{1i} usrate_{t-i} + \sum_{i=1}^m \gamma_{1i} lgdp_{t-i} + \sum_{i=1}^m \delta_{1i} cad_{t-i} + \sum_{i=1}^m \phi_{1i} rir_{t-i} + \sum_{i=1}^m \psi_{1i} lreer_{t-i} + \varepsilon_{1t} \\
lgdp_t &= \alpha_2 + \sum_{i=1}^m \beta_{2i} usrate_{t-i} + \sum_{i=1}^m \gamma_{2i} lgdp_{t-i} + \sum_{i=1}^m \delta_{2i} cad_{t-i} + \sum_{i=1}^m \phi_{2i} rir_{t-i} + \sum_{i=1}^m \psi_{2i} lreer_{t-i} + \varepsilon_{2t} \\
cad_t &= \alpha_3 + \sum_{i=1}^m \beta_{3i} usrate_{t-i} + \sum_{i=1}^m \gamma_{3i} lgdp_{t-i} + \sum_{i=1}^m \delta_{3i} cad_{t-i} + \sum_{i=1}^m \phi_{3i} rir_{t-i} + \sum_{i=1}^m \psi_{3i} lreer_{t-i} + \varepsilon_{3t} \\
rir_t &= \alpha_4 + \sum_{i=1}^m \beta_{4i} usrate_{t-i} + \sum_{i=1}^m \gamma_{4i} lgdp_{t-i} + \sum_{i=1}^m \delta_{4i} cad_{t-i} + \sum_{i=1}^m \phi_{4i} rir_{t-i} + \sum_{i=1}^m \psi_{4i} lreer_{t-i} + \varepsilon_{4t} \\
lreer_t &= \alpha_5 + \sum_{i=1}^m \beta_{5i} usrate_{t-i} + \sum_{i=1}^m \gamma_{5i} lgdp_{t-i} + \sum_{i=1}^m \delta_{5i} cad_{t-i} + \sum_{i=1}^m \phi_{5i} rir_{t-i} + \sum_{i=1}^m \psi_{5i} lreer_{t-i} + \varepsilon_{5t}
\end{aligned}$$

where $E(\varepsilon_{it}) = 0$; $E(\varepsilon_{it}\varepsilon'_{it}) = I$; and $E(\varepsilon_{it}\varepsilon'_{is}) = 0 \quad \forall t \neq s$

We apply this model by estimating a number of models with nominal variables, real variable and alternatively specified variables to compare the effect of various monetary variables on the current account.

The model uses the generalised non-recursive method that imposes restrictions to identify the structural components of the error terms and the equation below summarises the identification scheme used.

⁴We use this data set for illustrative purposes. However, in the empirical analysis we conduct a battery of experiments using alternative specifications with both nominal and real monetary variables.

$$\begin{bmatrix} e_{lusrate} \\ e_{lgdp} \\ e_{cad} \\ e_{rir} \\ e_{reer} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ g_{21} & 1 & 0 & 0 & 0 \\ g_{31} & g_{32} & 1 & g_{33} & 0 \\ g_{41} & 0 & 0 & 1 & 0 \\ g_{51} & g_{52} & g_{53} & g_{54} & 1 \end{bmatrix} \begin{bmatrix} u_{lusrate} \\ u_{lgdp} \\ u_{cad} \\ u_{rir} \\ u_{reer} \end{bmatrix} \quad (3.9)$$

$e_{lusrate}$, e_{lgdp} , e_{cad} , e_{rir} and e_{reer} are the structural disturbances which are foreign monetary policy shocks, output/ real GDP shocks, current account deficit shocks, domestic monetary policy shocks, and exchange rate shocks. $u_{lusrate}$, u_{lgdp} , u_{cad} , u_{rir} and u_{reer} are the residuals for the reduced form equations. The first line of restrictions in equation 3.9 shows the effect of global / foreign monetary policy which is considered to be exogenous to South Africa since South Africa is modelled as a small open economy, and does not have the capacity to affect world variables. The foreign interest rate thus captures exogenous monetary policy changes and their effects on the current account. The second line controls for the effects of business cycle fluctuations on the current account based on the assumption that output is not contemporaneously affected by other variables in the system, following Kim and Roubini (2000). This equation is used to show the goods market in the ISLM framework. Line 3 shows the current account deficit, which is contemporaneously affected by foreign and domestic monetary policy, but not the exchange rate. This assumption is made to analyse interest rate effects on the current account. Line 4 shows the real interest rate which is used to proxy the effects of domestic monetary policy on the current account. Since the main objective of monetary policy under the inflation targeting framework is to keep inflation within the band, we assume the real interest rate is not contemporaneously affected by other domestic variables in the model as well. This identification is supported by the relatively lower weight that the SARB places on output and exchange rate stabilisation compared to inflation (see Ortiz and Sturzenegger, 2007). In addition, output may only affect the interest rate at later periods, not within the quarter. Lastly, the exchange rate equation describes the equilibrium in the financial market. All variables are assumed to have contemporaneous effects on the exchange rate since it is a forward looking asset price (see Kim and Roubini, 2000; Kim and Roubini, 2008).

3.6 Data

These restrictions are applied to a model of South Africa using quarterly data from the third quarter of 1985 to the last quarter of 2012. The starting point of 1985:03 corresponds with the start of the dual exchange rate, so the sample covers two exchange rate regimes, the dual and the free float. A dummy variable is included to cater for the switch to a free floating

exchange rate/financial liberalisation in the second quarter of 1995, with 1 indicating the floating exchange rate from 1995:Q2 to 2012:Q4, and zero the dual exchange rate regime. Seasonal dummy variables are also included to cater for seasonality of GDP, and a dummy variable is used to control for the impact of the 2008 financial crisis. The US interest rate (*LUSRATE*) is measured by the log of the monetary policy related interest rate of the United States and is obtained from the IMF's international financial statistics (IFS). Output (*LGDP*) is measured by the log of gross domestic product. The current account deficit (*CAD*) is defined by the ratio of the current account balance to GDP in percentage terms. Values greater than zero indicate a deficit and those less than zero, a surplus. This conversion is for ease of interpretation since South Africa's current account balance has an average deficit for the period under study, hence interpretation of results is in terms of a current account deficit. The domestic real interest rate (*RIR*) is based on the REPO rate used in monetary policy formulation. The real interest rate is found by subtracting inflation from the REPO rate, and the measure of inflation used is the percentage point change of the consumer price index (CPI). The real effective exchange rate of the rand (*LREER*) is based on the average for the period of 20 trading partners using trade in manufactured goods, and the variable is measured in logs. The REPO rate is obtained from the IFS, whilst all other domestic variables for South Africa are obtained from SARB. Using the real interest rate and real effective exchange rate to proxy monetary shocks follows other studies that investigate the impact of monetary shocks on the current account (e.g. Bergin, 2006; Lee and Chinn, 2006; Lu, 2009; Kim and Roubini, 2008).

Apart from analysing the effect of global and domestic monetary shocks on the current account, the study also seeks to analyse how monetary shocks are transmitted to the current account, and to do this various current account components are used. Components include the trade balance (*TBAL*) which is measured as a percentage of GDP, the ratio of household savings to disposable income (*HSAV*), which is used to infer how monetary policy affects the decision of households to save, and the ratio of final household consumption to GDP (*HCONS*), which is used to infer households' consumption smoothing behaviour. Components used to analyse the the transmission of monetary shocks to the savings investment gap include net savings by the general government as a percentage of GDP (*GSAV*) and gross investment by the general government (*GINV*).

3.7 Results

3.7.1 Effects of Monetary Policy Shocks on the Current Account

Using the discussed variables and identification strategy, we focus on the main objective of analysing the relationship between the current account balance and monetary policy, and use the model to examine the effect of global and domestic monetary shocks on the current account. The descriptive statistics from the baseline model with the data vector $\{LUSRATE, LGDP, CAD, RIR, LREER\}$ are shown in table 3.1. These show a maximum current account deficit of 6.8% of GDP and a maximum domestic interest rate of 15.09%. The standard deviations show the most variation in the current account deficit, and in the domestic real interest rate, which could be a result of the use of interest rates as a policy tool in the inflation targeting framework.

Table 3.1: Descriptive Statistics

	MEAN	STD. DEV	MIN	MAX
LUSRATE	1.1735	1.0065	-1.3613	2.2836
LGDP	14.0956	0.2189	13.8091	14.4931
CAD	0.9373	3.4403	-8.4	6.8
RIR	2.9249	4.4459	-9.4107	15.0889
LREER	4.6089	0.1459	4.1582	4.8218

In table 3.2, there is high correlation between the current account deficit and LGDP, but LGDP is kept in the model to control for business cycle fluctuations. The domestic interest rate and current account deficit are positively correlated, suggesting that an increase in interest rates worsens the current account deficit, whilst the foreign interest rate and current account deficit are negatively correlated, suggesting that an increase in the foreign interest rate improves the current account. The exchange rate and current account deficit are negatively correlated, suggesting an appreciation (increase in LREER) could lead to an improvement of the current account position, which contradicts theoretical expectations and is further investigated in the analysis. as theoretically expected.

An unresolved issue that arises in the estimation of the SVAR model is whether to estimate using levels or first differences. This is a question that has been discussed in literature, with articles weighing the implications of non-stationary multivariate analysis, vis-a-vis a VAR model with stationary variables. Enders (2010), together with Sims, Stock and Watson (1990) present the argument that a differenced multivariate model gets rid of information that could otherwise be used to explain the relationship between variables and could introduce distortions in the results. Their central motivation is that, if the purpose of the analysis

Table 3.2: Correlation Coefficients

	LUSRATE	LGDP	CAD	RIR	LREER
LUSRATE	1.0000				
LGDP	-0.7496	1.0000			
CAD	-0.4546	0.8263	1.0000		
RIR	0.0845	-0.0611	0.3029	1.0000	
LREER	0.3236	-0.5844	-0.4325	-0.1283	1.0000

is to investigate the relationship between variables through impulse response functions and variance decompositions as opposed to parameter estimates, the data should mimic the true data generation process and should not be differenced. Other authors (e.g. Toda and Yamamoto, 1995; Yamada and Toda, 1998) argue that unit roots matter if the focus of the research is on testing the hypothesis expressed as coefficient restrictions, which essentially is the purpose of an SVAR model through the imposition of theoretically founded restrictions. The main concerns with non-stationary models are spurious relations between variables, and biased estimates. Toda and Phillips (1993) show that when the random walk is accounted for in tests, the estimates are not biased, suggesting the need to ensure stationarity in order to attain unbiased estimates. The authors also discuss how tests that suggest asymptotic properties hold for large scale non stationary VARs may be misleading, and suggest the use of bootstrapping methods to control for the presence of nuisance parameters in these tests. Sims and Uhlig (1991) however argue that these bootstrapping techniques are of little practical value, and suggest the need to take account of the unit roots.

Considering the pros and cons of stationary and non stationary VARs, we weigh the two options with the consequences of differencing the data being the loss of information, and the consequences of non-stationary data being biased estimates and spurious regressors. We proceed by using stationary data for the purposes of obtaining the asymptotic properties of unbiased estimates, and avoid spurious regressors. To circumvent the loss of information, we explore the difference stationary and trend stationary properties of the data in the structural VAR models. Results from stationarity tests conducted using the Augmented Dickey-Fuller (ADF) method and the Phillips-Perron (PP) method (table 3.3) show that all variables have unit roots at 1% and 5% levels of significance ⁵. As a result, since the variables are $I(1)$, we proceed to test for cointegration, but there appears to be no long run relationship between the variables. Other empirical models on the current account provide no evidence of a cointegrating relationship in current account models (e.g. Kano, 2008; Kim and Roubini, 2008), and there is no theoretical foundation that would suggest the existence of a cointegrating relationship, so we proceed to estimate a stationary SVAR.

⁵Current account components also have unit roots, with the exception of gross investment which is stationary in levels.

Table 3.3: Stationarity Tests using ADF Method and Phillips-Perron ADF

	Levels		1st Difference	
	Intercept	Intercept + Trend	Intercept	Intercept + Trend
LUSRATE	0.8265	0.5139	0.0000	0.0000
LGDP	0.9962	0.5698	0.0001	0.0002
CAD	0.7400	0.0942	0.0000	0.0000
RIR	0.4363	0.8253	0.0000	0.0000
LREER	0.2617	0.2464	0.0000	0.0000

PHILLIPS-PERRON				
	Levels		1st Difference	
	Intercept	Intercept + Trend	Intercept	Intercept + Trend
LUSRATE	0.8584	0.6361	0.0000	0.0000
LGDP	0.9980	0.7748	0.0001	0.0001
CAD	0.2613	0.0000	0.0000	0.0000
RIR	0.3729	0.7985	0.0000	0.0000
LREER	0.2389	0.2027	0.0000	0.0000

Note: H_0 - Series has a unit root.
Table records P-values of each test

A shortcoming of unit root tests however is that they are often criticised for having weak power, and it is often difficult to differentiate between difference and trend stationary variables. To deal with this, we also test for trends in the data to determine if the series are trend stationary. Trend stationarity is tested in two ways; first, we regress the variable of interest on a time trend, and test stationarity of the detrended residuals that result. This facilitates in determining whether the series has a deterministic trend. Second, we use the Hodrick-Prescott (HP) filter to extract the stochastic trend from the data, and test for stationarity of the resulting detrended cyclical series. These results are reported in table 3.4 and show that the data are trend stationary when the HP filter is used. Consequently, we compare inferences of the difference stationary model to inferences of the trend stationary model before analysing the transmission of monetary shocks to current account components, and we proceed to use the HP filtered series as this gives us more stable and significant models.

Before proceeding to estimate the VAR models, it is important to ensure selection of the appropriate lag length. This is done by using the Likelihood Ratio (LR) test, the Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC) and the Hannan-Quinn Information Criterion (HQ). Ng and Perron (2005) and Liew (2004) demonstrate that the lag length is affected by sample size, with the AIC, and FP performing better when the sample size is less than 60. In general, the SC and HQ tend to pick smaller lag lengths whilst the AIC over estimates. This shows the need to use all 5

Table 3.4: Stationarity Tests on Detrended Variables

	Time trend		HP Filtered Cycle	
	ADF	PP	ADF	PP
LUSRATE	0.9073	0.9239	0.0000	0.0539
LGDP	0.7018	0.6140	0.0038	0.0421
CAD	0.7400	0.2613	0.0000	0.0000
RIR	0.4363	0.3729	0.0001	0.0000
LREER	0.2617	0.2389	0.0022	0.0012

Note: Tests conducted with intercept
Table records P-values of each test

Table 3.5: Lag Length Selection

Lag	LR	FPE	AIC	SC	HQ
0	-	1.30e-08	-3.97*	-3.21	-3.66
1	101.57*	7.11e-09*	-4.58	-3.19*	-4.01*
2	34.57	7.83e-09	-4.49	-2.47	-3.67
3	29.18	9.04e-09	-4.36	-1.71	-3.28
4	19.74	1.16e-08	-4.13	-0.85	-2.80

*indicates lag order selected by the criterion

criteria for consistency in choosing the most suitable lag length. Table 3.5 reports the lag length selection criteria for the baseline differenced model, with an optimal lag length of 1 selected. Apart from ensuring selection of the optimal lag length, it is also important to test the overidentifying restrictions to ensure that the model is properly identified. Results for the Likelihood test for overidentifying restrictions are reported in table 3.6 and show that we fail to reject the identification restrictions used at the 10%, 5% and 1% levels of significance.

Given that the overidentifying restrictions are valid, equation 3.10 reports the estimated structural parameters for the VAR system in the differenced model. The signs of these coefficients show that an increase in the foreign interest rate reduces domestic output but improves the current account and appreciates the exchange rate through an outflow of capital. An increase in output worsens the current account deficit, which could be due to

Table 3.6: Likelihood Test for Overidentifying Restrictions in the Differenced Model

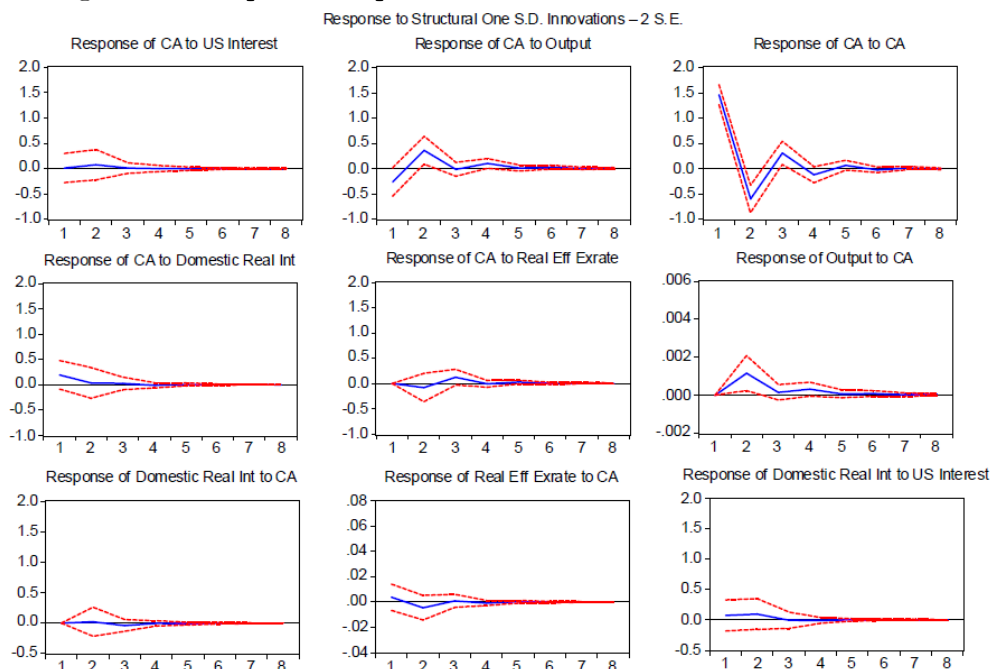
LogLikelihood	Chi-Square	P-Value
263.3936	0.1856	0.6666
H ₀ : Overidentifying restrictions are valid		

higher import requirements, whilst a widening of the current account deficit depreciated the exchange rate as theoretically expected. A lower domestic interest rate also improves the current account, which could also be indicative of capital outflow with relatively lower domestic interest rates.

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ -0.0051 & 1 & 0 & 0 & 0 \\ -0.2462 & 52.7992 & 1 & -0.1444 & 0 \\ -0.5311 & 0 & 0 & 1 & 0 \\ -0.0624 & 2.01940 & -0.0025 & 0.0055 & 1 \end{bmatrix} \begin{bmatrix} lusrate \\ lgdp \\ cad \\ rir \\ lreer \end{bmatrix} = G(L) \begin{bmatrix} lusrate \\ lgdp \\ cad \\ rir \\ lreer \end{bmatrix} + \begin{bmatrix} e_{lusrate} \\ e_{lgdp} \\ e_{cad} \\ e_{cad} \\ e_{lreer} \end{bmatrix} \quad (3.10)$$

After identifying the model, the next step involves analysing the effect of monetary shocks on the current account through the use of impulse response functions and variance decompositions, where the impulse response functions show the effects of a shock to one endogenous variable on the other variables in the system⁶. Figure 3.3 shows the effect of monetary shocks on the current account and the response of macroeconomic aggregates to current account deficit shocks when the model is first differenced.

Figure 3.3: Impulse Response Functions for the Differenced Model



From figure 3.3, a positive shock to the US interest rate, which is used to proxy foreign/global monetary policy shocks worsens the current account deficit in South Africa. This impact is

⁶We follow Kim and Roubini (2008) and report only the IRFs that are essential for the analysis. As a result, we do not report the full set of IRFs.

shown in row 1 of column 1. The shock lasts for 6 quarters with a percentage increase in world interest rates clearly raising the current account deficit by at most 0.07 percentage points⁷. Theoretically, an increase in the foreign interest rate relative to the domestic interest rate should result in an outflow of capital from South Africa and improve the current account. However in this case, domestic monetary policy is responsive to foreign monetary policy (row 3, column 3), such that when the foreign interest rate increases, the domestic interest rate increases as well by 0.07pp, resulting in capital inflow in South Africa from this feedback effect, which consequently worsens the current account. This suggests that the impact of foreign monetary on the current account is relative to the stance of domestic monetary policy. In response to output shocks, the current account position improves when there is a positive shock to GDP, as per theoretical expectations. The response of the current account to domestic monetary policy, proxied by the domestic interest rate in row 2, column 1 shows that the current account deficit worsens by 0.19pp in response to a contractionary monetary policy shock. In response to the appreciation of the real effective exchange rate (increase in *LREER*), the current account deficit first slightly improves before worsening by 0.12pp, indicating a J-Curve effect. The results in quarter 3 (row 2, column 2) are in line with studies based on the United States that find that a depreciation of the exchange rate improves the current account position (e.g. Kim and Roubini, 2008), and in this case, an appreciation worsens the current account by 0.12pp.

The impulse response functions in the preceding discussion provide the total effect of the shocks on variables, and the variance decompositions showing the contribution of each shock to the current account deficit are shown in table 3.7, with each column showing the percentage contribution of the relevant shock to variation in the current account.

Table 3.7: Structural Variance Decomposition of the Differenced Model

Horizon/Shocks	LUSRATE	LGDP	CAD	RIR	LREER
1	0.0082	3.0599	95.2902	1.6484	1.61E-30
4	0.1895	7.3261	90.3782	1.3466	0.7595
8	0.1908	7.3433	90.3378	1.3437	0.7849
12	0.1908	7.3435	90.3370	1.3737	0.7850

The variance decompositions show that the current account is mostly explained by own shocks which account for 90% of the variation, and output shocks which account for about 7% of the variation. Monetary shocks appear to play a small role as indicated by the short life span of the shocks and the low contribution in the variance decompositions. As a result, to fully confirm this relationship, we fully investigate the impact of monetary shocks on the differenced model by using alternative specifications of nominal monetary variables, and find

⁷Recall, an increase in the impulse response of the current account is a worsening of the deficit since negative values show a current account surplus and positive values show a current account deficit.

Table 3.8: Lag Length Selection Detrended Model

Lag	LR	FPE	AIC	SC	HQ
0	-	5.83e-07	-0.17	0.59	0.14
1	519.88	3.93e-09	-5.17	-3.79*	-4.61
2	87.95*	2.39e-09*	-5.67*	-3.66	-4.86*
3	28.97	2.77e-09	-5.54	-2.90	-4.47
4	32.93	3.01e-09	-5.48	-2.22	-4.16

*indicates lag order selected by the criterion

Table 3.9: Test for Overidentifying Restrictions in the Detrended Model

LogLikelihood	Chi-Square	P-Value
333.9307	2.380812	0.1228

H₀: Overidentifying restrictions are valid

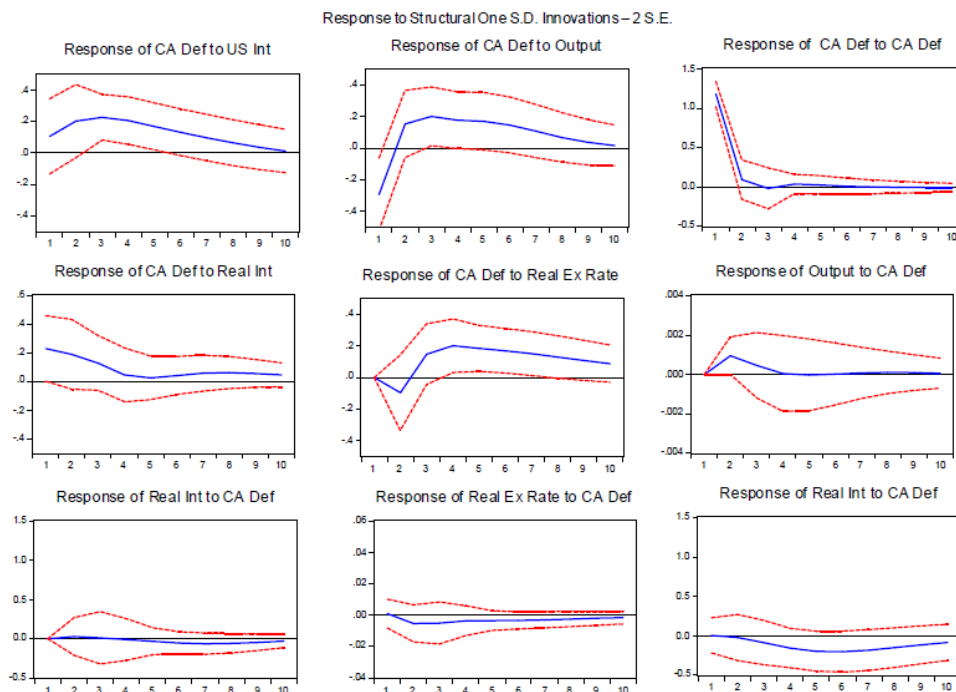
that the response of variables to monetary shocks remains similar to the baseline differenced model, and in some instances, variable response to shocks becomes even smaller. Figure 3.11 in the appendix shows one of the impulse response functions from these experiments with the differenced model, with little response to some shocks.

To ensure that these small responses are not driven by the loss of information from differencing to attain stationarity, we proceed to analyse the impact of monetary shocks in the same manner as discussed above, but in this case, using the detrended series obtained from the HP filter. Analysing the detrended model helps to ensure that the model is not misspecified by assuming the wrong form of stationarity, since tests in table 3.4 do reveal the possibility of trend stationarity. Table 3.8 reports the lag length selection criteria for the detrended model, with an optimal lag length of 2 selected. Using 2 lags, the same restrictions as in the differenced model are placed on the VAR model, with the validity of the overidentifying restrictions reported in table 3.9. The model restrictions are not rejected, and the structural coefficients are reported in equation 3.11.

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ -0.0067 & 1 & 0 & 0 & 0 \\ -1.2697 & 65.7319 & 1 & -0.1984 & 0 \\ -0.0360 & 0 & 0 & 1 & 0 \\ -0.0644 & 2.0503 & -0.0008 & 0.0039 & 1 \end{bmatrix} \begin{bmatrix} lu\ srate_T \\ lg\ dp_T \\ cad_T \\ rir_T \\ lreer_T \end{bmatrix} = G(L) \begin{bmatrix} lu\ srate_T \\ lg\ dp_T \\ cad_T \\ rir_T \\ lreer_T \end{bmatrix} + \begin{bmatrix} e_{lu\ srate_T} \\ e_{lg\ dp_T} \\ e_{cad_T} \\ e_{rir_T} \\ e_{lreer_T} \end{bmatrix} \quad (3.11)$$

The impulse response functions from the detrended model (figure 3.4), show the effect of monetary shocks on the current account, where each variable y_{t_DT} shows the detrended cyclical series.

Figure 3.4: Impulse Response Functions for the Detrended Model



From figure 3.4, a positive shock to the US interest rate (row1, column 1) clearly worsens the current account deficit in South Africa by at most 0.23pp in the third quarter. As with the differenced model, the effect of foreign monetary policy on the current account is relative to the response of domestic monetary policy, implying that the current account deficit worsens when the foreign interest rate increases, because domestic monetary authorities respond by raising interest rates as well. This suggests the need to address external imbalances given the change in global monetary conditions. The results are in line with Kano (2008) who analyses the effect of global shocks on the current account. Kano (2008) finds that global shocks (world interest rate shocks) widen the current account deficit in Canada, but improve the current account in the UK, a result in line with the findings of this paper since Canada is a small open economy like South Africa compared to the UK. In addition, in Kano (2008), whilst global shocks account for about 24% of the variation in the current account in the UK, they only account for at most 10% of the variation in the current account in South Africa, another finding in line with the structure of a small open economy. This suggests that the effect of global shocks should not be undermined in policy formulation as they have the potential of destabilising both internal and external balance.

The current account position improves when there is a positive shock to GDP, as per theoretical expectations. The improvement is however mostly significant in the first quarter

with a 0.29pp response (row 1, column 2), and suggests the importance of economic growth in attaining a sustainable current account balance. The response of the current account to domestic monetary policy, proxied by the domestic real interest rate in row 2, column 1 postulates that the current account deficit worsens in response to a contractionary monetary policy shock by 0.23pp in the first quarter. In response to the appreciation of the real effective exchange rate (increase in *LREER*), the current account deficit slightly improves before it worsens by a maximum of 0.2pp. These results conform to theory, with an appreciation making exports relatively expensive and imports relatively cheaper and as a result, the trade balance worsens and consequently the current account worsens (row 2 column 2). Of interest is that the predictions of the detrended IRFs are similar to the differenced model in terms of the direction of response of variables to shocks, but the IRFs have larger and more significant impacts, and not as short lived when the detrended variables are used.

We use the accumulated impulse responses in figure 3.5 to demonstrate the significance of these results and show that the predictions from figure 3.4 still hold over an accumulated period. In figure 3.5, we still observe that a positive shock to US interest rates worsens the current account deficit with a cumulative response of 1.1pp after 9 quarters. The current account deficit increases in response to output shocks, but this effects not significant. The current account deficit is also worsened by own shocks as expected. In row 2, an increase in domestic interest rates worsens the current account, whilst an appreciation of the exchange rate leads to a slight improvement of the current account, before the deficit deteriorates with an accumulated deterioration of 1.4pp in quarter 12. This confirms the J-Curve effect we find in figure 3.4, and the significance of this result is evident when we use the accumulated impulse responses. The response of output, domestic and foreign interest rates, and the exchange rate to current account deficit shocks is however not significant. This reflects that monetary policy affects current account dynamics, but however, the current account does not affect monetary policy decisions, and this result confirms our findings in figure 3.4. This indicates that the HP filtered series provided better predictions than the differences series, so we proceed to use the detrended series for the remainder of the analysis.

Using the variance decompositions to analyse the contribution of each shock proves useful for isolating the monetary shocks which have the largest impact on the current account. The variance decomposition of the current account in the detrended model is reported in table 3.10, with each column showing the percentage contribution of the relevant shock to variation in the current account.

The variance decomposition of the current account shows that most of the variation in the current account is due to own shocks, but the contribution of own shocks decreases over time. By the 16th quarter, the real effective exchange rate and foreign interest rate each account

Figure 3.5: Accumulated Impulse Response Functions for the Detrended Model

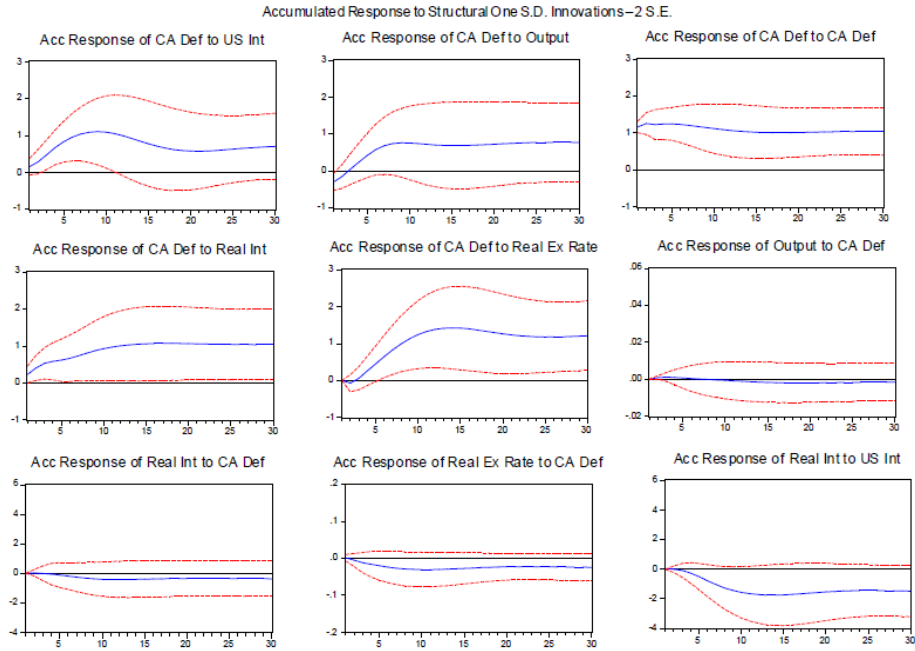


Table 3.10: Structural Variance Decomposition of the Current Account Deficit: Detrended Model

Horizon/Shocks	LUSRATE	LGDP	CAD	RIR	LREER
1	0.7352	5.5869	90.2203	3.4576	11.86E-30
4	7.6492	9.5696	73.3607	5.6583	3.7622
8	9.5520	11.6470	65.2388	5.4795	8.0827
12	9.4765	11.5231	64.1173	5.7203	9.1627
16	9.6494	11.4843	63.9018	5.7444	9.2200

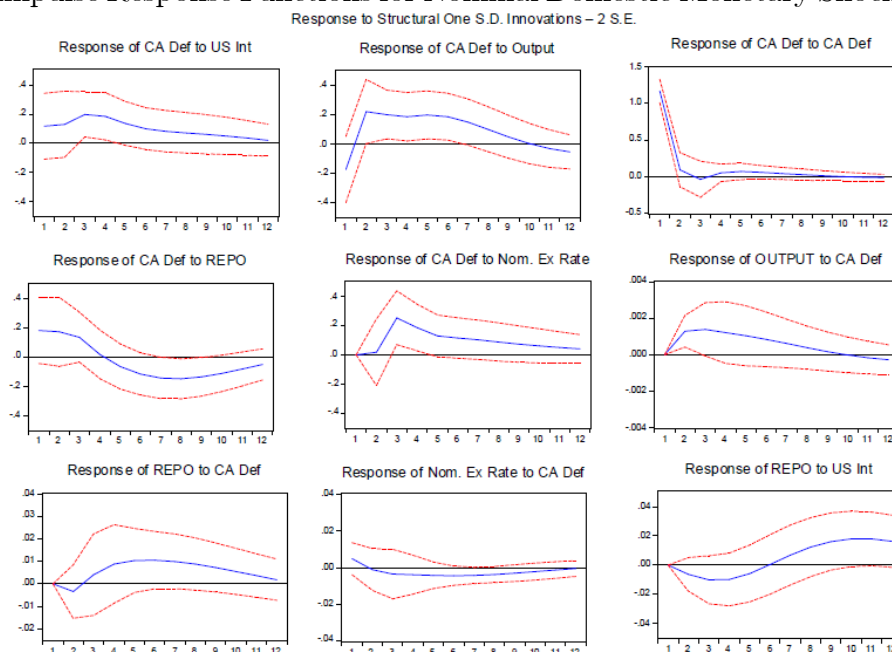
for a tenth of the variation in the current account, whilst output shocks explain about 11.5% of current account variation, and domestic interest rates explain 5% of variation. This is consistent with the results from the impulse response functions (figure 3.4) which show that the current account is significantly affected by both foreign and domestic monetary policy. As a result, the detrended model shows that contractionary foreign monetary policy worsens the domestic current account deficit through feedback to the domestic interest rate, as the domestic interest rate increases in response to contractionary monetary policy. At the same time, contractionary domestic monetary policy and exchange rate appreciation worsen the deficit as well, whilst exchange rate and foreign monetary policy shocks have larger impacts on the current account compared to domestic monetary policy. These findings suggest that monetary shocks have a stronger impact on the current account in South Africa than they do in more developed countries like the US. Bergin (2006) finds that the real exchange rate explains 6.8% of variation of the current in the US, compared to 10% in South Africa, whilst domestic interest rates explain 1.6% of current account variation in the US, compared to 5.7% in South Africa. This disparity signifies the susceptibility of small open economies, particularly emerging markets, to exogenous shocks as they are more affected by these shocks than developed countries. The predictions of the differenced model still hold in the detrended model and are more significant, suggesting that the detrended model performs better than the differenced model. This leads us to believe that the monetary variables have a stochastic trend, and motivates us to proceed with the analysis using the detrended model.

A key issue that may affect our results however is that VAR models are highly dependent on the choice of variables used in the model, and choice of restrictions, so it is necessary to vary the variables used to identify monetary shocks, and the restrictions used to identify the model, so as to analyse the robustness of these findings. To examine robustness, we first vary the variable specifications in the model to analyse sensitivity of results to alternate specifications, and then changes the identification restrictions to analyse the model's sensitivity as well. These robustness and sensitivity tests are all conducted using the HP filtered variables in the detrended model. In analysing the sensitivity of the model to alternate specifications of the global/foreign monetary policy shock, we use the real US interest rate (*USRIR*) in place of the short term monetary policy related interest rate. The direction of the IRFs is the same as in the baseline model, but however, the impact of the US real interest rate, and domestic interest rate are less significant, suggesting that the model with the US monetary policy related interest rate performs better than the US real interest rate which is calculated by subtracting CPI from the monetary policy related interest rate.

After analysing the sensitivity of the results to alternative foreign monetary variables, we move to analyse the sensitivity of the results to alternative specifications of the domestic monetary shocks. We do this by using the nominal interest rate (*REPO*) and the nominal

effective exchange rate (*NEER*) in place of the real interest rate and the real effective exchange rate. The purpose of this exercise is to analyse whether the current account is better explained by monetary variables in real terms or monetary variables in nominal terms. Using nominal variables implies the model has implications for nominal variables and does not account for inflation dynamics in the economy. We compare the predictions of this model to that which uses real variables, and the results are in figure 3.6. Using nominal variables gives the same predictions as the real variables, for instance, the current account deficit worsens in response to a foreign interest rate shock with a maximum increase of 0.21pp in the significant range of the impulse response (row 1 column 1), whilst the deficit worsens by a maximum of 0.19pp in response to a contractionary domestic monetary policy shock (row 2 column 1). The current account deficit also worsens in response to an appreciation of the nominal effective exchange rate, with a maximum impact of 0.22pp (ow 2 column 2). The magnitude of the impulse responses when we use nominal variables are similar to the model that uses real variables. However, the main difference is that when nominal variables are used, the response of the current account to a domestic contractionary monetary policy shock becomes less significant (see figure 3.6), suggesting that real variables have a larger impact on current account variation than nominal variables.

Figure 3.6: Impulse Response Functions for Nominal Domestic Monetary Shocks (Detrended)



The accumulated impulse responses of the current account to shocks are significant and show that current account responds to US interest rate shocks with a cumulative effect of 1.2pp that increases the deficit after 12 quarters. Output shocks worsen the current account deficit with an cumulative effect of 1.1pp after 9 quarters, whilst an exchange rate appreciation worsens the current account deficits by 1.2pp after 14 quarters. Even when observing the cumulative effect, the response of the current account to nominal Interest rates alone is still

Table 3.11: Structural Variance Decomposition of the CA Deficit: Nominal Variables

Horizon/Shocks	LUSRATE	LGDP	CAD	REPO	LNEER
1	0.5223	2.1975	95.8812	1.3990	0.0000
4	6.4620	7.9775	77.0831	4.2113	4.2660
8	8.2402	11.9445	68.3257	5.3848	6.1051
12	8.6374	11.9313	66.9094	6.0414	6.4804
16	8.6290	12.1391	66.6606	6.0426	6.5287

not significant.

The variance decompositions (table 3.11) show that the nominal exchange rate accounts for 6% of the variation in the current account, which is lower than the real effective exchange rate, i.e. 7.2% in table 3.10. Foreign monetary policy shocks account for 8.6% of the variation in the current account in this case, compared to 9.6% when we use real variables. When the nominal interest rate is used, domestic monetary policy also accounts for about 6% of the variation in the current account. This is similar to the magnitude of domestic monetary policy in the model with real variables, which is 5.7%, and suggests that domestic monetary policy may have a small role to play towards managing the external balance.

It is also necessary to use the bilateral real exchange rate ($LEXRATE_US$) between South Africa and the US to examine the effect of exchange rate shocks, in place of the real effective exchange rate ($LREER$), which is a basket of 20 trading partners. The bilateral exchange rate is used because the foreign interest rate in the study is based on US monetary policy. Predictions of the model with the bilateral exchange rate are similar to that with the basket of currencies. The results show that the current account deficit worsens by 0.22pp in the significant range in response to a foreign monetary policy shock, and is not responsive to a domestic interest rate shock. The current account improves when the currency depreciates (an increase in the bilateral exchange rate ($LEXRATE_US$) is a depreciation) by 0.18pp. Decomposing the contribution of shocks to the current account using these alternative specifications still shows that after 16 quarters, 8.32% of the variation in the current account is still explained by exchange rate shocks, 8.36% of current account variation is explained by foreign monetary policy shocks, almost 15% by output shocks, and about 6.3% by domestic monetary policy. The current account is responsive to domestic monetary policy when the nominal interest rate is considered, suggesting the possibility of a role for monetary policy in current account management. Lastly, a depreciation of the exchange rate improves the current account position as per theoretical expectations with all specifications. This demonstrates the robustness of the findings to different specifications of the monetary variables. An interesting finding that also proves to be robust is that with various specifications of both global and domestic monetary shocks, if the foreign interest rate is relatively higher

than the domestic interest rate, the current account balance improves, suggesting the risk of current account reversal in the event that domestic interest rates do not increase by a large enough magnitude to offset the increase in foreign interest rates.

Even though the results are robust to alternative specifications of the monetary variables, it is also important to test the sensitivity of the results to alternative identification restrictions. This is necessary for ensuring that the predictions given by the impulse responses and variance decompositions reflect the true relationships between variables, and are not significantly driven by the choice restrictions. The alternative identification restrictions used are reported in table 3.12, where superscripts 2 and 3 refer to the alternative identification schemes. In framing these alternative restrictions, we assume in identification scheme 2 that the real interest rate is not contemporaneously affected by foreign monetary policy. This is because the real interest rate includes inflation, but prices do not adjust immediately due to price stickiness. In restriction 3, we assume that changes in domestic interest rates are significant enough to affect the current account in the quarter due to their impact on capital flows, and GDP on the other hand is also affected by domestic interest rates, foreign interest rates and the current account within the quarter. This enables us to analyse how monetary policy affects real variables. Figure 3.7 shows the impulse responses from alternative identification set 2, and figure 3.8 shows the impulse responses from alternative identification set 3. Our alternative restrictions show that the model predictions still hold, that is, a shock to US interest rates still worsens the current account deficit, an increase in the domestic interest rate worsens the current account deficit, with an appreciation worsening the deficit as imports become cheaper. These key findings are significant when we report the accumulated impulse responses, indicating that monetary variables affect the current account, even though the current account itself has no effect on monetary variables. These findings demonstrate the robustness of the results as they are in line with baseline model, and are also supported by figure 3.8.

The robustness of the findings to various variable specifications and restrictions suggests that the detrended model given by the data vector $\{LUSRATE_DT, LGDP_DT, CAD_DT, RIR_DT, LREER_DT\}$ gives accurate results, so we proceed to use this model to understand how monetary shocks are transmitted to the various components of the current account.

3.7.2 Transmission of Monetary Shocks to the Current Account

Understanding the transmission of monetary shocks to current account components facilitates in narrowing down the components of the current account that are more affected by monetary policy shocks, and helps in narrowing down policy options. Transmission of

Figure 3.7: Impulse Response Functions Using Alternative Identification Scheme 2

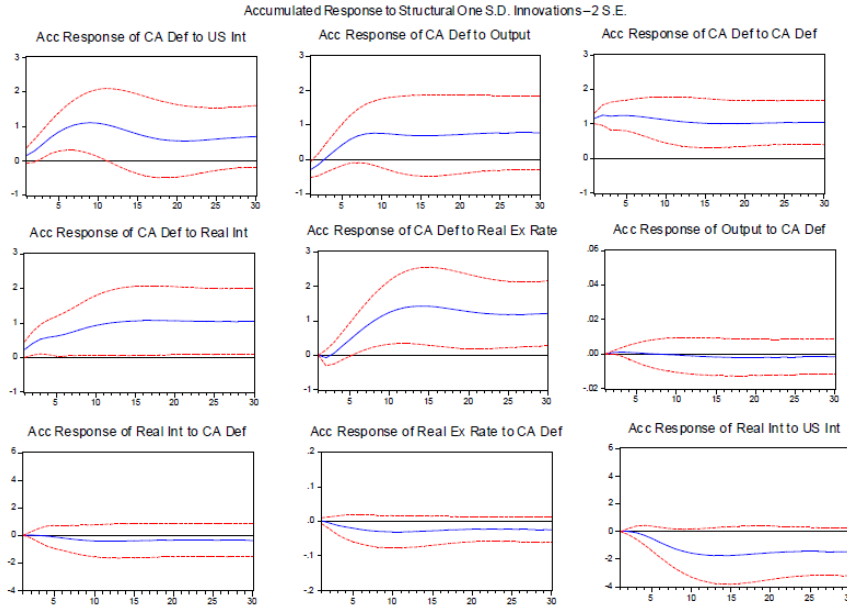


Table 3.12: Alternative Identification Restrictions

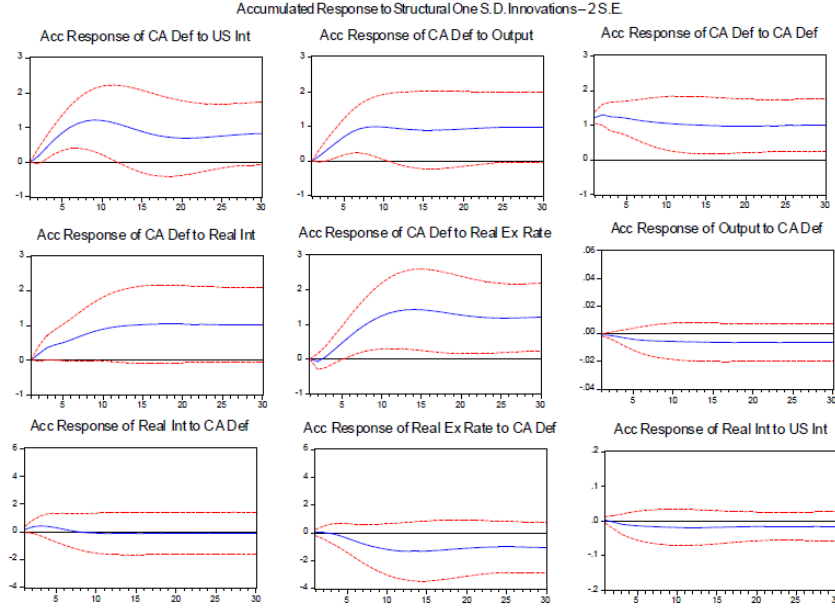
$$\left\{ \begin{array}{ccccc} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ g_{31} & g_{32} & 1 & g_{33} & 0 \\ 0 & 0 & 0 & 1 & 0 \\ g_{51} & g_{52} & g_{53} & g_{54} & 1 \end{array} \right\}^2 \quad \left\{ \begin{array}{ccccc} 1 & 0 & 0 & 0 & 0 \\ g_{21} & 1 & g_{22} & g_{23} & 0 \\ 0 & 0 & 1 & 0 & 0 \\ g_{41} & 0 & g_{42} & 1 & 0 \\ g_{51} & g_{52} & g_{53} & g_{54} & 1 \end{array} \right\}^3$$

Note: Overidentifying restrictions are not rejected in each case

monetary shocks is analysed by adding the current account component to the basic model detrended model that uses the data vector $\{LUSRATE_DT, LGDP_DT, CAD_DT, RIR_DT, LREER_DT\}$. The current account components used are household consumption ($HCONS_DT$) and household savings ($HS AV$), which are used to infer household behaviour in response to monetary shocks, the trade balance ($TBAL_DT$), used to infer the effect of monetary policy on exports and imports, government investment ($GINV_DT$) and government savings ($GSAV_DT$), which are used to analyse how monetary shocks are transmitted to savings and investment components. All current account components are tested for a stochastic trend and are detrended using the HP filter.

To identify the expanded models, we maintain the same assumptions as in the baseline model. We still consider foreign monetary shocks to be exogenous to South Africa. Output is not contemporaneously affected by other domestic variables, the current account deficit is contemporaneously affected by foreign and domestic monetary policy, but not the exchange rate. The real interest rate is not contemporaneously affected by other domestic variables, whilst all variables besides current account components are assumed to have contempora-

Figure 3.8: Impulse Response Functions Using Alternative Identification Scheme 3



neous effects on the exchange rate since it is a forward looking asset price. In addition to this, we assume that current account components are contemporaneously affected by other variables in the system (see Kim and Roubini, 2000; Kim and Roubini, 2008). An illustration of these identification restrictions for the expanded model is given below where e_{comp} are the structural disturbances from current account components and u_{comp} are the residuals from the reduced form equations.

$$\begin{bmatrix} e_{lusrate} \\ e_{lgdp} \\ e_{cad} \\ e_{rir} \\ e_{reer} \\ e_{comp} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ g_{21} & 1 & 0 & 0 & 0 & 0 \\ g_{31} & g_{32} & 1 & g_{33} & 0 & 0 \\ g_{41} & 0 & 0 & 1 & 0 & 0 \\ g_{51} & g_{52} & g_{53} & g_{54} & 1 & 0 \\ g_{61} & g_{62} & g_{63} & g_{64} & g_{65} & 1 \end{bmatrix} \begin{bmatrix} u_{lusrate} \\ u_{lgdp} \\ u_{cad} \\ u_{rir} \\ u_{reer} \\ u_{comp} \end{bmatrix} \quad (3.12)$$

Household consumption increases in response to contractionary foreign monetary policy, indicating that relatively lower domestic interest rates encourage borrowing which stimulates an increase in consumption whilst the real effective exchange rate affects household consumption, with an appreciation in the exchange rate causing an increase in consumption. This result is consistent with the response of household consumption to domestic real interest rates but is not significant, which conforms earlier findings that domestic interest rates are less important for the current account compared to foreign interest rate and exchange rate shocks. Even though an increase in the current account deficit reduces household savings, there is no significant impact of monetary shocks on these household savings. This indicates

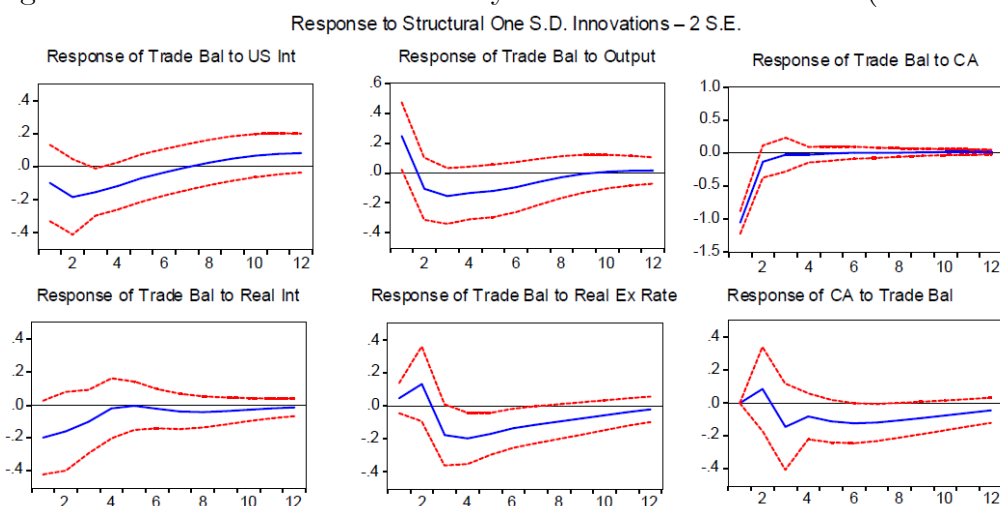
that monetary shocks are not transmitted to the current account through household behaviour, and motivates for an analysis of the transmission of monetary shocks to the current account through the trade balance and the public sector components.

Investigating the impact of monetary shocks on the trade balance gives an indication of how these shocks are transmitted to export and import components. An improvement in the trade balance improves the current account position, and an appreciation of the exchange rate worsens the trade balance by 0.35pp. This shock is significant between quarters 3 and 7, and is consistent with theory as an appreciation makes imports relatively cheaper and exports relatively expensive, suggesting that the consumption of imports increases and the current account deficit worsens. The response of the trade balance to both domestic and foreign interest rates is not significant, suggesting the use of the exchange rate to influence the trade balance as an appropriate tool as compared to interest rates. These findings prove the existence of a J-Curve effect as the trade balance first improves before deteriorating, following an exchange rate appreciation, (see row 2, column 3 of figure 3.9). Findings on the impact of exchange rate shocks on the trade balance and current account are similar to Lee and Chinn (2006) and Ncube and Ndou (2013), where temporary shocks depreciate the exchange rate and improve the current account. The results are also in line with findings on France, UK and Italy by Kim (2001a) who finds that an expenditure switching effect exists, whereby contractionary monetary policy appreciates the currency and worsens the trade balance. One notable difference however is that whilst Kim (2001a) fails to find evidence of a J-Curve in these countries, the J-Curve does exist in South Africa, which reflects the importance of the exchange rate in explaining South Africa's current account. We also analyse the accumulated response of the trade balance to shocks in the other variables and find that the results are consistent and significant. The trade balance is worsened by at most 1.3pp in response to a current account deficit shock, and this response is significant, whilst a positive shock to the trade balance improves the current account by at most 1pp in the 13 quarter.

Analysing the transmission of monetary policy shocks to public sector components reveals how the government sector responds to monetary shocks. We find that both contractionary foreign monetary policy shocks and exchange rate shocks affect government savings. When foreign interest rates increase, the domestic interest rate increases through the feedback effect as the domestic interest rate increases in response to contractionary foreign monetary policy, and consequently government savings increase. At the same time, an appreciation reduces government savings as they may be used to finance the deteriorating current account position, (see figure 3.10). With regards to government investment, an increase in the current account deficit increases government investment by 0.38pp, but however, the response of government investment to monetary shocks is only significant as far as the domestic interest rate is

concerned, (figure 3.12; row 2, column 1 in the appendix). Contractionary monetary policy increases government investment by 0.046pp in quarter 4, which is a result of higher returns on investment since the real interest rate is used. However, the magnitude of this response is very small and is outweighed by the impact of monetary shocks on the trade balance and government savings, suggesting that monetary policy is more suited to influence current account dynamics through exports, imports, and public sector savings. The results for these transmission mechanisms are summarised and compared in table 3.13 and show that foreign monetary shocks are mostly transmitted to the current account through the public sector, whilst the trade balance is significantly affected by the exchange rate. This suggests the need for consideration of foreign monetary policy on the current account, and particularly, on the savings-investment gap through the behaviour of the public sector.

Figure 3.9: Transmission of Monetary Shocks to Trade Balance (Detrended)



Decomposition of these effects in table 3.14 shows the proportion of variation in current account components that is explained by monetary shocks. This is essential in clarifying how

Figure 3.10: Transmission of Monetary Shocks to Government Saving (Detrended)

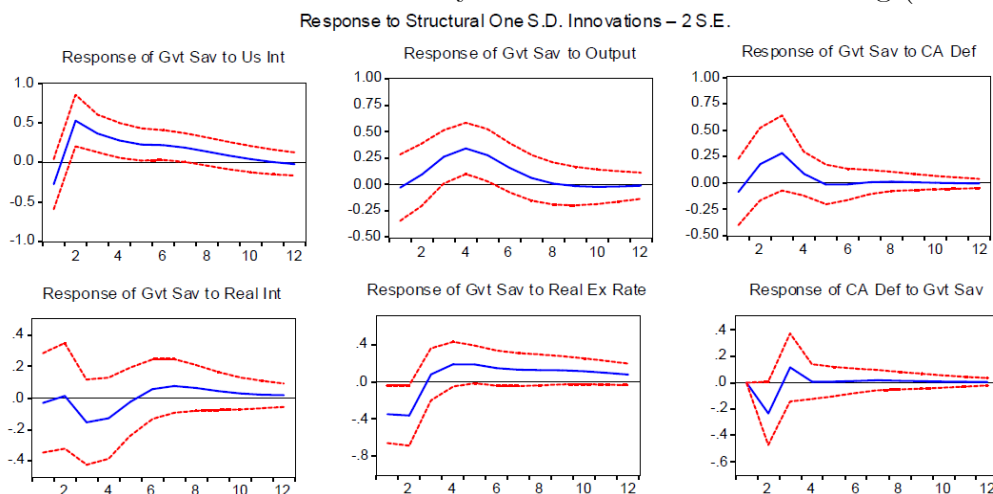


Table 3.13: Summary of Transmission of Monetary Shocks

CA Component	LUSRATE	RIR	LEXRATE_US
TBAL	not significant	not significant	-0.12pp
GSAV	+0.53pp	not significant	-0.36pp
GVTINV	-0.25pp	+0.023	not significant

+ increase in response to shock
- decrease in response to shock

monetary policy actually influences the savings-investment gap and the trade balance. Table 3.14 confirms the findings of the IRFs and shows that the larger proportion of variation in the trade balance is explained by exchange rate shocks (about 9%), whilst 17.4% of the variation in government savings is explained by foreign monetary policy, and 10% by exchange rate shocks. This highlights the importance of foreign monetary shocks on the current account as they explain almost 30% of the variation in government savings alone. These findings imply that monetary policy targeted at current account management should consider the impact on exports and imports. Government savings play a large role in improving the savings-investment gap, but more effort is needed to stimulate household savings which may compliment efforts by the public sector to improve the current account balance.

Issues about the reliability of inferences from the results arise in VAR models, and to deal with this, it is necessary to test for stability, serial correlation, and any evidence of heteroscedasticity. The requirement for stability is that the roots should lie inside the unit circle, which is verified in figure 3.13 in the appendix. Table 3.15 reports results for heteroscedasticity and serial correlation tests for the two basic models used, and the results show that there is no evidence of serial correlation, and variances are homoscedastic in these and subsequent models, suggesting that the results can be relied on for policy inference.

3.8 Conclusion

The changes in global monetary conditions as countries adjust from the effects of the 2008 financial crisis have had unforeseen consequences in many economies. In particular, expectations about the normalisation of US monetary policy have raised concern about the stability of the current account balances and macroeconomic fundamentals in emerging market economies. This is more so in countries that have run large current account deficits financed by an influx of foreign capital. Emerging markets fall into this group as they have been characterised by relatively higher interest rates than the rest of the world. The risk of a sudden stop of capital flows to emerging markets has raised concerns about how current

Table 3.14: Structural Variance Decomposition of the Transmission of Monetary Shocks to Current Account Components

CA Component		LUSRATE_DT	RIR_DT	LREER_DT
TBAL_DT	4 quarters	4.6752	4.2929	5.1777
	8 quarters	4.6585	4.1425	8.4141
	12 quarters	5.5709	4.1897	8.7894
	16 quarters	6.5113	4.1524	8.7338
GSAV_DT	4 quarters	14.9278	1.0771	7.7505
	8 quarters	17.2869	1.3095	9.2284
	12 quarters	17.2675	1.3766	10.140
	16 quarters	17.4203	1.3921	10.244
GVTINV_DT	4 quarters	0.5478	3.4141	0.9686
	8 quarters	1.0942	5.7445	1.5799
	12 quarters	1.5631	5.7640	2.5916
	16 quarters	1.5805	5.7582	2.9480

account deficits in these countries are affected by global monetary conditions, and the extent to which domestic monetary policy can be used to insulate the effects of exogenous shocks, and achieve stable adjustment of the current account. This, coupled with the need for case studies that analyse the link between the current account and monetary policy in countries of different income levels motivate this study to investigate the role of monetary policy in the stabilisation of the external balance.

To carry out the objectives, we utilise SVAR models to determine the effects of global/foreign and domestic monetary shocks on current account movements, and to analyse the channels through which monetary shocks are transmitted to the current account. We contribute to the literature on the effects of monetary policy on the current account and provide a case study of South Africa, an emerging economy, that has developing country characteristics, a highly depreciated currency, and widening current account deficit which has been affected by global monetary conditions in comparison to similar emerging markets. South Africa also has impressive availability of time series data that has not been used extensively to analyse the dynamics of the current account, and we exploit this dataset to understand the relationship between the current account and monetary policy.

The findings show that should domestic interest rates fail to rise by a large enough magnitude to offset the increase in foreign interest rates, there is a possibility of a current account reversal as the deficit narrows. In addition, the monetary shocks that are most important for the determination of the current account are the foreign interest rate and exchange rate, with the exchange rate depreciation improving the trade balance, and a contractionary foreign

monetary policy shock stimulating an increase in the domestic interest rate, which increases government savings. These findings are similar to other studies on developed countries such as Lee and Chinn (2006) and Kim (2001a), although South Africa, being an emerging market, is more susceptible to these shocks. The novelty of our findings is in the effect of foreign monetary policy, which poses a risk of current account reversal. Combating these risks requires appropriate policy measures to ensure a smooth adjustment of the current account, with minimal effects on the economy. As a result, further research should investigate the optimal monetary policy that would ensure smooth adjustment of the current account.

3.A Appendix to Chapter 3

Figure 3.11: Impulse Response Functions - Differenced model with Nominal Interest rate and Exchange Rate

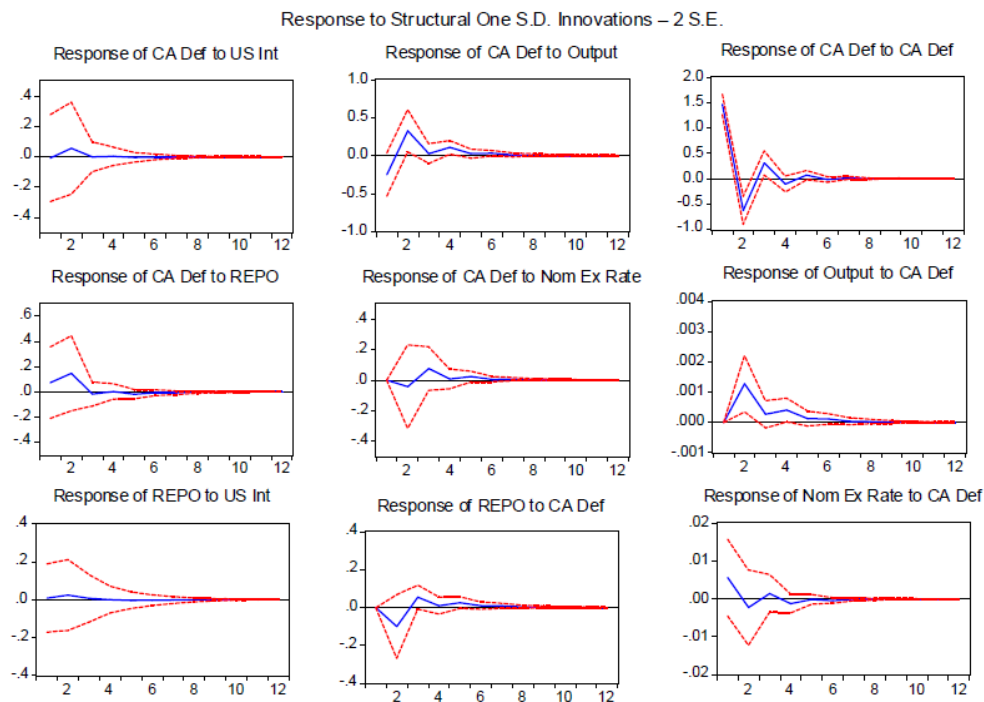


Table 3.15: Diagnostic Tests

Variables	LAGS	LM test	WHITE test
Differenced Model	2	0.3517	0.0016
Detrended Model	2	0.3748	0.0014

Notes: P-Values recorded

LM Test H_0 : no serial correlation

White Test H_0 : heteroscedasticity

Figure 3.12: Transmission of Monetary Shocks to Government Investment (Detrended)

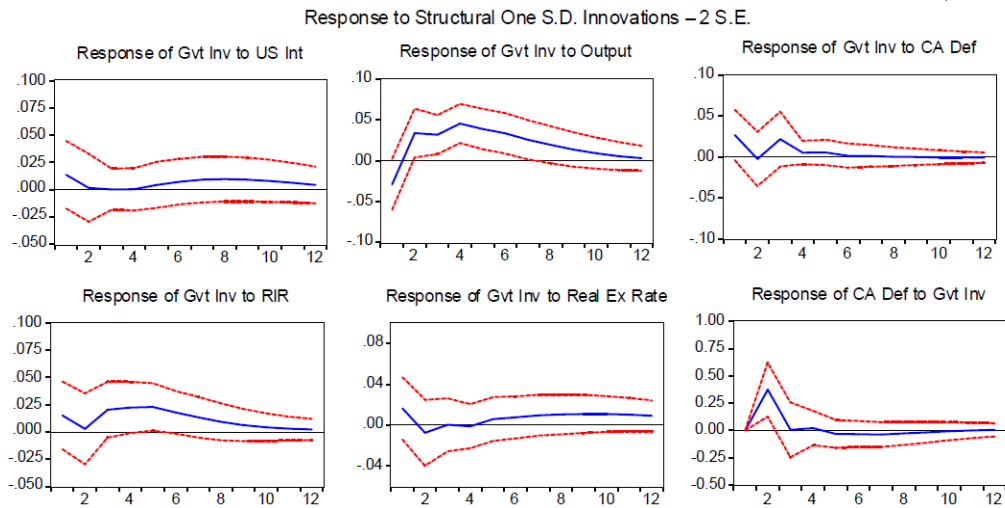
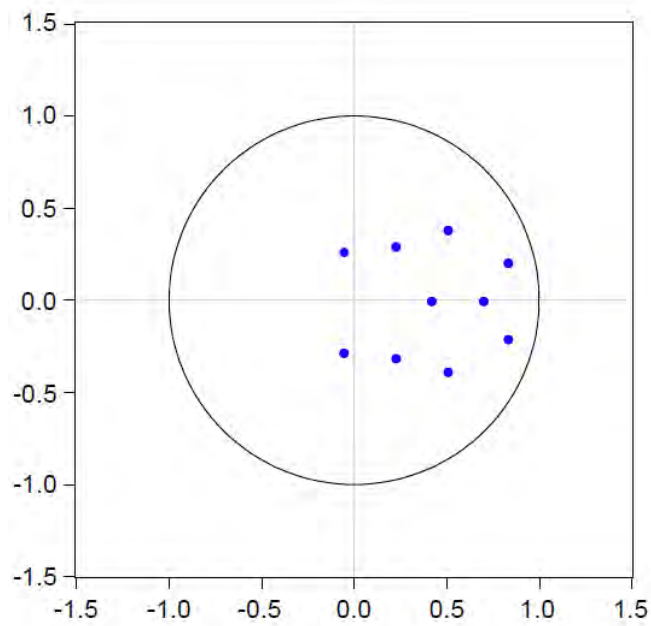


Figure 3.13: Stability of the Detrended VAR



Chapter 4

The role of Non-Traded Goods in Current Account and Exchange Rate Determination

4.1 Introduction

External imbalances have continued to get attention in international macroeconomics for decades, with several studies arguing that current account imbalances are one of the main reasons for financial sector fragility due, to the ease of financing imbalances through the more integrated global financial system (e.g. Obstfeld and Rogoff, 2009; Milesi-Ferretti and Blanchard, 2009; Obstfeld, 2012). These studies argue that current account dynamics play an important role in the macroeconomic stability of emerging market economies and remain a policy-relevant variable on both financial and macroeconomic grounds. The recognition of the significance of the current account for macroeconomic stability urges researchers to find the best possible policy solutions for current account stability (Milesi-Ferretti and Blanchard, 2009). However, finding solutions to large external imbalances remains a challenge for researchers, particularly in emerging markets, where there is still little research on current account dynamics.

Current account research in the context of general equilibrium models has so far focused on the evolution of the current account in developed countries (e.g. Bergin, 2006; Lu, 2012; Herz and Hohberger, 2013), and most models that have been developed assume that the current account balance is a direct result of the traded goods sector. However, because of structural rigidities in the production process, multi-sector middle and low income economies are normally characterised by high levels of consumption of the non-traded good in addition to

traded goods, and shocks emanating from the non-traded goods sector can have destabilising effects on the economy, a feature overlooked in most current account models. This is because when consumption is an aggregate of both traded and non-traded goods in a dynamic model, the non-separability of consumption between these two types of goods in constant elasticity of substitution form implies that shocks to the non-traded goods sector have effects which may influence tradeables consumption, and consequently spillover on the current account (see Obstfeld and Rogoff, 1995a; Lu, 2009). Such a scenario can be illustrated by an example in which the consumption of tradeables increases together with the consumption of non-tradeables. Under such circumstances, a boom in the non-traded goods sector would increase demand for tradeables, thereby increasing demand for imports and worsening the current account deficit. This implies that non-traded goods play a vital role in current account determination and should not be overlooked as one of the drivers of the current account. This aspect is particularly relevant in developing countries and emerging markets where the size of the non-traded goods sector can be relatively large. The significance of the non-traded goods sector suggests that to fully understand how the current account evolves in emerging markets and developing economies, there is need for a fully specified current account model that accounts for all the sectors that contribute to economic development in a multi-sector economy. The inclusion of the non-traded goods sector helps to address questions that cannot be answered by single sector models since different sectors in the economy have different driving forces and react differently to exogenous shocks (Batini, Harrison and Millard, 2003). This makes the separate treatment of different sectors in the economy of paramount importance as it facilitates in the design of efficient macroeconomic policy.

The lack of investigation into the current account dynamics of emerging markets, and the size of the non-traded goods sector in emerging markets and developing economies motivate us to present the notion that the non-traded goods sector is relevant for current account dynamics, and developed country models cannot be relied upon for inference of the evolution of the current account in emerging and developing countries as they may be misspecified. We investigate the hypothesis that shocks to the non-traded goods sector have spillover effects on the current account and exchange rate, and develop a model of the current account that allows for a distinction between the traded and non-traded goods sectors. This model is used to explore the extent to which the non-traded goods sector influences the dynamics of the current account and the exchange rate, by analysing the response of the current account to exogenous shocks in a dual sector setting with both traded and non-traded goods. This provides a platform to examine the model's ability to replicate stylised facts established from data in chapter 3, thereby testing the fit of the model. It is important to analyse the importance of the non-traded goods sector in the evolution of the current account by analysing how important shocks from the non-traded goods sector are in determining the current account and macroeconomic variables, compared to those from the traded goods

sector. The main contribution we make is in the advancement of NOEM models in South Africa provide a role for non-traded goods, and more specifically, to analyse the impact and importance of this sector on the current account. The model is calibrated to suit features of most emerging markets, with focus on South Africa as an appropriate case study.

The key findings provide an interesting departure from single sector models that attribute most of the variation in the current account to risk premium shocks. In our dual sector model, we find that the non-traded goods sector plays a significant role in the determination of the current account. When we include this sector, half the variation in the current account is explained by non-traded goods productivity shocks, and the contribution of risk premium shocks to current account variation decreases. This result is stronger when households have a larger share of non-traded goods in the consumption bundle, are able to substitute between traded and non-traded goods with ease. The model provides a good fit to stylised facts presented in chapter 3, suggesting that the non-traded goods sector is vital for the evolution of the current account and exchange rate in South Africa.

The next section discusses the advances made in current account modelling in literature, and evaluates the implications of the non-traded goods sector for such models. We start off by evaluating the shortfalls of single sector current account models, and identify the gaps in the few current account models that have included non-traded goods in section 4.2. Section 4.3 then describes the size and significance of the non-traded goods sector in South Africa, and the current account in relation to other emerging markets so as to highlight the salient features that make South Africa a suitable case study. In section 4.4, we develop the model, with focus on the alterations made to existing models, so as to incorporate the dynamics of the non-traded goods sector. Section 4.5 discusses the calibration technique, with section 4.6 discussing the results. Finally, section 4.7 presents some conclusions.

4.2 Literature Review

New Open Economy Macroeconomic (NOEM) models are increasingly accepted as the basis for analysing the macroeconomic behaviour of countries as they combine microeconomic foundations with the macroeconomic structure of an economy to incorporate nominal rigidities and dynamic optimisation. These attractive features have led these models to become the dominant theoretical model used to study structural current account and trade balance issues (Yamamoto, 2013). However, a shortcoming of these models is that, because of their complexity, little work has been done to advance the theoretical work, and as a result, aspects key to the evolution of the current account, such as the relevance of the non-traded goods sector in emerging markets has been overlooked in these models.

Some structural models still consider the current account to be a result of traded goods only, and by so doing, eliminate the effects of non-traded goods on the current account in a dual sector economy (e.g. Bergin, 2006; Lombardo, 2002). These models assume that domestic households consume a domestically produced good which can be exported, and imported goods only. Adopting such a model usually yields results that show that the direction of response (surplus or deficit) of the current account to exogenous shocks is determined by intertemporal consumption smoothing, and the magnitude of the response of the current account to shocks is affected by the degree of real rigidity in the economy as in Lombardo (2002). In a two country model that tries to explain the exchange rate and the current account, Bergin (2006), by developing a traded goods model finds that deviations from uncovered interest parity (UIP) are strongly related to shifts in the current account, whilst monetary shocks are not. This result is in line with the findings of Herz and Hohberger (2013) who analyse the response of the current account to stochastic shocks when fiscal rules are implemented under various exchange rate regimes in a small open economy. Although Herz and Hohberger (2013)'s study analyses the dynamics of the current account in a monetary union, like Bergin (2006), the study analyses the effect of a negative risk premium shock on the current account, with the finding that negative risk premium shock appreciates the exchange rate, which reduces output through loss of competitiveness and worsens the current account deficit. In these single sector models, a large proportion of the variation in the exchange rate and current account is explained by risk premium shocks, with little role for other exogenous shocks.

An interesting issue which Herz and Hohberger (2013) further address is the impact of negative productivity shock on the current account, and they find that the decline in output increases government spending, which further increases inflation, appreciates the exchange rate, and ultimately worsens the current account deficit. However, by implying that all goods in the model are traded, the productivity shock modelled in the analysis implicitly becomes a traded goods productivity shock. Exclusion of the non-traded goods sector in these models means they fail to adequately characterise the response of the current account and exchange rate to exogenous shocks, and this raises the question of whether the findings would still hold in a model with a fully characterised production sector.

In middle income and low income economies, the non-traded goods sector can arise for various reasons. This sector can arise endogenously because less productive firms decide not to export their products, such that traded and non-traded goods become substitutes (Ghironi and Melitz, 2005). As the ease of substitutability between traded and non-traded goods increases, an appreciation of the real exchange rate is caused by aggregate productivity shocks as opposed to shocks specific to the traded-goods sector, implying the impact of productivity shocks on the current account would be expected to vary from the case of single

sector models. Another reason that could lead to a dominant non-traded goods sector in an economy is the home bias in consumption. Home bias implies that residents of the domestic economy place a relatively higher weight on consumption of goods produced in the domestic economy, implying demand expansion is biased towards home produced goods. As a result, the current account is then defined by the path of both tradeables and non-tradeables due to non separability of consumption.

Studies that argue for the inclusion of non-traded goods in a structural model find that incorporating this sector increases the initial size of the response of the exchange rate in response to a monetary shock, and also increases the volatility of the exchange rate in the model. This is particularly useful as NOEM models are often criticised in literature for failing to generate sufficient exchange rate volatility as is displayed in the data, and in some instances, productivity shocks from the non-traded goods sector explain as much as a third of the variation in macroeconomic aggregates (e.g. Hau, 2000; Rabanal and Tuesta, 2013). The inclusion of non traded goods may help in explaining the volatility of the exchange rate and current account in many emerging market economies and could significantly alter the manner in which the current account and exchange rate are affected by risk premium shocks or deviations from UIP.

Given the advancement of structural models towards the inclusion of non-traded goods (e.g. Dotsey and Duarte, 2008; Benigno and Thoenissen, 2008; Corsetti, Dedola and Viani, 2011), authors in the field of current account dynamics are reverting back to the Obstfeld and Rogoff (1995b) Intertemporal Current Account model to include non-traded goods in this framework, but this practice is still largely restricted to current account models of developed countries. When the non-traded goods sector is included in the model, the findings suggest that the initial response of the current account to a monetary shock is affected by the intratemporal elasticity of substitution between traded and non-traded goods, and the intertemporal consumption smoothing (e.g. Lu, 2012; Lu, 2009). This result is in line with Obstfeld and Rogoff (1995b)'s initial finding which suggests that the direction of response of the current account (surplus or deficit) may depend on the inverse of the intertemporal elasticity of substitution in consumption and on the intratemporal elasticity of substitution between traded and non-traded goods. If the former is less than the latter, we should expect an increase in non-tradeables as people substitute more non-traded goods for traded goods, such that a positive monetary shock leads to a current account surplus as households prefer to consume more of the home produced good. If the former is greater than the latter, a current account deficit will emerge, and a current account balance will theoretically be expected when the two are equal.

In addition to the significance of the intratemporal elasticity, exchange rate changes are found

to have intratemporal effects which can cause substitution between traded and non-traded goods. These intratemporal effects are the reason most current account models argue that to fully understand the evolution of the current account in a structural and dynamic framework, the current account and exchange rate should be jointly determined. Bergin and Sheffrin (2000) demonstrate this by including the interest rate and exchange rate in a current account model with both traded and non-traded goods, and their findings show that inclusion of the exchange rate improves the model's ability to predict current account movements and the model is better able to replicate the volatility of the current account that is displayed in the data. Studies that concur with the importance of the exchange rate in current account determination include the exchange rate as a key variable in the current account model with traded and non-traded goods, but most of these studies only go so far as to analyse current account adjustment or response under alternative monetary rules or exchange rate regimes such as CPI targeting, exchange rate targeting, and various specifications of the Taylor rule. The results generally show that monetary rules are important for domestic variables, but less important for international variables such as the exchange rate and the current account (e.g. Ferrero, Gertler and Svensson, 2008; Lu, 2009).

Several shortfalls emerge from these studies. First, studies that model the current account as a function of non-traded goods are mostly limited to developed countries. However, because of the structural rigidities in production faced by lower income countries, developing countries and emerging markets are likely to be affected more than developed countries by the non-traded goods component. The second shortfall is that although there is a general consensus on the importance of the exchange rate in current account models, the discussed studies account for the macroeconomic exchange rate only. The inclusion of non-traded goods in a model raises an interesting question of how the relative price between tradeables and non-tradeables (microeconomic exchange rate) affects the dynamics of the current account, an issue which is not addressed in these studies. Finally, the aforementioned studies do not analyse the relative importance of shocks emanating from the production sectors in determining current account movements. This is important because one of the implications of separate treatment of the traded and non-traded goods sectors is that technology shocks emanating from these sector will not have similar effects on the current account. Productivity shocks are a feature that has long attracted attention in current account dynamics literature (e.g. Glick and Rogoff, 1995; Bussière, Fratzscher and Müller, 2010), but focus of this analysis has so far been on the differentiation between global and country specific productivity shocks, with the finding that global productivity shocks have no significant impact on the current account, whilst country specific productivity shocks worsen the current account deficit. To the best of our knowledge, given the relative importance of the non-traded goods sector, and the significance of country specific productivity shocks, no study has yet analysed the importance of traded goods productivity shocks in relation to non-traded goods

productivity shocks for current account determination.

To address these shortfalls, this study develops a small open economy current account model that accounts for the dynamics of non-traded goods and is representative of an emerging market. The model is used to analyse the significance of the non-traded goods sector for current account dynamics in emerging markets, by analysing how productivity shocks and dynamics of the non-traded goods sector impact the current account and exchange rate vis-a-vis shocks from the traded goods sector. We expect our study to produce a well specified model of the current account with salient emerging market features, which can provide a basis for understanding the evolution of the current account in these economies. Understanding current account dynamics is important in order to be able to come up with any policy prescriptions for current account management. We calibrate the model to the South African economy, an emerging market characterised by a dominant non-traded goods sector and a large current account deficit, features which are discussed in more detail in the next section. To the best of our knowledge, although there has been extensive research on NOEM modelling in South Africa, particularly in the aspects of optimal monetary policy and forecasting (e.g. Steinbach, Mathuloe and Smit, 2009; Alpanda, Kotze and Woglom, 2010; Liu, Gupta and Schaling, 2009), the literature in this field has neither tried to explain current account dynamics nor investigated the role of the non-traded goods sector in the macroeconomy in South Africa.

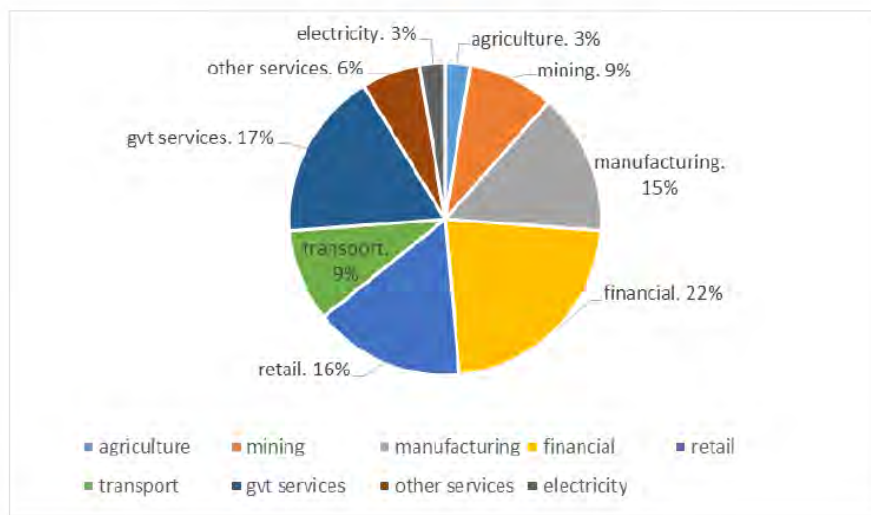
4.3 South Africa's Non-Traded Goods Sector

The nature of the different goods produced and consumed in the South African economy is reflective of two distinct sectors, the traded and non-traded goods sectors. SARB (2014) classifies South Africa's economic activities into 9 key sectors, agriculture, mining, manufacturing, financial services, retail, transport, government services, electricity (including water and other utilities), and other services (inclusive of health and education). Following studies that decompose the South African economy into traded and non-traded goods sectors (e.g. Rodrik, 2008), this section decomposes the South African economy into these two sectors to give an indication of the magnitude and contribution of each sector. The traded goods sector comprises of mining, manufacturing and agriculture, whilst the rest of the sectors are classified as non-tradable¹. From figure 4.1, the dominant sectors in the economy in 2013 were manufacturing, financial services, government services and retail. The size of the agriculture and mining sectors is small, so following Rodrik (2008)'s categorisation, the non-traded

¹Traded goods are generally defined as those that can be traded a distance from their point of location with the law of one price holding. Non-traded goods cannot be provided from a distance because of high transport costs or a significant loss of utility.

goods sector accounts for about 74% of the value addition to GDP. Rodrik (2008) categorises financial services as non-traded because the variable includes transactions from insurance, real estate and other business transactions. However, because of the well developed financial sector in South Africa and the degree of financial sector liberalisation, financial services may well be categorised as traded, and following this categorisation implies that the non-traded goods sector becomes 52% of all sectors as opposed to 74%, whilst the traded goods sector is 48%. Regardless of the manner in which financial services are categorised, the non-traded goods sector is still the dominant sector in the South African economy. Moreover, the traded goods sectors (except financial services) experienced a decline in growth from 2000, whilst the sectors that experienced an expansion are government services, retail and transport (see figure 4.2).

Figure 4.1: Contribution of Sectors to the Economy in 2013

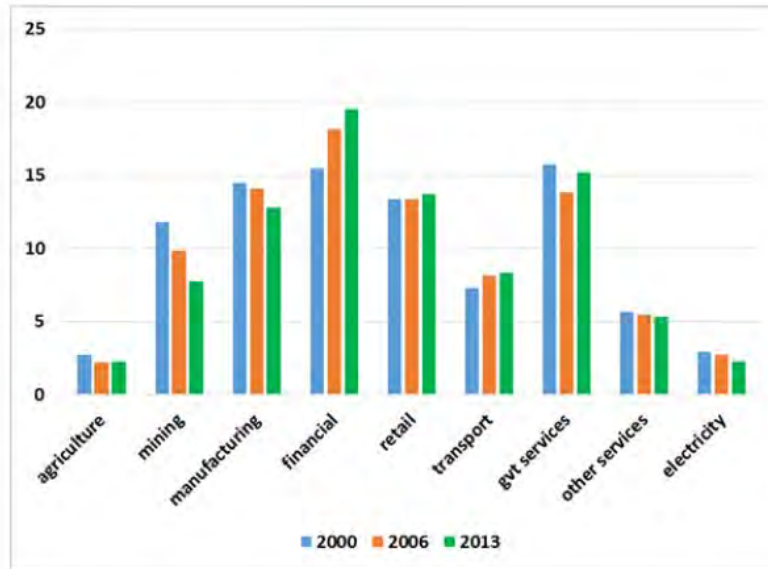


Source: Author's compilations using data from SARB (2014).

Of interest is that given the relative size of the non-traded goods sector, which is more than half of the South African economy, and the manner in which this sector has been expanding, South Africa's current account deficit has continued to widen, and is the second highest current account deficit amongst EMEs². The deficit is characterised by macroeconomic instability which includes above target inflation and a highly depreciated currency. The problem of a widening current account deficit financed by short term capital inflows despite an expanding non-traded goods sector is not only specific to South Africa, but is evident in other emerging markets (see table 4.1), indicating the need for emerging markets to address external sector vulnerability. However, addressing these risks faced by EMEs requires rethinking of the manner in which current account models that guide policy formulation are designed, so as the focus on the particular macroeconomic issues faced by EMEs.

²Decomposition of sectors in other emerging markets shows that the non-traded goods sector is growing in terms of value addition to GDP, whilst the traded goods sector is also deteriorating.

Figure 4.2: Growth in Sectors: 2000, 2006 and 2013



Source: Author's compilations using data from SARB (2014).

Table 4.1: Performance of the Fragile 5 Economies as at 2013

Country	YTD performance vs USD	GDP growth	Inflation	CA Deficit
Brazil	-7.6%	3.28%	6.09%	3.23%
South Africa	-14.4%	2%	6.4%	6.5%
India	-12.1%	4.4%	6.1%	5.07%
Turkey	-9.9%	4.4%	8.17%	6.62%
Indonesia	-15.4%	5.81%	8.79%	3.27%

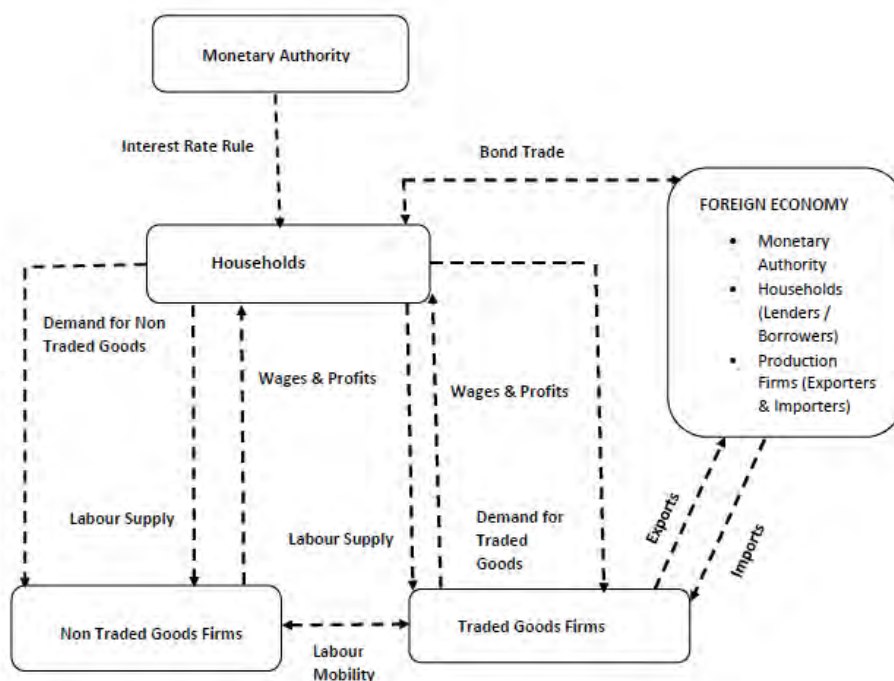
Source : Morgan Stanely / Bloomberg (2014)

The importance of addressing macroeconomic stability in emerging markets implies it is necessary to explore the problem of growing current account deficits, and the role played by the non-traded goods sector in driving the current account in emerging markets. To address these goals, we develop a current account model that resembles the features and rigidities faced by most EMEs, with particular focus on the role and size of the non-traded goods sector. Our analysis uses South Africa as an emerging market case study as the country provides a rich data set of parameters from previously estimated NOEM models, and resembles all the features of an emerging market that are of interest in this study (i.e. high current account deficit, dominant non-traded goods sector, depreciated exchange rate). In the next section, we develop a current account model with non-traded goods and describe in detail the features of South Africa that make the model characteristic of an emerging market.

4.4 Model

A useful starting point for laying the foundations of the model is a dynamic stochastic general equilibrium (DSGE) model which builds on the work of Galí and Monacelli (2005) and Justiniano and Preston (2010), models commonly used to develop DSGE models for South Africa, and Alpanda, Kotze and Woglom (2010), an existing single sector DSGE model for South Africa that does not analyse the dynamics of the current account. These studies provide the basic framework for a small open economy DSGE model with nominal rigidities, a framework which this paper adopts. The model is based on an economy with three domestic agents, namely households, firms, and a monetary authority that models monetary policy through a Taylor rule. Given that the small open economy cannot affect world prices, the rest of the world is regarded as exogenous to the domestic economy. This basic model is modified to meet the objectives of this chapter by incorporating a production sector characterised by both traded goods firms and non-traded goods firms. We assume, domestic households consume the non-traded good, the domestically produced traded goods, and the imported good, and both production sectors face monopolistic competition. The current account is jointly determined by the exports and imports of goods, as well as the trade in financial assets between domestic and foreign households, and the link between these various sectors and agents in the economy is illustrated in figure 4.3.

Figure 4.3: Flow Chart of the Economy



Source : Author's compilations

Whilst the setup of the non-traded goods sector is similar to Batini, Harrison and Millard

(2003), a number of key differences exist between our study and theirs. Batini, Harrison and Millard (2003)'s contribution is in the evaluation of monetary rules that can stabilise inflation and output in a dual sector small open economy, and the authors also use a welfare function to evaluate the implications of the alternative rules. On the other hand, we use a dual sector economy to analyse the role of the non-traded goods sector in the determination of the current account and exchange rate, and the impact of traded good and non-traded good productivity shocks on the current account in South Africa. To the best of our knowledge, this is an aspect that has been overlooked in dual sector models.

Some key features are incorporated in our model to make it more representative of South Africa. Firstly, labour market rigidities are central to a model reflecting emerging markets and developing countries as they prevent the labour market from adjusting to exogenous shocks, and prevent the wage from adjusting to market clearing conditions. In addition, such frictions affect the response of the economy to shocks and including them in the model enhances the model's ability to generate realistic dynamics. The study includes nominal rigidities applicable to South Africa as guided by Alpanda, Kotze and Woglom (2010), with focus on wage rigidities included to reflect labour market frictions³. Rigidities are also modelled through price adjustment costs which are reflective of sluggish price adjustment in emerging markets and developing countries. Next, South Africa has high levels of household debt, almost 80% of disposable income, and government debt of 46% of GDP (SARB, 2014). A large proportion of this debt is in the form of foreign borrowing, so a risk premium on foreign debt is included to reflect that domestic households do not equally share risk with foreign households when they borrow. The risk premium is also useful for incorporating the incomplete assets market assumption, which enables the current account to be defined as the change in net foreign assets in reflection of the debt levels. Lastly, South Africa, being a commodity exporter is prone to terms of trade shocks, hence terms of trade shocks are also included in the model to capture movements in world prices. In addition, an interest rate rule is used to model monetary policy in line with the Taylor rule which is used in South Africa's inflation targeting framework.

Key modifications from Justiniano and Preston (2010) and Alpanda, Kotze and Woglom (2010) are the introduction of the current account and the non-traded goods sector, and the model notation closely follows Alpanda, Kotze and Woglom (2010) and Lu (2009).

³Fedderke (2012) gives a detailed discussion of labour market rigidities in the South African Economy.

4.4.1 Households

The model is based on a representative utility maximising household whose instantaneous utility (equation 4.1) depends positively on consumption C_t , and negatively on labour effort H_t . $\beta \in (0, 1)$ is the discount factor and σ represents the inverse of the intertemporal elasticity of aggregate consumption, ζ is a consumption habit parameter where present consumption depends on past aggregate consumption.

$$E_t \sum_{T=t}^{\infty} \beta^{T-t} \left[\Theta_T^d \left\{ \frac{(C_T - \zeta C_{T-1})^{1-\sigma}}{1-\sigma} \right\} - \frac{H_T^{1+\psi}}{1+\psi} \right] \quad (4.1)$$

Θ_t is an AR(1) exogenous demand shock, E_t is the expectations operator, and income sources and expenditure choices are governed by the budget constraint (equation 4.2).

$$\frac{C_t}{P_t} + \frac{B_t}{P_t} + \frac{S_t B_t^*}{P_t} \leq \frac{W_t}{P_t} H_t + r_{t-1} \frac{B_{t-1}}{P_t} + r_{t-1}^* \phi_{t-1} \frac{S_t B_{t-1}^*}{P_t} + \frac{\Pi_t}{P_t} \quad (4.2)$$

The household earns labour income, where W_t is the nominal wage rate and P_t is the price level, and earns firm profits Π_t . In addition, the household holds two assets, non contingent bonds denominated in domestic currency B_t , and paying return r_t , and a foreign currency denominated bond B_t^* , paying return $r_t^* \phi_t$ where r_t^* is the foreign interest rate and ϕ_t is the risk premium factor. S_t is the current exchange rate used to convert foreign bonds to domestic currency, with Ponzi schemes ruled out. Households consume the traded good C_{Tt} and the non-traded good C_{Nt} , which together form aggregate consumption C_t modelled in CES form with non separability between traded and non-traded goods (equation 4.3);

$$C_t = \left[a_1^{\frac{1}{\rho_1}} C_{Nt}^{\frac{\rho_1-1}{\rho_1}} + (1-a_1)^{\frac{1}{\rho_1}} C_{Tt}^{\frac{\rho_1-1}{\rho_1}} \right]^{\frac{\rho_1}{\rho_1-1}} \quad (4.3)$$

$\rho_1 > 0$ is the constant elasticity of substitution between traded and non-traded goods, with a large value of ρ_1 showing that the goods are stronger substitutes and a_1 measures the share of non-traded goods in the household's aggregate consumption bundle. C_{Tt} is a homogenous traded good composed of the domestically produced traded good C_{Ht} and the imported good C_{Ft} , hence C_{Tt} is defined by the following CES index;

$$C_{Tt} = \left[a_2^{\frac{1}{\rho_2}} C_{Ft}^{\frac{\rho_2-1}{\rho_2}} + (1-a_2)^{\frac{1}{\rho_2}} C_{Ht}^{\frac{\rho_2-1}{\rho_2}} \right]^{\frac{\rho_2}{\rho_2-1}} \quad (4.4)$$

ρ_2 is the intratemporal elasticity of substitution between domestically produced traded goods and imports whilst a_2 is the share of the imported good in the traded goods consumption

bundle. The aggregate consumption based price index, P_t , is an aggregate of the prices of traded goods P_{Tt} and non-traded goods P_{Nt} .

$$P_t = \left[a_1 P_{Nt}^{1-\rho_1} + (1 - a_1) P_{Tt}^{1-\rho_1} \right]^{\frac{1}{1-\rho_1}} \quad (4.5)$$

Likewise, P_{Tt} is a CES aggregate of the price of domestically produced traded goods P_{Ht} , and the price of imported goods P_{Ft} . Optimising with respect to P_{Nt} and P_{Tt} gives the demand functions for both traded and non-traded goods as below

$$C_{Tt} = (1 - a_1) \left(\frac{P_{Tt}}{P_t} \right)^{-\rho_1} C_t \quad (4.6)$$

$$C_{Nt} = a_1 \left(\frac{P_{Nt}}{P_t} \right)^{-\rho_1} C_t \quad (4.7)$$

Substituting for the home produced and imported traded goods also gives their respective demand functions. The total expenditure on consumption is therefore given by the sum of expenditure on the domestic traded good, the non-traded good and the imported good. Optimal conditions are determined by the first order conditions from the household's maximisation problem and comprise of first the intertemporal Euler condition (equation 4.8), where λ_t is the Lagrange multiplier, second, the intratemporal optimal labour supply schedule (equation 4.9), which shows the marginal rate of substitution of labour for consumption, and is found by equating the marginal disutility from labour effort to the marginal utility from increased wages, and third, optimal bond holdings (equation 4.9), determined by differentiating the objective function with respect to domestic bonds, and gives the asset pricing equation for domestic bonds.

$$\Phi_t^d (C_t - \zeta C_{t-1})^{-\sigma} = \lambda_t \quad (4.8)$$

$$\Phi_t^d H_t^\psi = \lambda_t \frac{W_t}{P_t} \quad (4.9)$$

$$1 = E_t \left[\beta \frac{\lambda_{t+1}}{\lambda_t} \left(\frac{r_t}{\pi_{t+1}} \right) \right] \quad (4.10)$$

In equation 4.9, $\beta \frac{\lambda_{t+1}}{\lambda_t}$ is the stochastic discount factor and π_{t+1} is inflation defined as $\pi_{t+1} = \frac{P_{t+1}}{P_t}$. Likewise, differentiating the objective function with respect to foreign bonds also gives the asset pricing equation for foreign bonds where D_{t+1} is the depreciation of the domestic

currency defined as $\frac{S_{t+1}}{S_t}$

$$1 = E_t \left[\beta \frac{\lambda_{t+1}}{\lambda_t} \left(\frac{D_{t+1} r_t^* \phi_t}{\pi_{t+1}} \right) \right] \quad (4.11)$$

The model is represented as a log-linear approximation around the steady state using the first order Taylor approximation and lower case variables indicate deviations from the unique deterministic steady state⁴.

Recent studies incorporate the current account into the intertemporal framework by incorporating the incomplete asset markets assumption (e.g. Bergin, 2006; Lu, 2009). This assumption reflects current account dynamics as the inability of households to smooth consumption in all periods, so the disparities in interest rates charged on lending and borrowing across countries are the underlying causes of current account imbalances. By assuming that the domestic bond is in zero net supply, incomplete asset markets assist in characterising the dynamics of the current account⁵. However, one of the consequences of the incomplete assets markets assumption is that the model will exhibit non stationarity (see Lewis, 1995) which could lead to poor approximation of the non linear model when the model is linearised around the steady state. A common solution to this problem is to impose a premium on the assets return (e.g. Schmitt-Grohe and Uribe, 2003; Bergin, 2006), which implies that the interest rate faced by an economy increases with an increase in the aggregate debt held, such that when consumers borrow, they will be charged a premium over the foreign interest rate and when they lend, they will receive interest that is lower than the foreign rate. The premium is proportional to the outstanding stock on foreign debt, implying that wealth allocations are in the long run forced to return to their original allocations and converge to a unique steady state, hence ensuring stationarity.

Combining the optimal domestic and foreign bond equations gives the Uncovered Interest Parity (UIP) condition which when loglinearised, gives the basic UIP condition with the risk premium added to the right, as a share of debt (equation 4.12).

$$r_t - r_t^* = E_t [d_{t+1} + (\Phi_t - \chi z_t)] \quad (4.12)$$

The UIP condition shows that an increase in the interest differential causes the currency to appreciate today but depreciate in future, whilst an increase in the risk premium depreciates the currency today but reduces the expected future depreciation. The risk premium factor

⁴The loglinearised model is found in the appendix.

⁵Obstfeld and Rogoff (1995b) discuss the shotfalls of the complete markets assumption and demonstrate how monetary policy will affect real variables with market imperfections. The inability of households to fully insure against risk when they borrow implies asset markets are incomplete.

Φ_t is an exogenous AR(1) risk premium shock, and χ regulates the sensitivity of the risk premium to changes in foreign bond holdings or foreign debt to trend GDP (z_t) where

$$Z_{t-1} = \frac{S_{t-1}B_{t-1}^*}{P_{t-1}\bar{Y}} \quad (4.13)$$

The steady state of the trade balance is set to zero implying that the steady state value of foreign debt to GDP is also zero (equation 4.14). This is attained by setting the risk-premium shock's mean value $\bar{\Phi}$ to $-\log(\beta\bar{i}^*)$, ensuring that $nx_t/y_t = a_t = 0$.

$$Z_t = -\frac{NX_t/Y_t}{\bar{i} - 1} \quad (4.14)$$

4.4.2 Production

In the production sector of the model there are two categories, the traded goods sector and the non-traded goods sector. In each sector there are two types of firms, intermediate goods producers, and final goods producers. Intermediate goods producers produce differentiated products and are monopolistically competitive. In the traded goods sector, final goods firms aggregate the intermediate goods into a homogenous product that can be used for either home consumption, C_{Ht} or exports C_{Ht}^* . On the other hand, in the non-traded goods sector, final goods firms aggregate the intermediate goods into a homogenous product that is only used for home consumption, C_{Nt} . Final goods firms are perfectly competitive and are only introduced into the model for tractability. Labour is assumed to be the only factor of production and is internationally immobile, but mobile across sectors, implying the wage rate is equalised across sectors⁶.

Non-Traded Goods Sector

The contribution of the study is in the evaluation of the role of non-traded goods in current account dynamics and exchange rate dynamics given the size of this sector in South Africa, so there is need to discuss how the non-traded goods sector is modelled in detail. Final producers of non-traded goods are perfectly competitive and purchase differentiated goods $Y_{Nt}(i)$ from an intermediate goods producer i . The goods are then aggregated into a final good using the following production function;

$$Y_{Nt} = \left[\int_0^1 Y_{Nt}(i)^{\frac{\theta_{Nt}-1}{\theta_{Nt}}} \partial(i) \right]^{\frac{\theta_{Nt}}{\theta_{Nt}-1}} \quad (4.15)$$

⁶Capital is assumed to be constant in this model based on empirical studies which show that endogenous variations of capital do not significantly affect the variation of output and business cycle frequencies (McCallum and Nelson, 2000).

where θ_{Nt} is the elasticity of substitution between non-traded intermediate goods. θ_N is the steady state value of θ_{Nt} and the non-traded goods markup shock is given by $\mu_{Nt} = \frac{\theta_{Nt}}{\theta_{Nt}-1}$. Perfect competition in the production of final non-traded goods implies the profit maximisation problem is given by

$$\max P_{Nt} C_{Nt} - \int_0^1 P_{Nt}(i) Y_{Nt}(i) \partial i \quad (4.16)$$

and this yields the demand function for the intermediate good

$$Y_{Nt}(i) = \left(\frac{P_{Nt}(i)}{P_{Nt}} \right)^{-\theta_{Nt}} Y_{Nt} \quad (4.17)$$

Production technology used for intermediate non-traded goods is described in equation 4.18, with an AR(1) productivity shock.

$$Y_{Nt}(i) = A_{Nt} H_{Nt}(i) \quad (4.18)$$

Intermediate firms set prices to maximise the present value of profits and they take the demand function of final goods firms as given. Profits are discounted at the same rate as households such that the objective function of intermediate firms is given by

$$\max E_t \sum_{\tau=t}^{\infty} \beta^{T-t} \frac{\Lambda_T}{\Lambda_t} \left[\frac{P_{N\tau}(i)}{P_{N\tau}} Y_{N\tau}(i) - \frac{W_{N\tau}}{P_{N\tau}} H_{N\tau}(i) - \frac{\kappa}{2} \left(\frac{P_{N\tau}(j)/P_{N\tau-1}(j)}{\pi_{N\tau-1}^{\varphi}} - 1 \right)^2 Y_{Nt} \right] \quad (4.19)$$

where $\frac{\kappa}{2} \left(\frac{P_{N\tau}(i)/P_{N\tau-1}(i)}{\pi_{N\tau-1}^{\varphi}} - 1 \right)^2$. Y_{Nt} is the quadratic cost of price adjustment which is scaled by aggregate domestic output and regulated by the parameter κ . φ regulates the extent to which current price changes are indexed to past inflation. Profits are used to pay wages and are then distributed to households such that the real distributions are given by

$$\frac{\Pi_{Nt}(i)}{P_{Nt}} = \frac{P_{Nt}(i)}{P_{Nt}} Y_{Nt}(i) - \frac{W_t}{P_{Nt}} H_{Nt}(i) \quad (4.20)$$

Log linearising the first order condition derived from firm maximisation gives the New Keynesian Phillips curve for non-traded goods;

$$\pi_{Nt} - \varphi \pi_{Nt-1} = \beta E_t [\pi_{Nt+1} - \varphi \pi_{Nt}] + \frac{\theta_{Nt} - 1}{\kappa^*} [\mu_{Nt} + w_t - p_{Nt} - a_{Nt}] \quad (4.21)$$

implying

$$\pi_{Nt} = \frac{\beta}{1 + \beta\varphi} E_t [\pi_{Nt+1}] + \frac{\varphi}{1 + \beta\varphi} \pi_{Nt-1} + \frac{\theta_N - 1}{\kappa(1 + \beta\varphi)} mc_{Nt} + \mu_{Nt} \quad (4.22)$$

where the markup shock μ_{Nt} is redefined as

$$\mu_{Nt} = \frac{\theta_N - 1}{\kappa(1 + \beta\varphi)} \widehat{\mu}_{Nt} \quad (4.23)$$

and $mc_{Nt} = w_t - p_{Nt} - a_{Nt}$. The marginal cost can also be expressed as

$$mc_{Nt} = \varphi y_{Nt} - (1 + \varphi) a_{Nt} + \alpha tot_t + \frac{\sigma}{1 - \zeta} (c_t - \zeta c_{t-1}) \quad (4.24)$$

Aggregate inflation (CPI) is a weighted average of the price of traded and non-traded goods and is given by

$$\begin{aligned} \pi_t &= (1 - a_1) \pi_{Tt} + a_1 \pi_{Nt} \\ &\Rightarrow (1 - a_1) [(1 - a_2) \pi_{Ht} + a_2 \pi_{Ft}] + a_1 \pi_{Nt} \end{aligned} \quad (4.25)$$

In the traded goods sector, inflation is the weighted average of home and foreign produced traded goods, with the proportion of each good in the consumption bundle used to determine the weight. Since monetary policy affects non-traded goods through inflation, it also affects the markup and the current account.

Traded Goods Sector

The structure of the traded goods sector is similar to that of non-traded goods with a perfectly competitive final goods sector and a monopolistically competitive intermediate sector. The production function used to aggregate the differentiated intermediate goods into the final good Y_{Tt} is given by;

$$Y_{Tt} = \left[\int_0^1 Y_{Tt}(j)^{\frac{\theta_{Tt}-1}{\theta_{Tt}}} \partial j \right]^{\frac{\theta_{Tt}}{\theta_{Tt}-1}} \quad (4.26)$$

where θ_{Tt} is the elasticity of substitution between traded intermediate goods and the gross markup is similarly defined as in the case of non-traded goods. The final traded good is either domestically consumed, C_{Ht} or exported C_{Ht}^* such that the final goods firms maximise profits according to;

$$\max P_{Ht} C_{Ht} + S_t P_{Ht}^* C_{Ht}^* - \int_0^1 P_{Tt}(j) Y_{Tt}(j) \partial j \quad (4.27)$$

This maximisation problem gives the demand function for intermediate goods given by

$$Y_{Tt}(j) = \left(\frac{P_{Tt}(j)}{P_{Tt}} \right)^{-\theta_{Tt}} Y_{Tt} \quad (4.28)$$

whilst the foreign demand for exports (home goods) is given by

$$C_{Ht}^* = (C_{Ht-1}^*)^\Upsilon \left[a^* Y_{Tt}^* \left(\frac{P_{Tt}}{S_t P_{Tt}^*} \right)^{-\rho_1} \right]^{1-\Upsilon} \quad (4.29)$$

where Υ determines the extent to which current level of exports are dependant on past exports and is a persistence parameter based on the specification in the foreign utility function. a^* regulates the share of home produced consumption goods in the overall expenditure of foreign households and Y_{Tt}^* is foreign output of the traded goods sector.

Intermediate goods firms are monopolistically competitive with each firm indexed by j . Their production function is given by

$$Y_{Tt}(j) = A_{Tt} H_{Tt}(j) \quad (4.30)$$

where A_{Tt} is the AR(1) aggregate productivity shock. Quadratic price adjustment is used to model price rigidity, and maximising the present value of profits with respect to own price gives the price setting rule below;

$$\left(\frac{\Pi_{Tt}}{\Pi_{Tt-1}^\varphi} - 1 \right) \frac{\Pi_{Tt}}{\Pi_{Tt-1}^\varphi} = E_t \left\{ \beta \frac{\Lambda_{t+1}}{\Lambda_t} \left(\frac{\Pi_{Tt}}{\Pi_{Tt-1}^\varphi} - 1 \right) \frac{\Pi_{Tt+1}}{\Pi_{Tt}^\varphi} \frac{Y_{Tt+1}}{Y_{Tt}} \right\} + \frac{1}{\kappa} \left[(1 - \theta_{Tt}) + \theta_{Tt} \frac{W_t/P_{Tt}}{A_{Tt}} \right] \quad (4.31)$$

Log linearising this condition gives the New Keynesian Phillips curve

$$\pi_{Tt} = \frac{\beta}{1 + \beta\varphi} E_t [\pi_{Tt+1}] + \frac{\varphi}{1 + \beta\varphi} \pi_{Tt-1} + \frac{\theta_T - 1}{\kappa(1 + \beta\varphi)} mc_{Tt} + \mu_{Tt} \quad (4.32)$$

where the markup shock μ_{Tt} is redefined as

$$\mu_{Tt} = \frac{\theta_T - 1}{\kappa(1 + \beta\varphi)} \widehat{\mu}_{Tt}$$

and $mc_{Tt} = w_t - p_{Tt} - a_{Tt}$. The marginal cost can also be expressed as

$$mc_{Tt} = \varphi y_{Ht} - (1 + \varphi) a_{Tt} + a_2 tot_t + \frac{\sigma}{1 - \zeta} (c_t - \zeta c_{t-1}) \quad (4.33)$$

and shows that an increase in traded output and terms of trade increases the marginal cost of traded goods firms.

Households exhibit staggered wage setting such that the wage inflation Phillips curve is given by;

$$\pi_{wt} - \mu\pi_{wt-1} = \beta E_t [\pi_{wt+1}] - \mu\beta\pi_t + \frac{(1 - \theta_w)(1 - \theta_w\beta)}{\theta_w(1 + \varphi\epsilon_w)}\mu_t^w \quad (4.34)$$

where π_{wt} is the inflation of the nominal wage. μ shows the degree of overall inflation indexation to nominal wage inflation whilst φ is the elasticity of labour supply. ϵ_w denotes the elasticity of substitution between different labour services and μ_w shows the difference between the marginal rate of substitution between consumption and labour, and the real wage such that;

$$\mu_t^w = \frac{\sigma}{1 - \zeta} (c_t - \zeta c_{t-1}) + \varphi [(y_{Tt} - a_{Tt}) + y_{Nt} - a_{Nt}] - rw_t + \eta_t^w \quad (4.35)$$

where η_t^w is the wage cost push shock following an AR(1) process. The following expression gives the relationship between nominal wage inflation and real wage inflation;

$$\pi_{wt} = rw_t - rw_{t-1} + \pi_t \quad (4.36)$$

4.4.3 Current Account, Exchange Rate Dynamics and Terms of Trade

The terms of trade tot_t is defined as the the ratio of the price of the imported good to that of the home produced traded good and is included to cater for commodity price shocks given that South Africa is a commodity exporter. Equation (4.37) defines the terms of trade.

$$tot_t = \frac{P_{Ft}}{P_{Ht}} \quad (4.37)$$

Our aim is in analysing the role of the non-traded goods sector in current account dynamics and exchange rate determination, so we analyse the evolution of both the macroeconomic and microeconomic exchange rate in the model. The macroeconomic exchange rate is given by the real exchange rate Q_t defined as;

$$Q_t = \frac{S_t P_t^*}{P_t} \quad (4.38)$$

The difference between the real exchange rate and the terms of trade gives the marginal cost of foreign intermediate traded good firms who buy the product at $S_t P_t^*$ and sell it at P_{Ft} . Following Monacelli (2005), the difference between the real exchange rate and terms of trade can also be considered to be the deviation from the law of one price, such that the

loglinearised law of one price gap is defined as

$$\begin{aligned}\psi_{Ft} &= s_t + p_t^* - p_{Ft} \\ &= q_t - s_t\end{aligned}\tag{4.39}$$

The microeconomic exchange rate gives the relative price of the traded and non-traded goods in the domestic economy and is included to analyse the extent to which it is also affected by stochastic shocks. This exchange rate is defined as

$$Q_t^N = \frac{P_{Tt}}{P_{Nt}}\tag{4.40}$$

The current account is modelled as the change in net foreign assets. This embeds the net exports which are derived from the national income identity as;

$$\frac{W_t}{P_t}H_t + \frac{\Pi_t}{P_t} = \frac{C_t}{P_t} + NX_t = Y_t\tag{4.41}$$

where Y_t is an aggregate of traded and non traded goods output. From the national income identity, consumption can be related to output by

$$y_t = \alpha s_t + c_t + \alpha (c_{H,t}^* - m_t)\tag{4.42}$$

where $c_{H,t}^*$ denotes home goods which are exported and is a function of past exports, home goods and foreign output expressed as;

$$c_{H,t}^* = \Upsilon c_{H,t}^* + (1 - \Upsilon)(\rho_2 q_t + y_t^*)\tag{4.43}$$

Imports m_t are affected by terms of trade and consumption;

$$\begin{aligned}m_t &= tot_t + c_{F,t} \\ \Rightarrow m_t &= c_t + [1 - \rho_2(1 - \alpha)] tot_t\end{aligned}\tag{4.44}$$

The balance of payments is described by the household budget constraint, combined with profits received by households such that;

$$\frac{S_t}{P_t} [B_t^* - r_t^* \phi_{t-1} B_{t-1}^*] = NX_t = C_{Ht}^* - \frac{P_{Ft}}{P_t} C_{Ft}\tag{4.45}$$

where NX_t gives the net exports which is the difference between exports and imports in the domestic economy. The difference between this period's asset holding and the previous period's makes the net foreign assets of the household, and consequently defines the current

account. The balance of payments therefore relates the flow of assets to the flow of goods such that

$$z_t - \frac{1}{\beta}z_{t-1} = \alpha (c_{H,t}^* - m_t) \quad (4.46)$$

This implies that the current account ca_t can be modelled as the change in net foreign assets such that it incorporates the high levels of household debt which are characteristic of the South African economy.

$$ca_t = z_t - z_{t-1} \quad (4.47)$$

4.4.4 Foreign Economy

Foreign output of traded good firms Y_{Tt}^* , foreign inflation $\pi_{Tt}^* = \frac{P_{Tt}^*}{P_{Tt-1}^*}$, and foreign interest rates r_t^* are all exogenous and follow an AR(2) process such that

$$\log Y_{Tt}^* = (1 - \kappa_{1,y^*} - \kappa_{2,y^*}) \log \bar{Y}^* + \kappa_{1,y^*} \log Y_{Tt-1}^* + \kappa_{2,y^*} \log Y_{Tt-2}^* + \varepsilon_{y^*,t} \quad (4.48)$$

$$\log \pi_{Tt}^* = \kappa_{1,\pi^*} \log \pi_{Tt-1}^* + \kappa_{2,\pi^*} \log \pi_{Tt-2}^* + \varepsilon_{\pi^*,t} \quad (4.49)$$

$$\log r_t^* = (1 - \kappa_{1,r^*} - \kappa_{2,r^*}) \log \bar{r}^* + \kappa_{1,r^*} \log r_{t-1}^* + \kappa_{2,r^*} \log r_{t-2}^* + \varepsilon_{r^*,t} \quad (4.50)$$

where \bar{r}^* is the mean of r_t^* . The structure of producers in the foreign economy is similar to that in the domestic economy. Imports in the domestic economy are obtained directly from foreign producers of traded goods who engage in monopolistic competition, such that pricing to market implies that foreign producers sell their goods in the domestic economy at the domestic price with the pricing decision defined by

$$\pi_{Ft} - \varphi^* \pi_{Ft-1} = \beta E_t [\pi_{Ft+1} - \varphi^* \pi_{Ft}] + \frac{\theta - 1}{\kappa} [q_t - s_t + \Psi_t^*] \quad (4.51)$$

where π_{Ft} is the inflation of the imported good and Ψ_t is the foreign exogenous cost push shock defined as

$$\log \Psi_t^* = \varepsilon_{\Psi_t^*} \quad (4.52)$$

4.4.5 Monetary Authority

To complete the characterisation of the model, we describe the monetary rules adopted by the central bank. The monetary authority uses an interest rate rule based on the Clarida, Gali and Gertler (2000) specification in which the authors demonstrate the need for a central

bank to adjust interest rates in response to economic conditions. This specification is based on a Taylor rule as these rules are found to adequately explain monetary policy decisions in several countries. Following Alpanda, Kotze and Woglom (2010) and Ortiz and Sturzenegger (2007), we assume a generalised Taylor rule (equation 4.53) in which the central bank targets inflation π_t , output y_t , and the exchange rate d_t .

$$\log r_t = \rho_r \log r_{t-1} + (1 - \rho_r) \left(\omega_\pi \pi_{t-1} + \omega_y \frac{y_{t-1}}{\bar{y}} + \omega_d \log d_t + \log \bar{r} \right) + \varepsilon_{rt} \quad (4.53)$$

In this framework, $d_t = s_t - s_{t-1}$, ε_{rt} describes the monetary policy shock, and ρ_r is the degree of interest rate smoothing, which enables gradual adjustment of interest rates over time in response to inflation movements. Interest rate smoothing is incorporated to introduce history dependency of policy in the model. This is essential for forward looking models where commitment is necessary for the central bank's ability to affect the public's expectations of future interest rates (Woodford, 2003). Clarida, Gali and Gertler (2000) argue that policy rules without interest rate smoothing are too restrictive to give a perception of actual interest changes in most central banks. In addition, interest rate smoothing is based on empirical studies which show that the majority of central banks adjust interest rates in small steps to help curb unintended fluctuations in economic activity.

Log linearising the Taylor rule gives equation 4.54, where ω_π , ω_y , and ω_d are relative weights on inflation, output, and the nominal exchange rate depreciation respectively. The nominal interest rate is conditioned on lagged output and inflation to capture data dissemination delays, but conditioned on current depreciation since data on current depreciation are normally readily available. Although the mandate of the SARB is to stabilise inflation, estimations of South Africa's policy reaction function show that the SARB targeted both inflation and the exchange rate in the pre-inflation targeting regime, and targeted inflation, the exchange rate and output in the inflation targeting regime. However, the weight placed on the exchange rate is much lower in the inflation targeting regime (Ellyne and Veller, 2011), so to capture this, we incorporate a very low value of ω_d .

$$r_t = \rho_r r_{t-1} + (1 - \rho_r) [\omega_\pi \pi_{t-1} + \omega_y y_{t-1} + \omega_d d_t] + \varepsilon_{rt} \quad (4.54)$$

4.4.6 Equilibrium

The model equilibrium is defined where households maximise utility, final producers of traded and non-traded goods maximise profits, and intermediate producers of non-traded goods and home produced traded goods maximise the present value of profits distributed to households (equation 4.58) such that all markets clear. To determine this equilibrium, domestic bonds

are assumed to be in net zero net supply (equation 4.55), total labour demanded is equal to total labour supplied to the traded and non-traded goods sectors (equation 4.56), total output is equated to total production (equation 4.57), and aggregate profits distributed to households are a sum of profits from both traded and non traded goods firms (equation 4.58).

$$B_t = 0 \quad (4.55)$$

$$H_t = \int_0^1 H_{Tt}(j) \partial j + \int_0^1 H_{Nt}(i) \partial i \quad (4.56)$$

$$Y_t = A_{Tt}H_{Tt} + A_{Nt}H_{Nt} \quad (4.57)$$

$$\Pi_t = \int_0^1 \Pi_{Tt}(j) \partial j + \int_0^1 \Pi_{Nt}(i) \partial i \quad (4.58)$$

With the key features of the model now fully characterised, we move on to discuss the calibration technique used. This is necessary to ensure that model is representative of South Africa.

4.5 Calibration

To display the characteristics of South Africa, it is important to use parameter values that match data on South Africa as closely as possible using parameter values obtained from business cycles literature on small open economies and other emerging markets.

The rate of time preference is set at 0.01 so that the subjective discount factor β is 0.99. The intertemporal elasticity of substitution σ is set at 0.5 following Alpanda, Kotze and Woglom (2010) and Ortiz and Sturzenegger (2007) who estimate this parameter and find it to have a posterior mean of 0.5 in South Africa. The degree of habit formation in consumption is considered to be 0.7 (e.g. Smets and Wouters, 2007; Steinbach, Mathuloe and Smit, 2009). We set the initial value of the elasticity of substitution between traded and non traded goods (ρ_1) to 1 in line with Devereux, Lane and Xu (2006). Studies on developed countries assume the elasticity is lower than this, for example Ostry and Reinhart (1992) and Lu (2009) assume an elasticity of 0.75, but given the production structure of emerging markets and developing countries, and the share of consumption of non traded goods, the elasticity is set at a higher value than developed countries. Senbeta (2011) posits an intratemporal elasticity as high as 12 in low income economies, implying the value for emerging market economies should

lie in between that of developed and developing countries. The share of non-traded goods in the household's consumption bundle a_1 is set at 0.5, following Devereux, Lane and Xu (2006) for Malaysia and Thailand. This value is consistent with our findings of the share of non-traded goods reported in section 4.3 of the paper. However, Harberger, Jenkins, Kuo and Mphahlele (2003) find an aggregate demand for non-tradeable goods of 38.6% in 2009. In addition, STATSSA (2014) reports that the manufacturing sector in South Africa shrunk by 3.4% in the third quarter of 2014. To cater for this, the parameter used for the share of non-traded goods is varied between 0.5 and 0.7 to test sensitivity. The share of imported goods in traded consumption a_2 is set at 0.3 to mimic the average share of imports in GDP from 2000 to 2013.

The degree to which prices are indexed to past domestic price inflation φ is 0.25 whilst the intratemporal elasticity of substitution between imports and domestically produced traded goods ρ_2 is set to 0.67 following Alpanda, Kotze and Woglom (2010). Persistence of the productivity shocks, demand shocks and risk premium shock are based on estimations on South African models, whilst persistence of traded and non-traded goods productivity shock follow Hove, Touna Mama and Tchana Tchana (2015), and the parameters are set to 0.85 and 0.75 respectively. The sensitivity of the risk premium to changes in foreign bond holdings χ is set at 0.01 in line with Schmitt-Grohe and Uribe (2003) and Bergin (2006) who set a small value for this parameter, and Alpanda, Kotze and Woglom (2010) who finds the prior density of the parameter to be in line with this value. The probability that importers cannot adjust price in any given period θ_F is set to 0.82 reflecting price stickiness in the traded goods sector. The degree of overall inflation indexation to nominal wage inflation is set at 0.78.

The interest rate smoothing parameter ρ_r is set at 0.73 following Ortiz and Sturzenegger (2007) who estimate South Africa's policy reaction function. This value is supported by Alpanda, Kotze and Woglom (2010) who estimate this parameter and find a posterior mode of 0.72 and Liu and Zhang (2010) who find an estimate of 0.82 for China. The weight in inflation is set at 1.6 whilst weight on output is 0.59. The coefficient of exchange rate intervention is set to 0.03 to reflect the flexible exchange rate regime in South Africa. This is also in line with the value estimated by Ellyne and Veller (2011) for the inflation targeting regime in South Africa.

Based on these parameter values summarised in table 4.2, DYNARE is used to solve the model and generate impulse response functions and variance decompositions of the variables to shocks, with focus on the response of the variables to shocks from the traded and non traded goods sectors.

Table 4.2: Calibration of the Model

Parameter	Value	Description
β	0.99	Discount factor
σ	0.5	Intertemporal elasticity of substitution in consumption
ζ	0.7	Consumption habit persistence
ψ	3	Elasticity of labour supply
ρ_d	0.78	Persistence of demand shock
ρ_1	1	Elasticity of substitution between traded and non traded goods
a_1	0.5	Share of non-traded goods in the household's consumption bundle
a_2	0.3	Share of imported goods in traded consumption
ρ_2	0.67	Intratemporal elasticity of substitution between imports and home traded goods
χ	0.01	Sensitivity of risk premium to changes in foreign debt
ρ_Φ	0.92	Persistence of risk premium shock
θ_{Tt}	7	Elasticity of substitution between traded intermediate goods
θ_w	0.8	Probability that domestic firms cannot adjust prices in any given period
ρ_{aT}	0.85	Persistence of traded goods productivity shock
φ	0.25	Degree to which prices are indexed to past domestic price inflation
θ_{Nt}	7	Elasticity of substitution between non traded intermediate goods
ρ_{aN}	0.74	Persistence of non traded goods productivity shock
μ	0.78	Degree of overall inflation indexation to nominal wage
ϵ_w	1	Elasticity of substitution between different labour services
ρ_{tot}	0.9	Persistence of terms of trade shock
ρ_r	0.73	Interest rate smoothing parameter
ω_π	1.6	Relative weight on inflation
ω_y	0.59	Relative weight on output
ω_d	0.03	Relative weight on nominal exchange rate depreciation

Table 4.3: Summary Statistics

	<i>ca</i> Model Correlations	<i>ca</i> Data Correlations ((Post Inflation Targeting))
<i>y</i>	-0.2733	-0.7658
<i>rr</i>	0.5489	0.5637
<i>rer</i>	-0.3898	-0.2411
<i>ca</i>	1.0000	1.0000

4.6 Results

To analyse the role of the non-traded goods sector in the economy, the model is simulated and the impact of technology shocks from the traded and non-traded goods sectors is analysed on the current account (*ca*), real exchange rate (*rer*), output (*y*) and interest rates (*rr*). Whilst the focus of the study is mainly on the current account and exchange rate, we analyse the response of output to shocks to infer the impact of these shocks on growth, and the response of the interest rate to analyse how these shocks affect monetary policy. It is also necessary to analyse the impact of monetary and risk premium shocks on variables to determine whether the findings of this dual sector model differ from findings of single sector models.

Simulating the model and analysing the correlation coefficients shows that most of the theoretical relationships between the variables hold. The current account is positively correlated to output showing that an increase in output improves the current account position. The positive correlation between the current account and real interest rate suggests that an increase in the real interest rate also leads to current account improvement. Since investment is assumed to be fixed in the model, the interest rate channel could be explained by a dominant substitution effect where private saving increase and consumption reduces, thereby improving the current account. The results show a negative correlation between the current account and real exchange rate, suggesting that an exchange rate depreciation is accompanied by a current account deficit which worsens, which contradicts theoretical predictions, but is consistent with the correlations from the data. The correlation coefficients generated from the model are a close fit to coefficients generated from quarterly time series data from 2000 to 2012 in the post inflation targeting era, with the exception of the correlation coefficient of output which is much larger with data. We restrict the comparison to this period as it is consistent with the use of the Taylor rule in monetary policy formulation. Table 4.3 gives the model's summary statistics and those obtained from data.

As in the case of VAR models, we use the impulse response functions and variance decompositions to analyse the impact of shocks on variables of interest, with the results generated with values of $\rho_1 = 1$, $\sigma = 0.5$, and $a_1 = 0.5$.

4.6.1 Impulse Response Functions

The impulse response functions show the total response of variables of interest to exogenous shocks to traded and non-traded goods productivity shocks, a monetary shock and a UIP shock⁷. This helps in evaluating the model's fit by analysing its ability to match stylised facts generated from the data in chapter 3. It also enables a comparison of the model's predictions about the current account to predictions from models where all goods are assumed to be tradeable. All impulse responses are in response to 100 basis points on the innovation.

Analysing the response of the current account to shocks (figure 4.4), an increase in traded goods productivity worsens the current account deficit by 65 basis points and the shock is persistent for 6 quarters, whilst an increase in non-traded goods productivity improves the current account to a surplus by 65 basis points⁸. The improvement in the current account lasts for 3 quarters before a deficit is experienced and the shock is persistent for almost 16 quarters. The stylised facts established in chapter 3 (figure 3.4) show that a shock to output moves the current account to a surplus in the first quarter with a deficit experienced by the second quarter which gradually declines. Results generated by this model demonstrate that the non-traded goods sector plays a larger role in influencing current account position since it is more persistent than the traded goods shock. A possible explanation for this is that an increase in non-traded productivity encourages consumption of the domestically produced equivalent of imported goods impact, and induces a current account surplus through the trade balance channel through a reduces import requirement. This suggests that in South Africa, given the high levels of consumption, the consumption path may play a great role in the generation of current account dynamics. Given the low savings in South Africa, increased productivity could be considered as a windfall gain in income. If current income is lower than the anticipated permanent income, consumers dis-save to smooth consumption. This reduces savings and in turn worsens the current account through this income effect. It is because of the fixed capital assumption that productivity gains are used for consumption since the capital stock does not adjust. This is demonstrated in the model as the current account is directly affected by the income path which feeds into the net foreign assets variable, Zt .

The results are in line with other findings in literature such as Glick and Rogoff (1995) who find that the current account responds negatively to productivity shocks in a single sector model with traded goods. Iscan (2000) extends the Glick and Rogoff (1995) single

⁷Other shocks are included in the model to include rigidities specific to the South African Economy such as cost push shocks, foreign shocks and a terms of trade shock. However, these shocks depart from the main focus of the paper and their contribution to variation in the variables of interest is negligible hence their interpretation is left out.

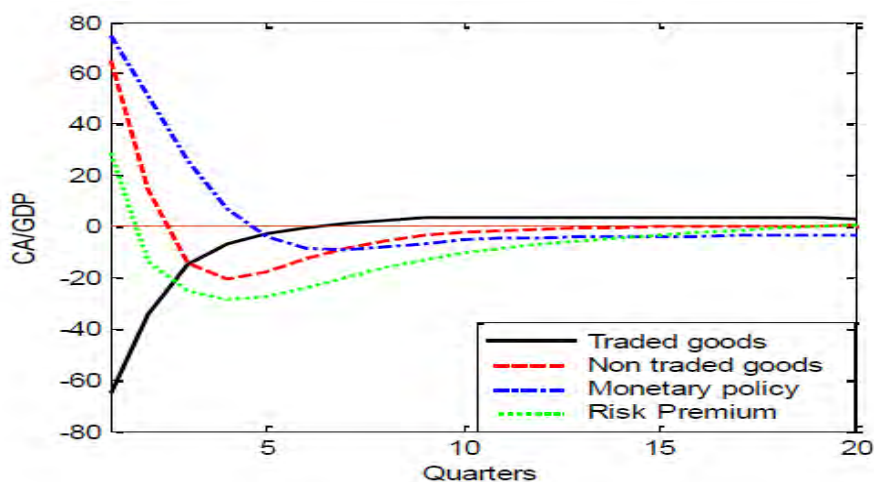
⁸100 basis points are equal to 1 percentage point, so a response of 65 basis points on the current account balance would be a change from a surplus of say 5% of GDP to 5.65% of GDP

sector model to include non-traded goods, and find that inclusion of the non-traded goods sector magnifies the response of the current account to country specific traded productivity shocks, a result confirmed by this study. Glick and Rogoff (1995) argue that it takes time for the capital stock in an economy to adjust in their single sector model. As a result, a permanent country-specific traded good productivity shock increases permanent income by more than current income such that the current account deficit widens. Iscan (2000) on the other hand attributes the result to the structure of the economies under analysis, and hence the calibration of the model. The current account only responds to traded good productivity shocks to the extent that consumption responds, that is the share of traded goods consumed. Non-traded goods in Iscan (2000)'s model have no impact on the current account as the author argues that the share of consumption of this good in the G7 countries they investigate is negligible. In our model however, the share of non traded goods in South Africa is sizeable, and this explains the impact of non traded goods on the current account.

A 100 basis points decrease in the risk premium improves the current account position. The current account moves to a surplus by about 29 basis points, with the shock persistent for about 16 quarters. This could be explained by the relationship between the risk premium and the levels of debt in the form of short term capital flows which finance the current account deficit, and increase the risk premium of the country. A reduction in the amount of debt reduces the available financing for the deficit and forces the current account to adjust towards a surplus. An innovation in the Taylor rule also moves the current account to a surplus by 75 basis points, with the shock being persistent for about 16 quarters. This suggests that monetary policy may have a stabilising role to play in current account management in South Africa, a result which departs from models of developed countries (e.g. Ferrero, Gertler and Svensson, 2008). These results are consistent with stylised facts which show that a monetary shock generated through the interest rate moves the current account to a surplus, provided the domestic interest rate is relatively lower than the foreign interest rate. This emphasises the possible role that monetary policy can play in current account management in a dual-sector model with non-traded goods as in Lu (2009).

It is necessary to analyse the response of the exchange rate to shocks, since the current account and exchange rate are often jointly determined in structural models, and we do so in two phases. First we analyse the response of the macroeconomic exchange rate (the relative price of foreign goods to domestic goods) in figure 4.5, then we analyse the microeconomic exchange rate (the relative price of tradeables to non-tradeables in the domestic economy) in figure 4.6. This facilitates in making inferences about how shocks affect the relative price of traded goods in the domestic economy, both with regards to foreign prices and non-traded good prices. From figure 4.5, a positive traded goods productivity shock induces an exchange rate depreciation by about 82 basis points, which lasts for about 30 quarters.

Figure 4.4: Response of current account to orthogonalised shocks



An increase in non-traded goods productivity also induces an exchange rate depreciation by 35 basis points. However, unlike in the traded goods sector, the depreciation from an increase in non-traded goods productivity is smaller and quickly dies out after 6 quarters. From the stylised facts in the data, an output shock leads to a depreciation of the exchange rate as well. On the other hand, a positive monetary shock depreciates the exchange rate by about 208 basis points (roughly 2 percentage points), whilst a risk premium shock causes the exchange rate to appreciate substantially as in Bergin (2006). The largest response in the exchange rate is generated by risk premium shocks, where a decrease in the risk premium appreciates the exchange rate. This may be because the risk premium is closely related to volatile capital flows in the economy. A decreased risk premium improves prospects of the country's ability to repay its debts, which makes the country a more attractive investment destination. This filters to volatility in the exchange rate, and appreciates the exchange rate through the increase in capital inflows. Furthermore, the incomplete markets assumption we incorporate implies that the exchange rate is more responsive to risk premium shocks since domestic households do not share risk equally with foreign households. The response of the exchange rate is thus stronger because of the interaction between the exchange rate and risk premium in framing the uncovered interest parity condition (equation 4.12). It is no surprise that traded goods generate more volatility in the exchange rate as compared to non-traded goods, given the relation between exports, imports, and the exchange rate.

The microeconomic exchange rate is affected by shocks in a similar manner, i.e. it depreciates in response to traded and non-traded goods productivity shocks and appreciates in response to a reduction in the risk premium. Whilst the macroeconomic exchange rate depreciated in response to a monetary shock, the microeconomic exchange rate appreciates. However, the response of the microeconomic exchange rate is much larger, suggesting that the relative price between tradeables and non tradeables is affected more by shocks than by the relative

price between domestic and foreign goods.

Figure 4.5: Response of real exchange rate (macroeconomic) to orthogonalised shocks

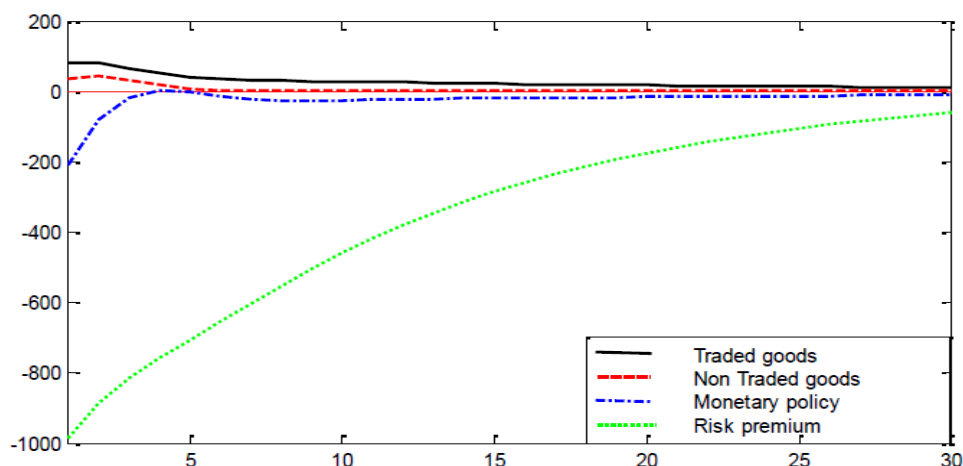
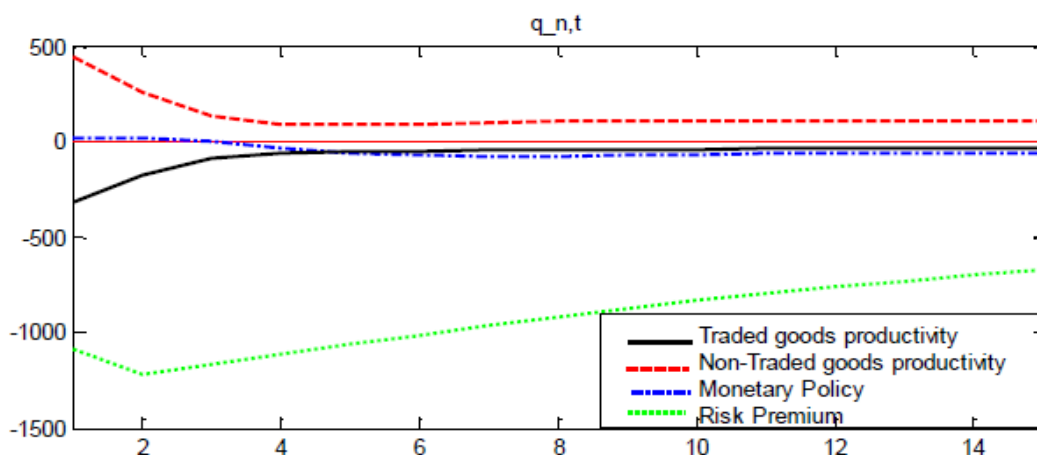
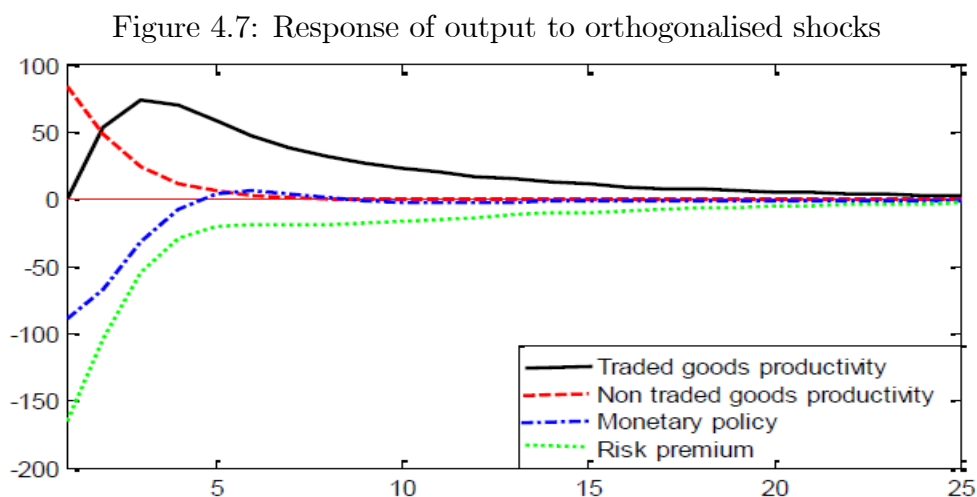


Figure 4.6: Response of real exchange rate (microeconomic) to orthogonalised shocks



Moving on to the response of output shocks (figure 4.7), a traded goods productivity shock has a lagged effect on output, with the peak in the increase in output of 74 basis points only experienced after 3 quarters and lasting for about 20 quarters. On the other hand, a non-traded goods productivity shock causes an immediate increase in output of 84 basis points, though the impact of the shock only lasts for 6 quarters. An increase in the monetary policy shock causes a decline in output of 88 basis points. This could be explained by a rise in interest rates causing a decline in borrowing and consequently a fall in consumption. The result reflects consumption driven GDP in South Africa which is based on households accumulating debt, and matches the stylised fact established in the data and reflects the high levels of consumption against debt. This result is similar to other studies on the South African economy such as (e.g. Alpanda, Kotze and Woglom, 2010; Steinbach, Mathuloe and Smit, 2009). However, the response of output to monetary shock is slightly less when non-traded goods are included in the model. A decline in the risk premium also causes a decline

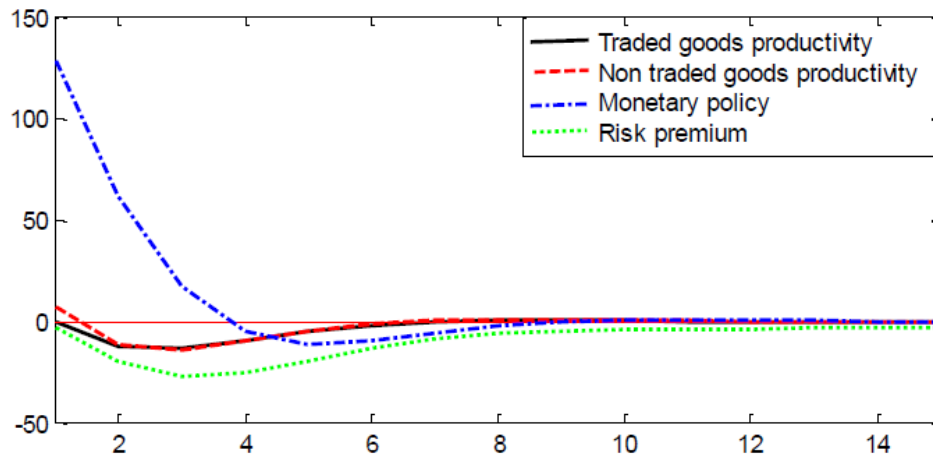
in output. This is also explained through the consumption path financed by debt and liquid short-term capital flows. A lowering of the debt position improves the risk premium, but lowers consumption and output through reduced borrowing by households. The inclusion of non-traded goods doubles the response of output to a decrease in the risk premium shock on impact when compared to Alpanda, Kotze and Woglom (2010) and Steinbach, Mathuloe and Smit (2009). Risk premium shocks also cause a reduction in output in advanced economies, (e.g. Bergin, 2006), but the effect is larger in South Africa, more so with the inclusion of the non-traded goods sector.



The interest rate responds mainly to monetary policy shocks (figure 4.8). This is explained by the use of interest rates as a policy tool in the inflation targeting framework. At the onset of a positive monetary shock, the interest rate shoots up by 128 basis points with the increase lasting approximately 4 quarters. The response is stronger to shocks in non-traded goods productivity as opposed to traded goods productivity, with a positive non-traded goods productivity shock increasing interest rates by 8 basis points before the rate falls, whilst, the interest rate only falls with a lag of 2 quarters in response to traded goods productivity shocks. A reduction in the risk premium shock also reduces interest rates with a lagged effect, and there is no response to the shock on impact. This differs with studies that do not include the non-traded goods sector, where the interest rate is reduced by a risk premium shock on impact, so the inclusion of non-traded goods dampens the effect of the risk premium shock on interest rates.

Overall, the IRFs show that the current account, output and interest rate are more affected by non-traded goods productivity shocks as opposed to traded goods productivity shocks, whilst the exchange rate is mostly affected by the risk premium and traded goods productivity shocks. The ability of the model's IRFs to match stylised facts further reflects the importance of the non traded goods sector in the South African economy, particularly when modelling the current account.

Figure 4.8: Response of real interest rate to orthogonalised shocks



4.6.2 Forecast Error Variance Decompositions

It is important to understand the contribution that each of these innovations actually makes to variation in the variables, and to do this, we use the variance decomposition analysis which helps in analysing the importance of each shock in shaping macroeconomic dynamics.

The current account is more affected by shocks to both traded goods and non traded goods, with non traded goods productivity shocks accounting for half the variation in the current account, even at longer horizons. The contribution of non-traded goods productivity shocks is still substantial, over 40%, with a maximum variation of 49% in the second and third periods. This result departs from the stylised facts established when all goods are assumed to be traded, in which GDP shocks account for at most 7% of variation in the current account. Bergin (2006), in a single sector model, finds that technology shocks account for 24% of variation in the current account in the first period, and 32% by the 20th period, while interest rate parity shocks account for as much as 64% of variation in the current account in the first period, and 36% by the 20th period. The inclusion of non-traded goods in this model has the effect of attributing a substantial amount of variation in the current account to technology shocks, particularly non-traded goods technology, whilst the impact of the risk premium on the current account is substantially reduced. Monetary policy shocks however only account for a small proportion of variation in the current account, a result which is consistent with the stylised facts established from the data. Risk premium shocks also account for very little variation in the current account, a significant difference from the United States economy modelled by Bergin (2006). This variation in results demonstrates the need for current account models tailored to the circumstances of emerging markets.

At most 85% of variation in the exchange rate is explained by risk premium shocks, with the contribution increasing at larger horizons. This result is similar to Alpanda, Kotze and

Woglom (2010) and could be explained by the volatility of short term capital flows which has immediate effects on the exchange rate. The results are however in contradiction to Bergin (2006), suggesting that exchange rate dynamics in advanced and emerging economies may differ, with exchange rate volatility in emerging economies mostly explained by UIP and the risk premium. Monetary policy shocks account for very little variation in the exchange rate, a result which is not surprising in South Africa, considering the SARB mandate to maintain a flexible exchange rate. However, the inclusion of non traded goods reduces the role of monetary policy in exchange rate dynamics as compared to Alpanda, Kotze and Woglom (2010)'s single sector model. Another feature to note is that in a single sector traded good model of South Africa, almost all the variation in the exchange rate is explained by deviations from UIP, but the introduction of non traded goods attributes some exchange rate variation to productivity shocks as well.

The real interest rate is largely affected by monetary shocks in the first period (71%). This is because the nominal interest rate is the tool used for monetary policy intervention in the inflation targeting framework. In the first period, non-traded goods productivity shocks account for 17% of the variation in interest rates, whilst traded goods productivity shocks account for almost none of the variation in interest rates. The contribution of monetary policy shocks to real interest rate variation decreases at longer horizons to about 17% after 20 periods, whilst the contribution of non-traded goods productivity shocks increases to 37% after 20 periods. Traded goods productivity shocks also increase in contribution to variation in the real interest rate, with a contribution of 28% after 20 periods. This suggests that traded goods productivity shocks have a lagged effect on the real interest rate, but are still outweighed by non traded goods productivity shocks. Risk premium shocks account for 6% of variation in the interest rate at most, a result which is similar to Bergin (2006).

The decomposition of the variation of output shows that output is greatly affected by non-traded goods productivity shocks at shorter horizons, but affected more by traded goods productivity shocks at longer horizons. Non-traded goods productivity shocks account for 84% of variation in output in the first period, with the impact declining to 30% by the 20th period. Traded good productivity shocks affect the variation in output with a lagged effect, with a contribution of 18.8% in the second period. By the fourth period, traded goods productivity shocks account for half the variation in output, a substantial amount more than the non-traded goods productivity shocks. Risk premium shocks also account for a significant proportion of the variation in output, with a contribution of 13% in the first period, and 6% after 20 periods, whilst monetary policy shocks account for almost non of the variation in output.

A dual sector economy with non traded goods reveals that variation in the current account

is mostly due to traded and non traded goods productivity shocks, with the risk premium explaining very little variation in the current account. The exchange rate is largely explained by risk premium shocks whilst non traded goods account for a significant proportion of variation in output and interest rates as well. This demonstrates the significance of the non traded goods sector in determining current account movements and movements in monetary variables such as the interest rate. The result that monetary policy shocks account for very little of the variation in the current account (1%) supports the findings by Lu (2012), Lu (2009) and Bergin (2006) who suggest that there are small gains from monetary policy intervention in current account management. This is also in line with the results from chapter 3 which suggest that real interest rate shocks have a smaller and less significant impact on the current account.

With an understanding of the effect and contribution of each of the shocks to the evolution of macroeconomic variables, we now analyse how these results vary within different ranges of the parameters. This is useful for examining the sensitivity of the model to the chosen parameter values, and helps in ensuring the reliability of the results.

Table 4.4: Baseline Model Forecast Error Variance Decomposition

Shocks	Variance Decomposition			
	Traded Goods	Non traded goods	Monetary	Risk Premium (UIP)
<i>A. 1 quarter ahead forecast error variance decomposition (in%)</i>				
Current Account	44.74	49.24	0.81	0.38
Exchange rate	12.34	2.59	1.13	81.13
Real Interest rate	0.09	17.02	71.16	0.16
Output	0.00	84.32	1.17	13.14
<i>B. 2 quarter ahead forecast error variance decomposition (in%)</i>				
Current Account	48.91	44.21	1.02	0.40
Exchange rate	13.15	3.48	0.70	79.48
Real Interest rate	21.21	30.01	39.14	2.59
Output	18.80	67.99	1.10	11.06
<i>C. 3 quarter ahead forecast error variance decomposition (in%)</i>				
Current Account	48.57	44.27	1.06	0.63
Exchange rate	12.87	3.36	0.52	79.91
Real Interest rate	27.64	38.10	24.19	4.34
Output	38.38	51.38	0.85	8.50
<i>D. 4 quarter ahead forecast error variance decomposition (in%)</i>				
Current Account	46.65	46.14	1.01	0.90
Exchange rate	12.22	2.97	0.42	81.08
Real Interest rate	29.00	39.02	19.83	5.58
Output	49.30	42.21	0.69	7.03
<i>E. 12 quarter ahead forecast error variance decomposition (in%)</i>				
Current Account	43.94	48.16	0.98	1.66
Exchange rate	10.04	1.80	0.27	85.37
Real Interest rate	27.88	36.83	19.95	7.13
Output	62.81	30.72	0.51	5.38
<i>F. 20 quarter ahead forecast error variance decomposition (in%)</i>				
Current Account	44.26	47.81	0.99	1.68
Exchange rate	10.28	1.65	0.25	85.39
Real Interest rate	27.83	36.74	17.91	7.29
Output	63.55	30.05	0.5	5.33

4.6.3 Sensitivity Analysis

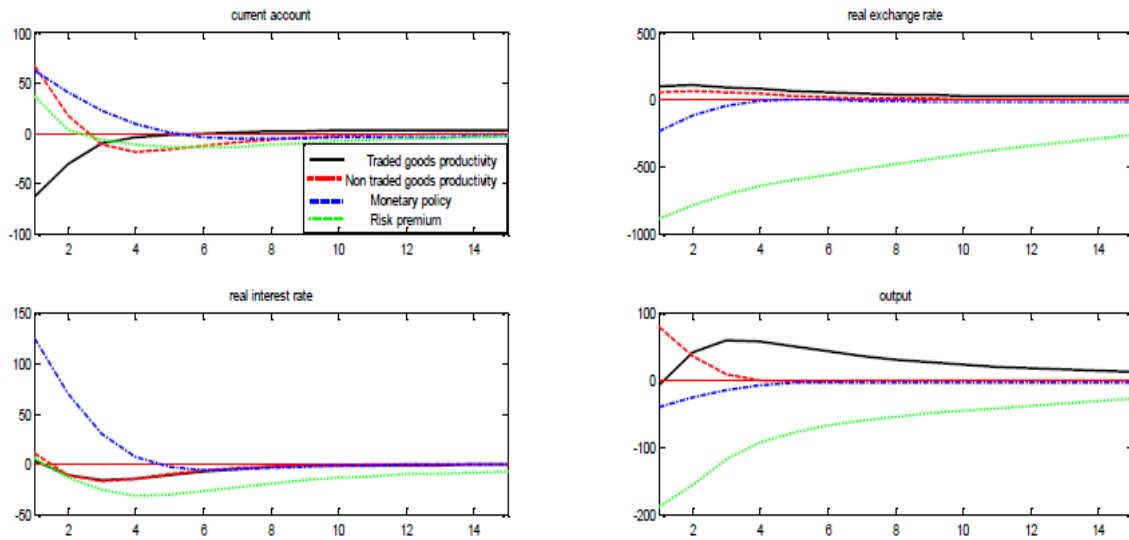
We have so far shown that the non-traded goods sector plays a significant role in shaping the dynamics of the current account and monetary variables in the South African economy. The results match stylised facts generated from quarterly data on South Africa in chapter 3, and show some departures from single sector models with traded goods. To further analyse the role played by the non-traded goods sector in shaping macroeconomic fundamentals, this section analyses the sensitivity of the above results to changes in the intertemporal elasticity of substitution in consumption σ , the intratemporal elasticity of substitution between traded and non-traded goods ρ_1 , and the share of non-traded goods in the household's consumption bundle a_1 . ρ_1 and a_1 are the key parameters that govern household consumption behaviour with regards to traded and non-traded goods, and sensitivity of the results to changes in these parameters sheds light on current account and exchange rate dynamics with regards to non-traded goods in a dual sector economy model.

A useful starting point is to consider changes in the intertemporal elasticity of substitution in consumption. The value of σ is changed from $\sigma = 0.5$ to $\sigma = 2$ and 0.2 . A high elasticity shows that consumption is not very costly to consumers and as a result if the real interest rate is high, consumers will save a large portion of their income and consume less. The results for the different values of σ show that the current account is pushed into deficit by positive traded goods productivity shocks, and surplus by non-traded goods productivity shocks. The response of the current account to monetary shocks increases, whilst the response to risk premium shock decreases. The decline in output in response to a monetary shock also worsens when the intertemporal elasticity of consumption is larger, whilst exchange rate and interest rate responses remain unchanged (see figure 4.9). The contribution of shocks to variation in the current account, exchange rate, and interest rate is also similarly distributed, though with a greater proportion of variation in the current account attributed to non-traded goods productivity shocks, and exchange rate variation slightly explained less by risk premium shocks. This result is in contradiction of the notion that the sign of the current account is determined by whether $\frac{1}{\sigma}$ is greater or smaller than ρ , posited in Lu (2009) and Obstfeld and Rogoff (1995b). The sign of the current account remains the same in this model, regardless of the relationship between $\frac{1}{\sigma}$ and ρ ⁹. Similar results hold at higher and lower values of σ , reflecting that the rate of consumption smoothing in South Africa may not necessarily play a large part in the evolution of the current account, especially given the growing consumption levels of South African households supported by increasing levels of household debt. The only change in results from the baseline scenario is that higher values of the intertemporal elasticity cause a larger response of the current account to non-traded

⁹The sign of the current account refers to a deficit or surplus position. A positive sign implies a surplus whilst a negative sign implies a deficit.

goods productivity shocks.

Figure 4.9: Response of variables to orthogonalised shocks: $\sigma = 2$



In analysing sensitivity to changes in the intratemporal elasticity of substitution between traded and non traded goods, the value of ρ_1 is also varied. When $\rho_1 = 2$, a positive traded goods productivity shock worsens the current account balance by 110 basis points, compared to 65 basis points in the case when $\rho_1 = 1$. The impact of the shock dies out two periods quicker when $\rho_1 = 2$. A non traded goods productivity shock also increases the current account surplus by 130 basis points, compared to 65 basis points with a lower elasticity of substitution. A positive monetary policy shock increases the current account surplus as well by 94 basis points with a higher value of ρ_1 , compared to 75 basis points in the baseline scenario. A decrease in risk premium now shifts from inducing a current account surplus to inducing a current account deficit when the elasticity of substitution between traded and non traded goods is higher. Sensitivity is also tested with values of $\rho_1 = 5$ and $\rho_1 = 0.5$. When the elasticity of substitution between traded and non traded goods is high, the current account deficit is worsened more by traded goods productivity shocks. Likewise, the higher the elasticity of substitution between traded and non traded goods, the bigger the current account surplus generated by non traded goods productivity shocks. However, the contribution of non traded goods productivity shocks still continues to outweigh that of traded goods productivity shocks, particularly at higher values of ρ_1 . A positive monetary shock generates a bigger current account surplus when the elasticity of substitution between traded and non traded goods is higher. This suggests that monetary policy may induce a bigger response in the current account when traded and non traded goods are more easily substituted. A decrease in the risk premium worsens the current account position the bigger the value of the elasticity of substitution between traded and non traded goods. In addition, all shocks are less persistent with a larger value of ρ_1 .

A traded goods productivity shock depreciates the exchange rate less when the elasticity of substitution is higher, with a 100 basis point depreciation when $\rho_1 = 0.5$ and a depreciation of 8 basis points when $\rho_1 = 2$. The depreciation in response to a non-traded goods productivity shock is also lower for higher elasticities of substitution, with a depreciation of 40 basis points when $\rho_1 = 0.5$ and 22 basis points when $\rho_1 = 2$. The appreciation of the exchange rate in response to monetary shocks is magnified with a higher elasticity of substitution, and the appreciation in response to a decline in the risk premium is less when the elasticity of substitution is higher.

The effect of a higher elasticity of substitution is robust across output and interest rates as well. When the elasticity of substitution between traded and non-traded goods is high, the interest rate is reduced more by traded goods productivity shocks and increased more by non-traded goods productivity shocks. The interest rate is only slightly less affected by monetary policy shocks and the decline in interest rates from a decline in risk premium also reduces. A higher value of ρ_1 increases the contribution of non-traded goods productivity shocks to variation in the current account, with non-traded goods productivity shocks accounting for as much as 62 basis points of variation in the current account when $\rho_1 = 5$. The effect of the risk premium on current account movements also increases, but only to as much as a 5 basis points contribution, which is substantially less than the contribution of risk premium shocks when all goods are assumed to be tradeable (64 basis points in the first period and 34 basis points after 20 periods in Bergin (2006)). The contribution of monetary shocks remains small, whilst that of traded goods productivity shocks decreases with the ease of substitutability between traded and non-traded goods.

The exchange rate is still largely affected by risk premium shocks, especially at larger horizons, but an increase in the elasticity of substitution between traded and non-traded goods reduces the contribution of the risk premium, whilst substantially increasing the contribution of traded goods productivity shocks and slightly increasing the contribution of non-traded goods productivity shocks. Increasing the elasticity of substitution between traded and non-traded goods also implies that the interest rate and output are more affected by monetary policy shocks and non-traded goods productivity shocks, whilst less affected by traded goods productivity shocks. Hence in this case, the intratemporal elasticity determines the magnitude of the current account deficit or surplus generated by a non traded goods productivity shock.

Considering that the consumption of non-traded goods is high in emerging markets and low income economies, the sensitivity of the results to the share of non-traded goods in the consumption bundle (a_1) is also analysed. Increasing the share of non traded goods in the household's consumption bundle reduces the current account deficit generated by a positive

traded goods productivity shock due to the reduced import requirement. The exchange rate depreciates less, whilst the real interest rate increases and output increases in response to a positive traded goods productivity shock when the household consumes more non-traded goods. In response to a non traded goods productivity shock, the current account balance worsens, the exchange rate depreciates more, interest rates decrease and the increase in output is less as the share of non traded goods consumed increases. A monetary shock still generates a current account surplus, though the surplus is smaller with more non-traded goods consumed. The exchange rate appreciates, and output falls more in response to a monetary shock. However, regardless of the share of non-traded goods in the consumption bundle, the response of interest rates to monetary shocks remains the same. Whilst small values of a_1 generate a current account deficit in response to a reduction in risk premium, high enough values of a_1 generate a current account surplus. The exchange rate appreciates more when the share of non-traded goods consumed is high and the risk premium reduces, whilst real interest rates fall and output falls more.

Another result we find from the sensitivity analysis is that whilst non traded goods productivity shocks generate a current account surplus at all times, the surplus is greater with bigger values of ρ_1 , and smaller with bigger values of a_1 . This suggests that an increase in the share of non-traded goods consumed may reduce the import requirement of the economy since the traded good consumed is an aggregate of home produced and imported goods. This may in turn affect the current account balance when imports are used in production, leading to a smaller current account surplus. As a result, in a dual sector economy with non-traded goods, dynamics of the current account are not shaped by the intertemporal elasticity of substitution as in a traded goods framework, but rather, the current account and macroeconomic variables are affected by the degree to which traded and non traded goods can be substituted, and by the share of non-traded goods in the consumption bundle. The greater the ease of substitutability between trade and non-traded goods, the greater the role that non-traded goods take in shaping macroeconomic fundamentals. Variance decomposition results for $\rho_1 = 2$ and $\rho_1 = 5$ are in tables 4.5 and 4.6.

Table 4.5: Forecast Error Variance Decomposition Sensitivity Analysis

Shocks	Traded Goods	Non traded goods	Monetary	Risk Premium (UIP)
$\rho_1 = 2$				
<i>A. 1 quarter ahead forecast error variance decomposition (in%)</i>				
Current Account	37.15	57.99	0.38	0.16
Exchange rate	17.02	1.34	1.80	76.46
Real Interest rate	8.12	47.09	36.42	0.00
Output	5.9	86.03	0.35	5.68
<i>B. 4 quarter ahead forecast error variance decomposition (in%)</i>				
Current Account	35.77	56.45	0.60	2.37
Exchange rate	14.60	3.90	0.75	76.85
Real Interest rate	38.88	32.60	16.78	4.92
Output	37.37	56.12	0.32	4.84
<i>C. 12 quarter ahead forecast error variance decomposition (in%)</i>				
Current Account	33.37	57.09	0.57	4.31
Exchange rate	10.88	2.90	0.51	82.69
Real Interest rate	35.93	32.58	15.04	7.16
Output	49.37	45.22	0.26	3.98
<i>C. 20 quarter ahead forecast error variance decomposition (in%)</i>				
Current Account	33.63	56.77	0.58	4.32
Exchange rate	10.75	2.79	0.50	82.69
Real Interest rate	35.86	32.52	15.01	7.16
Output	50.05	44.61	0.25	3.98

Table 4.6: Forecast Error Variance Decomposition Sensitivity Analysis

Shocks	Traded Goods	Non traded goods	Monetary	Risk Premium (UIP)
$\rho_1 = 5$				
<i>A. 1 quarter ahead forecast error variance decomposition (in%)</i>				
Current Account	32.84	62.83	0.15	0.38
Exchange rate	32.76	0.75	2.84	58.83
Real Interest rate	21.17	66.10	8.15	0.00
Output	16.63	79.01	0.05	1.73
<i>B. 4 quarter ahead forecast error variance decomposition (in%)</i>				
Current Account	31.06	62.20	0.33	2.20
Exchange rate	24.46	5.88	1.51	63.17
Real Interest rate	39.34	46.22	6.94	2.15
Output	29.02	66.66	0.06	2.04
<i>C. 12 quarter ahead forecast error variance decomposition (in%)</i>				
Current Account	29.66	62.10	0.32	3.82
Exchange rate	18.03	6.81	1.14	69.30
Real Interest rate	36.69	46.98	6.36	3.86
Output	34.79	61.17	0.05	1.92
<i>C. 20 quarter ahead forecast error variance decomposition (in%)</i>				
Current Account	29.83	61.80	0.33	3.87
Exchange rate	17.61	6.74	1.13	69.57
Real Interest rate	36.65	46.93	6.36	3.91
Output	35.13	60.85	0.05	1.91

4.7 Conclusion

The rate of consumption of non-traded good is high in emerging markets, posing the hypothesis that shocks from the non-traded goods sector together with the traded goods sector influence the dynamics of the current account and exchange rate. We investigate this hypothesis and contribute to literature by developing a model of the current account that includes both traded and non-traded goods. We exploit the model to analyse the response of the current account and exchange rate to shocks in this dual sector setting, and the importance of shocks from the non-traded goods sector in determining the current account and macroeconomic variables compared to those from the traded goods sector.

The model is calibrated to South Africa and shows that non-traded goods play a significant role in the determination of the current account, with half the variation in the current account explained by non-traded goods productivity shocks. This result particularly holds if the share of non-traded goods in the consumption bundle is large and households are able to substitute between traded and non-traded goods with ease. Whilst studies that assume that all goods are tradeable attribute a large proportion of variation in the current account to the risk premium, a dual sector framework shows that variation in the current account is mostly due to productivity shocks. A large proportion of variation in the exchange rate in single sector models is due to risk premium shocks (see Alpanda, Kotze and Woglom, 2010), but the contribution of these shocks decreases with the introduction of non-traded goods in the model. Our model is able to replicate stylised facts from data, suggesting it is a good fit. Also of interest is that our results provide a departure from other current account models of developed countries such as Bergin (2006) and Lu (2009), suggesting the importance of the non-traded goods sector in South Africa. This suggests that the non-traded goods sector has a role to play towards current account management, and policy targeted at current account sustainability should also consider productivity and structural rigidities in the non-traded goods sector.

Future research should estimate this model to analyse the model properties with data, as well as extend the model to analyse other emerging markets with similar characteristics.

4.A Appendix to Chapter 4

4.A.1 Extended Model

1. Exogenous AR(1) demand shock

$$\log \Theta_t^d = \rho_d \log \Theta_{t-1}^d + \varepsilon_{\Theta,t}^d \quad (4.59)$$

2. Price index for traded goods

$$P_{Tt} = \left[a_2 P_{Ft}^{1-\rho_2} + (1 - a_2) P_{Ht}^{1-\rho_2} \right]^{\frac{1}{1-\rho_2}} \quad (4.60)$$

3. Domestic traded goods demand

$$C_{Ht} = (1 - a_2) \left(\frac{P_{Ht}}{P_{Tt}} \right)^{-\rho_2} C_{Tt} \quad (4.61)$$

4. Domestic non-traded goods demand

$$C_{Ft} = a_2 \left(\frac{P_{Ft}}{P_{Tt}} \right)^{-\rho_2} C_{Tt} \quad (4.62)$$

5. Loglinearised aggregate consumption

$$c_t = a_1 c_{Nt} + (1 - a_1) c_{Tt} \quad (4.63)$$

6. Loglinearised traded goods consumption

$$c_{Tt} = a_2 c_{Ft} + (1 - a_2) c_{Ht} \quad (4.64)$$

7. Loglinearised aggregate price index

$$p_t = a_1 p_{Nt} + (1 - a_1) p_{Tt} \quad (4.65)$$

8. Loglinearised traded goods price index

$$p_{Tt} = a_2 p_{Ft} + (1 - a_2) p_{Ht} \quad (4.66)$$

9. Log linearisation of the demand function for non tradeables

$$c_{Nt} = -\rho_1(p_{Nt} - p_t) + c_t \quad (4.67)$$

10. Log linearisation of the demand function for domestically produced tradeables

$$c_{Ht} = -\rho_2(p_{Ht} - p_{Tt}) + c_{Tt} \quad (4.68)$$

11. Log linearisation of the demand function for imported tradeables

$$c_{Ft} = -\rho_2(p_{Ft} - p_{Tt}) + c_{Tt} \quad (4.69)$$

12. Loglinearised Euler, where $r_t - E_t[\pi_{t+1}]$ is the ex-ante real interest rate

$$c_t \approx \frac{1}{1+\zeta} E_t c_{t+1} + \frac{\zeta}{1+\zeta} c_{t-1} - \frac{1-\zeta}{\sigma(1+\zeta)} (r_t - E_t[\pi_{t+1}]) + \widetilde{\Theta}_t^{d10} \quad (4.70)$$

13. Demand shock

$$\widetilde{\Theta}_t^d = \frac{(1-\rho_d)(1-\zeta)}{\sigma(1+\zeta)} \widehat{\Theta}_t^d \quad (4.71)$$

14. Risk premium factor

$$\phi_t = \exp(\Phi_t - \chi Z_t) \quad (4.72)$$

15. Final non traded goods production markup

$$\log \mu_{Nt} = \log \bar{\mu} + \varepsilon_{\mu N,t} \quad (4.73)$$

16. Intermediate non traded goods productivity shock

$$\log a_{Nt} = \rho_{a_N} \log a_{Nt-1} + \varepsilon_{a_{Nt}} \quad (4.74)$$

17. Intermediate traded goods productivity shock

¹⁰where variables with \sim represent a level deviation from the steady state instead of a percentage deviation as the variables can be negative.

$$\log a_{Tt} = \rho_{a_T} \log a_{Tt-1} + \varepsilon_{a_T} \quad (4.75)$$

18. Log Linearised Terms of trade

$$tot_t = p_{Ft} - p_{Ht} + \mu_{tot,t} \quad (4.76)$$

lagging this

$$tot_t - tot_{t-1} = \pi_{Ft} - \pi_t \quad (4.77)$$

19. AR(1) TOT shock

$$\mu_{tot,t} = \rho_{tot,t} * \mu_{tot,t-1} + \varepsilon_{tot,t} \quad (4.78)$$

20. Log Linearised macroeconomic real exchange rate

$$q_t = s_t + p_t^* - p_t \quad (4.79)$$

lagging this

$$q_t - q_{t-1} = d_t + \pi_t^* - \pi_t \quad (4.80)$$

21. Law of one price gap

$$s_t + p_t^* = \psi_t - p_{Ft} \quad (4.81)$$

22. Log Linearised microeconomic real exchange rate

$$q_t^N = p_{Tt} - p_{Nt} \quad (4.82)$$

lagging this

$$q_t^N - q_{t-1}^N = \pi_{Tt} - \pi_{Nt} \quad (4.83)$$

23. Imports inflation

$$\pi_{Ft} = \frac{\beta}{1 + \beta\varphi^*} E_t[\pi_{Ft+1}] + \frac{\varphi^*}{1 + \beta\varphi^*} \pi_{Ft-1} + \frac{\theta_F - 1}{\kappa^*(1 + \beta\varphi^*)} \psi_{Ft} + \Psi_t^*$$

24. Foreign cost push shock

$$\Psi_t^* = \frac{\theta_F - 1}{\kappa(1 + \beta\varphi^*)} \widehat{\Psi}_t^*$$

25. Deviations from the law of one price

$$\psi_{Ft} - \psi_{Ft-1} = d_t + \pi_{Tt} - \pi_{Ft}$$

4.A.2 Sensitivity Analysis Figures

Figure 4.10: Response of variables to orthogonalised shocks when $\rho_1 = 2$

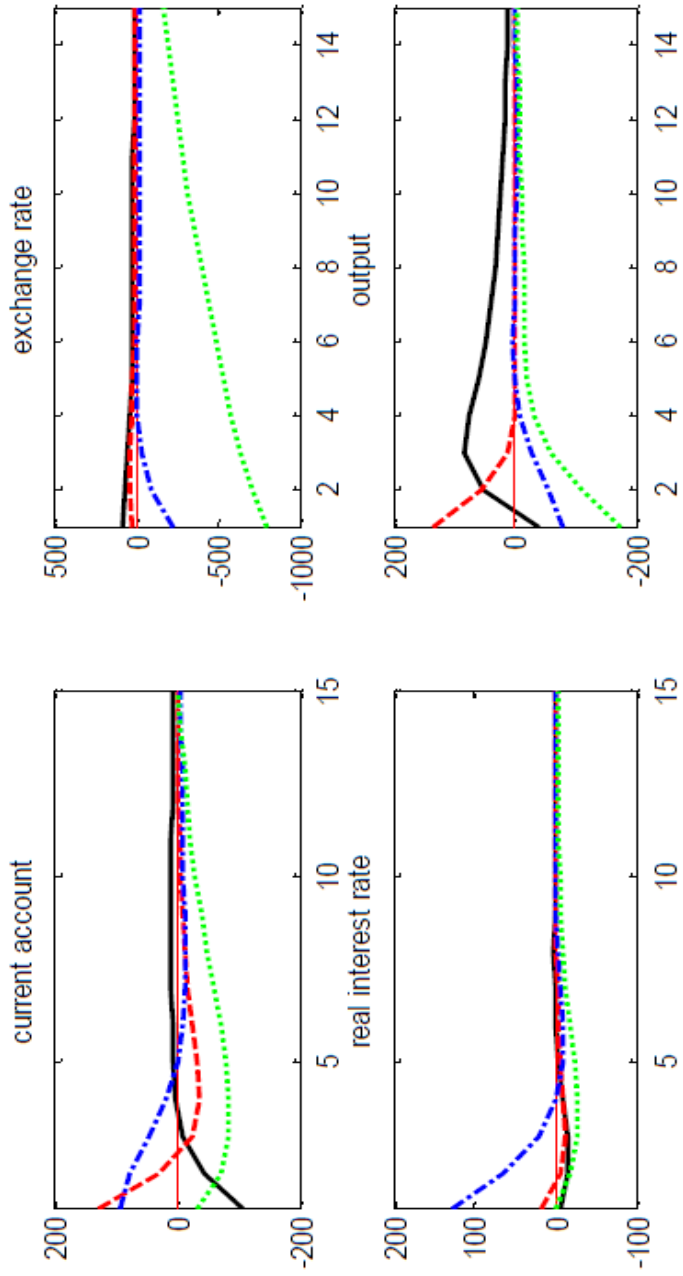


Figure 4.11: Sensitivity to traded goods productivity shock when α_1 varies

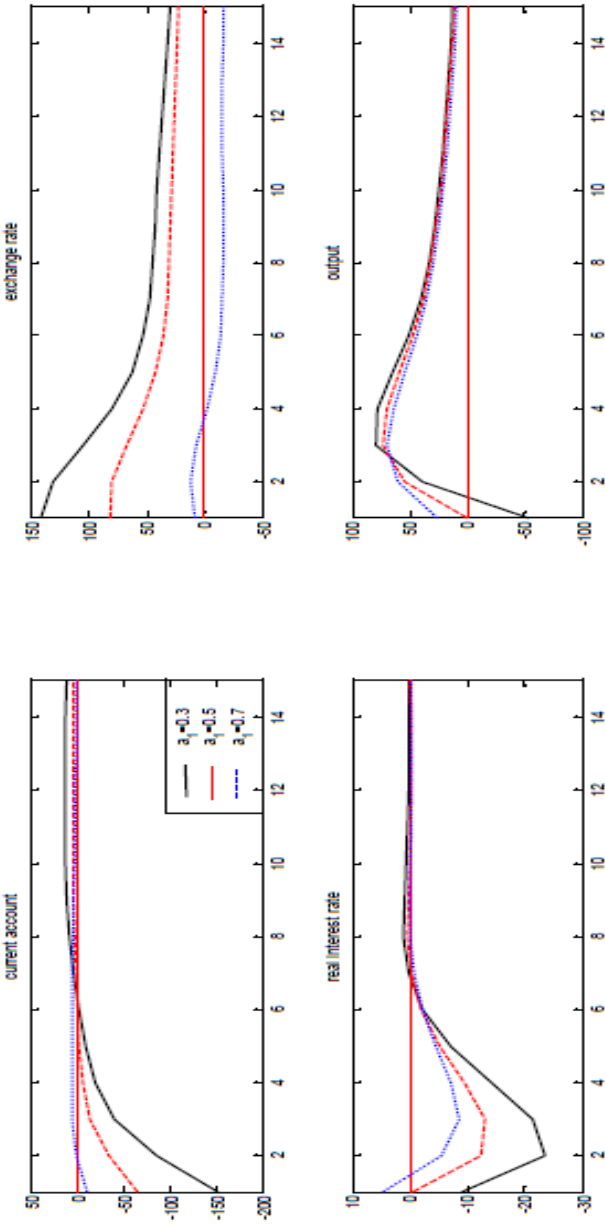
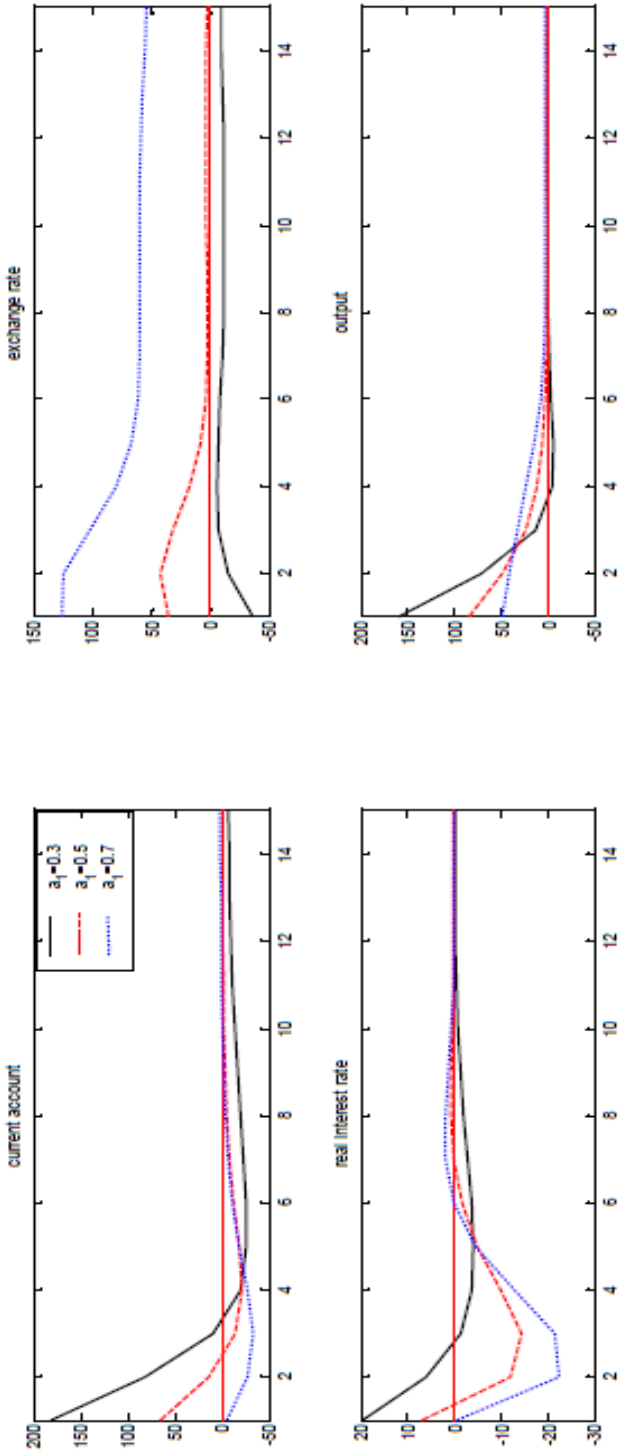


Figure 4.12: Sensitivity to non-traded goods productivity shock when a_1 varies



Chapter 5

Conclusion

The debate on global current account imbalances has gained attention in literature with concerns about the impact of fiscal and monetary policy on the widening current account deficits of emerging markets. Literature establishes that the current account behaves differently in countries of different income levels, with the response of the current account to shocks being shaped by the macroeconomic fundamentals of a country (e.g. Calderón, Chong and Zanforlin, 2007). This motivates for case studies of the current account, particularly in emerging markets which are susceptible to exogenous shocks. The thesis develops an understanding of the dynamics of the current account in South Africa, an emerging market case study, by analysing the implications of fiscal and monetary policy for current account management. We also develop a model that better explains the behaviour of the current account in South Africa by catering for the role of non-traded goods in current account determination. These issues are dealt with in three studies, which form chapters 2, 3 and 4 of the thesis.

Chapter 2 deals with the effect of fiscal shocks on the current account and analyses the usefulness of fiscal consolidation in reducing current account deficits. In the study, we use government budget deficit shocks and government spending shocks to examine the relationship between fiscal shocks and the current account using SVAR models. We also analyse the manner in which fiscal shocks are transmitted to the current account to provide a better understanding of the aspects that fiscal policy should focus on to improve the current account position. Interesting findings show that an expansionary fiscal shocks generate a reduction in the current account deficit, which indicates a departure from the twin deficits hypothesis. This result is driven by the endogeneity between the fiscal balance and output, and shows that when macroeconomic fundamentals such as the income level and business cycle fluctuations of an economy are taken into account, the twin deficit approach which has tended to inform policy formulation in South Africa does not hold. These findings are similar to other countries that exhibit strong business cycle fluctuations (e.g. Kim and

Roubini, 2008; Rafiq, 2010).

The third chapter uses SVAR models to determine the effects of global and domestic monetary shocks on current account movements, and to analyse the channels through which monetary shocks are transmitted to the current account. This is essential in weighing the consequences of the change in global monetary conditions on the current account, and provides insight on the potential role of domestic monetary policy in current account stabilisation. Global monetary shocks are generated through the US interest rate, and domestic monetary shocks are examined through the impact of the real interest rate and real effective exchange rate on the current account. Our findings show the risk of current account reversal from an increase in foreign interest rates if domestic interest rates cannot counter this change by a large enough magnitude. This is a novel result which is a cause of concern for policy makers. In addition, the exchange rate proves useful for managing the trade balance as theoretically expected. These findings are in line with studies by Lee and Chinn (2006) and Kim (2001a), and suggest the need for appropriate policy measures to ensure a smooth adjustment of the current account in anticipation of normalisation of US monetary policy.

Chapter 4 investigates the hypothesis that shocks from the non-traded goods sector influence the dynamics of the current account. The study develops a DSGE model of the current account that includes both traded and non-traded goods, and analyses the importance of shocks from the non-traded goods sector in determining the current account and macroeconomic variables compared to those from the traded goods sector. The model is calibrated to South Africa, a representative emerging market, and shows that half the variation in the current account is explained by non-traded goods productivity shocks, with a larger proportion explained if the share of non-traded goods in the consumption bundle is large and there is high substitutability between traded and non-traded goods. This is a deviation from studies that assume that all goods are tradeable as the latter studies attribute a large proportion of variation in the current account to the risk premium. Non-traded goods shocks also explain some variation in the exchange rate, which is a departure from single sector models (see Alpanda, Kotze and Woglom, 2010). Most importantly, our model is able to replicate stylised facts from data in terms of the correlations, impulse responses and variance decompositions of monetary and productivity shocks, suggesting it is a good fit. This provides a departure from other current account models of developed countries such as Bergin (2006) and Lu (2009).

We contribute to the literature in several ways. First, we provide a case study of an emerging market (South Africa) and analyse the dynamics of the current account in countries of similar income level. We also contribute to the debate on how the effect of fiscal policy on the current account is influenced by macroeconomic fundamentals such as the strength of the

business cycle (e.g. Kim and Roubini, 2008), and contribute to the debate on risks faced by EMEs from the changes in global monetary policy (e.g. Smit, Grobler and Nel, 2014), by providing insights on how monetary policy can cushion these risks. Additionally, we develop a model that explains the current account balance by accounting for the role of non-traded goods, and lastly, we contribute to the sparse literature on current account developments in South Africa.

The results from these studies suggest that measures should be taken to address the current account position as the change in global monetary policy could drive a wider current account deficit. This calls for actions from both monetary and fiscal authorities to attain a stable and sustainable current account balance. The findings also show that fiscal shocks are mainly transmitted to the current account through household savings and government investment, and call for a revision into the fiscal policy approach to external stability. Our findings suggest the need for incentives from policy authorities to boost household savings as this will work towards improving the savings investment gap, and a consideration of productivity and structural rigidities in the non-traded goods sector as this sector plays a role in driving the current account.

A number of areas for further research arise from this thesis. Further research should extend the DSGE model and include a fiscal authority to analyse how non-traded goods would affect the current account and exchange rate given fiscal policy. Further research should also estimate the DSGE model using Bayesian methods to analyse its properties with data, as well as extend the model to other emerging market economies to analyse how well it explains the current account. Since the thesis shows the need for both monetary and fiscal authorities to address current account deficits, future studies should extend this research to look at the optimal monetary and fiscal policy that will achieve a stable current account balance and enhance household welfare. An analysis of optimal fiscal policy would however be dependant on the model expansion to include a fiscal authority discussed above.

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