SOURCES OF CURRENT ACCOUNT FLUCTUATIONS IN SOUTH AFRICA: A VECTOR AUTOREGRESSIVE ANALYSIS

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Declaration

I, Miyelani Maluleke, declare that this research report is my own, except where otherwise indicated, referenced and acknowledged. The report is submitted in partial fulfillment of the requirements for the degree of Master of Commerce in Economics at the University of the Witwatersrand, Johannesburg. This research has not, either in whole or in part, been submitted for any degree or examination in this or any other university.

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Miyelani Maluleke

Signed at Johannesburg

On the 29th of March 2018.

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Abstract

In recent years the South African economy has faced persistent current account deficits which policymakers have labeled as worrisome. In order to identify the sources of current account deficits in South Africa, we employ a four-variable Vector Autoregressive (VAR) model. The Blanchard–Quah decomposition approach is used to impose long-run relationships on the following shocks; foreign income, domestic supply, relative demand, and real exchange rate. Our results indicate that the trade balance, a proxy for the current account balance, fluctuations in South Africa are mainly driven by relative demand shocks and to a lesser extent, by real exchange rate shocks and foreign income shocks. In addition we, find that domestic supply shocks have an insignificant effect on the trade balance fluctuations. Our findings suggest that demand management policies such as fiscal policy and credit policies should be considered as measures to reduce macroeconomic vulnerabilities associated with wide current account deficits, whilst policy interventions aimed at influencing the level of the exchange rate should not be expected to have a significant long-run effect on the trade balance.

Keywords: current account balance, trade balance, VAR, Blanchard-Quah, South Africa

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SECTION 1: INTRODUCTION

1.1 Background and problem statement

Wide and persistent current account deficits are often flagged as a source of external vulnerability with a potential for costly macroeconomic consequences, especially in emerging markets (Blanchard and Milesi-Ferretti, 2012; Milesi-Ferretti and Razin, 2000). South Africa, in particular, has not escaped these concerns and its current account balance is a prominent topic in macroeconomic policy discourse (National Treasury, 2017; Kganyago, 2017). Following a significant widening in the current account deficit from 2003, questions about the sustainability of South Africa's current account grew (Smit, 2007; Searle and Mama, 2010). One of the foremost concerns raised is that the deficit has largely been financed by portfolio inflows into the country's bond and equity markets, as opposed to long-term foreign direct investment. As a result, this leaves the country vulnerable to capital flow reversals or "sudden stops" and thus poses a challenge for domestic macroeconomic policy (Smit, 2007). Similar concerns about other emerging markets have emerged in international literature (see, Qureshi, 2016; Borio and Disyatat, 2011). Domestic political challenges coupled with a high likelihood of a scaling back of the 'quantitative easing' policies from developed countries, along with their implications for the current account balance financing, have amplified concerns on the sustainability of the current account balance in South Africa (Smit, Grobler and Nel, 2014).

In their seminal work that followed the Asian Crisis, Ferretti and Razin (2000) highlight some of the threats of the reversals of large current account deficits in the face of scarce financing but they find that the effects can be mixed across countries. For instance, they show that Uruguay experienced significant deterioration in output growth following an episode of current account reversal. However, they also indicate that the effects of these reversals are not homogenous. Amongst the contrasts cited was Malaysia, which experienced an improvement in growth after a current account reversal. A recent attempt to quantify the macroeconomic effects of current account reversals related to a drying up in funding in South Africa was done by Smit, Grobler and Nel (2014) and this work indicates that the effects could be severely adverse. Using a semi-structural model, they show that output growth could fall by as much as 2.3 percentage points following a "sudden stop" in financing for the current account. This, they show, would also be followed by a decline in employment of about 0.7%. This work provides some evidence that large current account deficits have a potential to pose macroeconomic problems. These results suggest that the current account balance and its management are an important policy concern in South Africa.

With the foregoing, however, we find that a lot of the recent literature for South Africa around this topic has largely focused on the financing side of the balance of payments, mainly attempting to offer an understanding of the nature of funding as well as the possible effects of sudden stops (see also Rangasami, 2014). However, arising from this is the need to ascertain the underlying drivers of current account fluctuations, and to examine the relative effectiveness of the various domestic and foreign factors on fluctuations in the current account balance. While we find a significant amount of international literature on this, to the best of our knowledge, very little work focused specifically on South Africa exists.

This paper aims to contribute to the South African literature on current account dynamics by examining the underlying drivers of current account balance fluctuations. The study follows Zhang and Wan (2007) in developing a Vector Autoregressive (VAR) model and seeks to estimate the relative importance of four primary shocks, namely, foreign income, domestic supply, relative domestic demand and real exchange rate shocks in driving variation in South Africa's current account balance within a small open-economy developed by Hoffmaister and Roldôs (2001). We believe that this understanding is necessary for policymakers such as the South African Reserve Bank and the National Treasury in devising policy measures to mitigate the risks associated with current account reversals.

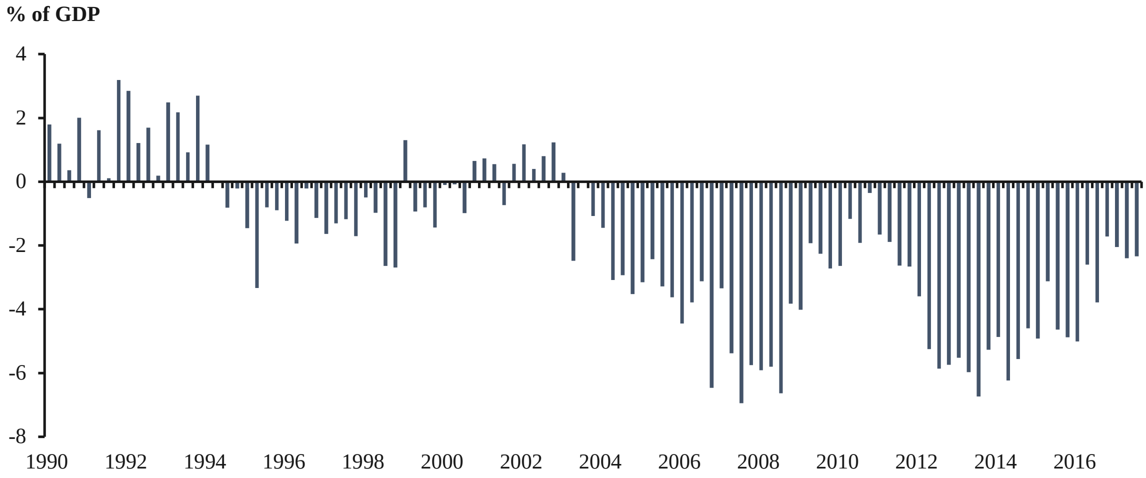
1.2 Recent developments in South Africa's current account balance

South Africa's current account balance is a regular feature in macroeconomic policy discussions. In a speech in November 2014, the Deputy Governor of the South African Reserve Bank (SARB), Daniel Mminele, warns of an "uncomfortably high current account deficit" as a problem that requires a pragmatic policy intervention. The SARB's concerns about the current account balance also feature regularly in its Monetary Policy statements (see, for example, SARB (2016). The SARB is not alone in its concern about the current account deficit. The International Monetary Fund's (IMF) 2016 Article IV consultation report also warns of elevated external risks stemming from a wide current account deficit. Within a historical context, the magnitude of the current account deficits in South Africa in recent years is a relatively new phenomenon. Data from the Quarterly Bulletin of the South African Reserve Bank show that between 1994 and 2000, South Africa’s current account balance as a percentage of GDP averaged just -0.9% of nominal GDP. In the year 2001 and 2002, the current account balance recorded small surpluses, equivalent to 0.3% and 0.9% of nominal GDP, respectively.

However, since 2003, South Africa's current account balance slipped into a deficit at -0.9% of GDP and it has remained in deficit territory since (see figure 1). Moreover, the current account is characterised by a high degree of volatility. In the years preceding the global financial crisis, the current account balance deteriorated significantly with the deficit reaching an unprecedented of 6.9% of nominal GDP in the third quarter of 2007. This period coincides with two broad themes. Firstly, global commodity prices increased sharply, partly fuelled by fast-growing emerging economies, particularly China, providing a strong positive terms-of-trade or foreign shock. According to data from the International Monetary Fund (IMF), the All Primary Commodity Price Index increased by 269% between the start of 2000 and before the effects of the global financial crisis was felt in commodity markets in July 2008 (IMF, 2017). For South Africa, this supported an increase in export revenue and GDP growth. However, the increased income also lifted import demand, widening the current account deficit.

Secondly, domestic demand was also supported by a strong increase in domestic credit extension. In the period between 2000 and 2007, household consumption expenditure grew by an annual average of 5.2% and reached a high of 8.8% in 2006. Gross domestic expenditure, which includes government consumption and gross fixed capital formation, expanded at a rate of 5.4% per annum between 2000 and 2007, supporting strong growth in imports. During this period, domestic demand was the primary driver of GDP growth whereas net exports were persistently negative.

Figure 1: South Africa's current account balance

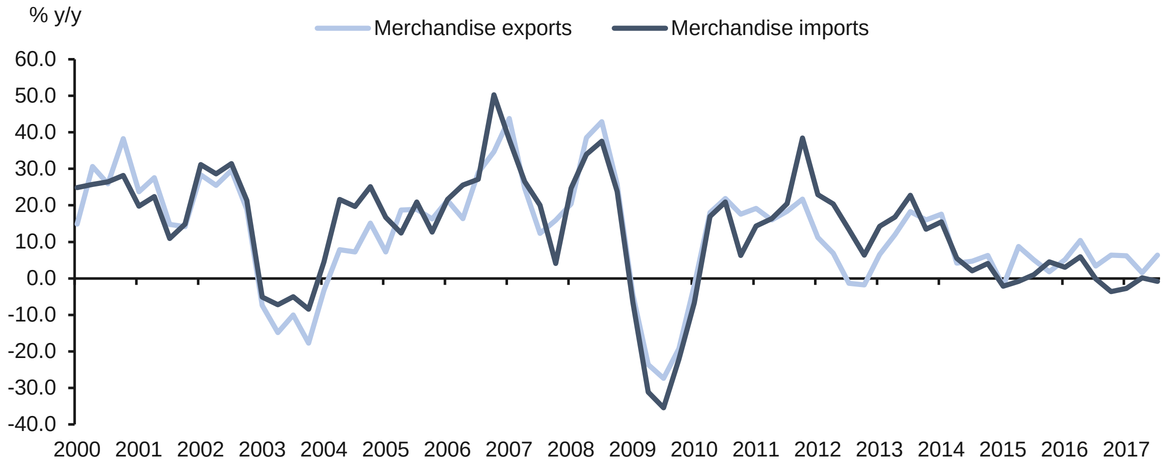


Source: South African Reserve Bank, own calculations

When the global financial crisis hit, South Africa, along with other commodity-exporting nations, was hit by an adverse commodity terms-of-trade and prices of its export commodities fell in addition to waning overall foreign demand. Data from the IMF's International Financial Statistics show that the All Primary Commodity Price index fell by nearly 40% between January 2008 and December 2008. Domestic demand also weakened sharply as the economy contracted. This saw the current account deficit narrow sharply to reach just 0.3% of GDP in the final quarter of 2010.

After the end of the global financial crisis and the subsequent gradual rebound in economic activity that followed this, South Africa's current account balance deteriorated anew. From just 0.3% of GDP in the fourth quarter of 2010, South Africa's current account deficit deteriorated significantly, reaching a high of 6.7% of GDP in the third quarter of 2013. The data in Figure 2 show that although growth in South Africa's merchandise exports and imports were slowing during this period, the growth in imports remained persistently higher than the growth in exports, resulting in the widening of the merchandise trade deficit. As such, the improvement in domestic demand could have been the major determinant of the current account balance deterioration.

Figure 2: Growth in South Africa's exports and imports of merchandise

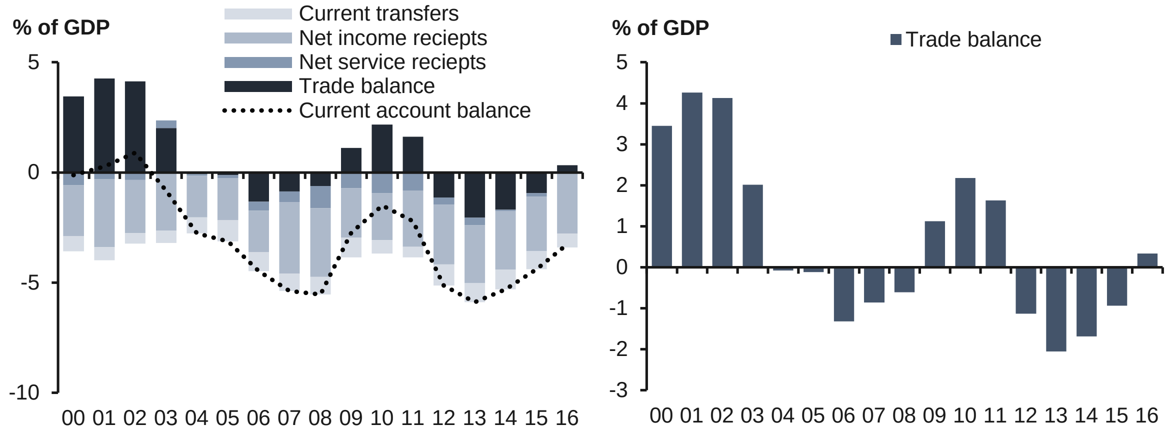


Source: South African Reserve Bank, own calculations

More recently, South Africa's current account deficit has narrowed substantially. After reaching a post-crisis low of 6.7% of GDP in the third quarter of 2013, the current account deficit has narrowed steadily to reach 2.0% of GDP in the second quarter of 2016. The Quarterly Bulletin of the South African Reserve Bank notes a consistent improvement in South Africa's terms of trade from around the third quarter of 2013, which could explain the improvement in the current account deficit. An additional factor could be the weakening in domestic demand, particularly a decrease in private sector investment, as well as the growing need for fiscal consolidation which has resulted in increased fiscal spending restraint.

The composition of the current account balance also warrants some attention. Data on Figure 3 show that the part of the current account that drives most of the volatility in the current account balance is merchandise trade. At the same time, while the balance on net service payments, net income payments and transfers tend to be negative over time, possibly due to the structure of the South African economy, these tend to be stable over time. In light of this, understanding the nature of fluctuations in the merchandise trade balance seems key to understanding overall fluctuations in the current account balance. Therefore, this study will use the trade balance as a proxy for the current account.

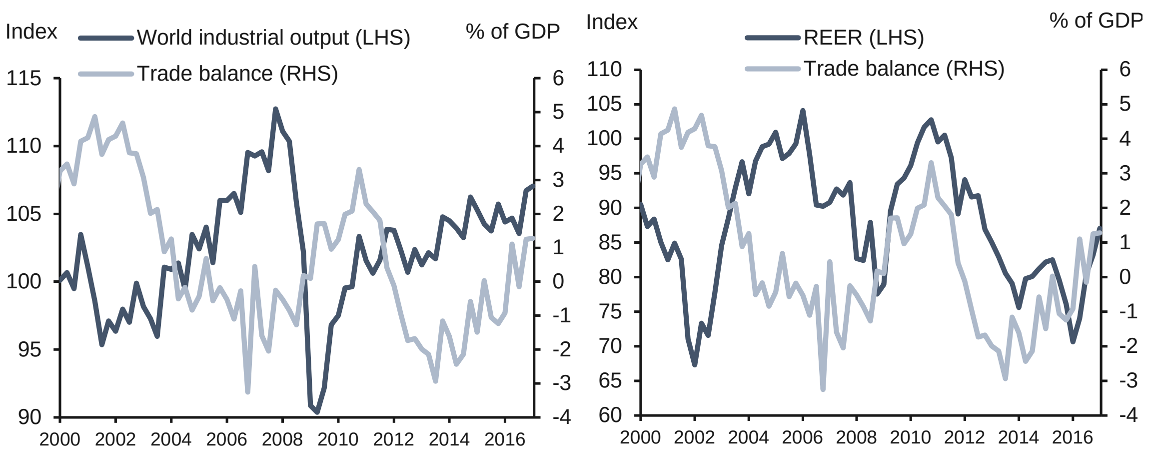
Figure 3: The composition of South Africa's current account balance



Source: South African Reserve Bank, own calculations

Observing the trade balance specifically, the data reveal an interesting read at a glance. Firstly, the right panel of Figure 4 shows that between 2000 and 2009, the relationship between the trade balance and the real effective exchange rate was negative. However, this appears to break down post the crisis with the nature of the relationship turning positive. Nonetheless, these correlations reveal nothing about the nature of the relationship. As Nikolaychuk and Shapovalenko (2013) argue, some of the effects evident in the data could be a result of either a positive demand shock or through a nominal monetary shock and may not necessarily reflect any causal relationship between the two variables.

Figure 4: The trade balance against the global economic activity and real exchange rate



*REER – real effective exchange rate, Sources: SARB, International Monetary Fund

Meanwhile, the left panel of Figure 4 shows that the relationship between the trade balance and global economic activity (proxied here by industrial output in advanced economies) between 2002 and 2004 was negative while in the period subsequent to this through to 2010, this relationship turns positive again. Meanwhile, between 2010 and 2017, the correlation only appears to be weakly positive. As such, the complexities of these relationships as evident in the data warrant closer investigation.

1.3 Objectives and research questions

The objective of this study is to undertake an empirical characterization of the underlying sources of current account fluctuations in South Africa, focusing specifically on the trade balance as the main item of variability in the current account. In particular, the study seeks to establish the relative significance of four key drivers within a small open economy framework, namely, foreign income shocks, domestic supply shocks, relative demand shocks and real exchange rate shocks in explaining merchandise trade balance variations.

Specifically, the study tries to answer the following questions:

- What is the effect of foreign income shocks, domestic supply shocks, relative demand shocks and real effective exchange rate shocks on the merchandise trade balance?
- What is the relative significance of each of the identified shocks in explaining overall current account fluctuations?
- What policy options exist for a sustainable current account balance in South Africa?

The remainder of this study is organised as follows; section 2 presents a review of both the theoretical foundations and empirical literature; section 3 introduces the econometric methodology to be used as well as the data and other tests to be conducted; section 4 will discuss the estimation and results and section 5 will provide concluding comments.

SECTION 2: LITERATURE REVIEW

2.1 Theoretical considerations

We identify three broad theories of the current account, namely, the absorption approach, the elasticity approach and the intertemporal approach and each will be discussed in turn. Based on the Keynesian framework of national accounts, the absorption approach to the balance of payments was first laid out by Alexander (1952) and later expanded by Johnson (1958). Following from the national accounting identity, Y= C + I + G + X – M, total domestic demand or absorption is given by AD = C + I + G, while the current account balance is given by CAB = X – M. The current account balance is thus given by CAB = Y – AD.

The absorption approach thus argues that the current account balance is simply given by a country's national output less its aggregate demand. A nation that spends more than it produces will run a current account deficit while a country that spends less than it produces will run a current account surplus. This approach emphasizes domestic demand dynamics as the major determinant of the current account. A clear policy intervention of a country battling a large current account deficit would, according to this approach, be to find ways to reduce domestic aggregate demand, which could, for instance, be achieved through tighter fiscal policy. However, the Mundell-Fleming model, which builds on the traditional IS-LM framework, argues that the effectiveness of monetary and fiscal policies is dependent on the mobility of capital and the exchange rate regime (Frenkel and Razin, 1987).

The second broad approach to the current account or trade balance adjustment is the elasticities approach. In this framework, current account adjustment is primarily seen based on the elasticity of the demand for both exports and imports to changes in relative prices of imports and exports (see, for example, Lord, 1999). For instance, a policy action such as devaluation of the exchange rate, which lowers prices of domestically-produced goods, will only increase foreign demand for domestic products only if the elasticity of foreign demand for locally produced goods is high. If, on the other hand, the elasticity is low, the price effect may dominate the increase in demand, resulting in a contraction in exports. Similar reasoning extends to domestic demand. If the demand for foreign produced goods is highly elastic, the lower domestic prices resulting from devaluation, domestic consumers would switch to locally produced goods. Thus, according to the elasticities approach, the effect of a change in the exchange on the trade balance depends entirely on the elasticities of demand for imports and exports.

There are two important extensions of the elasticities approach. The first is the so-called Marshall-Lerner condition. This extension argues that any devaluation in the exchange rate aimed at improving the trade balance requires that the elasticity of the demand for imports and exports must exceed unity in order for this policy intervention to be effective. If the elasticity is less than one, the trade balance will deteriorate. A further extension of the elasticities approach is the J-curve hypothesis, which shows how exchange rate developments affect the trade balance or current account over time. According to this hypothesis, due to the slow change in consumer behaviour, exchange rate devaluation is likely to result in an initial short-term worsening in the merchandise trade balance or the current account balance. However, over the long-term consumers switch from more expensive imports towards relatively cheaper domestic goods, resulting in a long-run improvement in the current account balance to a level higher than before the devaluation.

Since the revolution of the Rational Expectations Hypothesis (REH), championed by Robert Lucas and others in the later 1960s and 1970s (Andrada, 2016), the forward-looking behaviour of rational economic agents has come to form the basis of what is commonly called new open-economy macroeconomic (NOEM) models. The most commonly referenced approach within this area of research is the intertemporal approach, associated with Obstfeld and Rogoff (1995). According to this approach, the current account balance is determined by the savings and investment decisions of utility maximizing forward-looking economic agents who make these decisions based on current and expected outcomes of macroeconomic factors. In this approach, income fluctuations are matched by changes in savings behaviour that results in a stable long-run path of consumption.

Kollman et al (2014) summarise that there is broad agreement in the literature that a nation’s current account balance reflects several factors, namely, international, domestic and financial shocks as well as the structural dynamics of the domestic and foreign economies. What is less clear, however, is what the relative importance of these drivers is for various countries. And this is where this paper aims to make a contribution for South Africa, by consolidating variables that are identified in the various strands of literature as capable of driving current account fluctuations, looking specifically at the effects of four shocks, namely, global supply shocks, specific domestic supply shocks, domestic relative demand shocks and real exchange rate shocks.

2.2 Empirical literature review

In this section, we briefly review some of the empirical literature investigating drivers of current account fluctuations. There is a vast literature that looks at the underlying drivers of current account balance movements across countries. The empirical literature ranges from efforts that seek to demonstrate the significance of selected variables on the current account to specific issues such as fiscal policy or exchange rates or terms. For instance, studies have investigated terms of trade effects on the trade account, in search of evidence of the Harberger-Laursen-Metzler effect (Deardoff and Stern, 1978; Cashin and McDermott, 1998; Otto, 2003). Also, exploring the demand channel, previous empirical studies generally find that a loosening in fiscal policy has an adverse effect on the current account (Monacelli and Perotti, 2007; Corsetti and Muller, 2006). Kim and Roubini (2008) find that expansionary fiscal policy delivers an improvement in the current account balance and results in the depreciation of the real exchange rate.

A further set of studies employs panel data to investigate factors across several countries (see, Calderon, Chong and Loayza, 2002; Chinn and Prasad, 2000; Guerriery and Gust, 2006). A notable example in this regard is Chinn and Prasad (2000), who employ cross-section and panel regression analysis for several industrialised and developing economies. They find that government budget balances showed a positive correlation with the current account balance. Moreover, they find that an improvement in terms-of-trade resulted in an improved current account balance. A notable contrast with respect to the effects of fiscal policy is Abbas et al (2011). Looking at a large sample of developed and emerging economies, Abbas et al (2011) find that on average, an improvement in the fiscal balance equivalent to 1 percentage point of GDP was associated with an improvement in the current account balance of about 0.3-0.4% of GDP in the sample they explored.

However, other studies have also explored the current account question differently, seeking to understand underlying the composition of the different factors the drive observed fluctuations in current accounts (see, for example, Prasad and Gable, 1998; Garcia-Solanes et al. 2011; Barnett and Straub, 2008). This approach is especially relevant for the aims of this study. These studies, many of which focus on developed economies, use various specifications of vector autoregressive (VAR) models to decompose the current account in terms of various identified underlying drivers. This helps to identify the sources of fluctuations and could help to inform policy interventions. Using a structural vector autoregressive model, Barnett and Straub (2008), undertake to identify the drivers of the US current account, using a sign-restricted VAR focusing on domestic consumption, government spending, monetary policy, oil prices and productivity. They find that monetary policy and private absorption shocks are the major drivers of current account worsening in the US suggesting that demand has been a more important driver for the country. Moreover, they find that oil price developments explain only a relatively small component of US current account movements. However, other studies have presented contrasting evidence. For instance, evidence that nominal shocks are the major factor explaining current account fluctuations emerges from Prasad and Gable (1998) and Lee and Chinn (2006). Fisher and Huh (2002) confirm the significance of nominal shocks to the long-term trade balance dynamics for G-7 countries post-Bretton Woods.

A notable contrast in the developed world literature is Garcia-Solanes et al (2011) who, using a structural VAR, find that supply shocks explained 80% of the long-run forecast error variance in a number of industrialised countries including Japan, France and the US. They also find that demand shocks are also significant for explaining the forecast error variance. However, unlike earlier studies, they find that nominal shocks played a relatively insignificant role in all the countries they investigated.

We generally find studies that investigate that seek to decompose drivers of current account fluctuations in this manner in emerging markets to be relatively limited. That said, there are a few examples that are worth highlighting. Looking at a country in the emerging market universe that also had current account balance concerns, Nikolaychuk and Shapovalenko (2014) also employ a structural VAR identified with sign restrictions. They find results that are broadly consistent with a range of open-economy models. They find that fluctuations in the Ukraine trade balance were mostly driven by demand and terms-of-trade shocks. A surge in domestic demand associated with looser fiscal policies resulted in deterioration in the trade balance. Moreover, they find some evidence of J-curve effects but the overall impact of nominal shocks was relatively limited.

Two important studies also focusing on emerging markets, whose approach is an important inspiration for this research paper, were done by Hoffmaister (1997), Hoffmaister and Roldôs (2001). Following Dornbusch (1989), Hoffmaister and Roldôs (2001) develop a small open economy model that are then used to provide long-run identifying restrictions *à la* Blanchard-Quah with a structural VAR framework. Hoffmaister and Roldôs (2001) augment the model to introduce to account for the effects of nominal variables but this is done in a generalised way rather than singling out a specific nominal variable. We return to this model when discussing the identifying restrictions for this paper. Looking at Korea and Brazil, Hoffmaister and Roldôs (2001) find that domestic shocks accounted for the biggest share of fluctuations in economic activity while external factors accounted for a relatively smaller amount of movements in economic activity.

Looking specifically at Sub-Saharan Africa, Hoffmaister and Roldôs (1997) construct a structural VAR with long-run restrictions based on a small scale open-economy model. They explored the topic by looking macroeconomic fluctuations in Communauté Financière Africaine “African Financial Community” CFA franc and non-CFA franc counties. They found that the used of fixed exchange rates in CFA countries exposed them to higher vulnerability from terms-trade- compared to their non-CFA franc counterparts. In more recent work and an interesting innovation, Hove et al (2016) investigate the importance of terms-of-trade amongst inflation-targeting emerging countries and exchange rate targeting emerging economies. Hove et al’s results show that countries that have inflation targeting as their monetary policy framework respond better to terms-of-trade shocks but they tend to have more exchange rate volatility.

A more recent extension of the Hoffmaister-Roldôs framework was used by Zhang and Wan (2007) to investigate drivers of the trade balance dynamics in China. Zhang and Wan also construct a structural VAR with long-run restrictions. They find that large part of China's trade balance fluctuations could be explained by real shocks while nominal shocks had a limited effect. In particular, they find that relative demand shocks explain about 70% of the forecast error variance decomposition of trade balance variations in China while domestic supply shocks explained a further 10%. Nominal shocks were responsible for about 14% of the forecast error variance decomposition.

2.3 Summary of the literature review

Overall, available international evidence across developed markets and emerging markets on the underlying sources of current account fluctuations is mixed and depends on the underlying structure of the economy. For South Africa specifically, we find that a lot of the recent literature has focused on possible consequences of current account reversal as well as the financing side of the balance of payments (Smit, 2007; Smit, Grobler and Nel, 2014; Rangasamy, 2014). Smit et al (2014) in particular, warn of possible significant adverse consequences of current account reversal in South Africa. However, we find that there is a gap in the South Africa literature in terms of empirically characterising the underlying drivers of current account fluctuations.

SECTION 3: RESEARCH METHODOLOGY

This section explains the methodology and empirical strategy that is used in this study. The primary aim of this work is to examine the drivers of current account fluctuations in South Africa. This section will deal with the following issues; a broad outline of the methodology to be used in the study, the theoretical and identification strategy to be used as well as variables to be used other tests run on the model and data.

3.1 Introduction

The International Monetary Fund (IMF) Balance of Payments (BoP) Guide (2013) describes the balance of payments as a statement of a country's transactions with the rest of the world. The current account is only one side of the two main parts of a country's balance of payment. The other main aspect is the capital and financial account. The current account captures all transactions amongst residents of a country and non-residents, excluding those carried out in financial assets. The major components of the current account are thus merchandise goods, services and income such that the balance on the current account is given by receipts by residents minus payments made to non-residents.

The IMF BoP Guide also points out that the current account balance can also be presented within a savings-investment framework. In the standard Keynesian national income identity:

$$GDP = C + I + G + X - M \quad (1)$$

Where GDP is national output, C is consumption expenditure by households, I capital formation or investment, X is exports and M is imports or stated alternatively, X-M is net exports or the current account balance (CAB).

Similarly, the gross national disposable income identity is given by:

$$GNDY = C + G + I + CAB. \quad (2)$$

And since $GNDY - C - G = S$, (3)

where S is savings, or income that is not consumed, rearranging (3) into (2) gives:

$$S = I + CAB. \quad (4)$$

$$\text{Therefore, } CAB = S - I. \quad (5)$$

The outcome on equation (5) shows that the current account balance is a function of investment and savings decisions by households, firms and the government. This study extends the above to important aspects that the literature suggests are important, namely, the exchange rate and foreign income.

An econometric analysis is used to investigate the research problem. This study follows earlier work on current accounts imbalances (see, Hoffmaister and Roldôs, 1997, 2001; Prasad; 1999 and Zhang and Wan, 2007) by adopting a VAR model. The use of a VAR model in current account studies is routine and acceptable, however, our framework utilised the long run restrictions (Blanchard and Quah, 1989) as opposed to the Cholesky restrictions.

VAR models are popular tools of econometric evaluation in macroeconomics. Sims (1980), who is credited with the introduction of VARs, favoured their use and showed that these models performed relatively better compared to their large-scale simultaneous equation counterparts. Many have subsequently developed and refined the framework (see for instance Lutkepohl, 2007, Stock and Watson, 2001) and have been used in seminal papers in macroeconomics.

More specifically, a VAR framework is most appropriate for this research task for the following reasons:

- Firstly, VAR models allow for the interpretation of a one-time shock one variable of the model to capture its effects across the rest of the model. In other words, after model construction, a VAR model allows us to track the effects of shock of one variable across the rest of the system due to the interdependent nature of VAR models (Enders, 2004).

- Secondly, forecast error variance decompositions can be constructed to measure the relative contributions of variation as a result of different shocks. This feature of VAR models will allow for identification of variables (e.g. exchange rates, demand developments) that have the largest effect on current account fluctuations. (Lutkepohl, 2007)

- Thirdly, VAR models allow for the historical decomposition of structural shocks to the evolution of variables over a period of time. These properties will be important in determining the historical underlying dynamics of South Africa's current account deficit in terms of the identified shocks (Dungery and Fry, 2009).

3.2 The VAR Model

Following similar work that seeks to analyse underlying drivers of current accounts (see, for instance, Barnett and Straub, 2008) we develop a vector autoregressive (VAR) model to investigate the drivers of current account fluctuations in South Africa. An important property of VAR models is that all variables within the system are treated as endogenous. Therefore, in a VAR, all the variables are expressed as functions of their own past values as well the past values of other variables in the system. Once the VAR is adequately identified, the system can be estimated with the use of Ordinary Least Squares (OLS). A VAR model can be generalised as follows:

$$Y_t = \sum_{i=0}^{n} A_k \, Y_{t-i} + \varepsilon_t, \qquad (5)$$

where Y_t represents an $n \times 1$ vector of endogenous variables. In our case, this vector comprises a relatively parsimonious set-up of foreign output *(yf)*, the real effective exchange rate *(reer)*, domestic output *(y)*, and the trade balance *(tb_y)*. A_k are the $k = 1, \dots n$ coefficient matrices of the values of Y_t that are lagged *k* times and ε_t is a vector of shocks or innovations that are identically distributed. In our case and in line with Zhang and Wan (2007), the vector ε_t captures the structurally defined shocks that we want to test, namely, a foreign income shock (ε^i), a domestic supply shock (ε^s) a relative demand shock (ε^d) and a real exchange rate shock (ε^n).

The VAR model can also be presented in its structural form in the following manner:

$$Y_t = B(L)Y_{t-1} + u_t \,. \tag{6}$$

In equation (6) above, B equals $(1 - \mathrm{A}_0)^{-1}\mathrm{A}_\mathrm{k}$ and u_t equals$(1 - \mathrm{A}_0)^{-1}\varepsilon_t$. The term (L) is the lag polynominal operator. In this model, the structural innovations are assumed to have a zero mean, not serially correlated, have constant variance and no correlation between the individual shocks (Lutkepohl, 2007). Presented in its moving-average form, the structural reduced form model takes the following definition,

$$Y_t = A(L)\varepsilon_t \,. \tag{7}$$

The term *A(L)* in the equation above is the polynomial matrix in the lag operator defined as *L*, while ε_t the vector of our structural shocks as already defined above.

Furthermore, we present our reduced form equation as laid out in equation (7) as $Y_t = C(L)\varepsilon_t$, where $\varepsilon_t = G^{-1}e_t$, and the element e_t~iid(0, ∑). We also define $A(L) = C(L)G$ and in line with our number of endogenous variables, *G* is a 4 x 4 matrix that is non-singular. In this specification, the terms *C(L)* and ∑ are obtainable through estimating the following VAR:

$$D(L)Y_t = e_t \,, \tag{8}$$

, wherein the term $C(L) = D^{-1}(L)$. In order to recover *A(L)* from our structural moving-average form equation, we, therefore, need to identify *G*. Identification is a critical part of estimating VAR equations. Fernandez-Villaverde and Rubio-Ramirez (2006) highlight that the outcomes of structural VAR models are highly sensitive to identification restrictions. In our specification, the term identification of *G* will require 16 restrictions, in line with the number of variables (i.e. 4 x 4), that we have selected for our baseline model. As a point of departure, the normalisation the structural shock variances to unity and further assuming that these are jointly orthogonal and also serially uncorrelated will give us ∑= *E(ee')* = *GE(εε′)G'=GG'*, which gives us ten of the restrictions that are required. In order to recover the six missing restrictions, we rely on economic theory and existing literature.

3.3 Variable selection and motivation

The theoretical framework that underpins our empirical approach is largely inspired by the work of Hoffmaister (1997) and Hoffmaister and Roldôs (2001), later extended by Zhang and Wan (2007), who develop a small-open economy model to understand long-run dynamics of macroeconomic variables. We find the model appropriate for the South African set-up given that the economy exhibits both the characteristics of being small and being relatively open. According to the IMF's World Economic Outlook, South Africa's GDP accounts for less than 1% of world output. At the same time, South Africa's openness, as measured by a ratio of the sum of exports and imports to total GDP was 59% during 2017. The framework assumes the presence of a tradable and a non-tradable sector in the economy.

In this framework, the long-run value of the real exchange rate is affected by productivity disturbances in the tradable sector (which could be a result of changes in foreign technology) as well as productivity changes in the non-tradable sector. An increase in productivity in both sectors results in an appreciation of the real exchange rate. From the demand side, a change in preferences from goods or services in the tradable sector to those in the non-tradable sector will result in a decline in the price of tradables relative to those in the tradable sector, resulting in a real appreciation of the exchange rate and a reallocation of labour towards the tradable sector.

Finally, the current account balances in the long-run so that the domestic economy holds a stable amount of foreign assets. A productivity increase in the nontradable sector generates a higher current account surplus or a smaller current account deficit in the steady state as this allows the economy to carry less amounts of foreign borrowings to finance the capital stock. In the same manner, a change in relative domestic demand in favour of nontradables would also result in an improvement in the current account balance as resources in the economy are shifted towards nontradables. Domestic output is largely determined by supply with relative-demand shocks having a negligible long-run effect on the levels of domestic output.

The chosen variables below are informed by the underlying literature and the adopted framework on macroeconomic fluctuations in small open economies. The following variables will thus be used:

Domestic output (*y*) – Domestic output is measured by South Africa's real Gross Domestic Product (GDP). The inclusion of domestic output allows for the capturing of domestic supply shocks ε^s. South Africa is a country that regularly experiences supply disturbances, including labour-related disruptions and more recently, electricity outages. These disturbances have an influence on the level of output by reducing productivity as was observed during the protracted 2012 platinum sector strikes. Therefore, ε^s is suited to capturing the effect of domestic supply shocks that affect the level of productivity in the economy. The data on South Africa's GDP are available from Statistics South Africa's national accounts publication. The variable is included in order to capture the effects of domestic supply shocks on the trade balance.

Foreign output (*yf*) – The inclusion of foreign output is important for capturing the effect of exogenous foreign income shocks (ε^i) from the global economy (on which South Africa is assumed to have no influence) on domestic trade balance dynamics. For purposes of this paper, the foreign output variable is proxied with the use of an index of real industrial output in advanced economies as provided by the International Monetary Fund (IMF) in its International Financial Statistics database.

Merchandise trade balance (*tb_y*) – the balance on in the merchandise trade accounts is the difference between merchandise exports and merchandise imports. A trade balance is in surplus when the value of exports exceeds the value of imports and is in deficit when the opposite holds. In our chosen framework, the merchandise trade balance captures the effects of the relative demand shock (ε^d) because a spending increase shock changes preferences between tradables and non-tradables. In particular, Hoffmaister and Roldôs (2001) assume that a spending increase shock would fall mainly on nontradables relative to tradables, with the immediate effect of improving the trade balance. Therefore, in line with the Hoffmaister-Roldôs framework (see also Garcia-Solanes et al (2011), this relative demand shock will be introduced through ε^d. The trade balance used in this study is expressed as a percentage of nominal Gross Domestic Product. The data are available from the SARB.

Real effective exchange rate (*reer*) – this is defined as a trade-weighted average of South Africa's exchange rate relative to a basket of other currencies and adjusted for inflation. The weights used are dependent on the amount of trade that South Africa undertakes with another country over a period of time. A rise in the value of the real exchange rate means that the domestic exchange rate is appreciating while a fall in the value of the real exchange rate means that the domestic exchange rate is depreciating. Alternatively, an increase in the value of the real effective exchange rate makes domestic goods more expensive to foreigners while the opposite is true. This allows us to capture the effects of real exchange rate shocks (ε^n). The South African Reserve Bank publishes monthly data on the real effective exchange rate and a quarterly average of these will be used for this paper.

Current account balance (*cab_y)* – this is the sum of South Africa's trade balance and net service and income receipts as well as current transfers. Since the main focus of this paper is to focus on fluctuations on the current account that emanate from the trade balance, the current account variable will be used in a robustness test in order to see whether the effects of the shocks produce similar effects on the overall current account balance. Similar to the trade balance, it is taken here as a percentage of nominal GDP. The data are also published in the balance of payments section of the SARB's Quarterly Bulletin.

3.4 Identification strategy

One of the key challenges in estimating VARs is identification. Since the development of VAR models, several methods of generating identification or restrictions have emerged. Within these, there are three broad approaches, namely, identification by introducing short-run restrictions, identification by introducing long-run restrictions and more recently, identification by using sign restrictions (Kilian and Lutkepohl, 2013). In this study, we are interested in differentiating between the short-run and long-run factors of South Africa's current account fluctuations. Therefore, in line with the Hoffmaister-Roldôs framework, we utilise a Blanchard-Quah (1989) identification procedure and use long-run run restrictions in identifying the model, leaving the short-run dynamics unrestricted and to be determined by the data. In the analysis of business cycle and more specifically external accounts, the use of long-run restrictions is not without precedent (e.g. see Lee and Chin, 2006; Kano, 2008).

The primary aim of our research report is to identify the effects of four different innovations on South Africa's current account dynamics, i.e. foreign income, domestic supply, relative demand and nominal shocks. In line with Zhang and Wan (2007), our identification strategy yields the following matrix of the long-run effects of shocks.

$$\begin{bmatrix} log\_yf \\ \log\_y \\ tb\_y \\ log\_reer \end{bmatrix} = A(L)\varepsilon_t = \begin{bmatrix} C_{11}(L) & 0 & 0 & 0 \\ C_{21}(L) & C_{22}(L) & 0 & 0 \\ C_{31}(L) & C_{32}(L) & C_{33}(L) & 0 \\ C_{41}(L) & C_{42}(L) & C_{43}(L) & C_{44}(L) \end{bmatrix} \begin{bmatrix} \varepsilon^i \\ \varepsilon^s \\ \varepsilon^d \\ \varepsilon^n \end{bmatrix}, \qquad (9)$$

, wherein the C_{ij}'s are the polynomials in the defined lag operator L. The missing six restrictions are identified in the following manner. In equation (9), the first row reflects the small economy assumption. This is hardly controversial given that South Africa accounts for less than 1% of world output and likely does not have a significant effect on the global business cycle. Therefore, world supply is exogenous to South Africa. The second row satisfies the Blanchard-Quah assumption (1989) that domestic demand shocks have no long-run impact on domestic output while it is only foreign and domestic supply shocks that affect domestic output through stimulating productivity shocks to the tradable sector of the economy. The third row completes the long-run neutrality of nominal disturbances to the trade balance and output as already indicated above. Critically, we allow the real exchange rate to respond to all disturbances in the system, including nominal shocks. Nominal shocks here are defined in a general way as in Hoffmaister and Roldôs (2001) and Prasad (1999).

3.5 Lag length criteria

VAR models are specified with variables dependent on their own lagged values as well as the lagged values of other variables that enter the system. As such, selecting the lag length of the model is a critical step in the modeling process. In order to select the optimal lag length criteria, we utilise the Akaike Information Criterion (AIC), the Schwarz Criterion (SC) and Hannan-Quinn Criterion (HQC), LogLikehood (LogL) and Final Predication Error (FPE). We select the criteria that suggest the lowest lag length in order to optimise the efficiency of the estimation.

3.6 Unit root and cointegration tests

Unit root tests are an essential part of time series analysis. A stationary time series depicts two key properties according to Asteriou and Hall (2007). The first property of a stationary series is that its primary statistical characteristics such as the mean and variance should be time invariant. Secondly, a correlogram of the time series should fade with time. There are several ways of conducting unit root tests. The paper will focus on two methods that are broadly used in the literature, namely, the Augmented Dickey Fuller (ADF), which is an extension of the Dickey Fuller (DF). The augmented version of the Dickey Fuller test attempts to remedy serial correlation by adding lagged terms of the dependent variable. Moreover, the ADF has the ability to handle more complex underlying data-generation processes with unknown orders of p and q (Enders, 2004). The standard DF test has critical test values that are larger relative to the ADF and can, therefore, result in more cases where the null hypothesis of the presence of unit roots is rejected even when it is true (Brooks, 2002).

The null hypothesis of the ADF t-test is as follows:

$$H_0 \ : \ \theta = 0. \tag{10}$$

This implies that the observed time series needs to be differenced in order to make it stationary.

The alternative hypothesis of the ADF t-test is as follows:

$$H_A \ : \ \theta < 0. \tag{11}$$

This means that the observed time series is stationary and need not be differenced.

Phillips and Perron (1988) recommend the use of several tests for unit roots as some tests could be biased under some structures of the data. Therefore, the second method that will be used to complement the ADF is the Philips-Perron test. The Phillips-Perron test could be considered to be an extension of the ADF but this modifies the test statistic such that serial correlation has no bearing on the test statistic’s asymptotic distribution. As such, the null and alternative hypotheses of the Phillips-Perron test are similar to the ADF test. A time series y_t that is differenced d times in order to induce stationarity is referred to as being integrated of order d.

3.7 Impulse response analysis

In order to trace out the effects of the different shocks, we will follow established literature of conduct impulse response functions. An impulse response function traces out the effect of a shock to one variable in another variable in a system that includes a number of other variables (Lutkehpol, 2007). Impulse-response functions are typically presented in graphical form in order explore the dynamic relationships between the variables in the system. There are several ways of conducting impulse response functions. Sims (1980) uses the Cholesky decomposition method, in which the ordering of the variables in the VAR system is critical. In the Cholesky set-up, a change in the ordering of the variables can significantly affect the obtained results from the impulse response functions. In order to overcome the constraints presented by the Cholesky ordering, Pesaran and Shin (1998) proposed the Generalized Impulses method, which creates an orthogonal set of shocks where the ordering of the VAR is not important.

That said, the purpose of the structural VAR methodology is to use a theoretical framework to better understand the outcomes generated from shocks. As such, it is important to observe the impulse response functions embedded in the structural model. The computed IRFs for this study thus entail the use of the structural orthogonal decomposition from the structural factorisation matrices.

3.8 Forecast error variance decomposition

Forecast error variance decomposition is one of the most useful methods though which VARs allow the analysis of linkages between variables in the system. Forecast error variance decomposition accounts for all the shocks in the different variables in the system and shows which of the shocks explain the largest variation in the forecast error of the variable of interest (Lutkehpol, 2007).

Most of the literature on VARs tends to show variance decomposition using the Cholesky factorisation method. However, since this model is structurally identified, we will use factorisation that is based on the structural orthogonalisation that we have imposed on the VAR. This study will make use of forecast error variance decomposition to understand which of the shocks explain the forecast errors of the merchandise balance.

3.9 Shock accounting: historical decomposition

While SVARs are typically used to run one-time shocks and trace impulse response functions, the use of historical decomposition has also gained some prominence (e.g., see Nikolaychuk and Shapovalenko, 2014; Affandi and Mochtar, 2013). Historical decompositions allow for the quantification of how much each structural shocks in the VAR system explains historical observations of a variable of interest. Alternatively stated, historical decompositions provide the cumulative effect of an identified structural innovation on any variable in the VAR system at any given point in time (Kilian and Lutkepohl, 2016). This analysis will be used to decompose South Africa’s trade balance in terms of the identified four shocks and the structural identification imposed on the VAR. This will help to shed some light on which of these shocks explain past observed fluctuations in the merchandise trade balance.

SECTION 4: ESTIMATION AND RESULTS

This section presents the results of the modelling and analyses these results within the context of the literature and research methodology as discussed above.

4.1 Data description

The research uses quarterly data over the period 1996:01 to 2017: 01, covering national accounts data, balance of payments data and exchange rates. The reason for starting in 1996 is to capture dynamics after South Africa made the change to a freely floating exchange rate. With respect to the national accounts and balance of payments data, seasonally adjusted data as provided by the SARB are used. The descriptive summary statistics (see Table 1) show that South Africa's current account balanced recorded its highest deficit at 6.9% of GDP over the sample period while the highest surplus recorded over the same period was at just 1.3% of GDP. The mean of the current account balance over this period is -2.66%, reflecting the tendency for the current account balance to be in deficit.

Table 1: Summary statistics of the data used

	cab_y	*log_y*	*log_yf*	*tb_y*	*log_reer*
Mean	-2.66	14.69	4.60	0.87	4.49
Median	-2.60	14.74	4.62	1.00	4.50
Maximum	1.30	14.94	4.73	4.90	4.67
Minimum	-6.90	14.37	4.42	-3.30	4.21
Std. Dev.	2.21	0.19	0.07	2.00	0.11
Skewness	-0.13	-0.22	-0.90	0.12	-0.38
Kurtosis	2.04	1.55	3.53	2.18	2.54
Sum Sq. Dev.	411.22	3.06	0.37	337.43	0.96
Jarque-Bera	3.52	8.15	12.38	2.61	2.83
Probability	0.17	0.02	0.00	0.27	0.24
Observations	85	85	85	85	85

Source: South African Reserve Bank, International Monetary Fund, own calculations

4.2 Unit root tests

As indicated above, two tests were performed to check the stationarity of the data to be used in the modelling exercise. The Augmented Dickey-Fuller and Philips-Perron tests were used at 5% critical level and the results are presented in the tables below. Starting with the ADF, the results show that the null hypothesis of stationarity cannot be rejected at a 5% critical level for any of the series when presented as levels. In order to confirm that that differencing the data once would be sufficient to induce stationarity, the ADF test was also run for the first difference for each of the series. The ADF test results confirm that the null hypothesis of the presence of unit roots can be rejected for each of the series after differencing the data once.

Additionally, we conducted the Philips-Perron test. Similarly, the PP tests confirm that at a 5% critical level, the null hypothesis of the presence of unit roots cannot be rejected for any of the series. However, at first difference, the PP test also shows that the data become stationary after first difference. Overall, the stationarity tests reflect that the time series data used here are integrated of order (1). As a result, for further analysis, we use all of the series in first differences.

Table 2: Unit root tests results

Variable	Augmented Dickey Fuller		Phillips-Perron	
	Level	First difference	Level	First difference
Current account balance, % of GDP (*cab_y*)	-1.86	-14.01**	-2.43	-14.20**
Trade balance, % of GDP (*tb_y*)	-1.72	-14.69**	-2.40	-15.15**
Real gross domestic product, Rmn (*log_y*)	-1.07	-4.98**	-1.58	-4.98**
World industrial output, index (*log_yf*)	-2.62	-5.22**	-2.64	-9.73**
Real effective exchange rate (*log_reer*)	-2.69	-8.65**	-2.89	-8.65**

**indicates that series is stationary at 5% test critical level

4.3 Johansen cointegration results

Given that the unit root tests have shown that all the variables are integrated of the same order, i.e. *I(1)* and that they all have unit roots when tested in level terms, we proceed to undertake co-integration, using the Johansen approach. The co-integration test is taken for the variables that are used in the baseline model. In order to conduct the cointegration test, the optimal lag length of the VAR system is required. This was determined within the software package Eviews, which provides five criteria. We chose a lag length of one as suggested by the Schwarz Information Criterion (SIC) and the Hannan-Quinn Information Criterion (HQ)[1]. Two tests statistics are reported, namely, the Trace and Eigen statistics. The results are presented in A4 of the Appendix at the end of this report.

[1] The results of this test are presented in A3 of the Appendix section of this report.

The trace statistic test is a joint tests that tests that the null hypothesis that there is no cointegration ($H_0: r = 0$) versus the null hypothesis that there is no conintegration ($H_A: r \geq 1$). Meanwhile, the Maximum Eigenvalue test performs the tests on each eigenvalue separately. Under the Maximum Eigenvalue test, the null hypothesis is that the number of cointegrating vectors equals *r* while the alternative hypothesis is that there are *r+1* cointegrating vectors (Enders, 2004). The Trace and maximum Eigen statistics are derived, respectively, as follows:

$$\lambda_{trace}(r) = -T\Sigma_{i=r+1}^{k} ln\left(1 - \hat{\lambda}_i\right)$$
$$\lambda_{max}(r, r+1) = -Tln(1 - \hat{\lambda}_{r+1})$$

The results from the trace statistic are presented in A4 show that at the 5% level of significance, there are no linear combinations that exist between our chosen variables. As such, the null hypothesis of no cointegration in the variables cannot be rejected at this level of significance. The maximum Eigenvalue statistic supports the results of the trace statistic in showing that there is no cointegrating relationships amongst the chosen variables at a 5% level of significance. When co-integrating relationships are present, literature suggests that the use of a Vector Error Correcting Model (VECM) is more appropriate. Our results from the Johansen cointegration test show that there are no cointegrating relationships in the data. However, we are careful not to overstate the significance of the unit root and cointegratioin results. The use of stationary versus non-stationary data has generated vigorous debate amongst the key contributors in the literature on the use of VARs. For instance, Sims (1980), Sims, Stock and Watson (1990) argue that SVARs should be estimated in levels whether the data are stationary or not. They caution that differencing the data could result in the loss of useful informational properties about the relationships of the variables in the system.

In the spirit of Zhang and Wang (2007) and other studies that this research follows the work of Hoffmaister and Roldôs (2001); and most importantly, in order to be consistent with the Hoffmaister- Roldôs theoretical framework, the data in our baseline model are taken in their natural logs, with the exception of the trade balance, which is expressed as a ratio of nominal gross domestic product (GDP). Moreover, in order to test for the stability of the VAR, we checked the inverse roots of the AR characteristic polynomial. Stability requires that all the roots should lie within the unit circle. The results confirm that the roots all lie within the unit circle, suggesting that the estimated VAR is stable[2].

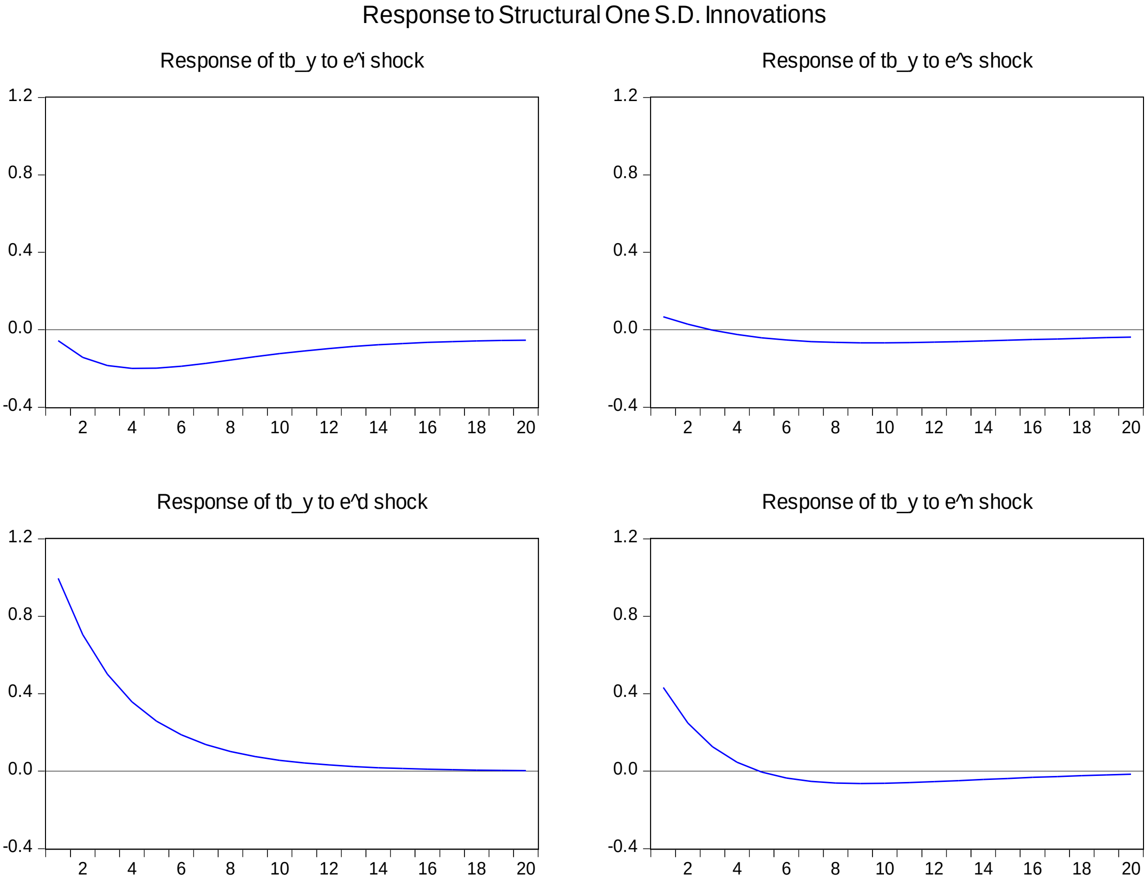
4.4 Benchmark model results: impulse response functions

In this section, we discuss the impulse response functions on the trade balance to a one-standard error structural shock in the identified four shocks. These shocks allow us to trace out the dynamic relationships between the different macroeconomic variables after the shocks. The shocks are presented as structural one standard deviation innovations. The impulse response functions for the trade balance are presented in figure 4 while the impulse response functions of the other variables are in Appendix A5 to A7.

We begin with a ***positive shock to foreign income (*** ε^i **).** At the onset, we observe that the effect of a positive shock on foreign income results in a negative effect on the trade balance (*tb_y)*. This negative effect worsens until the fourth period before beginning to decay towards the long-run equilibrium of the trade balance. This is at odds with the predictions of the Hoffmaister and Roldôs (2001) study which predicts that higher foreign income should result in higher demand for domestic exports and therefore improve the trade balance. While this outcome seems puzzling at first, we note that the theory is not unanimous on the effects of higher foreign income (see, e.g., Magee, 1973; Krugman, Obstfeld and Melitz (2015)). Magee (1973), for instance, argues that the effect of higher foreign income on the trade balance is ambiguous because while the higher income could result in higher domestic export, it could also result in lower domestic exports due import-substituting industries growing faster in the foreign economy. Therefore, the observed result could be due to foreign income substitution in foreign countries. Within the literature on emerging markets, a similar result emerges from Yueng-Ling (2008), who finds that Malaysia's trade balance responded negatively to higher foreign income.

[2] The results of the inverse roots of the AR characteristic polynomial are contained in A2 of the Appendix section of this report.

Figure 4: **Impulse response functions of the trade balance**



Secondly, we turn to the results of a ***positive shock on domestic supply (ε^s).*** The impulse response of the trade balance following a positive shock is initially positive but short-lived and after three periods it turns negative from the third period before gradually approaching its long-run equilibrium. We note that in Appendix 5, the positive shock on domestic supply results in a permanent increase in output. As a result, the persistence of the negative effect on the trade balance suggests that higher income coming from higher output results in higher demand for imports. This would be in line with the prediction of the absorption approach of the balance of payments. However, the intertemporal approach suggests that there could be two opposing effects of a supply shock. One the one hand, the supply shock could increase income levels, leading to a country lending to the rest of the world. On the other hand, if the shock is persistent, it could result in a country borrowing from the rest of the world in order to finance higher investment. As such, the effect on the current account balance could be ambiguous. However, we note that in a multi-country model, Gregory and Head (1999) also find that country-specific supply-side shocks have a limited effect on the current account in G7 countries.

Thirdly, we turn to a ***positive shock on relative demand (ε^d).*** As in the adopted theoretical framework, a positive relative demand shock implies an increase in domestic demand falling mostly on nontradables (Hoffmaister and Roldôs, 2001). In line with the prediction of the model, we observe that a relative demand shock has a positive effect on the trade balance. The outcome is also in line with Zhang and Wan (2007). The positive effect on the trade balance diminishes slowly with the trade balance approaching its long-run equilibrium. Moreover, our results show that this shock has the strongest effect on the trade balance compared to other shocks. This is in line with absorption approach of the balance of payments which argues that the trade balance is largely determined by demand dynamics. This is in contrast to several studies that suggest that demand shocks have a relatively limited effect on the trade balance (e.g. see Fisher and Huh, 2002; Prasad and Gable, 1998) but in line with studies that have specifically looked at emerging markets such as Nikolaychuk and Shapovalenko (2013) for Ukraine and Zangrand and Varela (2015) for Indonesia.

Finally, we look at the effect of a ***positive shock on the real exchange rate (ε^n).*** At the onset, the effect of a positive shock on the real exchange rate results on a positive effect on the trade balance. However, since an increase in the real effective exchange rate implies an appreciation of the domestic currency and therefore higher prices of domestic goods to foreign goods the improvement in the trade balance following a positive shock to the real exchange rate is somewhat puzzling. However, the elasticities approach of the balance of payments may offer some clues for this phenomenon. In particular, the elasticities approach says that the trade balance can improve, provided that the elasticity of foreign demand for domestic goods is relatively inelastic (Lord, 1999). In light of this, the initial response could suggest that domestic exports are relatively inelastic shortly after a real effective exchange rate shock. However, we note that the positive effect decays and turns slightly negative from the fourth period, possibly as foreigners find alternatives to domestically produced goods.

4.5 Benchmark model results: forecast error variance decomposition

The goal of this study is to analyse the sources of the underlying factors that drive fluctuations in South Africa’s current account dynamics, we begin with the forecast error variance decomposition (FEVD) in the trade balance. The FEVD gives a breakdown of the relative significance of each of the variables explains fluctuations in another variable in the VAR system.

The FEVD of the merchandise trade balance as shown in Table 3 shows that a significant amount of variation emanates from the relative demand shock, followed by the nominal shock and foreign income shock while the domestic supply shock explains a relatively benign part of the forecast error variance decomposition in the merchandise trade balance. About 80% of the total variance was found to have come from the relative demand shock, suggesting that domestic demand preferences are the key source of fluctuations in South Africa’s current account. The effect begins at more than 84% in the first period, decaying slowly over time.

Table 3: Forecast error variance decomposition of TB_Y

Period	ε^{i}	ε^{s}	ε^{d}	ε^{n}
1	0.2674	0.3779	83.6217	15.7329
2	1.3272	0.2996	84.2956	14.0776
3	2.7877	0.2561	84.1555	12.8007
4	4.3638	0.2634	83.4558	11.9170
5	5.8494	0.3239	82.4581	11.3687
6	7.1348	0.4301	81.3658	11.0694
7	8.1865	0.5697	80.3085	10.9353
8	9.0168	0.7295	79.3540	10.8998
9	9.6584	0.8978	78.5277	10.9162
10	10.1493	1.0654	77.8308	10.9545
11	10.5248	1.2258	77.2518	10.9976
12	10.8144	1.3746	76.7748	11.0363
13	11.0411	1.5097	76.3825	11.0667
14	11.2226	1.6300	76.0594	11.0880
15	11.3718	1.7357	75.7915	11.1010

The real exchange rate shock came as the second most important source of the forecast error variance in the merchandise trade balance, explaining an average of about 16% of the error variance after 15 periods. This result suggests that nominal exchange rates and other shocks of a nominal nature such as inflation differentials exert a notable influence on fluctuations in the merchandise trade balance. Meanwhile, the foreign income shock accounts on average for close to 8% of the forecast error variance decomposition after 15 periods. However, it is interesting to note that the effect begins at close to zero in the first period, rising steadily over time to exceed 10% only in the tenth period.

The domestic supply shock accounted for the smallest amount of forecast error variance decomposition, accounting for an average of just 3% over 15 periods. The results suggest that domestic productivity shocks explain only a modest amount of the forecast error variance decomposition in the merchandise trade balance. The results possibly reflect South Africa’s difficulty to introduce structural reforms and raise productivity growth.

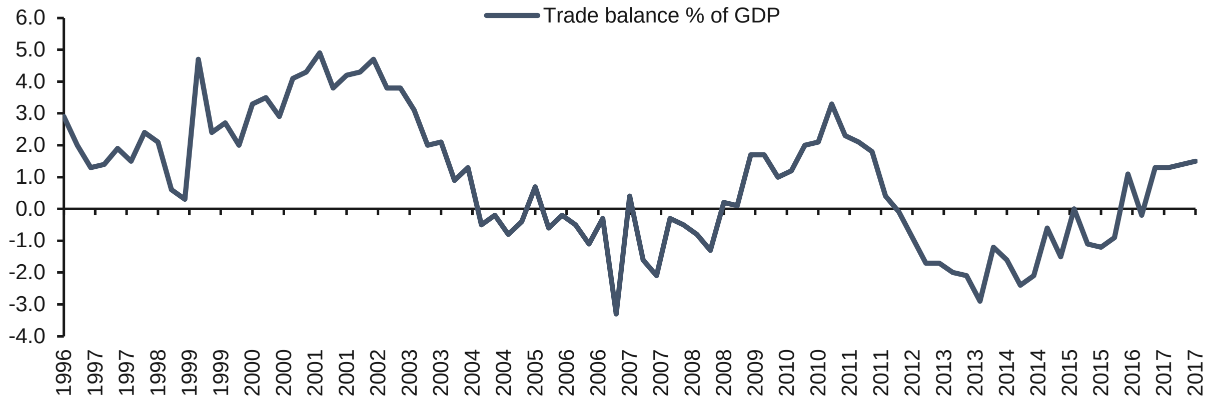
4.6 Benchmark model results: historical decomposition

A further useful application of the structural VAR approach is the ability to conduct historical accounting of fluctuations in terms of the underlying shocks. Firstly show the trade balance in figure 6 as published in the official statistics data. Secondly, we project a baseline forecast of the trade balance as generated by the VAR model and then decompose this in terms of the foreign income, domestic supply, relative demand and real exchange rate shocks. The results of this analysis are presented in figure 7.

The results show that a large part of the improvement in the trade balance in the early 2000s came largely from relative demand shocks. This outcome could possibly reflect the effects of a weakening in domestic demand in this period following the Asian financial crisis around this period. However, the effects on the merchandise trade balance of the domestic demand boom into the 2000s and before the global financial crisis in 2009 are also evident. The results of the historical decomposition show that domestic demand accounted for a large part of the deterioration in South Africa’s trade balance around this period. The results demonstrate that the demand-fuelled nature of the growth in this period played a key role in worsening South Africa’s current account balance. A further contribution to the widening trade deficit was foreign income shocks, contributing an average of 1% of GDP to the trade deficit between 2006 and 2008.With respect to the worsening in the trade balance from around 2012, we find an increasing role of real exchange rate shocks from the historical decompositions. This could reflect the protracted nature of the real exchange rate depreciation witnessed in South Africa between 2010 and 2016.

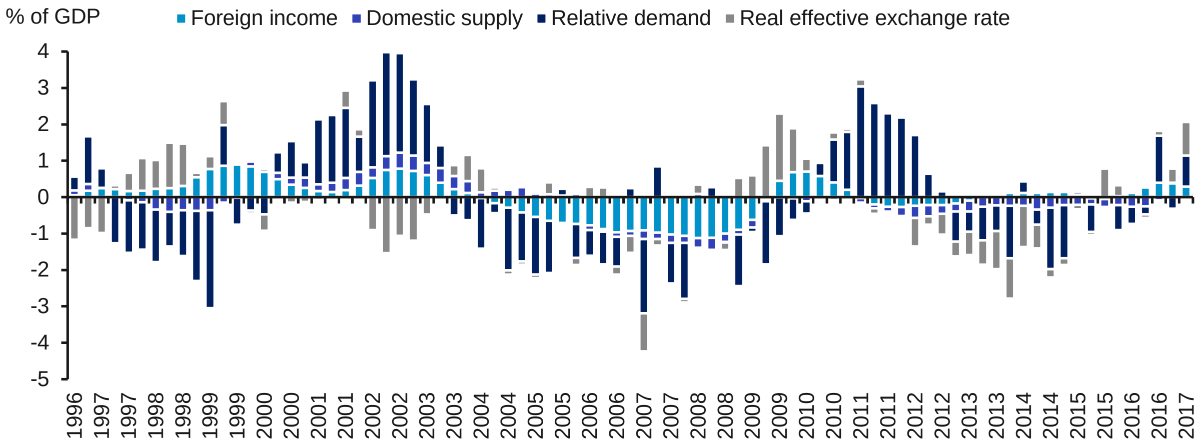
The results show the effects of domestic supply shocks to be relatively muted over the review period. However, these appear to turn consistently negative from 2011 to 2017. We note that from a supply perspective, this period was characterised by sporadic strike actions as well as electricity shortages. The effects of these developments on domestic productivity could explain the persistently negative contributions of domestic supply shocks to the merchandise trade balance.

Figure 6: Actual trade balance as a % of GDP



Source: South African Reserve Bank

Figure 7: Contributions of the shocks to fluctuations in the trade balance



Source: Authors' calculations

4.7 Robustness of the results

In order to the test the robustness of our results, we estimated another VAR with a slightly different specification. As argued, a large part of the variation in South Africa's current account balance comes primarily from the trade balance while the so-called "invisibles", i.e. net service receipts, net income payments and current transfers tend to be relatively stable over time, possibly due to the structure of the economy. As a first robustness test, we altered our baseline specification to replace the trade balance with the overall current account balance while keeping all other variables the same. The impulse response results are presented in figure 8 of the Appendix section of this report.

Overall, the results that come from using the current account balance are qualitatively similar from the baseline model results. Critically, the results show that the direction and the relative magnitude of the current account's response to all the shocks is largely the same as with the use of the trade balance. However, there are some differences worth noting. Specifically, the effects of supply shocks, both domestic and foreign, appear to have slightly different dynamics. For instance, a foreign income shock initially improves the current account balance before having a negative effect from around the third period. This result suggests that there are parts of the current account balance that responds positively to foreign income shocks that may be not be captured in the trade balance. A possible hypothesis for this phenomenon could be that a foreign income shock raises non-trade income, such as net service receipts or net income receipts in the short-term. Moreover, the variance decomposition results show a slightly larger role of foreign income shocks in explaining the forecast error variance decomposition when using the current account balance compared to when the trade balance is used. As such, while we find the overall results of our baseline model robust to this specification change, the use of the current account offers more insights about the behaviour of other parts of the current account balance beyond merchandise trade.

SECTION 5: CONCLUSION

5.1 Summary of the results

In this report, we present an empirical account of the underlying drivers of current account fluctuations in South Africa post the financial liberalisation era starting from 1996 to 2017. South Africa has experienced relatively large external imbalances and the theories of open macroeconomics offer an array of reasons for this in small open economies. That said, little work exists on determining the drivers of current account fluctuations. The paper aims to make a contribution in this regard. We construct a VAR within the context of a small relatively open economy framework to test the effects of foreign income shocks, domestic supply shocks, relative demand shocks and real effective exchange rate shocks.

The results of our study suggest that relative demand shocks and real effective exchange shocks are the main drivers of current account variations in the short-term. In the results of our benchmark model, demand shocks and nominal shocks explain more than 90% of the forecast error variance (about 74% from relative demand shocks and 21% from real effective exchange rate shocks). However, over the long-run, the significance of foreign income shocks gains prominence. Meanwhile, domestic supply shocks have a relatively muted effect on current account fluctuations. The robustness of the results was confirmed using a different identification strategy.

Results from a historical decomposition of the trade balance offer some information on the swings in the trade balance over the past two decades. The deterioration in the trade balance in the 2000s prior to the global financial crisis appears to have been driven in large part by demand shocks and to a lesser extent, by foreign income shocks. The results also offer some interesting results regarding the improvement in the trade balance more recently. In particular, the historical decomposition shows that nominal shocks and demand shocks explain the recent swing of the trade balance to a surplus in 2016. This occurs in the context of increasing efforts at fiscal consolidation and relatively weak investment and consumer demand as well as recent gradual tightening in monetary policy since 2014.

5.2. Policy recommendations

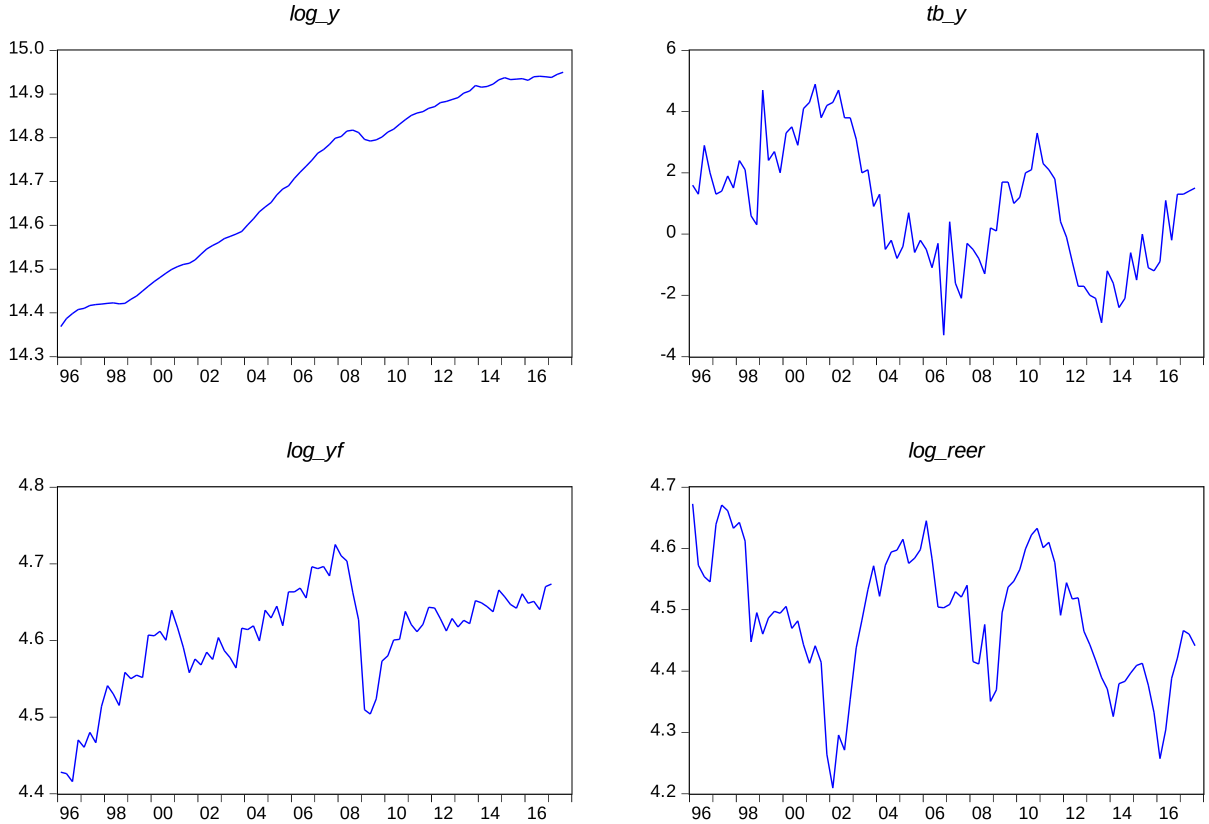
The results of the study provide evidence that demand and nominal shocks are a major source of current account movements in South Africa. In particular, the results from the historical decomposition also offer a unique insight into the drivers of recent current account fluctuations in South Africa with demand shocks coming out as the most important. As such, demand management policies such as fiscal policy and credit policies should be considered as measures to reduce macroeconomic vulnerabilities associated with wide current account deficits. Moreover, our results suggest that policy interventions to influence the level of the exchange rate should not be expected to have a significant long-run effect on the trade balance.

5.3 Further research

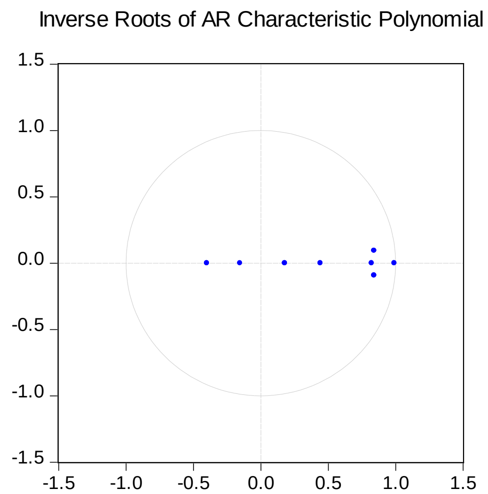
While this study has shown that domestic demand is an important source of current account dynamics in South Africa, the research did not consider in detail the relative importance of the various categories of demand, i.e. government consumption, household consumption and investment demand. This could be an important area for future research.

Appendix

A1: Plots of time series data in the baseline model



A2: Inverse roots of the AR characteristic polynomial



A3: Lag length section

VAR Lag Order Selection Criteria
Endogenous variables: ***log_yf log_y tb_y log_reer***
Exogenous variables: C
Sample: 1996Q1 2017Q4
Included observations: 81

Lag	LogL	LR	FPE	AIC	SC	HQ
0	83.93031	NA	1.63e-06	-1.973588	-1.855344	-1.926147
1	520.0815	818.4565	5.10e-11	-12.34769	-11.75647*	-12.11048*
2	542.1802	39.28660	4.40e-11*	-12.49828*	-11.43408	-12.07131
3	547.1208	8.295268	5.83e-11	-12.22520	-10.68803	-11.60847
4	564.4659	27.40957*	5.72e-11	-12.25842	-10.24826	-11.45192

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

A4: Johansen cointegration test results

Series: ***log_yf log_y tb_y log_reer***

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.236145	41.67276	47.85613	0.1681
At most 1	0.126699	19.31441	29.79707	0.4705
At most 2	0.079506	8.070003	15.49471	0.4580
At most 3	0.014281	1.193907	3.841466	0.2745

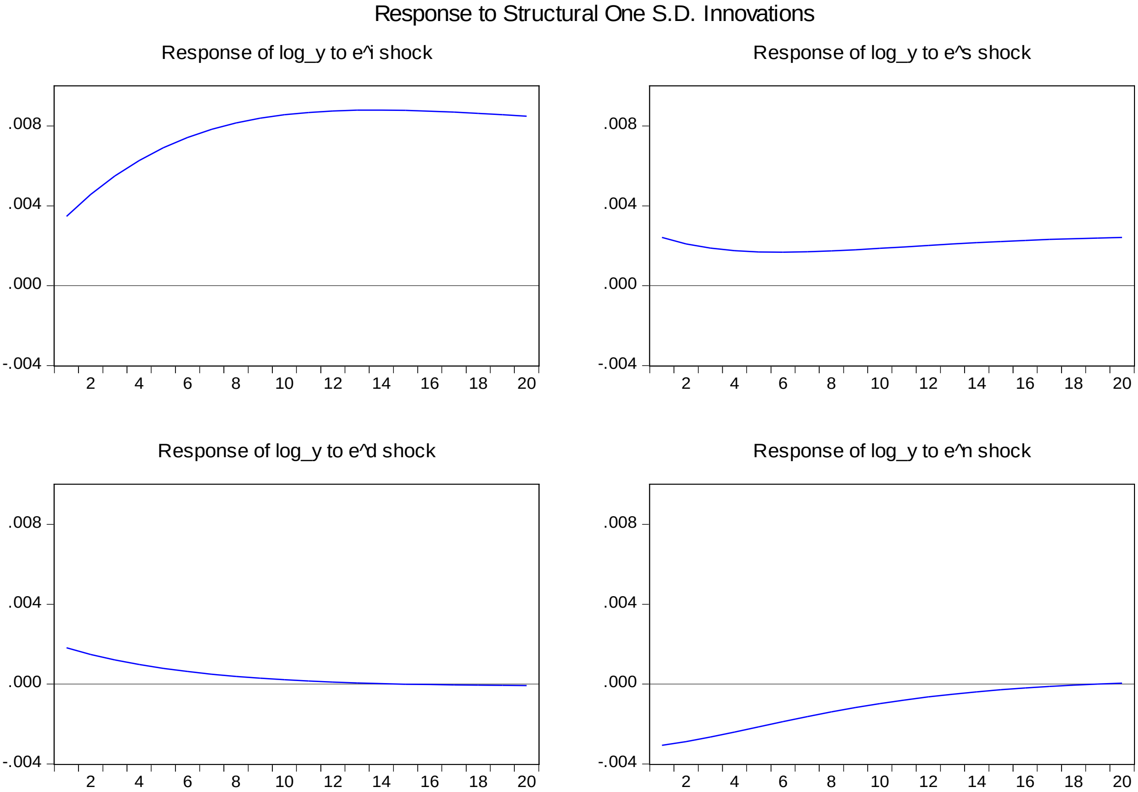
Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.236145	22.35835	27.58434	0.2026
At most 1	0.126699	11.24441	21.13162	0.6229
At most 2	0.079506	6.876096	14.26460	0.5039
At most 3	0.014281	1.193907	3.841466	0.2745

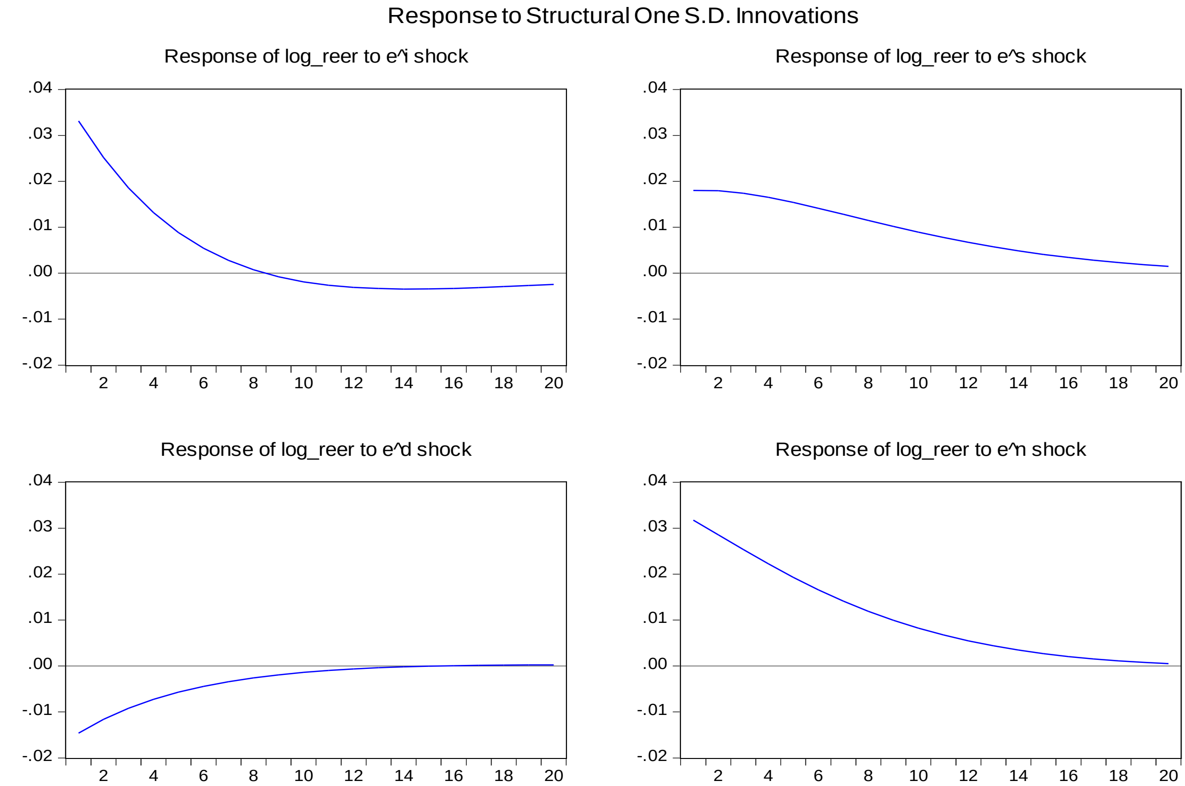
Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

A5: Impulse response functions of real GDP*



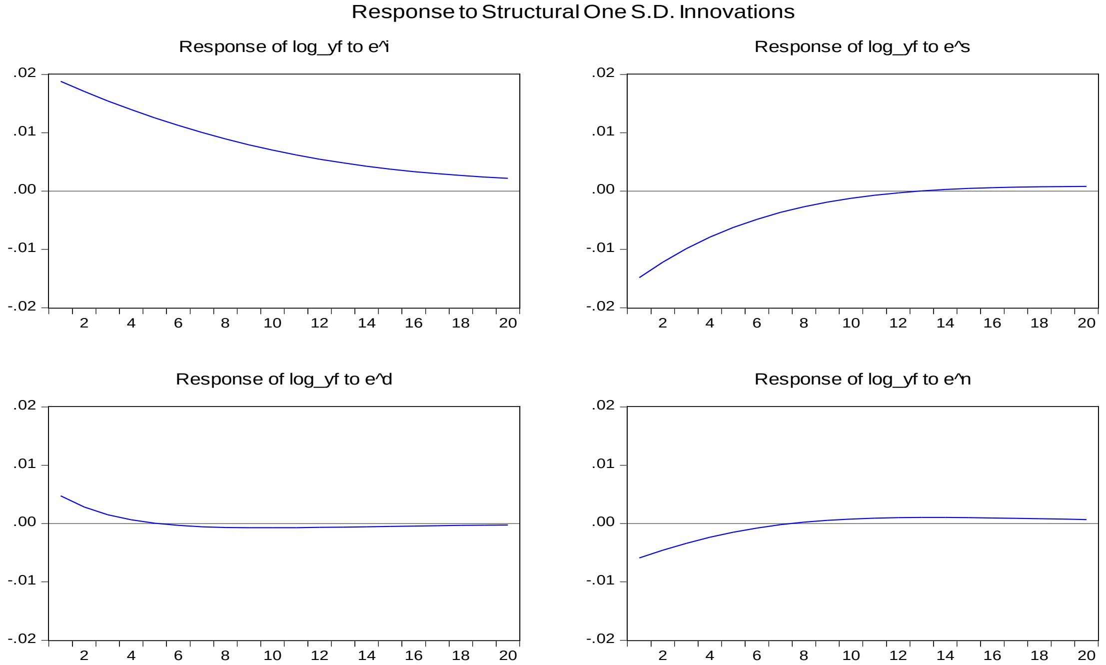
*shock 1 – ε^i; shock 2 – ε^s; shock 3 – ε^d; shock 4 – ε^n

A6: Impulse response functions of the real effective exchange rate*



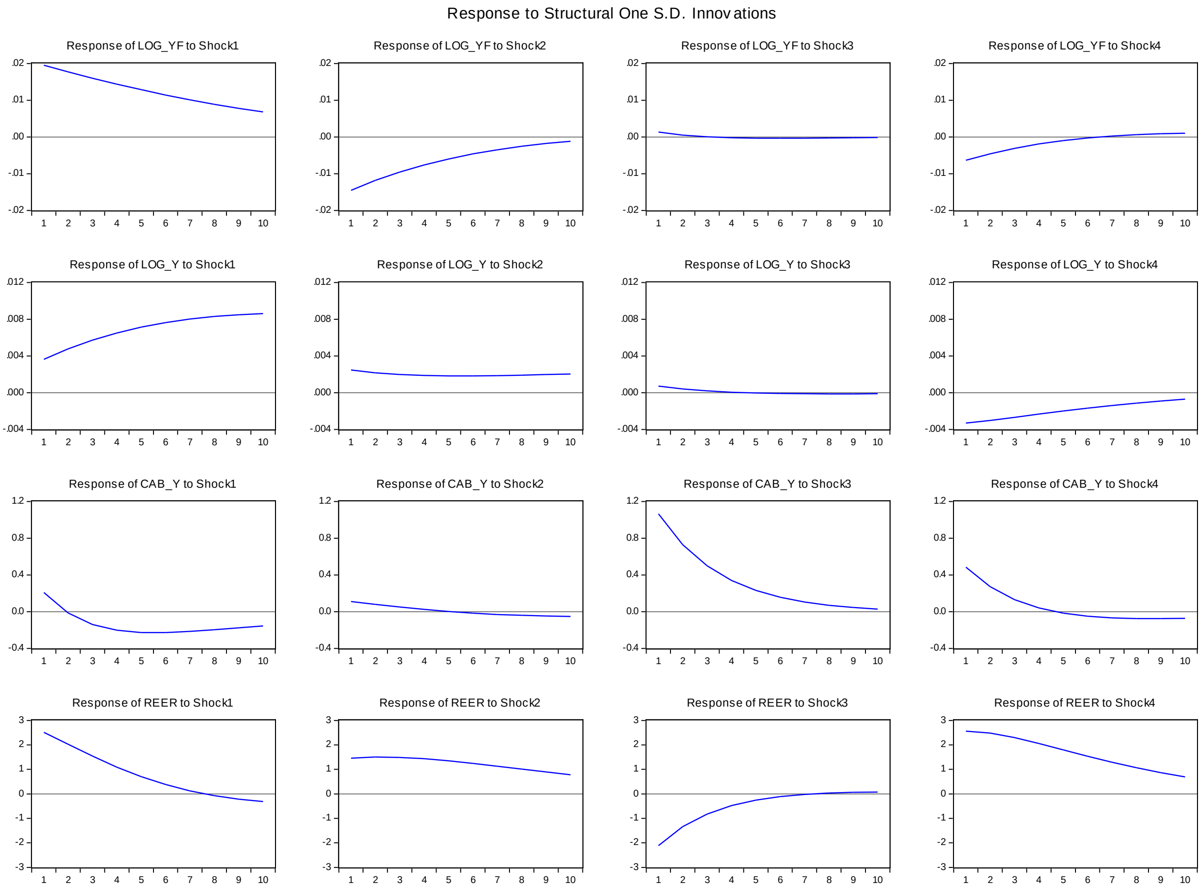
*shock 1 – ε^i; shock 2 – ε^s; shock 3 – ε^d; shock 4 – ε^n

A7: Impulse response functions of world industrial output*



*shock 1 – ε^i; shock 2 – ε^s; shock 3 – ε^d; shock 4 – ε^n

A8: Impulse responses with trade balance replaced with current account*



*shock 1 – ε^i; shock 2 – ε^s; shock 3 – ε^d; shock 4 – ε^n

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