TIPS

F O R U M 2003

2003 P A P E R S

A Structural Analysis Of The Sources and Dynamics of Macroeconomic Fluctuations in the South African Economy

Thandinkosi Ndlela , PeterNkala

Development Policy Research Unit
School of Economics, University of Cape Town

A STRUCTURAL ANALYSIS OF THE SOURCES AND DYNAMICS OF MACROECONOMIC FLUCTUATIONS IN THE SOUTH AFRICAN ECONOMY

By

Thandinkosi Ndlela

Peter Nkala

Prepared for the TIPS Annual Forum, 8 – 10 September 2003

Abstract

Since the attainment of independence in 1994 the new government in South Africa has adopted two outward looking development-oriented economic reform programmes, that is, the Reconstruction and Development Programme, (RDP) in 1994 and the Growth Employment and Redistribution (GEAR) strategies in 1996. RDP clearly outlined the broad framework of the new government's economic and social policy while GEAR clearly defined the policy instruments and objectives to be pursued from 1996 to 2001. These initiatives have however not been able to put the country on a stable growth path and only marginal growth has been realized. Both internal and external shocks have resulted in negative developments of most macroeconomic variables.

In light of the above developments, this paper provides a Vector Auto Regression (VAR) empirical analysis of macroeconomic fluctuations in the South African economy from 1972 to 2002. An analysis of the role of domestic and external factors on macroeconomic shocks is conducted through a focus on real domestic product, terms of trade, inflation, government consumption, money supply, real exchange rate, and the world interest rate. The paper also evaluates the effectiveness of South Africa's macroeconomic policy framework, with particular emphasis on its ability to counteract trade and financial shocks as well as its overall success in achieving positive structural change and a sustainable growth path.

The results indicate a general validity of the predictions of the analytical model and hence confirm macroeconomic theory postulations about the nature of the relationship between each of the variables and macroeconomic fluctuations in South Africa. The analysis shows that although the South African economy has experienced marked fluctuations in output and macroeconomic fundamentals, the economy shows resilience to permanent effects of shocks, as these tend to be short-lived and this reflects macroeconomic policy effectiveness. Money supply and world interest rates account for 30% and 18% of the output fluctuations respectively. On the other hand, real exchange rate fluctuations are more associated with monetary policy. There is strong evidence that exchange rate stability is also susceptible to external shocks.

1

ACRONYMS

FDI: Foreign Direct Investment

GDP: Gross Domestic Product

GEAR: Growth Employment and Redistribution Programme

IMF: International Monetary Fund

RDP: Reconstruction and Development Programme

SACU: South African Customs Union

SADC: Southern African Development Community

SAPC : South African Communist Party

SSA: Statistics South Africa

TIPS : Trade Industrial Policy Strategy

USA: United States of America

VAR: Vector Auto regression

WTO: World Trade Organisation

Table of Contents

Abstract……2
ACRONYMS ……3
1. INTRODUCTION ……5
1.1 Background……5
1.2 Objectives of the Study ……6
1.3 Empirical Methodology……6
1.4 Justification and Policy Relevance of the Study……7
2. THE STRUCTURE OF THE SOUTH AFRICAN ECONOMY……8
2.1 Economic Growth and Production……8
2.2 Employment and Industry Structure……8
2.3 Regional and International Trade Composition……9
2.4 Macroeconomic Policy Implementation……11
2.5 Challenges to Structural Transformation……11
3. THEORETICAL AND EMPIRICAL OVERVIEW ……13
3.1Analytical Framework……13
3.2 Review of Empirical Literature……15
4. ECONOMETRIC METHODOLOGY……18
4.1 Specification of the Vector Autoregressive Model ……18
4.2 Generalized VAR Analysis ……19
4.3 Data Definition, Unit Roots and Co-integration Tests ……20
4.4 Impulse Response Analysis and Forecast Error Variance Decompositions ……22
4.4.1 The Real Exchange Rate……23
4.4.2 The Terms of Trade ……24
4.4.3 Government Consumption……24
4.4.4 Inflation Differentials……25
4.4.5 Money Supply……25
4.4.6 The World Interest Rate……26
5 CONCLUSIONS ……27
BIBLIOGRAPHY……28
Annex A: Impulse Response Analysis……30
Annex B: Forecast Error Variance Decompositions……32
Annex 3: Generalized Impulse Response Functions……34

List of Figures

Figure 2.3: Terms of Trade Developments: 1960-2002……10

List of Tables

Table 2.2: South African Economy: GDP Contribution by Sector: (1993-2002)……9
Table 4.3 Co-integration Tests……...21

1. INTRODUCTION

1.1 Background

The relationship between macroeconomic performance and structural change remains a key issue in developing country economies. Moreover, the disappointing growth performance in sub-Saharan Africa over the past two decades has been largely attributed to the constraints imposed by institutional and economic factors. These include the lack of resource endowments, the low level of human capital, the administrative, legal and institutional framework, the stance of macroeconomic and, structural polices that have often been distortionary (Hoffmaister, Roldos and Wiekcham 1997). These factors coupled with adverse external shocks, with significant declines in terms of trade, have all contributed to macroeconomic fluctuations that have impeded growth and effective structural change in African economies (Ibid.).

In particular, the issue of sustained economic growth and stability has posed one of the greatest challenges to macroeconomic management in post independence South Africa. In real terms, South Africa's growth performance has progressively declined over the past four decades, with growth falling from an average of 4.9% per annum for the period 1960 to 1975, 2.3% during the period 1976 to 1989, and to 1.3% during the 1990s. Gross domestic product (GDP) growth, averaged 2.6% a year from 1995 to the third quarter of 2001, while average annual real GDP growth was about 1.4% per annum between 1988 and 2002. With population growth estimated at just over 2.1% a year, annual GDP per capita growth averaged a mere 0.5% (ECA 2002).

Most recent studies on the sources of macroeconomic fluctuations have found that trade shocks constitute a major factor in the poor growth performance in developing countries, particularly in Sub Saharan Africa. According to the UN ECA (1989), due to high degree of openness and the dominance of the external sector, African economies have remained highly susceptible to external shocks. These have mainly prevailed in the form of fluctuations in the prices of exported primary commodities, imported capital goods, intermediate inputs, and financial shocks, namely fluctuations in the world interest rate (Kose and Riezman, 1999).

Domestic shocks have emanated from sudden changes in macroeconomic fundamentals such as government expenditure, money supply, inflation, the emergence of perennial droughts, sudden changes in domestic interest rates and shifts in political regimes that bring high levels of uncertainty resulting in massive capital outflows. Macroeconomic shocks have been the source of high degrees of exchange rate volatility and uncertainty that has been one of the major barriers to positive structural transformation. In South Africa, external shocks have mainly been manifested through volatile capital flows that resulted from the loss of confidence among portfolio investors worldwide. Coupled with the Rand crisis that occurred in the first half of 1996, in mid-1998, and in the second half of 2001 such factors have affected the money market and reduced the confidence of both domestic producers and foreign direct investors (ECA 2002).

1.2 Objectives of the Study

The South African government in 1994, adopted the Reconstruction and Development Programme, (RDP)—which set the broad framework of the new government's economic and social policy. This was followed in 1996 by the launching of the Growth, Employment, and Redistribution (GEAR), programme—which defined policy instruments and objectives for the five years until 2001. However, despite the implementation of these economic reform initiatives, the country has since not yet been able to achieve stable and sustained macroeconomic performance. Thus although the economy has been recording positive growth in the post independence period, this has been marginal and the effect of domestic and external shocks has continued to result in negative developments in most macroeconomic fundamentals.

In light of the above, the main objective of this paper is therefore to provide a structural review of macroeconomic performance in the South African economy by analyzing the role of domestic and external factors on macroeconomic fluctuations. This will entail an evaluation of the sources of output fluctuations in the economy and the structure of their dynamic adjustment path. Furthermore, the analysis seeks to evaluate the effectiveness of South Africa's macroeconomic policy framework, with particular emphasis on its ability to counteract trade and financial shocks as well as its overall success in achieving positive structural change and a sustainable growth path.

1.3 Empirical Methodology

To investigate the dynamics and sources of macroeconomic fluctuations in the South African economy, the study employs a structural Vector Auto Regression (VAR) framework. This is in line with most recent studies that have emphasized research on the understanding and distinguishing among the factors that affect the short- and long-run behavior of macroeconomic time series. Most of these studies have found strong credibility of structural VAR modeling, as compared to static partial equilibrium models in empirical investigations of the sources of macroeconomic fluctuations (Blanchard and Quah 1989, Hoffmaister and Roldos 1997, Hoffmaister, Roldos and Wieckham, 1997 and, Kosea and Riezman, 1999).

The structural VAR model has been seen as particularly useful in modern macroeconomic analysis because it permits measurement of the importance of external versus domestic shocks. Indeed developing countries tend to be prone to sudden crises and marked gyrations in macroeconomic variables, often making it difficult to discern any type of cycle or economic regularity (Agénor, McDermott and Prasad, 2000). In its application to developing countries, the structural VAR methodology has also found empirical credibility through its ability to trace the dynamics of the recovery of the adjustment of the economy following standard economic shocks, namely world interest rates, terms of trade, supply, fiscal, and nominal shocks (Hoffmaister, Roldos and Wieckham, 1997).

1.4 Justification and Policy Relevance of the Study

Macroeconomic fluctuations are a feature of the behavior of most economies, and an understanding of their patterns and causes is important to the decisions of both policymakers and market participants. This coupled with an understanding the structure of an economy is a key requirement in the design of appropriate macroeconomic policies. In this regard, the structure of an economy is defined by its supplies of productive factors—labour, capital, and natural resources—and their employment in different uses or sectors (Chenery, Robinson and Syrquin 1986). Moreover, according to Kose and Riezman (1999), there is a large and expanding literature suggesting that a highly unstable domestic macroeconomic environment is one of the primary reasons for the poor growth performance of African countries in the last thirty years. This implies that an improvement in Africa's growth performance requires a thorough understanding of the causes of volatility in most of the economies.

In addition, a thorough understanding of the sources of macroeconomic fluctuations in African economies requires a good grasp of the impact of trade shocks, namely fluctuations in the prices of exported primary commodities, imported capital goods, and intermediate inputs, and financial shocks, namely the impact of fluctuations in the world real interest rate, on domestic economic activity. Thus the issue of whether domestic and external disturbances account for a significant fraction of macroeconomic fluctuations and how they are transmitted through macroeconomic fundamentals is not only a sufficient but also a necessary condition in the design of stabilization policies that ensure positive sustained growth and structural transformation.

The study also takes into account the fact that a major weakness in the application of traditional growth models to policy formulation therefore lies in the structural differences between industrialized and developing countries. While neoclassical growth theories have advocated the importance of moving resources from lower productivity to higher productivity uses, for example, by expanding exports or by turning from agriculture to industry, most empirical attempts have shown than such shifts are more important sources of growth in developed than in developing countries. Furthermore, neoclassical growth theory assumes that the economy has sufficient flexibility to maintain equilibrium prices, whereas the structural approach identifies conditions that hinder complete adjustment (Goodfriend and King, 1997). Indeed such structural issues hinder effective policy formulation and can only be understood within the dynamics of the sources and consequences of macroeconomic fluctuations.

2. THE STRUCTURE OF THE SOUTH AFRICAN ECONOMY

2.1 Economic Growth and Production

South Africa has the most sophisticated free-market economy on the African continent. With total real GDP of US$76 billion in 2002, it accounts for approximately 40% of all industrial output, 25% of gross domestic product (GDP), over half of generated electricity and 45% of mineral production in Africa. In terms of economic performance, the South African economy grew by 3.4% during 2000 and 2.2% during 2001. In addition, the country is by far the continent's most important source of foreign direct investment (FDI) with an average of US$1 billion investment in 1994 (ECA 2002). However, since the early 1970s a persistent downward trend characterized South Africa's growth performance in terms of real Gross Domestic Product (GDP) and real per capita GDP growth.

Moreover, this decline in growth performance has been persistent over the past four decades, falling from an average of 4.9% per annum for the period 1960 to 1975, 2.3% during the period 1976 to 1989, to 1.3% during the 1990s (Ibid). After an impressive average real growth rate of 3.3% in 1995-1996, the economy experienced a sudden slowdown. In 1997 growth declined to 1.7% before sliding back to 0.5% in 1998. According to Hartzenberg and Stuart (2002), the short-lived recovery between 1994 and 1996 raises an important question of sustainability and the role of inherent structural weaknesses in the economy. In particular, the negative growth rates recorded in the early 1990s raise a key consideration in the design of policies to ensure the achievement of a stable growth pattern. This has also been observed in the prevailing high-income distribution inequality, land redistribution problems and absolute poverty levels.

2.2 Employment and Industry Structure

The South African economy is characterized by a high degree of duality. After the Second World War, a sophisticated industrial economy sector developed alongside an underdeveloped "informal" economy. By 1960, this had become the largest and most "dynamic" productive sector, contributing more to the GDP as agriculture and mining combined. The industrial economy has over the years attained strong infrastructure and economic base with great potential for further growth and development. The "informal" sector on the other hand represents both untapped potential and a developmental challenge for South Africa (SAPC, 1999). The sectoral composition of the structure of the South African economy is illustrated in table 2.2 below.

Table 2.2: South African Economy: GDP Contribution by Sector: (1993-2002)

Sector	Percentage contribution
Agriculture and Forestry	7
Mining and Quarrying	10
Manufacturing	33
Electricity and Water	6
Construction	5
Wholesale/Retail/Hotel and Restaurants	22
Transport and Communication	16

Source: Statistics South Africa

The services (tourism, transport and business services) and manufacturing sectors are the two most important sectors respectively. The increasing contribution of transport, financial services and commerce reflect the growing contribution of the services sector. Moreover, the South African economy has experienced significant transformation in the past four decades with agriculture contributing less than 10% of total value added towards the end of the 1990s (SSA, 2002). Although the mining industry has historically occupied a dominant role in the development structure of the economy, its importance in terms of contribution to overall output in the past decade has declined from about 20% between 1975-1989 to current levels of about 10% of GDP. [1] With an industrial sector accounting for nearly a quarter of GDP by the 1990s, South Africa came to be characterized as a "middle income" country along with such countries as Brazil, South Korea, Singapore and Taiwan.

Unemployment, currently averaging about 25% to 35% of the economically active population, constitutes one of the major economic policy challenges to the South African economy. According to the ECA (2002) report, in 1995, industry accounted for 32% of formal employment in South Africa. Between 1995 and 2001, it fell by around 14%, compared with a drop in total non-agricultural employment of around 10%. In the construction sector and mining sectors, employment fell by 37% and 30% respectively, mainly reflecting a shift towards casual labour in the former (Ibid.).

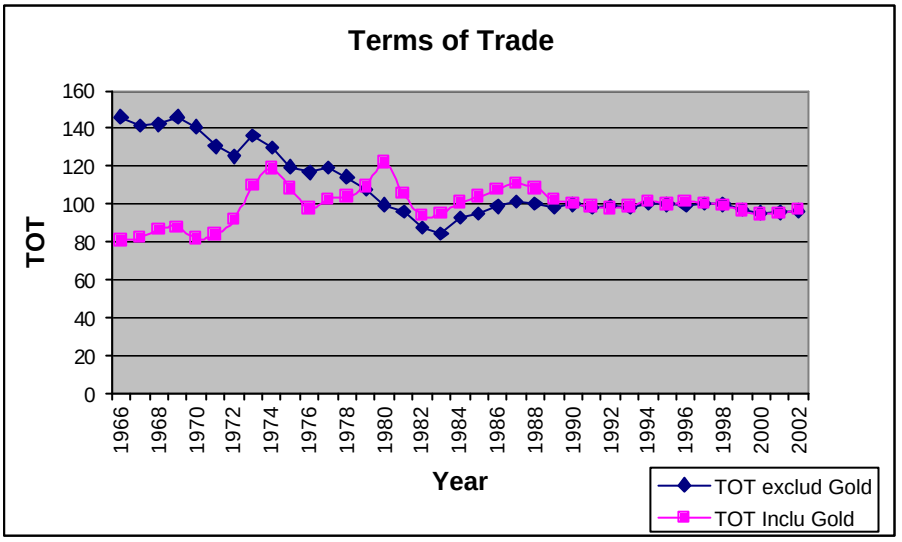
2.3 Regional and International Trade Composition

South Africa is a dominant player in the economic performance of the region. The country's sustained macroeconomic performance is attributed to a well-diversified export base that has been established in the past 10 years. South African exports increased by 695% in the last 8 years and the country is the 18th largest exporter of motor vehicles and vehicle components in the world. In 1996, the country contributed 84% of US$159.2 billion SADC total output. The country also accounts for 88% of the manufacturing sector exports from the region although other countries like Mauritius, Mozambique,

[1] South Africa's major mineral products include gold, uranium, zinc, platinum group metals, lead, diamonds, silver, iron, steel and minerals for petrochemical production while agricultural products agricultural products comprise of wheat, maize, sugar-cane, fruits, vegetables, wool, meat and dairy products.

Swaziland, Zambia and Zimbabwe have significant manufacturing sectors (Ndlela 2002). Intra-SADC cross border trade is skewed in favour of South Africa and this dominance is worrying especially at the time South Africa is considering tariff reduction for other trading blocks like the European Union. In terms of trade competitiveness, South Africa has on average experienced a 50% decline in terms of trade with the exclusion of gold. Although the terms of trade inclusive of gold have however increased by about 20% during the same period, the overall decline in the terms of trade reflects a critical weakness in the structure of the country's trade composition (see figure 2.3)

Figure 2.3: Terms of Trade Developments: 1960-2002



Source: Statistics South Africa

The main structural weakness in South Africa's trade composition is the fact that the country is a major exporter of primary and intermediate commodities to industrialized country markets. Like all developing countries, a large proportion of exports consists of unprocessed raw materials, with the mining industry contributing the greatest proportion to the country's total exports. The proportion of manufactured goods in exports has however experienced a significant rise with a higher proportion of raw materials being processed before export. Major export commodities are gold, diamonds, platinum, wool, sugar, manganese and chrome ores, asbestos, atomic energy materials and base minerals such as coal, antimony, copper and iron ore. Exports of chemicals, metal products, machinery, transport equipment and manufactured goods have increased, particularly to Africa, in recent years.

Imports consist mainly of capital goods, raw materials, intermediate goods as well as sophisticated consumer goods. South Africa maintains formal trade relations with most industrialized countries and trade with Africa, Latin America and Asia is growing. At a regional level, South Africa is a member of the Southern African Development Community (SADC) and the Southern African Customs Union (SACU). The European Union, the USA and Japan are amongst South Africa's largest trade partners.

2.4 Macroeconomic Policy Implementation

South Africa's reintegration into the world economy, which followed on the country's peaceful and successful transition to democracy in 1994, caused the domestic economy to be more prone to international economic and financial developments than in the past. In addition, although evidence over the period 1960 –1999 shows that policy generally was not supportive of long-term sustainable growth, during the last decade however, credible strides are made especially in respect of macroeconomic policy and trade liberalization (Ibid).

Monetary and exchange rate policy was strongly influenced by the interests of the gold mining industry, especially during the period 1976-1989. The interests of the mining sector, in particular gold mining are evident in exchange rate policy. From 1971 to the late 1980s exchange rate policy was designed to benefit the gold mining industry. As the gold price fell, the value of the Rand was allowed to fall; for example in 1975 it was devalued by 17.85%. A review of South Africa's policy implementation over the last four decades indicates that policy generally was not supportive of long-term sustainable growth. During the last decade however credible strides are made especially in respect of macroeconomic policy and trade liberalization (Hartzenberg and Stuart, 2002).

Thus, since the first democratic elections in 1994, the economy has undergone liberalisation of internal and external financial markets, labour markets and the trade regime. Major changes have also taken place in terms of monetary and fiscal policy, where "discipline" and "sustainability" have become the guiding principles, while industrial policy saw a shift from demand-side to supply-side measures (TIPS 2002).

2.5 Challenges to Structural Transformation

Despite South Africa's position as the biggest economy in terms of regional and international trade composition in Africa, the country still faces a number of challenges, with regards to the structure of its trade composition. Firstly, while the current strong performance of the Rand is expected to negatively affect current and future exports, the strong export base is also expected to cushion the South African economy from vagaries of international volatility. Furthermore, high inflation relative to that of trading partners is likely to have a negative effect on export competitiveness. According to the SAPC (1999) report, the following features can be observed in terms of the structure of South African exports, in particular the manufacturing sector:

- Under apartheid, the South African manufacturing industry never emerged as a significant export sector unlike the East Asian newly industrialized countries. In the 1980s for example, mineral products alone generated more than 80% of export earnings, while manufactured exports accounted for less than 10% of visible foreign exchange earnings.
- The South African manufacturing sector emerged through " import substitution" as a sector largely orientated towards producing consumer goods for higher income, namely white consumers. It was not orientated to either the production of basic

consumer goods for the majority of the people, or to producing capital goods for the means of production. Consequently, the country remained highly dependent on imported machinery, equipment and technology. Thus in the 1980s, 80% of imports were composed of capital equipment and intermediate goods.

- The manufacturing sector depended on high levels of protection, subsidy and state support. It developed on the basis of "import substitution" and a large proportion of it was relatively uncompetitive against potential imports from other countries.

The above factors, which have constituted critical vulnerabilities in the growth of the South African economy, have been characterized in the SAPC report as follows:

> This reality underlay the well-known balance of payments constraint to growth. Frequently, and to an increasing extent in the last two decades of apartheid rule, periods of boom, which were generally led by the manufacturing sector, tended to draw in imports of equipment and technology at a faster pace than foreign exchange could be earned by exports of primary products. As mineral wealth began to become exhausted, and as the terms of trade for primary products on world markets deteriorated, balance of payments crises increasingly frequently limited and aborted cycles of growth. The same realities also meant that the South African economy was highly exposed to, and dependent on, international economic relations. It became what is known as a "small, open economy" whose performance was, and still is, highly susceptible to externally controlled variables (SAPC, 1999).

Despite the structural constraints, the manufacturing export sector has great potential for growth and employment. Major constraints that undermine the growth potential of manufactured sector exports include the inability to maintain competitiveness in global market, low levels of investment rates and investor confidence, shortage of skilled labour and a labour market that is generally perceived as highly fragmented and "inflexible"[2] (Vandana 2002). In addition, the shift in globalization trend in the mid 1990s towards rapid liberalization of international trade, accompanied by falling tariffs, and the removal of other protective measures under the WTO initiative further exposed South Africa to foreign competition in the manufacturing sector. Notwithstanding, this was followed by a period of heightened free capital flows, resulting in excessive foreign currency volatility, which characterized South Africa in 1996, 1998 and in 2001.

[2] According to Vandana (2002), with the exception of government corruption, the three structural constraints - recent labour regulations, skills shortage and crime - pertain to the South African labour market. A strong nexus between these structural constraints reflects a unique past, checkered with apartheid-created distortions designed to create a Black African labour force with poor technical, managerial and entrepreneurial skills (Ibid).

3. THEORETICAL AND EMPIRICAL OVERVIEW

3.1Analytical Framework

Recent models on macroeconomic fluctuations have mainly tended to focus on the combinations of shocks and propagation mechanisms that give rise to fluctuations in economic activity (IMF, 1998). In this study, the analysis of the dynamics of domestic and external shocks in the South African economy, is based on the adoption of a small open economy macroeconomic model in line with Hoffmaister and Roldos (1996), Hoffmaister, Roldos and Wieckham (1997). The model assumes a small open economy that produces an exportable (Y_x) and a non-tradable good (Y_n) using imported intermediate inputs. The tradable goods sector uses capital (K_x) and labour (l_x) as well as an intermediate input (M). Optimization in consumption and production decisions results in the equality of marginal rates of substitution and transformation, leading to an equilibrium real exchange rate (Q). Total GDP is denoted as

$$Y_t = Y_x + QY_n \quad \text{.....(3.1)}$$

[3]Using lower-case letters to denote the logs of uppercase variables, the logarithm of total GDP can be expressed as follows:

$$y = a_1 a_x - b_1 p_{m_t} + g_1 k_t + d_1 (k_t - l_t) \quad \text{.....(3.2)}$$

Where p_m is the domestic price of the intermediate inputs in terms of the exportable good inclusive of the tariff. The first two terms in equation (3.2) represent supply shocks that enter asymmetrically in the model. For most developing agrarian-based economies, changes in a_x could be due to shocks on agricultural output as a result of sudden changes in weather patterns. An increase in the price of intermediate inputs (p_m) is tantamount to a reversal of technological progress. This second term can be decomposed into the world price of intermediate inputs, p^*_m and the tariff rate, t. The specification thus allows for the modeling of the impact of structural reforms such as trade liberalization and terms of trade shocks on aggregate supply. Higher trade taxes reduce the marginal product of capital and can lead to either a lower level of GDP or a reduction in the growth rate.

Structural reforms that eliminate macroeconomic distortions or lead to an improvement in the terms of trade triggers a positive response in log-run total output. Capital stock, denoted by the (log) capital stock, k_t, and the (log) capital/labour ratio, (k_t - l_t), responds endogenously to the different shocks. The long-run level of output therefore depends on the level of the technology (a_x), the domestic price of imported intermediate goods, (p_m), fiscal policy (g), and the endogenous response of the capital stock (k) (Hoffmaister and Roldos 1996). Furthermore, the model assumes that a fraction d of the technological progress generated in the industrial countries will exert spillover effects on the small open economy. Thus the level of technology, $a_x = dy^*$ where y^* is output in the industrial countries and d is an inverse measure of the barriers to technology adoption in the small country's due to its degree of openness as well as the level of human capital (Ibid.).

[3] Y_x is the total value of tradable goods produced in the economy and QY_n, the product of the real exchange rate and the quantity of non-tradables (produced using imported intermediate inputs whose price is in foreign currency) denotes the value of non-tradables in domestic currency.

With respect to demand shocks, an increase in government expenditure, *g*, leads to an rise in the demand for non-tradables. A fiscal expansion thus causes a shift in the structure of demand—hence production—from tradable to non-tradable goods. However, as shown in Hoffmaister and Roldos (1997), an increase in government expenditure results in a decline in the capital stock. Thus, although the model suggests that an expansion in government spending increases GDP in the long run, its effect of reducing the capital stock makes its overall effect ambiguous. Furthermore, a fiscal expansion could in the long run, result in an increase in distortionary taxes, thus reducing total output.

The effect of external shocks is incorporated by assuming that individuals have access to international capital markets, where they borrow an amount, *D*, at the world interest rate *r**. In the long, under perfect capital mobility, the marginal productivity of capital, determined by the capital/labour ratio equals r*, the world interest rate. The effect of a shock in the world interest rate is thus captured by $d_1(k_t - l_t)$, the capital-labour ratio, in (3.1). An increase in world interest rate tends to have a contractionary effect on output. In terms of the response of the real exchange rate and trade balance, excess demand pressures lead to real exchange rate appreciation and a worsening trade deficit. The long-run response of the (log) real exchange rate, q, to the differential shocks is therefore:

$$q_t = a_2 a_{x_t} - b_2 p_{m_t} + g_2 k_t + d_2(k_t - l_t) \quad \text{.....(3.3)}$$

Structural shifts that lead to an increase in output or supply of goods in the economy constitute positive supply shocks. These shocks, which may result from factors such as technological expansion in the tradable goods sector, a bumper agricultural output, trade liberalization, as well as an improvement in the terms of trade, lead to a real exchange rate appreciation. This is because the positive wealth effects of these trade shocks stimulates demand for non-tradables, which is met by a reallocation of labour to the non-traded goods sector, due to the increase in the relative price of the non-traded goods.

In the framework, the real exchange rate also appreciates due to an increase in government expenditure, implying a negative wealth effect[4] of government spending on total output. Because government spending is biased towards non-tradable goods, the relative price of the non-tradables should increase in order for the economy to attain a new equilibrium. The fiscal expansion leads to a decline in the capital stock, which has a first order effect on the real exchange rate, but a negligible effect on the level of total GDP. It also causes a reduction in the trade surplus as the decline in the capital stock leads to a lower steady-state level of the external debt and interest payments. An increase in world interest rates leads to a larger trade surplus, as the fall in domestic absorption relative to output accommodates the increased interest payments. The model assumes that there is long run neutrality of money and the nominal exchange rate and, includes a general unspecified equation to capture the evolution of the price level.

[4] Government compete with the private sector in buying goods. An increase in government spending on non-tradables leads to an upward pressure on domestic prices and a real exchange rate appreciation. As the price level rises, the real value of foreign currency dollar-denominated assets declines (real wealth declines). This decline in wealth results in a decline in consumption spending. This affect is also called the real-balance effect (or Pigou effect)

3.2 Review of Empirical Literature

Macroeconomic fluctuations, in particular, sudden and often negative variations in output and economic fundamentals pose major limitations in the design of sound economic and stabilization policies. Indeed most recent literature does confirm that a highly unstable domestic macroeconomic environment is one of the primary reasons for the poor growth performance of African countries in the last thirty years (Koze and Riezman 1998, Collier and Gunning 1999, Sachs and Warner 1996 and Rodrick 1998). Thus, the need to establish why African economies are so volatile constitutes a major prerequisite to improving their growth performance (Koze and Riezman, 1998). This is despite the fact that traditional stabilization programs that were designed to achieve a viable balance of payments, long-term economic growth and price stability, have scored limited success in most developing countries (Doroodian, 1994).

Moreover, countries that have pursued distortionary macroeconomic policies, including high inflation, large budget deficits and misaligned exchange rates, appear to have suffered higher levels of macroeconomic volatility and, slow growth during the postwar period (Acemoglu, Johnson, Robinson and Thaicharoen, 2002). This general finding has received wide empirical support in developing countries. In particular, Mariotti (2001), in an examination of the impact of economic policy on long-run economic growth in South Africa, found significant evidence of the negative impact of high government consumption expenditure and a high inflation rate on output. The results of the study illustrate the existence of a point beyond which any further increases in either government consumption expenditure or the inflation rate will lead to a decline in output. The results, which are consistent with mainstream macroeconomic theory, imply that there is limited scope for demand-side stimulus to long-run growth (Ibid).

Other consistent findings by Acemoglu, Johnson, Robinson and Thaicharoen (2002), using the case of Ghana and Argentina have found that policies often blamed for crises and poor macroeconomic performance include excessive government spending, high inflation, and overvalued exchange rates. The study concludes that the macroeconomic crisis in Argentina was caused by an overvalued exchange rate. The relatively high inflation in Ghana since independence in 1957 until the early 1980s, coupled with the one of the most overvalued exchange rates, does provide strong confirmation that bad polices are to blame for macroeconomic fluctuations (Ibid).

Studies emphasizing the role of exchange rate polices on growth have provided support on the credibility of floating exchange rate regimes in output growth. Edwards and Yeyati (2003) in a analysis of whether negative and positive terms of trade shocks have asymmetric effects on growth, and whether the magnitude of these asymmetries depends on the exchange rate regime found that terms of trade shocks get amplified in countries that have more rigid exchange rate regimes. In addition their results give evidence of an asymmetric response to terms of trade shocks: the output response is larger for negative than for positive shocks. The final evidence points to the fact that after controlling for other factors, countries with more flexible exchange rate regimes grow faster than countries with fixed exchange rates (Edwards and Yeyati 2003).

In addition to the role played by distortionary policies in triggering negative output response, other studies, have emphasized the impact of external shocks on output fluctuations. Kose and Riezman (1999), in a study of trade shocks and macroeconomic fluctuations in Africa, document the relationship between some of the major characteristics of industrial structure, composition of international trade, and the dynamics of trade shocks. They also provide empirical evidence that there is a strong link between international trade disturbances and domestic economic activity in African countries. Major findings by Kose and Riezman (1999), indicate that, despite the fact that these countries are typically heavily indebted, trade shocks play a much more important role in triggering macroeconomic fluctuations than financial shocks. In particular, they show that trade shocks explain almost half of the volatility in aggregate output. International trade can induce macroeconomic fluctuations in a small open economy through trade in goods and services, and in financial assets. In African economies, the following channels have distinctive roles in shaping domestic economic activity:

- Firstly the volume of international trade on average accounts for more than 70% of the aggregate output in these countries. Moreover, a narrow range of primary commodities constitutes a significant fraction of exports, and they mainly import intermediate inputs and capital goods. Their export revenues are highly unstable due to recurrent and sharp fluctuations in the prices of primary commodities.
- Second, most of the African countries are heavily indebted, and a significant fraction of their export revenues are used to meet their debt service obligations. These make African countries extremely vulnerable to sudden changes in the world interest rate.

According to Kose and Riezman (1999), trade shocks were observed to have a direct impact on output fluctuations where the major economic sectors relied mainly on imported goods as factors of production. The results show that a significant fraction of the macroeconomic volatility in the final goods sector, which heavily relies on imported intermediate inputs and domestic capital goods, was explained by the trade shocks. Interestingly, trade disturbances were found to play a more important role in explaining consumption fluctuations than they do in output variation (Ibid.)

Hoffmaister, Roldos, and Wickham (1998) in an estimation of a structural VAR model, examined the role of terms of trade, world output, domestic supply, fiscal policy, and nominal policy shocks to analyze the sources of macroeconomic fluctuations in Sub-Saharan Africa. Their results suggest that terms of trade shocks play only a minor role in accounting for aggregate output fluctuations. Domestic shocks were however found to be the main sources of macroeconomic fluctuations, in particular supply shocks. Mendoza (1995) in a similar analysis found that terms of trade shocks explain roughly half of the output volatility in developing countries.

In support of the theory of trade shocks, Agénor, McDermott, and Prasad (2000), found that business cycle conditions in industrial economies could influence fluctuations in developing economies through the world real interest rate. The world real interest rate affects economic activity in the developing world, through its effects on domestic interest

rates. It also reflects credit conditions in international capital markets that may be especially important for developing countries that do not have well-developed domestic capital markets. Thus, real interest rates in industrial countries tend to be positively associated with output fluctuations in middle-income countries. On the other hand, the fiscal impulse is negatively correlated with the business cycle (Ibid.)

Contrary to most of the findings on the negative impact played by external trade shocks and domestic macroeconomic policies in dampening output, other studies provide support to the positive effect of structural shocks on output response. Hoffmaister and Roldos (1996) highlight the effects of a positive supply shock in Brazil and Korea in the form of an import tariff reduction or more generally a structural reform that increases efficiency, and leads to an expansion of output. In Brazil however, it was observed that a fiscal expansion has a strong effect on GDP, followed by a dampened cycle. This response is consistent with the Keynesian view of fiscal policy, as Brazil's efforts to consolidate its fiscal policy were not sustained during the sample period. In addition, monetary and exchange rate shocks were found to have a contractionary effect on aggregate output.

Overall, the empirical evidence illustrates that positive productivity shocks stimulate the economy and cause short-lived expansions. Adverse trade disturbances however result in negative income effects, a fall in consumption, and contraction in demand for productive inputs. Furthermore, trade shocks lead to prolonged recessions due to their detrimental impact on aggregate investment. In addition, recent perspectives indicate that macroeconomic performance in most developing countries may reflect not only the effect of distortionary macroeconomic policies, but also the deep institutional causes leading to these particular macroeconomic policies. Acemoglu, Johnson, Robinson and Thaicharoen, (2002) conclude that both poor macroeconomic performance and distortionary policies are symptoms rather than causes, of crises. Thus they conclude that although unsustainable policies will necessarily lead to some sort of crisis, perhaps one critical factor is that, in institutionally-weak societies, elites and politicians will find various ways of expropriating different segments of the society, ranging from microeconomic to various macroeconomic policies. It is the presence of this expropriation and the power struggle to control the state and take advantage of the resulting rents that underlies bad macroeconomic outcomes and volatility (Ibid.).

A summary of the studies reviewed indicate that adverse macroeconomic fluctuations are bound to present one of the major constraints to policy makers in low and middle-income countries. This is because the objectives of macroeconomic policy have long included the avoidance of protracted recessions in which resources are underutilized, and periods of unsustainable growth that jeopardize reasonable price stability. Similarly, market participants implicitly or explicitly assess current and prospective economic conditions when weighing risks and making choices about saving and investment plans and portfolio allocation. In this regard, a central implication of New Keynesian theories is that economic policy matters and that policy measures can help to stabilize the economy, particularly in cases where contractions in activity are induced by bouts of pessimism economic performance.

4. ECONOMETRIC METHODOLOGY

4.1 Specification of the Vector Autoregressive Model

In order to analyze the sources and dynamics of macroeconomic fluctuations in the South African economy, we develop Vector Autoregressive model (VAR) linking real output, the world interest rate, the terms of trade, the real exchange rate, government expenditure, inflation differentials and money supply. In developing the methodology, we consider a theoretical framework denoting a univariate time series y_t and a forecast $h = 1$ period into the future.

According to Lutkepohl (1993), given that y_t is the value of the variable of interest in period t, the forecast for period $T + h$, made at the end of period T, may have the form

$$\hat{y}_{T+h} = f(y_T, y_{T-1}, \ldots), \quad (4.1)$$

where f(.) denotes some suitable function of past observations $y_T, y_{T-1}, \ldots$ If (4.1) is a linear function, we have

$$\hat{y}_{T+1} = v + a_1 y_T + a_2 y_{T-1} + \ldots \quad (4.2)$$

Assuming that only a finite number p, say of past y values are used in the prediction formula we get

$$\hat{y}_{T+1} = v + a_1 y_T + a_2 y_{T-1} + \ldots + a_p y_{T-p+1} \quad (4.3)$$

Because the true value y_{T+1} will not be exactly equal to the forecast $\hat{y}_{T+1}$, the forecast error is denoted as $u_{T+1} = y_{T+1} - \hat{y}_{T+1}$ so that

$$y_{T+1} = \hat{y}_{T+1} + u_{T+1} = v + a_1 y_T + \ldots a_p y_{T-p+1} + u_{T+1} \quad (4.4)$$

Assuming that the numbers are realizations of random variables and that the same data generation law prevails in each period T, (4.4) has the form of an *autoregressive process*

$$y_t = v + a_1 y_{t-1} + \ldots a_p y_{t-p} + u_t \quad (4.5)$$

where the quantities, y_t, $y_{T-1}, \ldots y_{T-p}$, and u_t are random variables. The specification assumes that the forecast errors u_t of different periods are uncorrelated for $s \neq t$. In the case of a multiple time series an extension of (4.3) will be given by

$$\hat{y}_{k,T+1} = v_k + a_{k1,1} y_{1,T} + a_{k2,1} y_{2,T} + a_{kK.1} y_{K,T} + \ldots + a_{k1,p} y_{1,T-p+1} + \ldots a_{kK,p} y_{K,T-p+1} \quad (4.6)$$

where $k=1,\ldots K$.

Letting $y_t := (y_{1t}, \ldots, y_{Kt})'$, $\hat{y}_t := (\hat{y}_{1t}, \ldots, \hat{y}_{Kt})'$, $v := (v_1, \ldots, v_k)'$ and that A_I is a KxK matrix of coefficients, then (4.6) can be written as

$$\hat{y}_{T+1} = v + A_1 y_T + \ldots + A_p y_{T-p+1} \quad (4.7)$$

If the y_t are regarded as random vectors, this predictor is the optimal forecast obtained from a vector autoregressive model of the form

$$y_t = v + A_1 y_{t-1} + \ldots A_p y_{t-p} + u_t \quad (4.8)$$

where the $u_t = (u_{1t},\ldots,u_{kt})'$ form a sequence of independently identically distributed random K-vectors with zero mean vector (Lutkepohl, 1993).

In addition to the basic analytical framework discussed in section 3.1, the dynamic VAR specification is extended to capture the role of the "New Keynesian" models of the business cycle which emphasize the effect of demand shocks in causing economic fluctuations. This extension is based on the emphasis placed by traditional Keynesian theories that focus on the roles of aggregate demand and market failure in causing macroeconomic fluctuations (IMF, 1998). In the Keynesian framework, prices and wages are assumed to adjust only slowly in response to disturbances. The relatively slow adjustment of prices and wages is attributed to the environment of imperfect information in which economic agents have to make decisions. Consequently, markets for both goods and labor fail to clear instantaneously, and a variety of aggregate demand shocks can cause fluctuations in economic activity and employment. The effect of the aggregate demand shocks is captured by adding government expenditure, inflation differentials and broad money supply to the analytical model in 3.1.

The main justification for the model specification is that policy induced shocks have been found to be the main sources of explaining fluctuations in aggregate output. According to the IMF (1998), old as well as New Keynesian theories argue that both anticipated and unanticipated changes in monetary policy can cause fluctuations in output. Exogenous disturbances to either consumption or investment, arising perhaps from shifts in the degree of optimism or pessimism in the economy, can also be sources of fluctuations in aggregate output and employment. This includes cases where such sentiments are not warranted by objective changes in economic fundamentals. Thus, economic fluctuations can arise solely because of self-fulfilling changes in expectations.

4.2 Generalized VAR Analysis

To analyze the sources and dynamics of macroeconomic fluctuations in the South African economy, we compute variance decompositions and impulse response functions in a "generalized" VAR framework, as proposed by Koop, Pesaran, and Potter (1996). The choice of the generalized methodology is justified on grounds that it does not suffer from the "compositional effect" inherent in standard VAR analysis (Agenor, et al 1997). Variance decompositions and the impulse response functions derived from standard VAR analysis depend on the ordering of the variables used to obtain orthogonal shocks. As a result of this dependence, a change in the ordering of the variables changes the implicit linear combination of the VAR innovations used to obtain the orthogonal shock, that is, changing the ordering changes the "composition" of the orthogonal shocks (Ibid.).

Thus, the main aim in using the generalized VAR analysis is to circumvent the problem of dependence of the orthogonalised impulse responses on the ordering of the variables in the VAR. In the case of impulse response functions, if a VAR is subjected to an orthogonal shock, the impulse responses trace out the dynamic response of the model to that shock. Implicitly these impulse responses compare the evolution of the model following the shock to a baseline model not subject to that shock. Generalized impulse

responses build on this idea through comparing the average dynamic response of the model given a typical historical shock and the history of the model compared to the "average" baseline model not subject to the shock (Agenor, *et al* 1997). The adoption of this methodology therefore avoids the problem of causality that is inherent in orthogonalised VAR analysis.

4.3 Data Definition, Unit Roots and Co-integration Tests

In line with the analytical frame, we formulate a generalized VAR model of real output as a function of real exchange rate, the terms of trade, government expenditure, the inflation differential, money supply and the world interest rate. All variables are defined in real terms. The general model is expressed as:

$$output = F(RER, TOT, g, IDFF, MS, IW) \quad \text{.....(4.9)}$$

Where *RER* is the bilateral real exchange rate with the US dollar, *TOT* is the terms of trade, *g* is real government consumption, *IDFF* is the inflation differential, *MS* is money supply and *IW* is the world interest rate. The estimation uses data obtained from the IMF International Financial Statistics and the South African Reserve Bank. Government expenditure is adjusted using the GDP deflator in order to get the real effects of fiscal policy. All real variables and indices are based on the 1995 base year. The inflation differential is calculated as the difference between South African inflation and the inflation level for industrialized countries, who form the major trading partners.

The US Treasury bill rate is used a proxy for the world interest rate. The real exchange rate denotes the SA-US bilateral real exchange, which is the nominal exchange rate adjusted for price level differences and is expressed as follows:

$$RER = e = \frac{EP_T^{US}}{P_{SA}} \quad \text{.....(5.0)}$$

Where $P^{US}{}_t$ is US consumer price index, E is the nominal exchange rate, denoting the number of Rands per US dollar while P_{SA} is the consumer price index in South Africa. The terms of trade data, obtained from the South African Reserve Bank, are inclusive of the price of gold.

The model is estimated for the period 1972 to 2002 using natural logarithms of the endogenous variables. Unit root tests are conducted in order to determine the time series properties of the data. This is because economic time series are often non-stationary, as their means and variances change over time. Thus, a necessary condition for fitting trending data is that the variables share the same trend; otherwise, there is no meaningful statistical relation between them. Testing for co-integration is a way of finding out if the data has a common trend, or if they tend to drift apart as time increases. Non-stationary variables are differenced. The model requires the use of stationary data that is co-integrated of the same degree. Augmented Dickey Fuller stationarity tests indicate that all variables become stationary after first differencing. Table 4.3 illustrates the cointegration tests used to confirm the number of cointegrating vectors.

Table 4.3 Co-integration Tests

Co-integration with unrestricted intercepts and unrestricted trends in the VAR
Co-integration LR Test Based on Maximal Eigen-value of the Stochastic Matrix
29 observations from 1974 to 2002. Order of VAR = 1.
List of variables included in the co-integrating vector:
DRGDP
List of I(0) variables included in the VAR:
DRER DTOT DG DIDIFF DMS
DIUS
List of eigen-values in descending order:
.47988

Null	Alternative	Statistic	95% Critical Value	90% Critical Value
r = 0	r = 1	18.9570	11.5400	9.7500

Co-integration with unrestricted intercepts and unrestricted trends in the VAR
Co-integration LR Test Based on Trace of the Stochastic Matrix

29 observations from 1974 to 2002. Order of VAR = 1.
List of variables included in the co-integrating vector:
DRGDP
List of I(0) variables included in the VAR:
DRER DTOT DG DIDIFF DMS
DIUS
List of eigen-values in descending order:
.47988

Null	Alternative	Statistic	95% Critical Value	90% Critical Value
r = 0	r = 1	18.9570	11.5400	9.7500

Cointegration with unrestricted intercepts and unrestricted trends in the VAR
Choice of the Number of Cointegrating Relations Using Model Selection Criteria

29 observations from 1974 to 2002. Order of VAR = 1.
List of variables included in the co-integrating vector:
DRGDP
List of I(0) variables included in the VAR:
DRER DTOT DG DIDIFF DMS DIUS
List of eigen-values in descending order:

Rank	Maximized LL	AIC	SBC	HQC
r = 0	-304.0619	-312.0619	-317.5311	-313.7748
r = 1	-294.5834	-303.5834	-309.7362	-305.5104

AIC = Akaike Information Criterion SBC = Schwarz Bayesian Criterion
HQC = Hannan-Quinn Criterion

The order of the VAR was determined using Akaike's information criterion. Based on the general criterion that an extra variable should be included in the model only if it decreases the Akaike information criterion, the optimal order of the VAR is found to be equal to one. The results using the maximum eigen-value and the trace of the stochastic matrix reject the presence of more than one co-integrating vectors.

4.4 Impulse Response Analysis and Forecast Error Variance Decompositions

In order to determine the dynamics and structure of macroeconomic fluctuations in South Africa, we generate generalized impulse response to a unit shock on each of the variables. Forecast error variance decompositions are also generated to capture the proportion of the variation in output and all the endogenous variables explained by a shock in each of the system variables. Detailed impulse response and variance decomposition results are presented in Annex 1 and 2, while graphical illustrations of the impulse responses are presented in Annex 3. The results indicate a general validity of the predictions of the analytical model. The graphical analysis also confirms the tendency of the system to revert to a steady state after an initial shock. Generally the period required for stabilization after an initial shock is less than ten years for all the variables, with an average of about six years. The real exchange rate appears to have the greatest volatility in response to an initial shock as compared to all other variables as well as the length of time required to achieve equilibrium.

Overall, changes in output are shown to have a positive relationship with the real exchange rate; thus confirming the effectiveness of currency devaluation in enhancing export competitiveness and hence growth. There is a positive relationship with the terms of trade that persists after the third year, a unit shock on output, though associated with a small and less than proportionate change in output, is positive up to the fourth year. The negative relationship that exists between the seventh and eighth horizon is an indication of the negative inflationary pressures that can build up with a further increase in money supply. The world interest rate also moves in the same direction with real output up to the fourth horizon while the effect of an increase in government consumption triggers an increase in output for the first two years before exerting a negative influence during the third year. This result is in line with the general Keynesian postulation on the effects of a fiscal expansion on aggregate demand.

An overview of the generalized impulse response and forecast error variance indicates that in general, the effects of macroeconomic shocks in the South African economy are short lived – and on average die out within a five year medium-term period. Due to this observation, the forecast period is limited to a ten-year horizon. The graphical illustrations do confirm the tendency of impulse response to die out within a reasonable short period of time; generally stabilizing to equilibrium within the fifth year after the shock is initiated. Such an observation could be an indication that although the South African economy has witnessed significant structural shifts and changes in output within the last three decades, it has generally exhibited strong resilience to domestic and external shocks. The large size of the economy in relation to the overall economic performance of Sub Saharan Africa makes the economy relatively resistant to the permanent effects of macroeconomic shocks. Moreover, this could also reflect the success of the South African government towards maintaining sound and flexible macroeconomic policies, even within the era of international economic sanctions that were imposed during the apartheid rule. A detailed analysis of the dynamics and sources of macroeconomic fluctuations is presented below.

4.4.1 The Real Exchange Rate

Following the Rand crisis that gripped the economy towards the end of 2001, the impact of real exchange rate competitiveness has since been a subject of considerable debate. Impulse response function illustrates that output exhibits a cyclical response with to real exchange rate devaluation[5]. The results show that a 1% shock in the real exchange rate, equivalent to a real depreciation, triggers a very small response in real output of 0.1% in the immediate period. This is followed by a –0.6% and –0.4% contraction in output after the first and second year, before reverting to positive growth impact from the fourth to the sixth year. [6]

In addition, the variance decomposition illustrate that shocks in the real interest rate account for 0.39% of the variation in real output. This figure rises and stabilizes at about 2.2 – 2.0% after the first year. The analysis also shows that on average, over 63% of the variation in the real exchange rate is due to its own innovations. With respect to other variables, shocks in the real exchange rate were found to have a major effect on government consumption. It accounts for about 18% of the variation in government expenditure in the immediate period, and declines to 15% before stabilizing to about 9% after the fifth year.

The results on the macroeconomic implications of a shock in the real exchange rate show that the general elasticity devaluation pessimism may to a large extent characterize the behaviour of the South African economy. These findings also find strong support from Vandana (2002) who notes that the series of real and significant depreciations since 1996 did not help much in raising export growth. This is because South Africa exports to niche markets where demand is necessarily small and relatively price-inelastic. Instead, the depreciation of the exchange rate had other deleterious economic effects such as erosion of investor confidence and a pass-through to real wages (Ibid).

Thus, consistent with the general stylized facts of most developing countries that are net importers of capital equipment and exporters of primary products, the impact of a positive shock in the exchange rate reflects the inelastic nature of exports. In the case of South Africa, this could be accounted for by the fact that about 80% of exports are from the mining sectors, which has faced an acute decline in the terms of trade since the early 1970s. Thus, the impact of devaluation could be felt much strongly in the rising price of critical imports that are necessary for the growth of the domestic industry than in increased export earnings, which stimulate further growth.

---

[5] For the ten year forecast horizon, the contractionary-expansionary response cycles of output to real exchange rate devaluation have a duration of two years up to the fourth year, after which it averages three years for the remainder of the forecast period. In the long run, 1% devaluation has a positive impact on output. The results are in agreement with Reinhart and Reinhart (1991) and Kamin and Klau (1998), in which it was found that devaluation is not contractionary in the long run.

[6] It is possible that the direct expansionary effect of devaluation on output may be offset by contractionary effects in the short run (J-curve effect), but that over a longer period, a sustained real devaluation would promote growth. The observed cyclical response between devaluation and growth in South Africa may merely reflect the fact that in general real depreciation have never been pursued long enough to allow sustained positive growth effects to become evident.

4.4.2 The Terms of Trade

International terms of trade are defined as the ratio of the price of exports to imports. Theoretically, positive terms of trade shock will result in a contraction in the output of non-tradable goods. The resulting excess demand in the non-traded goods market lowers the trade balance and the effects on the external schedule depends on whether the real value of total traded goods output increases or decreases. The value of the traded goods output will increases through the income effect arising from the higher relative price of exportable and a substitution effect arising from the absorption in the exportable sector of labour released by the non-traded goods sector. These income and substitution effects reinforce each other and cause the RER to appreciate in order to maintain the trade balance at its sustainable level (Montiel, 1999).

The same effect can be observed in the case of South Africa, where the results show that a unit shock in the terms of trade is related to an exchange rate appreciation in the immediate period up to the fourth year. The real appreciation is however very small, averaging less than 2% in the first four-year horizon. Thus, although South Africa currently pursues a freely floating exchange rate regime, the fact that historically, exchange rate policy has tended to follow the interests of the mining sector could possible introduce some degree of rigidity in float and account for the observed RER response.
In terms of output response, a unit positive shock is followed by a positive, though less than proportionate increase in real GDP, averaging about 0.6% in the immediate period. The terms of trade are however observed to account for about 18% and 20% of the variation in output during the first and second forecast horizon. On average, the effects of a shock in the terms of trade are well pronounced on output.

4.4.3 Government Consumption

The effects of a unit positive shock on government expenditure are a 0.6% increase in real output, which is however immediately followed by a 0.2% contraction after the first year. This contraction persists, though on a very small magnitude up to the fourth year, after which the economy experiences a very small growth impact. In terms of the forecast error variance decompositions, shocks in government expenditure account for about 9% of the variation in real output. On average, shocks in government expenditure account for about 15% of the variation in output and about 10% of the changes in money supply.

The limited extent to which an economy can apply expansionary polices to boost aggregate demand is indeed reflected in the nature of the results. In particular, the fact that a unit shock in government expenditure triggers a worsening terms of trade is an empirical fulfillment of the Keynesian analysis, which predicts that an increase in government expenditure results in an increase in the demand for non-tradables, hence an increase in their price. The real exchange rate however does not appreciate, as it is largely influenced by external shocks reflected in the price of mineral products that constitute about 80% of export earnings.

4.4.4 Inflation Differentials

A positive shock in inflation differentials is defined by widening of the gap between domestic and industrialized country inflation. In South Africa, increases in the inflation differential have mainly been due to either a rise in domestic inflation or a fall in industrialized country inflation. The impact of a unit increase in inflation is a 0.5% and 0.7% decline in real output in the first two years. Although the real exchange rate depreciates in the second year, the overall impact of an increase in the inflation differential is a real appreciation. In the medium to long run, an increase in domestic inflation will, in the absence of an exchange rate depreciation lead to an appreciation of the external real exchange rate by increasing the domestic price of nontradables relative to their foreign price. Consistent with mainstream theoretical predictions, the rise in the inflation differential is also accompanied by an increase in money supply during the first three years. Real government consumption however falls in response to the declining purchasing power of the Rand. The variance decompositions indicate that shocks on the inflation differential account for about 14% of the variation in output.

4.4.5 Money Supply

Generally, the dynamic impact of broad money supply is a useful indicator of the effectiveness of a country's monetary policy. The results show that a unit shock in money supply results in a more than proportionate 1.2% shock in real output in the immediate period. This is consistent with the neoclassical analytical framework, which states that sudden monetary policy shocks may generate a short run deviation of output from its capacity level. Conversely, an increase in output will be accompanied by a rise in money supply to compensate for the increase in money demand due to higher output growth. However, in the long run, the exchange rate and prices will adjust and output returns to its capacity level. The real exchange rate depreciates by at most 2.5% between the first and fourth years while government consumption expands by about 2% in the first two years of the duration of the shock.

On average, the shocks in money supply account for about 30% of the improvement in real output in the immediate period. This declines to about 18% after the first year and stabilizes at an average of about 14% after the fourth year. Such a trend reflects the overall strength of monetary policy in driving economic. Also interesting to note is that, shocks in money supply are related to real exchange rate devaluation and that the biggest impact of shocks in the money supply is felt in the real exchange rate. About 31% of the variation in real exchange rate after the second year of the impact of the shock is explained by monetary policy innovations. Thus, it can be concluded that monetary policy exerts a very significant impact on the behaviour of the real exchange rate and should therefore be treated as one of the major targets of exchange rate management[7].

[7] Such behaviour of real exchange rates under floating exchange rate regimes is consistent with the observations that the exchange rate tends to behave like an asset price, being extremely responsive to changes in expectations and availability of new information (see Edwards 1998). This is also a manifestation of the Dornbusch (1976) overshooting model whereby a monetary expansion will result in an instantaneous jump of the nominal exchange rate that will exceed the long-run equilibrium nominal depreciation where domestic prices of non tradables are sticky (Ibid).

The fall in interest rates that was reflected in Treasury bill rate declining from about 16.5% in 1998 to about 9.7% in the end of 2001 was accompanied by massive capital outflows that triggered the Rand devaluation crisis.

4.4.6 The World Interest Rate

The world interest rate is proxied by the US Treasury bill rate and captures the effect of changes in industrialized country macroeconomic and financial conditions in the South African economy. In line with theoretical predictions, a unit positive shock on the world interest will result in an immediate proportionate change in real output. The effect is positive though declining after the first and second years. It becomes negative in the fourth and fifth forecast years. This impact of the world interest rate which acts through influencing changes in the domestic interest rates and also reflects attractive credit conditions in the international capital markets however persists only in the short run. By reducing the interest rate differential in favour of international capital markets, increases in the world interest rate could trigger capital outflows particularly in developing countries where capital markets are less advanced and less sophisticated.

Variations in the world interest rate also account for a significant proportion of output, which is about 18% in the immediate period and declines to an average of 12% in the forecast period. Furthermore, the results also show that changes in the world interest rate account for the biggest proportion of changes in the real exchange rate. This proportion increases from about 6% in the immediate period to about 17% after the first year, and thereafter they resort to a permanent effect of about 25%. The observation verifies that the changes in the world economic and financial conditions have a significant effect on real exchange rate of emerging market economies. Their high degree of openness and susceptibility to the vagaries of international capital markets are a major factor that developing countries have to contend with in their policy formulation.

5 CONCLUSIONS

The study has reviewed the structure of the South African the economy, as well as the sources and dynamics of impacts of macroeconomic fluctuations. Overall, the analysis reflects a general compliance with economic theory predictions, and confirms a number of stylized facts concerning macroeconomic aggregates in developing and middle-income countries. The main point that emerges in the analysis is that the structure of an economy cannot be ignored in the analysis of the dynamics of domestic and external macroeconomic shocks. It is further observed that while the South African economy is by far the biggest in terms of output and export contribution in Africa, its stature as a middle income country that is highly susceptible to changes in international conditions imposes significant weaknesses with regards to the design of appropriate stabilization policies.

Another structural weakness that is evident in the South African economy is the fact a very high proportion of exports to industrialized countries are in the primary, mineral products that have been highly subjected to weak and declining terms of trade, with low world elasticities of demand. The manufacturing sector on the other hand is a net importer of capital equipment. The implication is that such industrial structures, derived from past import substitution policies and sanctions due to former colonial regimes are an important factor that policy makers should consider before they draft appropriate policies consistent with the underlying nature of the economy. This requires industrial polices that will facilitate a major long term transformation in the production and export structure before the country is able to strengthen its trade competitiveness and attain a growth path consistent with most industrialized countries of the same resource potential.

In summary, the analysis shows that although South Africa recently experienced marked fluctuations in macroeconomic fundamentals, the economy has a strong resilience to the permanent effects of shocks[8]. On average, fluctuations induced by shocks are short lived and the fundamentals revert to a steady state within a five year forecast period. Although the currency crisis has been of critical importance within the last three years, the dynamic path of a shock in the real exchange rate on output is consistent with the general elasticity devaluation pessimism, which characterizes most developing countries. Terms of trade shocks account for about 20% of the variation in output, while government expenditure accounts for about 10% of fluctuations in real GDP. The most important sources of output fluctuations are money supply, accounting for about 30% of output fluctuations, and the world interest rate, which explains at least 18% of short-term output variations. Money supply is also the most important variable affecting real exchange rate fluctuations – a factor, which significantly weakens the role of the exchange rate as an external competitiveness indicator. Moreover, the results provide evidence that external shocks have a strong influence on the South African economy with a significant effect on real exchange rate stability.

[8] Adherence to sound macroeconomic policies, particularly fiscal and monetary polices as well as maintaining policy consistency has generally been observed in both the pre and post independence South African governments. This eliminates policy volatility and, is generally a major characteristic of economies that have high resilience to domestic and external shocks. Macroeconomic shocks, particularly from external and domestic natural factors are unavoidable but policy discipline remains a major prerequisite in maintaining long run stability.

BIBLIOGRAPHY

Acemoglu D, Johnson S, Robinson J, Yunyong T. (2002). Institutional causes, macroeconomic Symptoms: Volatility, Crises and Growth. *Working Paper 9124*, NBER Working Paper Series http://www.nber.org/papers/w9124

Agénor P. R, McDermott C. J, & Prasad E. S. (1999). Macroeconomic Fluctuations in Developing, Countries: Some Stylized Facts

Agenor R.P, Hoffmaister A.W, Medeiros C.I. (1997). Cyclical Fluctuations in Brazil's Real Exchange Rate: The Role of Domestic and External Factors, *International Monetary Fund Working Paper* 97/128.

Blanchard O. Quah D. (1989). The Dynamic Effects of Aggregate Demand and Supply Disturbances, *American Economic Review*, Vol 79, September, pp. 655-73

Chenery H, Robinson S, Syrquin M. (1986). Industrialization and Growth: A Comparative Study, *Published for the World Bank*, Oxford University Press

Collier Paul, Gunning Jan Willem (1999). Explaining African Economic Performance, *Journal of Economic Literature* (March 1999)

Doroodian K (1994). IMF Stabilization Policies In Developing Countries: A Disaggregated Quantitative Analysis, *International Economic Journal* 41, Volume 8, Number 4, Winter 1994

Economic Commission for Africa (2002). Tracking Performance and Progress, *Economic Report for Africa 2002*. Economic Commission for Africa.

Edwards S (1998). The Economics of Real Exchange Rates *in Exchange Rate Misalignment in Developing Countries*. John Hopkins U. Press.

Edwards Sebastian, Yeyati Eduardo Levy (2003). Flexible Exchange Rates as Shock Absorbers, *NBER Working Paper* No. w9867 Issued in July 2003

Goodfriend M, King G. (1997). The New Neoclassical Synthesis and the Role of Monetary Policy.

Hartzenberg T, Stuart J (2002). South Africa's Growth Performance since 1960: A Legacy of Inequality and Exclusion, *Prepared for AERC Growth Project.*

Hoffmaister A. W, Roldos J.E, Wieckham P. (1987). Macroeconomic Fluctuations in Sub-Saharan Africa, *IMF Working Paper* 97/82.

Hoofmaister A.W, Roldos J. E. (1996). The Sources of Macroeconomic Fluctuations in Developing Countries: Brazil and Korea, *IMF Working Paper* 96/20.

IMF (1998). Financial Crises: Causes and Indicators, *World Economic And Financial Surveys, World Economic Outlook*. May 1998.

Kamin S B, Klau M (1998), Some Multi-country Evidence on the Effects of Real Exchange Rate on Output, *International Finance Discussion Papers*, no .611. Washington, D.C, Federal Reserve Board.

Khosrow D. (1994). IMF Stabilization Policies in Developing Countries: a Disaggregated Quantitative Analysis, International Economic Journal 41volume 8, number 4, winter 1994

Koop G, Pesaran M. G, Potter S.N. (1996). Impulse Response Analysis in Nonlinear Multivariate Models, *Journal of Econometrics* volume 74 Vol 74 (March 1996), 119-47

Kose A. M, Riezman R (1999). Trade Shocks and Macroeconomic Fluctuations in Africa, 1999 *Eastern Economic Association in Boston.*

Lutkepohl H (1993). Introduction to Multiple Time Series Analysis, 2nd Edition. Springer-Verlag.

Mariotti M. (2001). An Examination of the Impact of Economic Policy on Long-run Economic Growth: An Application of a VECM Structure to a Middle -Income Context, TIPS Annual Forum, 10-12 September 2001 – Johannesburg.

Montiel Peter J (1999). Determinants of the Long-Run Equilibrium Real Exchange Rate: An Analytical Model, *in Hinkle L E and Montiel P J (1999), Exchange Rate Misalignment, Concepts and Measurement for Developing Countries*, World Bank.

Ndlela Daniel (2002). Determinants of Exports from SADC and the Role of Market Access. *Paper presented at the Trade and Industrial Policy Strategies (TIPS), 2002 Annual Forum at Glenburn Lodge, Muldersdrift*

Reinhart, C M, Reinhart V R (1991). Output Fluctuations and Monetary Shocks: Evidence from Colombia, *IMF Staff Papers 38*, no 4: 705-35.

Rodrik, D (1998). Where did all the Growth go? External Shocks, Social Conflict, and Growth Collapses, *NBER working paper series*, No: 6350

Sachs, J. D., and M. Warner (1996). Sources of slow growth in African Economies, *Journal of African Economies 5* (Supp.), 335-376

SAPC (1999). Structure of the South African Economy: Challenges for Transformation, *Paper presented at the Special Strategy Conference 3-5 September 1999*

Statistics South Africa and Reserve Bank of South Africa database

TIPS (2002). A Review of the Changing Composition of the South African Economy, *Report compiled by Trade and Industrial Policy Strategies*

United Nations ECA (1989). Alternative Framework to Structural Adjustment Programmes for Socio-Economic Recovery and Transformation (AAF-SAP), *United Nations Economic Commission for Africa.*

Vandana C (2002): Constraints to Growth in South Africa's Manufactured Exports Sector, *in Trade & industry, A Joint Trade & Industrial Policy Strategies & Development Policy Research Unit Newsletter*, Volume 21 March 2002

Annex A: Impulse Response Analysis

Generalized Impulse Responses to one SE shock in the equation for Real GDP							
Horizon	**Real GDP**	**RER**	**TOT**	**Money Supply**	**World Interest Rate**	**Government Consumption**	**Inflation Differential**
0	0.021443	0.010573	0.014388	0.056398	0.098697	0.019039	-0.094676
1	0.00932	0.026564	-0.02143	0.015927	0.027207	0.014975	0.14778
2	-0.001623	-0.0105	-0.013097	0.00428	-0.040546	0.0050458	0.044943
3	-0.00233	-0.00618	-0.00474	0.007017	-0.011874	-9.10E-04	-0.016114
4	-0.001062	0.012659	-8.98E-04	0.001824	0.011109	-0.003787	-0.024199
5	-6.86E-04	0.014663	0.0010814	-0.00755	0.0062333	-0.0033722	-0.00422 84
6	-5.60E-04	5.29E-04	0.0023929	-0.009	-0.0064133	-9.14E-04	0.007327
7	1.64E-05	-0.01017	0.0020221	-0.00198	-0.007787	0.0012751	0.0044991
8	5.61E-04	-0.00784	2.55E -04	0.004618	-1.75E-04	0.001626	-0.0017734
9	5.12E-04	8.04E-04	-0.001166	0.004845	0.0051939	5.33E -04	-0.0032307
10	3.80E-05	0.005445	-0.001133	7.37E -04	0.0036948	-5.51E-04	-6.47E-04
Generalized Impulse Responses to one SE shock in the equation for Real Exchange Rate							
0	0.001343	0.16877	-0.008071	0.005976	-0.05579	0.028158	0.0031736
1	-0.006814	-8.54E-04	-0.003493	-0.0761	-0.10021	-0.0062871	0.15182
2	-0.00426	-0.09381	0.0103	-0.01074	-0.092474	0.0095715	0.020005
3	0.002771	-0.05263	0.0020271	0.039939	0.0097873	0.0080423	-0.052308
4	0.003507	0.025205	-0.007716	0.031477	0.053685	3.97E -06	-0.036091
5	-2.35E-04	0.047292	-0.006308	-0.00523	0.024445	-0.0058152	0.0038654
6	-0.00251	0.015789	0.0011931	-0.02308	-0.015973	-0.0043681	0.020177
7	-0.001464	-0.01765	0.0050695	-0.01248	-0.024118	4.38E -04	0.009764
8	6.23E-04	-0.02127	0.0028186	0.005365	-0.0061985	0.0030016	-0.0048728
9	0.00134	-0.0041	-0.001163	0.011146	0.010014	0.0018934	-0.0083685
10	5.46E-04	0.009654	-0.002539	0.004535	0.010312	-4.35E-04	-0.0025958
Generalized Impulse Responses to one SE shock in the equation for Terms of Trade							
0	0.005883	-0.02597	0.052443	0.019956	0.041368	-0.012005	-0.16541
1	0.01106	-0.00261	0.0079566	0.016243	0.035694	0.01738	0.095323
2	0.004275	-0.03117	-0.00572	0.017396	-0.022024	0.013165	0.060873
3	0.001253	-0.01758	-0.008745	0.024296	-0.0060195	0.0065527	0.0074858
4	-1.33E-04	0.0146	-0.007033	0.014201	0.015433	-0.0014369	-0.019062
5	-0.001246	0.026425	-0.00269	-0.00515	0.010858	-0.004964	-0.0079454
6	-0.001596	0.010397	0.0019705	-0.0146	-0.0067426	-0.0034148	0.0058221
7	-7.22E-04	-0.00961	0.0036781	-0.00846	-0.012939	1.26E -04	0.0061987
8	4.73E-04	-0.01374	0.0019441	0.002693	-0.004605	0.00208	-7.07E-04
9	8.83E-04	-0.00412	-6.98E-04	0.007226	0.0051891	0.0015022	-0.0042371
10	4.04E-04	0.005318	-0.001726	0.003697	0.0066311	-8.54E-05	-0.0021012
Generalized Impulse Responses to one SE shock in the equation for Government Expenditure							
0	0.006292	0.073242	-0.009703	0.034122	0.002768	0.064885	-0.013581
1	-0.00168	0.017588	-0.010768	-0.03178	0.0043188	-0.017137	-0.0069121
2	-0.00276	9.89E-04	-2.63E-04	-0.01648	-0.017993	-0.0011266	0.01735
3	-0.001176	-0.0135	0.0038273	-0.00511	-0.011147	-0.0010037	-0.012573
4	6.21E-04	-0.00656	0.0016818	0.00384	0.0043585	8.89E -04	-0.007864
5	7.31E-04	0.001859	-5.16E-04	0.003784	0.0068896	4.46E -04	-0.0023878
6	1.53E-04	0.004215	-9.18E-04	2.27E -04	0.002549	-1.87E-04	0.0021091
7	-2.24E-04	0.001519	-2.04E-04	-0.00171	-0.0016182	-3.11E-04	0.0023168
8	-1.78E-04	-0.00124	3.19E -04	-0.00107	-0.0021687	-3.77E-05	6.21E-04
9	1.29E-05	-0.00156	2.56E -04	2.86E -04	-5.28E-04	1.63E -04	-6.67E-04
10	9.57E-05	-2.96E-04	-3.48E-05	7.57E -04	7.79E -04	1.18E -04	-7.36E-04
Generalized Impulse Responses to one SE shock in the equation for Inflation Differential							
0	-0.005699	0.001504	-0.024351	0.009711	-0.012829	-0.0024737	0.35623
1	-0.006888	-0.03515	0.00995	0.019799	-0.063191	-1.46E-04	-0.097746
2	8.62E-04	0.012837	0.0027665	0.012302	0.032011	-0.0029621	-0.036016
3	6.20E-04	0.023044	5.11E -04	-0.00464	0.016396	-0.00275	7.31E-04
4	-4.96E-04	0.003179	0.0014562	-0.01113	-0.0092294	-5.48E-04	0.018006
5	-2.69E-04	-0.01371	0.0019739	-0.00301	-0.013424	0.0017084	0.0080655
6	5.39E-04	-0.01086	3.10E -04	0.006073	-0.0011932	0.0019699	-0.0038747
7	6.33E-04	0.00147	-0.001429	0.006412	0.0074784	5.11E -04	-0.0057448
8	4.92E-05	0.007765	-0.0014	6.79E -04	0.0052977	-8.47E-04	-0.0010179
9	-4.11E-04	0.004465	-1.22E-04	-0.00352	-0.0011734	-9.60E-04	0.002517
10	-3.36E-04	-0.00157	8.10E -04	-0.00291	-0.0039927	-2.03E-04	0.0020396

Generalized Impulse Responses to one SE shock in the equation for Money Supply							
Horizon	**Real GDP**	**RER**	**TOT**	**Money Supply**	**World Interest Rate**	**Government Consumption**	**Inflation Differential**
0	0.011782	0.009827	0.010196	0.10264	0.017397	0.02157	0.033703
1	0.00517	0.025441	-0.013625	0.031771	0.0020337	0.012561	0.090168
2	-0.001462	0.004189	-0.009397	0.003922	-0.026514	0.0024369	0.034515
3	-0.002158	-0.00166	-0.002459	2.74E-05	-0.013582	-0.0012663	-0.0051553
4	-9.63E-04	0.003411	6.10E-04	-8.52E-04	0.0015915	-0.0021424	-0.013662
5	-2.48E-04	0.004904	0.0012033	-0.0031	0.0032243	-0.0014499	-0.0041544
6	-6.05E-05	5.73E-05	0.0011648	-0.00327	-0.0015374	-2.30E-04	0.002865
7	9.67E-05	-0.00408	7.29E-04	-5.51E-04	-0.0028608	6.52E-04	0.0025372
8	2.40E-04	-0.00319	-1.36E-05	0.001999	-1.82E-04	7.18E-04	-3.25E-04
9	1.94E-04	3.62E-04	-5.34E-04	0.002022	0.0020418	2.11E-04	-0.0013382
10	1.72E-06	0.00232	-4.74E-04	2.83E-04	0.0015299	-2.56E-04	-3.90E-04
Generalized Impulse Responses to one SE shock in the equation for World Interest Rate							
0	0.009206	-0.04096	0.0094372	0.007768	0.22988	7.81E-04	-0.01988
1	0.006776	0.055624	0.0055147	0.018222	0.1183	-0.012266	-0.14071
2	0.002269	0.067436	-0.003371	-0.02591	0.039408	-0.005646	0.052858
3	-0.002373	-0.00833	0.0037577	-0.03264	-0.045096	5.77E-05	0.054118
4	-6.17E-04	-0.04598	0.0050765	-0.00122	-0.035574	0.0056408	0.010788
5	0.001869	-0.02347	-4.06E-04	0.021391	0.0070077	0.0047273	-0.019785
6	0.00159	0.013363	-0.004653	0.01533	0.024863	1.70E-05	-0.015247
7	-3.29E-04	0.023309	-0.003247	-0.00301	0.010791	-0.003057	0.0015651
8	-0.001327	0.007767	7.30E-04	-0.01162	-0.0080113	-0.002317	0.0089179
9	-7.25E-04	-0.00861	0.0026345	-0.00631	-0.011672	1.49E-04	0.0044247
10	3.24E-04	-0.01053	0.0014589	0.002549	-0.0030279	0.0014918	-0.0022639

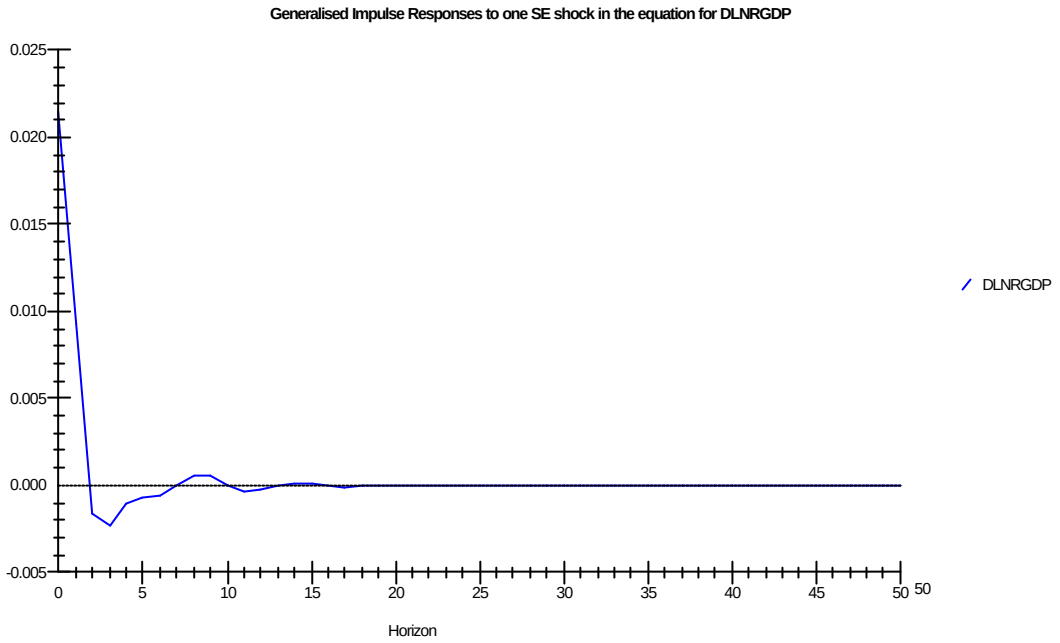
Annex B: Forecast Error Variance Decompositions

Generalized Forecast Error Variance Decomposition for Real GDP							
Horizon	**Real GDP**	**RER**	**TOT**	**Money Supply**	**World Interest Rate**	**Government Consumption**	**Inflation Differential**
0	1	0.003925	0.075269	0.30191	0.18433	0.086098	0.070635
1	0.82496	0.072789	0.23684	0.24983	0.19719	0.064002	0.12062
2	0.76953	0.092995	0.24546	0.23492	0.19027	0.070086	0.11301
3	0.74857	0.099938	0.23856	0.23257	0.19087	0.069378	0.10938
4	0.73401	0.11404	0.23347	0.22881	0.18728	0.068399	0.10736
5	0.72341	0.11237	0.23192	0.22539	0.18896	0.068049	0.10581
6	0.71051	0.11834	0.23091	0.22125	0.18871	0.066828	0.10424
7	0.70677	0.12044	0.23035	0.2201	0.18786	0.066539	0.1042
8	0.70306	0.12023	0.2293	0.21889	0.18899	0.066193	0.10359
9	0.69988	0.12189	0.22913	0.21785	0.18871	0.065863	0.10329
10	0.69909	0.12212	0.22908	0.2176	0.18862	0.0658	0.10332
Generalized Forecast Error Variance Decomposition for Real Exchange Rate							
0	0.003925	1	0.023683	0.0033901	0.058897	0.18833	7.94E-05
1	0.022843	0.79595	0.01904	0.020784	0.13334	0.15855	0.034578
2	0.017747	0.71322	0.031615	0.014564	0.17827	0.10855	0.026823
3	0.017056	0.70725	0.034636	0.013492	0.16578	0.10342	0.034135
4	0.01827	0.6601	0.035281	0.012585	0.1866	0.095714	0.031526
5	0.020352	0.65138	0.043596	0.012136	0.1829	0.08958	0.032339
6	0.020067	0.64584	0.044593	0.011963	0.18296	0.088571	0.033642
7	0.021133	0.63602	0.04495	0.011941	0.18684	0.086634	0.032925
8	0.021757	0.63461	0.047115	0.011938	0.18538	0.085573	0.033384
9	0.021699	0.63289	0.047213	0.011903	0.18587	0.085344	0.033568
10	0.022013	0.63099	0.047377	0.011919	0.18651	0.084909	0.033432
Generalized Forecast Error Variance Decomposition for Terms of Trade							
0	0.075269	0.023683	1	0.037802	0.032382	0.034233	0.2156
1	0.17558	0.020381	0.74148	0.076319	0.031485	0.055368	0.18235
2	0.20268	0.044375	0.68858	0.09142	0.031652	0.050843	0.16925
3	0.1989	0.04336	0.67578	0.088771	0.033516	0.051979	0.16182
4	0.19095	0.054793	0.65913	0.085226	0.037861	0.050482	0.15567
5	0.18821	0.062619	0.65038	0.084206	0.037304	0.049749	0.15409
6	0.18685	0.062062	0.64225	0.083338	0.04145	0.049245	0.15198
7	0.18509	0.066644	0.6361	0.082278	0.043105	0.048561	0.15028
8	0.18443	0.06808	0.63456	0.081977	0.043059	0.048405	0.15014
9	0.18403	0.068114	0.63233	0.081735	0.044363	0.04824	0.14959
10	0.18371	0.06925	0.63093	0.081521	0.044668	0.048086	0.14925
Generalized Forecast Error Variance Decomposition for Government Consumption							
0	0.086098	0.18833	0.034233	0.11051	1.45E-04	1	0.0014535
1	0.10243	0.14532	0.077894	0.10877	0.026373	0.78624	0.001072
2	0.099678	0.15045	0.10087	0.10241	0.029788	0.73351	0.0024284
3	0.097308	0.15694	0.10516	0.1001	0.029041	0.71526	0.0035679
4	0.097938	0.15435	0.10374	0.099157	0.033528	0.70356	0.0035557
5	0.097881	0.15669	0.10561	0.097657	0.036336	0.69066	0.0039376
6	0.097429	0.15867	0.10676	0.097088	0.036122	0.68658	0.0045055
7	0.097341	0.15816	0.1064	0.096818	0.037416	0.68423	0.0045295
8	0.097346	0.15888	0.10662	0.096503	0.038076	0.68146	0.0046197
9	0.09728	0.15924	0.10684	0.096402	0.038037	0.6807	0.0047538
10	0.097252	0.15915	0.10676	0.09634	0.038344	0.68019	0.0047564
Generalized Forecast Error Variance Decomposition for Inflation Differential							
0	0.070635	7.94E-05	0.2156	0.0089512	0.0031143	0.0014535	1
1	0.13608	0.10187	0.161	0.040935	0.08921	0.0010259	0.6028
2	0.14024	0.10023	0.17154	0.044679	0.098215	0.0022782	0.58853
3	0.13751	0.10888	0.16712	0.043577	0.10772	0.0028734	0.57256
4	0.13849	0.11311	0.16688	0.043893	0.10709	0.003098	0.56796
5	0.13823	0.1129	0.16674	0.043857	0.10843	0.0031139	0.56684
6	0.13798	0.11418	0.16631	0.043742	0.10901	0.0031215	0.56498
7	0.13796	0.11448	0.16634	0.043736	0.10894	0.0031412	0.56471
8	0.13789	0.11451	0.16624	0.043709	0.1092	0.0031407	0.56435
9	0.13786	0.11473	0.16622	0.043692	0.10922	0.0031408	0.56407
10	0.13784	0.11475	0.16622	0.043688	0.10923	0.0031427	0.56403

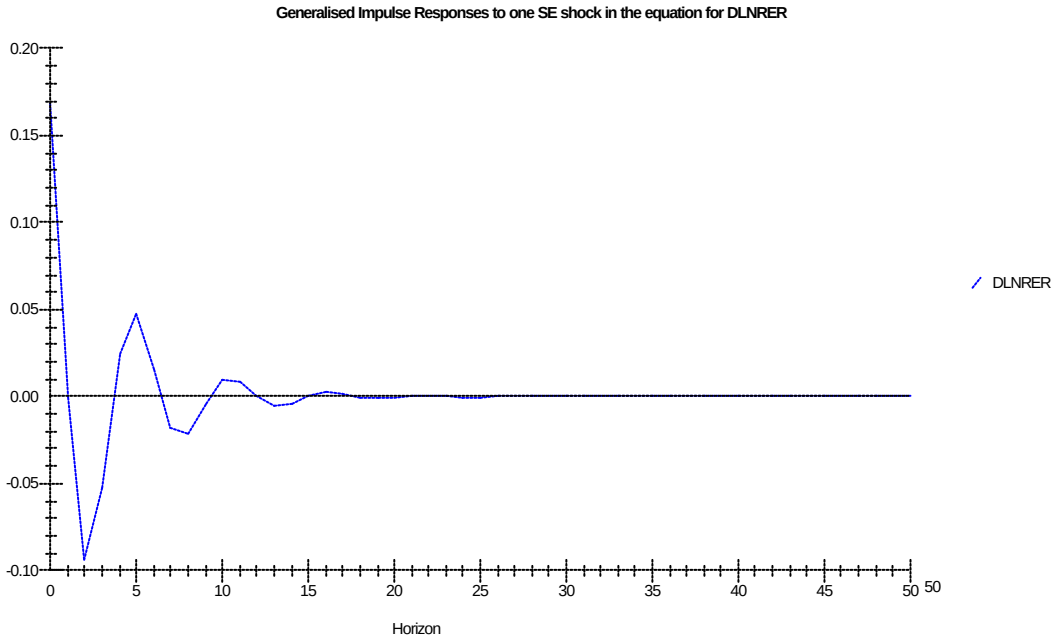
Generalized Forecast Error Variance Decomposition for Money Supply							
Horizon	**Real GDP**	**RER**	**TOT**	**Money Supply**	**World Interest Rate**	**Government Consumption**	**Inflation Differential**
0	0.30191	0.00339	0.037802	1	0.0057272	0.11051	0.0089512
1	0.18874	0.32018	0.036385	0.63443	0.021563	0.11947	0.026725
2	0.1651	0.28411	0.04613	0.55277	0.050868	0.11694	0.03049
3	0.1392	0.29959	0.061811	0.45951	0.084641	0.098246	0.026203
4	0.1314	0.31966	0.065851	0.43337	0.079877	0.093203	0.029353
5	0.12818	0.30782	0.064162	0.41633	0.093136	0.089979	0.028502
6	0.12528	0.31249	0.068651	0.39823	0.097088	0.085991	0.028506
7	0.12404	0.31434	0.070327	0.39386	0.096326	0.085144	0.02959
8	0.1234	0.31188	0.069803	0.38969	0.099817	0.084253	0.029283
9	0.12302	0.31309	0.070887	0.38617	0.1002	0.083464	0.029421
10	0.12279	0.31314	0.071199	0.38539	0.10022	0.083315	0.029644
Generalized Forecast Error Variance Decomposition for World Interest Rate							
0	0.18433	0.058897	0.032382	0.0057272	1	1.45E-04	0.0031143
1	0.13238	0.16615	0.037706	0.0038751	0.84424	3.32E-04	0.052514
2	0.13135	0.23514	0.037594	0.010939	0.7409	0.0037923	0.056139
3	0.12835	0.22813	0.036692	0.012496	0.73693	0.0049632	0.057039
4	0.12324	0.24553	0.037248	0.011904	0.71312	0.004907	0.055069
5	0.12229	0.24877	0.038008	0.011879	0.70594	0.0053214	0.05625
6	0.121	0.24781	0.037924	0.011737	0.70218	0.0053109	0.055487
7	0.12037	0.25091	0.039151	0.011698	0.69624	0.0052826	0.055466
8	0.1201	0.25071	0.039267	0.011672	0.6953	0.0053159	0.055612
9	0.1199	0.25071	0.039374	0.011667	0.69394	0.0052982	0.055412
10	0.11981	0.25126	0.03972	0.011668	0.69274	0.0052942	0.055461

Annex 3: Generalized Impulse Response Functions

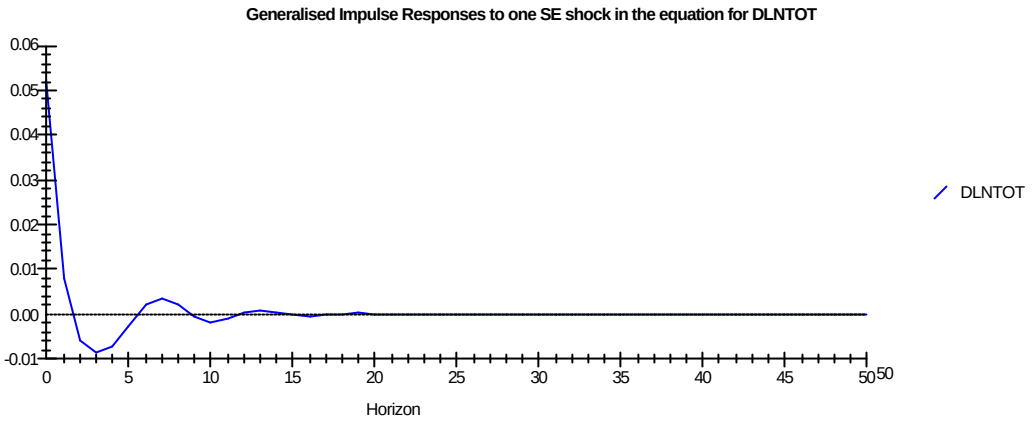
A Unit Shock on Equation for Real GDP



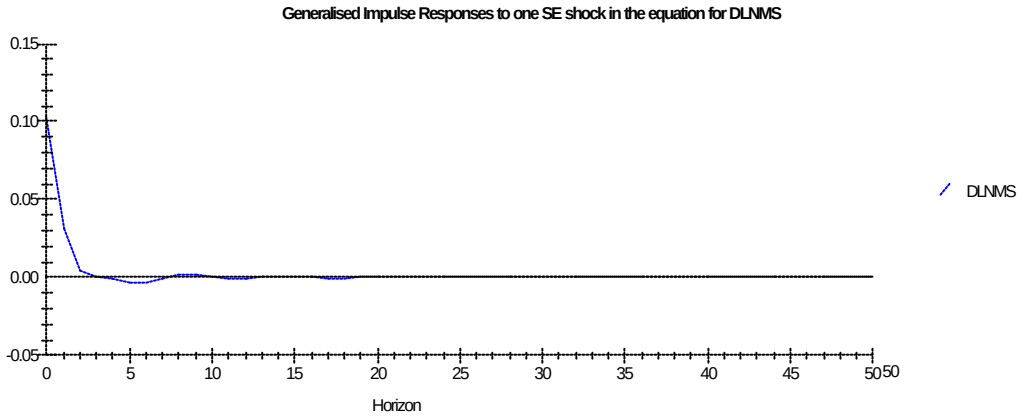
A Unit Shock on Equation for Real Exchange Rate



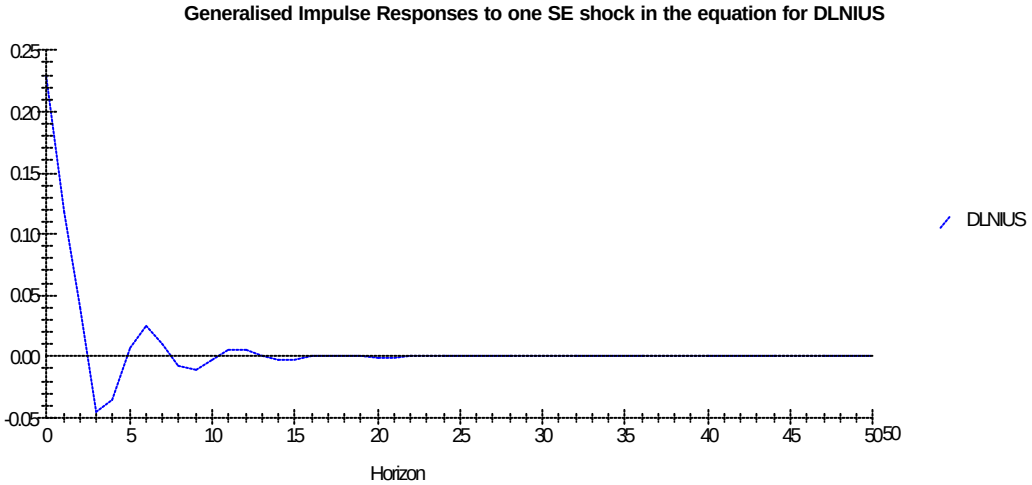
A Unit Shock on Equation for Terms of Trade



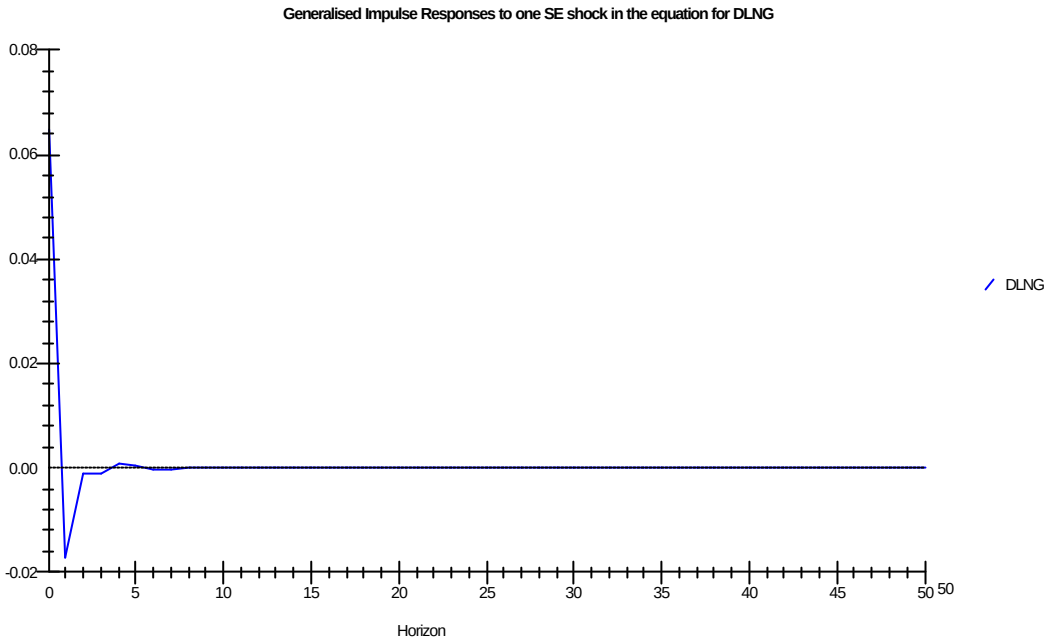
A Unit Shock on Equation for Money Supply



A Unit Shock on Equation for World Interest Rate



A Unit Shock on Equation for Government Consumption



A Unit Shock on Equation for Inflation Differential