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# FISCAL ASPECTS OF MACROECONOMIC STABILITY IN AFRICA

By

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## ABSTRACT

This study analyses empirically the nature of fiscal and monetary policy interdependence and fiscal dynamics in Africa. It also looks at the possibility of implementing viable fiscal policy rules and institutions that are consistent with economic and monetary stability and growth.

The study starts off by looking at the way economists have framed the analysis of fiscal and monetary policy interdependence. While conventional theory holds that inflation is a monetary phenomenon, recently the Fiscal Theory of Price Determination (FTPD) has instead argued that inflation can be a fiscal phenomenon. We argue that the latter is an encompassing description of the relation between fiscal policy and monetary policy in Africa and it forms the basis of our empirical analysis.

Hence, we test the FTPD in Africa using recursive vector autoregressive (VAR) model for 20 African countries. The results show that fiscal policy is dominating monetary policy in many countries in the sample. It also points out that a fiscal dominance regime may arise regardless of monetary policy independence. This implies that fiscal policy matters for achieving and maintaining price stability in Africa.

Next, we extend the analysis using panel data techniques on a set of 43 African countries to assess the robustness of the preceding results, and at the same time to evaluate the stabilising or destabilising characteristics of fiscal policy in Africa. The results support the existence of a fiscal dominant regime on the continent. This response however seems to be weaker in the sub-sample period, suggesting that there has been an effort by the fiscal authorities to improve on fiscal outcomes in recent times, although a regime shift has not yet occurred. Additionally, evidence seems to support a procyclical fiscal policy or fiscal destabilization in Africa.

Further, we use panel Granger causality tests to examine the direction of causality between government revenue and expenditure. Specifically, this aims at detecting symptoms of fiscal instability deriving from the dynamic interaction of fiscal revenues and expenditures. The results support a unidirectional causality from revenue to spending in the full sample period, and no causality in the recent period (in line with the Panel evidence). Government expenditure follows revenue, suggesting a pro-cyclical expenditure policy to changes in government revenue. Hence, African countries could enhance the effectiveness of fiscal policy by making budget expenditure less driven by revenue availability.

Finally, we use Monte Carlo simulation techniques to evaluate how the introduction of fiscal rules might affect the risk of unsustainable debt accumulation in an environment where fiscal revenues are highly uncertain, a typical characteristic of fiscal processes in Africa. Contrary to the prevailing literature, the results suggest that introducing some element of flexibility in the way fiscal expenditure is planned, with the use of flexible policy rules, might, under realistic circumstances, increase the risk of unsustainable debt accumulation because it magnifies the effect of unexpected revenues' reversal

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University of Cape Town

# DEDICATION

To His Majesty – Lord Jesus Christ

University of Cape Town

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# CHAPTER ONE

## 1. INTRODUCTION

### 1.1 Fiscal and Monetary Policy Management in Africa: A Historical Experience

The complexity of fiscal management in Africa became apparent as early as the 1950s, the decade in which the decolonization process got off the ground, and this has had implications on the way in which monetary policy has since then been conducted.

In a review of fiscal developments from 1950 to 1958, the United Nations Economic Commission for Africa (1961) showed that nearly all the African countries for which data was available had experienced rapid growth in government expenditure. Indeed, the growth in public spending outpaced that of government revenue to such an extent that several countries severely depleted reserve funds accumulated to finance future capital spending. According to the United Nations report, the major reasons for the rapid growth in government spending in the continent during the 1950s were the assumption of additional responsibilities by the government of newly independent countries, the expansion of social services (notably education, health care and low-cost housing) and increase in recurrent spending related to earlier development programmes.

The pattern of faster growth in government expenditures than in government revenues continued during the 1960s and 1970s. The resulting high budget deficits fuelled the accumulation of a crippling external debt burden. During the 1970s, for example, the average public deficit for African countries amounted to 6.4 percent of GDP – well above the corresponding figures for Latin America and the Caribbean (4.6 percent), other developing countries (4.5 percent) and the OECD countries (1.2 percent). According to Greene (1989),

the external debt of sub-Saharan African countries increased from 14.6 percent of the region's GDP in 1970 to 28 percent in 1980. Debt service payments accordingly increased from 7.8 percent of the region's export of goods and services to 13.7 percent.

The Sub-Saharan Africa's debt burden remained manageable while it experienced rapid economic growth (which in many cases, was closely linked to buoyant commodity prices). Matters became worse, however, with the global slowdown in economic growth after the second oil price shock in 1979 and 1980. The external debt burden of sub-Saharan Africa, which was still dominated by publicly guaranteed liabilities, increased from 28.7 percent of GDP (96.2 percent of exports of goods and services) in 1980 to 53 percent of GDP (250.1 percent of exports of goods and services) in 1985.<sup>1</sup> Over the same five-year period, actual debt service payments rose from 13.7 percent of exports of goods and services to 33.9 percent.

Progressively worsening macroeconomic conditions forced more and more African countries into persistent budget deficits and unsustainable levels of debt. Fiscal policy still remains a challenge for many countries in the recent period. In 2006, 32 of 47 African countries for which data are available recorded an primary deficits (excluding grants) (table 1.1).

Table 1.1: Distribution of Primary Deficits in Africa, 1997-2006

Range	1997-2001	2002	2003	2004	2005	2006
Countries with a deficit	43	43	42	40	36	32
Less than 3 percent	11	7	6	9	7	
3-5 percent	4	7	8	5	8	3
More than 5 percent	28	29	28	26	21	23
Countries with a surplus	4	4	5	7	11	15
Total number of countries	47	47	47	47	47	47

Source: IMF

<sup>1</sup> Greener (1989)

The deficits exceeded 5 percent of GDP for 23 countries. The major cause of the high fiscal deficit in 2006 is increases in public spending in anticipation of resource revenues and aid in Sao Tome and Principe (-36.8 percent), Malawi (-18.9 percent), Rwanda (-13.2 percent), Ghana (-11.3 percent), Tanzania (-10.9 percent), Uganda (-9.1 percent), Zambia (-6.0 percent), among others.

Moreover, lower tax rates, poor budget management and expenditure decisions contributed to high primary deficits in Eritrea (-26.5 percent), Burundi (-21.5 percent), Sierra Leone (-10.7 percent), Guinea Bissau (-15.9 percent), Zimbabwe (-10.1 percent), Burkina Faso (-10.8), among others.

Nevertheless, there is some effort to consolidate fiscal positions, with the average primary deficit down from 4 percent of GDP between 1997 and 2001 to a surplus of 0.5 percent in 2006. Similarly, external debt falls from 44.3 percent of GDP to 18.1 percent between 1997 and 2006 (table 1.2). Of 44 countries for which data are available, only 14 countries recorded a high external debt of more than 60 percent of GDP in 2006 compared with 30 countries in 1997-2001.

Table 1.2: Distribution of External Debt in Africa, 1997-2006

Range	1997-2001	2002	2003	2004	2005	2006
Less than 30 percent	6	5	6	8	12	18
30-60 percent	8	7	13	13	14	12
60.1-80 percent	10	12	6	6	8	4
More than 80 percent	20	20	19	17	10	10
Total number of countries	44	44	44	44	44	44

Sources: IMF and WEO

Table 1.3: Distribution of Inflation in Africa, 1997-2006

Range	1997-2001	2002	2003	2004	2005	2006
Less than 0 percent	0	4	6	5	0	1
0-5 percent	24	22	15	24	19	19
5.1-10 percent	12	7	13	3	14	14
10.1-20 percent	4	10	8	12	10	10
More than 20 percent	7	4	5	3	4	3
Total number of countries	47	47	47	47	47	47

Source: IMF

Despite the pressure from high oil prices, the inflation rate in Africa dropped to 11.8 percent in 2006 from 15.0 percent between 1997 and 2001. Thirteen countries experienced double digit inflation in 2006: Guinea (33.9 percent), Sao Tome and Principe (21.4 percent), Eritrea (17.3 percent), Angola (13.3 percent), the Democratic Republic of Congo (13.2 percent), Mozambique (13.2 percent), Kenya (14.1 percent), Botswana (11.3 percent), Ghana (10.9 percent), among others. Zimbabwe has had triple-digit inflation since 2002. Considering that most of these countries also recorded a high deficit suggests that both variables may be positively correlated in the continent. This indicates that Africa may have been prone to a fiscal-dominance regime, although more concrete evidence would be required to confirm this observation.

Importantly, although the recent period has witnessed stronger efforts to restore positive fiscal positions by lowering deficits and debt in most of the countries, for some of the countries, this recent reduction in the level of debt is due to the write-offs of debt by industrial countries and international financial institutions (the Heavily Indebted Poor Countries (HIPC) relief initiative) and does not necessarily mean that national authorities are becoming more prudent. Past experience has shown however that deficits and debt problems in the continent are endemic, and that this has been the root cause of price and macroeconomic instability.

## **1.2 Macroeconomic Dynamics in Africa: A Case of Nigeria and South Africa**

We carry out a preliminary analysis of fiscal and monetary data on the two largest countries in the continent (Nigeria and South Africa) whose data are at least available annually for the period 1980-2006. The goal is to provide some background information on the dynamic interaction of fiscal and monetary policy in Africa.

The long periods of persistent budget deficits and a large stock of public debt has increased the possibility of creating inflation out of fiscal imbalances in Nigeria. Over the past 20 years, there has been a substantial increase in budget deficits to GDP and public liabilities to GDP as well as inflation in Nigeria. The oil windfall between 1991 and 1993 was followed by rapid growth in government spending. However, as the oil market weakened in the subsequent years, oil receipts were not adequate to meet increasing levels of demands, and expenditure being reinforced by political pressures, were not rationalized. Government resorted to borrowing mainly from the central bank to finance the huge deficits. Although the democratically elected government in 1999 adopted Central Bank independence and other policies to restore fiscal discipline, the rapid monetization of foreign exchange earnings between 2000 and 2003, another era of oil windfall, resulted in large increases in budget deficits and public liabilities, and culminated in high inflation, which averaged from 21 percent a year in 1980s to 31 percent in 1990s. In 2003 alone, the inflation rate increased to 24 percent from 12 percent in 2001 (figure 1.1).

Nigeria is heavily dependent on highly volatile revenue (oil), making its budget vulnerable to fiscal shocks. Absent suitable fiscal rules and a proper fiscal management framework for oil related risks over the past two decade in Nigeria have led to boom-and-bust-type fiscal policies that have generated large and unpredictable movements in government finances. Consequently, this has been a recurrent source of destabilizing effect of fiscal surprises on the domestic prices.<sup>2</sup>

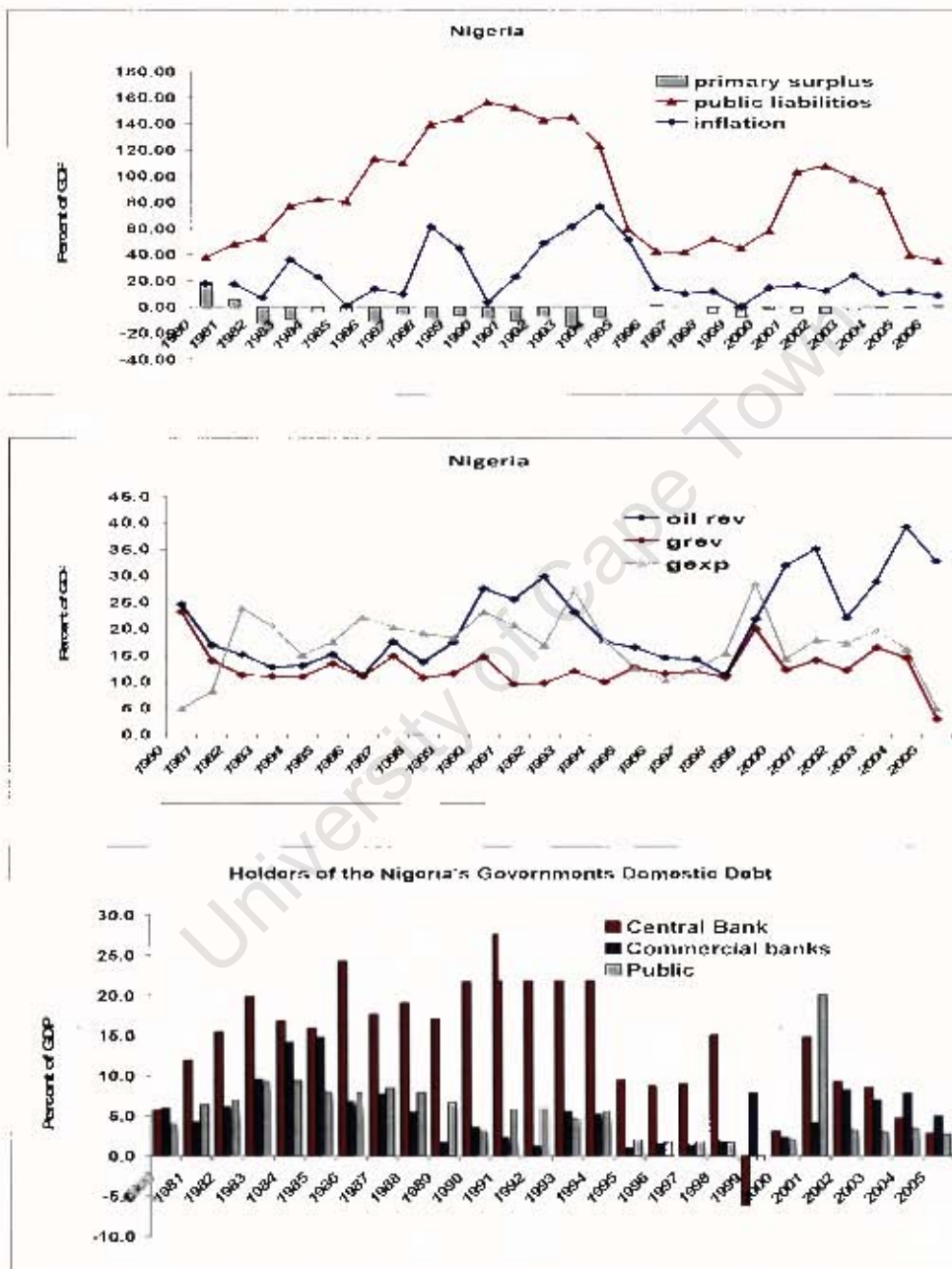
In contrary, South Africa has exhibited a relatively more stable environment. With the exception of the period 1991-1993, the government has committed itself towards a more sustainable fiscal policy stance. Supported by the

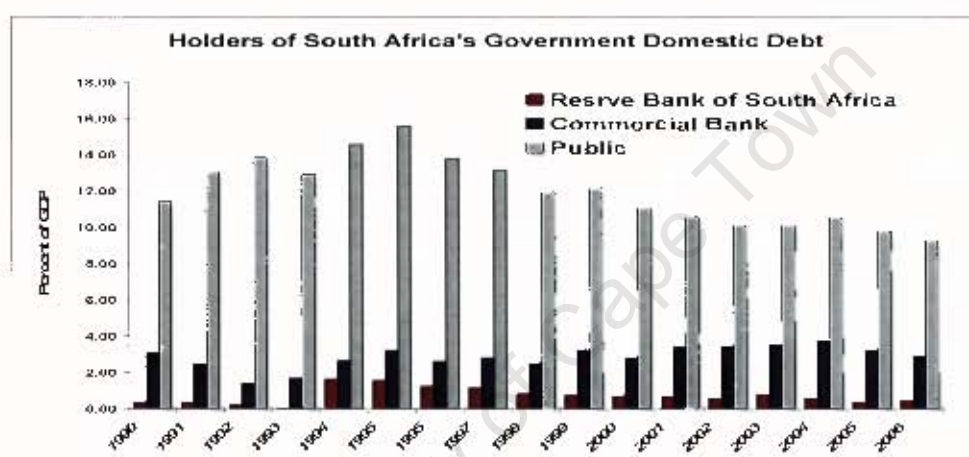
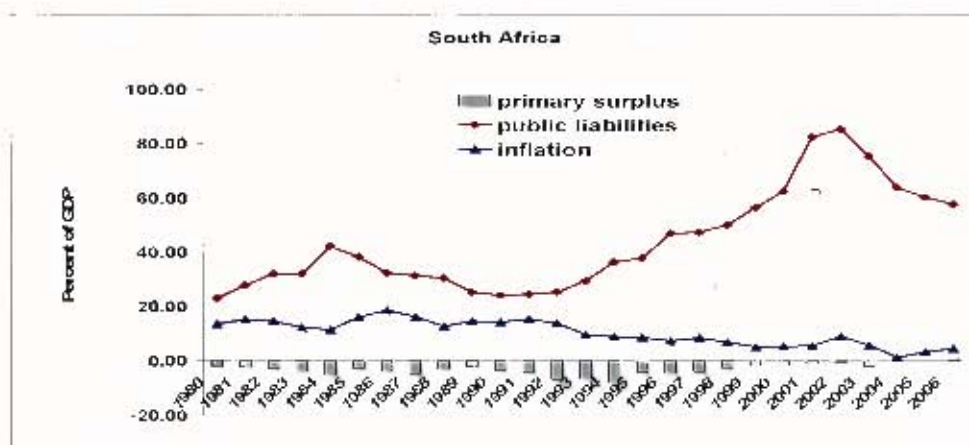
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<sup>2</sup> See Welcome Address by the former CBN Governor, Dr. J. Sanusi on 2004 Federal Government Budget, an Address by the immediate former CBN Governor, Professor C.C. Soludo, on the Bankers' Committee Meeting, July 2004 and Katz (2004).

optimistic revenue outcomes recorded over the past years and the declining expenditure, the deficit to GDP has declined since 1994.

Figure 1.1: Monetary and Fiscal dynamics in Nigeria and South Africa





In addition, unlike in Nigeria, figure 1.1, reveals that almost half of the South African domestic debt is held by public followed by Commercial bank, the Reserve Bank of South Africa was all but absent.

Further, we examine the history and prospects of domestic government markets in Nigeria and South Africa. Debt markets can be useful to efficient financing of a sustainable budget deficit. Experience in emerging markets and industrial countries has shown that market-based borrowing in deep and well-financing domestic debt markets can avoid the monetary consequences and interest rate distortions often associated with government borrowing from central banks.

Despite some recent deepening, domestic debt market in Nigeria is in its infancy. Until recent, Nigeria had a narrow financial market environment, and had limited ability to formulate and implement careful debt management; most of its debt management centered on external debt. In contrast, South Africa has a relatively more developed domestic debt market, having the “deepest” financial sector where broad money to GDP amounted to more than 60 percent on average between 2001 and 2006. The country had extensively relied on domestic financing since the beginning of the observable period (table 1.4).

**Table 1.4: Financial Sector Depth, Domestic and External Debts  
(percent of GDP, 1980-2006)**

Year	NIGERIA			SOUTH AFRICA			Sub-Saharan AFRICA		
	Fin	Domestic	External	Fin	Domestic	External	Fin	Domestic	External
1980-1989	17	13	44	56	-	-	31	11	49
1990-1994	21	37	95	53	35	1	30	12	87
1995-2000	27	20	40	56	41	2	32	15	103
2001-2006	29	16	46	68	29	5	43	22	34

Source: IMF

Note: Financial sector depth measures the ratio of broad money to GDP.

Moreover, although the size of domestic debt is still lagging behind the size of external debt, the domestic debt market is growing rapidly in Sub-Saharan Africa (SSA). While external debt has fallen considerably from an average of 103 percent of GDP in 1995-2000 to about 34 percent of GDP in 2001-2006, SSA’s domestic debt has doubled to about 22 percent of GDP by the end of 2006 from an average of about 11 percent between 1980 and 1989. Thanks to the recent HIPC Initiative which has reduced foreign concessional debt in most African countries to more sustainable levels.

Another way to evaluate whether fiscal dynamics contributes directly towards price dynamics is to look at the Emerging Market Bond Index (EMBI +), which summarizes on a daily basis what investors think about the state of both the

Nigerian and the South African economy.<sup>3</sup> As stressed by Favero and Gavazzi (2004), a high and volatile risk premium has three main consequences for the conduct of monetary policy. First, if risk premium is high, and a large part of public debt is denominated in foreign currency, an increase in the real interest rate in response to higher inflation will not only lead to real depreciation, but also increases the output value of debt repayments due to dollarization of liabilities, and this in turn lead to a further increases in inflation unless suitable fiscal rule is in place (Blanchard, 2004). Second, changes in the risk premium affect short term policy rates via inflation expectations. Third, changes in the risk premium influence the return on long term securities either by influencing interest risk, term premia, and default risks (all of which feed on that return) or through the effect that changes in the short term interest rate have on expectations about that return.

Table 1.5 lists the average and volatile (both expressed in basis points) of the EMBI+ spread based on monthly averages for Emerging countries, South Africa and Nigeria over the period December 1997 to December 2005. Over this period, Nigeria displays-by far-the highest spread on average around 1157 basis points higher than that of South Africa. All spreads are quite volatile, with standard deviations always higher than 118 basis points.

**Table 1.5: Emerging Markets Bond Index + (EMBI+), monthly averages 1997Q1 – 2005Q4**

<b>Range</b>	<b>Average</b>	<b>Standard Deviation</b>	<b>Coefficient of Variation</b>
Emerging Markets	559.27	155.23	0.28
South Africa	270.75	133.93	0.49
Nigeria	1427.75	142.99	0.10

Source: IMF

<sup>3</sup> It measures the difference between the yield of a dollar-denominated bond issued by a non-US emerging market economy over a corresponding bond issued by the US Treasury – or the risk premium that investors expect in compensation for interest rate risk and default risk (but not currency risk) run by investing in one particular country.

The implication is that markets perceive the riskiness of the Nigerian government debt to be high and, in fact, higher than that of South Africa and other emerging market economies debt. In these circumstances, it is reasonable for investors to expect that the Nigerian government may default on its debt or that it may resort to finance a sizeable part of its expenditure by printing money.

To gain further insights into the foregoing analysis, the primary surplus (measured as government revenue less its expenditure) as a percentage of GDP is regressed against the public liabilities (calculated by adding the net federal debt to the money base) as a percentage of GDP. The estimation results of this simple OLS regression suggest a significant negative (positive) correlation between primary surplus and liabilities in Nigeria (South Africa). This suggests that while Nigeria may have been prone to a fiscal dominance regime, South Africa may have been characterized by a monetary dominance regime. However, the relatively low value of the R-squared coefficient (0.36 percent) suggests that fiscal policy can also affect monetary policy through other channels, such as through the impact of fiscal variables on exchange rates, interest rates and sovereign spreads.

This preliminary evidence on inflation and its fiscal determinants in Nigeria and South Africa seems to suggest the following conclusions:

- Country with chronic budget deficits and high public liabilities seem to have been more prone to fiscal dominance regime and high inflation
- Country with deep and well-financing domestic debt markets can avoid the negative consequences of large deficits and debt on inflation
- Without appropriate fiscal rules, the exigencies of the budget can too easily take precedence over the control of inflation, particularly for resource-countries whose revenues are highly volatile

### **1.3 The Importance of Fiscal and Monetary Policy Interdependence**

A renewed emphasis on price stability and need to achieve and maintain low inflation, higher growth and good governance has placed the issue of monetary cooperation across Africa at the centre of the economic policy debate.

The case for monetary policy cooperation in Africa is based on the need to overcome weak national economic policy institutions. Existing national central banks generally are not independent and countries with their own currencies have often suffered periods of high inflation because central banks have been forced to finance large public deficits and a mounting stock of debt.<sup>4</sup> The need to overcome this perverse characteristic of fiscal-monetary policy interaction in Africa is one of the main motivations behind the project of a continental monetary union.

The project received maximum priority in 2001 with the transformation of the Organization for African Unity (OAU) into the African Union (AU) that took on a broader mandate to meet the challenges of globalisation. In August 2003, the Association of African Central Bank Governors announced that it would work for a single currency and common central bank by 2021. The strategy is based on the initial adoption of monetary union in five existing regional economic communities. These regional monetary unions would be an intermediate stage, leading ultimately to their merger, and the creation of a single African central bank and currency.

However, many economists have expressed skepticism regarding either the feasibility or desirability of the project. In the words of Paul Collier “African monetary integration requires other institutional buttresses that do not emerge from monetary union alone” (Collier, 1991).

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<sup>4</sup> Masson and Pattillo (2005).

The historical experience of regional monetary integration in Africa seems to support this point. For example, the CFA Franc zone has two regional central banks, yet the independence of the two central banks was compromised in the 1980s by large countries bypassing limits on monetary financing through borrowing by state-owned banks. This led to a serious economic downturn and a financial crisis, culminating in the 1994 devaluation (see Guillaume and Stasavage, 2000).

However, the Common Monetary Area (CMA) between South Africa and some of its neighbours has been quite successful in providing price stability to its members, but at the price of giving South Africa complete control of monetary policy. In doing so the CMA members are not only borrowing South African monetary policy but also its relative stable fiscal policy and institutions.

These experiences, together with an analysis of the theoretical and political debate about monetary union in Europe, suggest that monetary union alone may not guarantee the sustainable regime needed in Africa. What it does is that it highlights the importance of interdependence between monetary and fiscal policy. Even, the recent global financial crisis has thought us a lesson in this direction, that greater policy coordination is imperative. Hence, the central problem of this study is to analyse systematically the relationships between fiscal and monetary policies in Africa with a particular focus on fiscal discipline, stabilization and coordination.

The main objective of this study is to analyse empirically the nature of fiscal and monetary policy interdependence and fiscal dynamics in Africa. We will also look at the possibility of implementing viable fiscal policy rules and institutions consistent with economic and monetary policy stability and growth, which is also a necessary condition for a feasible monetary union in the continent.

The dissertation is organized as follows.

In the next Chapter we start off by reviewing the theoretical foundations of our study looking in particular at the way economists have framed the analysis of fiscal and monetary policy interdependence. The conventional theory holds that prices are determined by the demand for liquidity and its evolution over time and therefore fiscal policy can affect price dynamics in so far it can force monetary authorities to monetise unsustainable fiscal positions. This implies that an independent monetary authority alone can guarantee price stability, regardless of fiscal policy dynamics. Recently the Fiscal Theory of Price Determination (FTPD) has instead argued that fiscal policy can have a direct effect on real and nominal outcomes through the effect that inter-temporal fiscal imbalances have on private wealth. The implication of the theory is that fiscal policy can be the main determinant of inflation, and that independent monetary authority alone may not suffice to ensure price stability. We argue that the FTPD is an encompassing description of the relation between fiscal policy and monetary policy in Africa and hence will form the basis of our empirical analysis.

The third chapter hence tests the FTPD in Africa using recursive vector autoregressive (VAR) model for 20 African countries. The results show that fiscal policy is dominating monetary policy in many countries in the sample. It also points out that a fiscal dominance regime may arise regardless of monetary policy independence. This implies that fiscal policy matters for achieving and maintaining price stability, supporting the FTPD view.

In Chapter 4 we extend the study using panel data techniques on a set of 43 African countries to assess the robustness of the preceding results, and at the same time to evaluate the stabilising or de-stabilising characteristics of fiscal policy in Africa. The results support a fiscal dominant regime for the continent. This response however seems to be weaker in the sub-sample

period, suggesting that there has been an effort by the fiscal authorities to improve on fiscal outcomes in recent times, although a regime shift has not yet occurred. Additionally, when allowing for the interaction between fiscal policy and the business cycle, the evidence seems to support a pro-cyclical fiscal policy or fiscal destabilisation in Africa. Meanwhile, the theoretical framework underlying the FTPD is limited only to the analysis in the chapter 3 and 4.

In Chapter 5 we use panel Granger causality tests to examine the direction of causality between government revenue and expenditure. Specifically, this chapter aims at detecting symptoms of fiscal instability deriving from the dynamic interaction of fiscal revenues and expenditures. The results support a unidirectional causality from revenue to spending in the full sample period, and no causality in the recent period. In this context, African countries could enhance the effectiveness of fiscal policy by making budget expenditure less driven by revenue availability

Finally, in Chapter 6, we use Monte Carlo simulation techniques to evaluate how the introduction of fiscal rules might affect the risk of unsustainable debt accumulation in an environment where fiscal revenues are highly uncertain, a typical characteristic of fiscal processes in Africa. Contrary to the prevalent literature, the results suggest that introducing some element of flexibility in the way fiscal expenditure is planned, with the use of flexible policy rules, might, under realistic circumstances, increase the risk of unsustainable debt accumulation because it magnifies the effect of unexpected revenues' reversal. Chapter 7 concludes and suggests further areas of research.

## CHAPTER TWO

### 2. THE ECONOMICS OF MONETARY AND FISCAL POLICY INTERDEPENDENCE

#### 2.1 Introduction

The experience of extreme macroeconomic instability in Africa has its origin in the inability of controlling fiscal dynamics and the effect that this has on the overall policy stance.

Economists have long noticed the feedback between fiscal and monetary policies that is embedded in the government's inter-temporal budget constraint. If the fiscal authority pursues an unsustainable fiscal policy, the monetary authority will be forced to print money (or use seigniorage) to satisfy the government's budget constraint, as in the "Unpleasant Monetarist Arithmetic" of Sargent and Wallace (1981), with the consequent inflationary effects.

However, money creation may not be the only channel through which fiscal policy becomes dominant and budget deficits cause inflation. A fiscal dominant regime may also arise through wealth effects of public debt not matched by future fiscal surpluses (Woodford, 1998b). These wealth effects could jeopardize the objective of price stability, irrespective of central bank commitment to low inflation. The implication is that fiscal policy can be the main determinant of inflation; independent monetary authority alone may not suffice to ensure price stability unless accompanied with an appropriate fiscal policy rule.<sup>5</sup> <sup>6</sup> This is the modern view of fiscal and monetary policy interdependence, the Fiscal Theory of Price Determination (FTPD).

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<sup>5</sup> The ability of fiscal authorities to affect monetary commitment is also explained in Dixit and Lambertini (2000b, 2001, and 2003) and Dixit (2000). They conclude that fiscal discretion 'destroys monetary commitment' and as such may justify rules imposed on budgetary behavior.

<sup>6</sup> This is the idea behind the desirability of fiscal constraints which has been central in the debate about monetary union in Europe. The Stability Pact's 3% of GDP limit on fiscal deficit

These competing views of the interaction between fiscal and monetary policy and their effect on price stability are central in the process of designing institutions for macroeconomic stability and growth. In the conventional view, it is the demand for liquidity and its evolution over time that determines prices. Fiscal policy is passive, which implies that government bonds are not net wealth (Barro, 1974) and monetary policy works through the interest rate or another instrument to determine prices. In the FTPD view, fiscal policy becomes active and does not accommodate or adjust primary surpluses to guarantee solvency of the public sector.<sup>7</sup> The increase in nominal public debt to finance persistent budget deficits is perceived by private agents as an increase in nominal wealth. Consequently, it is the outstanding government liabilities and the present value of primary surpluses plus seigniorage that matter.<sup>8</sup>

The importance of this theoretical development for designing economic policy institutions cannot be underestimated. If prices are exclusively a monetary phenomenon, a project of monetary unification in Africa could be a way to enforce monetary discipline upon undisciplined fiscal authorities (Masson and Patillo, 2005). But if prices are linked directly to government fiscal behaviour, then fiscal stability and fiscal policy rules might be a necessary condition for any project of monetary unification in Africa.

This chapter offers a critical review of the theoretical and empirical literature on fiscal and monetary policy interdependence, with particular attention paid on the fiscal explanation of monetary phenomena.

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and debt limit at 60% of GDP are stipulated to force and ensure fiscal discipline within a monetary union.

<sup>7</sup> In which case, the price level will have to rise for the government inter-temporal budget constraint to keep on being balanced; this may result in an inconsistency between inflation targeting and fiscal policy (Uribe and Yue, 2003).

<sup>8</sup> This implies that for countries in which seigniorage accounts for only a small part of the total revenues, the monetary authority will lose control of the price level (Canzoneri et al, 2001a)

The rest of the chapter is organised as follows. Section 2.2 reviews the main debate about fiscal and monetary policy interdependence. Section 2.3 reviews the empirical literature. Concluding remarks are drawn in section 2.4.

## **2.2 Theoretical Framework**

The literature on this topic, from the conventional theory of Sargent and Wallace to the modern Fiscal Theory of the Price Determination by Leeper, Sims, Woodford and Cochrane among many others, has discussed how an unsustainable fiscal policy may hinder the effectiveness of monetary policy. Their work demonstrates that the way in which the government's present-value budget constraint is satisfied affects how prices are determined.

If government is committed to maintaining fiscal solvency, an independent monetary policy that responds to a rise in the deficit by raising interest rates can force the government to adjust. In such a Ricardian regime, monetary policy could dominate fiscal policy. And primary surpluses move automatically to assure fiscal solvency for any path the price level might take. If on the other hand the primary budget balance evolves through the political process, and fiscal policy is not anchored by a medium-term rule, the government's liabilities would simply grow out of control, raising expectations that government debts would not be paid by raising future taxes. This creates the temptation to reduce the real value of government debt by inflation. In such a non-Ricardian regime, the equilibrium price level "jumps" to guarantee fiscal solvency.

Basically, it is perhaps useful to begin by recalling how the quantity-theory analysts argue that the path of the price level can be determined in such a case without any reference to the time path of a government's deficit or of the outstanding government debt.

In rational-expectations versions of the model of Cagan (1956), it is assumed that desired real money balances are a decreasing function of the expected rate of inflation, so that the money demand function is (in log form)

$$M_t - P_t = -\gamma(P_{t+1} - P_t) \quad (1)$$

Where  $M_t$  is the log of the quantity of money at time  $t$ ,  $P_t$  is the log of the price level at time  $t$ , and  $\gamma$  is the parameter that governs the sensitivity of money demand to the rate of inflation.<sup>9</sup> Under the assumption of perfect foresight; equation (1) becomes:

$$P_t = \left(\frac{1}{1+\gamma}\right)M_t + \left(\frac{\gamma}{1+\gamma}\right)P_{t+1} \quad (2)$$

After some algebra, the equilibrium price level sequence becomes

$$P_t = \left(\frac{1}{1+\gamma}\right) \sum_{s=0}^{\infty} \left(\frac{\gamma}{1+\gamma}\right)^{s-t} M_{t+s} \quad (3)$$

This simply means that the current price level is a weighted average of the current and all future money supplies.<sup>10</sup> Moreover, by relaxing the assumption of perfect foresight that the future is not known with certainty, then, equation (3) becomes;

$$P_t = \left(\frac{1}{1+\gamma}\right)M_t + E \sum_{s=0}^{\infty} \left(\frac{1}{1+\gamma}\right)^{s-t+1} M_{t+s+1} \quad (4)$$

<sup>9</sup> By the property of logarithms,  $M_t - p_t$  is the log of real money balances, and  $p_{t+1} - p_t$  is the inflation rate between period  $t$  and  $t+1$ .

<sup>10</sup> Equation (1) is derived from a pure quantity theory of money equation with constant income and constant real interest rate.

This means that the price level or the rate of inflation depends on the current money supply and expected future money supplies. However, while it is admitted that various real factors affect the form of the function  $\gamma$ , the time variation in the real factors is regarded as negligible in this model. Thus, the specification of the time path of the government budget deficit, among other things is irrelevant for the determination of the price level.

Yet, if the price level is independent of fiscal deficits, it is not independent of debt unless debt is zero; money growth must finance the interest obligations of the government. Fiscal policy implies deficits which require a future inflation (and implies price level) sequence to validate the debt. So, while the current money supply is set to fix current prices, that of future or expected money supply must reflect fiscal requirements. Unless there is credibility on the part of fiscal authorities – that is achieved by removing the need for seigniorage (the underlying cause of high money supply in future) – monetary policy cannot be credible. This is the conventional view of Sargent and Wallace.

Modern analysis of interdependence between monetary and fiscal policy has a central point of reference in the seminal paper by Sargent and Wallace (1981). The main objective of the paper was to show that, even in a pure monetarist framework, unbounded fiscal policy produces negative spillover effects on monetary policy, and ultimately it can undermine the ability of monetary policy to control inflation.

This conclusion is largely based on the “assumption” that permanent budget deficits must be eventually monetized. Not surprisingly, with an exogenous stream of budget deficits, there is only one integral of money creation that is consistent with long-run equilibrium (in terms of satisfaction of agents’ transversality conditions), and the only choice in the hand of the monetary authority is the time profile of money creation.

In the words of Sargent and Wallace, "without help from the fiscal authorities, fighting current inflation with tight monetary policy must eventually lead to higher future inflation"

On the other hand, the introduction of rational expectations has the effect of anticipating the inflationary pressure at time zero. This eliminates even the possibility of choosing the desired time profile of inflation consistent with the long-run solvency of the public sector.

But the most influential result of the Sargent and Wallace contribution has probably been the fact that the policy conflict between fiscal and monetary policy could be resolved simply by assigning policy leadership to the Central Bank. If it was possible to give the "first move" to the monetary authority, then the fiscal authority would be constrained in its policy choice by the amount of seignorage provided by the Central Bank.

In fact, in the Sargent and Wallace model, the monetary authority is the loser of the policy game simply because it is not able to influence the spending decision of the fiscal authority. Sargent and Wallace themselves recognise that the conflict could be resolved with appropriate institutional arrangements. As they say "One can imagine a monetary authority sufficiently powerful vis-à-vis the fiscal authority that by the imposition of slower rates of growth of base money, both now and into indefinite future, it can successfully constrain fiscal policy by telling the fiscal authority how much seignorage it can expect now and in the future."

A recent stream of research (Woodford (1994, 1995, 1996, 1998, 2001), Sims, (1994, 1995, 1997, 1999), Cochrane (1999), Dupor (2000) and Bergin, 2000), building on previous works of Calvo (1990) and Leeper (1991) among others, has renovated the interest in the analysis of the interrelation between monetary and fiscal policy, partly questioning the conclusions derived from the Sargent

and Wallace approach. The main innovation introduced by these contributions is that the interrelation between fiscal policy on one side, and monetary policy and the private sector on the other, manifests itself through changes in the level of prices that move to achieve public sector solvency, independently of the institutional arrangements between the fiscal and monetary authorities.

Variables like net government liabilities and expectations regarding the stream of future surpluses are given an immediate role in the determination of the equilibrium price level. If the government's solvency condition is not satisfied at a particular point in time, (that is, the stream of current and expected future surpluses would not pay the existing debt) price will move to ensure that it does hold.

The first goal of this approach to monetary and fiscal policy interdependence is to derive conditions under which the level of price is determined even in a regime of nominal short run interest rate targeting. In the quantity theory tradition, when the monetary authority targets the nominal interest rate, it supplies any amount of money demanded by the private sector. Given that the demand for money is a demand for real money balances, a given quantity of real money can be determined by an infinite number of combinations of nominal money supply and prices, producing indeterminate levels of prices and money stocks (Patinkin, 1961, Sargent and Wallace, 1975). On the contrary, the fiscal theory of price determination (FTPD) finds an anchor for the price level in the dynamics of expected future fiscal surpluses.

The basic mechanism behind the theory can be illustrated using an infinite horizon model with money in the utility function similar to the one used by Bergin (1997). In this model, a representative agent solves a standard optimisation problem,

$$\max_{B,M} U(C) = E_{t-1} \left[ \sum_{t=0}^{\infty} \beta^t \left( \log C_t + \mu \log \frac{M_t}{P_t} \right) \right] \quad (5)$$

subject to

$$C_t + \frac{B_t}{P_t} + \frac{M_t}{P_t} = (1 + i_{t-1}) \frac{B_{t-1}}{P_t} + \frac{M_{t-1}}{P_t} + Y_t - \tau_t \quad (6)$$

and

$$B_t \geq 0 \quad M_t \geq 0 \quad C_t \geq 0$$

where all the variables have the standard meaning,  $i_t$  is the nominal interest rate, the income  $Y_t$  is an independent and normally distributed positive random variable,  $C_t$  is consumption and  $\tau$  is a lump sum tax imposed by the government. The government budget constraint, expressed in nominal terms, is:

$$B_t + P_t \tau_t = (1 + i_{t-1}) B_{t-1} - (M_t - M_{t-1}) \quad (7)$$

The government must fix two of the five variables in (7), or define a function for each of them, in order for the model to be complete. The other three variables will then be determined by the private agent first order conditions. The first-order conditions (FOCs) are given by:

$$\frac{\delta U}{\delta C} : \frac{1}{C_t} = \lambda_t \quad (8)$$

$$\frac{\delta U}{\delta B} : \frac{1}{P_t C_t} = \beta (1 + i_{t-1}) E \frac{1}{P_{t+1} C_{t+1}} \quad (9)$$

$$\frac{\delta U}{\delta M} : \frac{M_t}{P_t} = \mu \frac{1 + i_t}{i_t} C_t \quad (10)$$

Suppose that the government follows a policy of nominal interest rate targeting and fixes  $i$  and the level of taxes and, that the default rate is restricted.<sup>11</sup> Then the government budget constraint divided by  $P_t C_t$  is given by:

$$\frac{B_t}{P_t C_t} = \frac{P_{t-1} C_{t-1}}{P_t C_t} \left( (1 + \bar{i}) \frac{B_{t-1}}{P_{t-1} C_{t-1}} + \frac{M_{t-1}}{P_{t-1} C_{t-1}} \right) - \frac{M_t}{P_t C_t} - \frac{\tau}{C_t} \quad (11)$$

Taking the expectations of equation (11) and using the private sector FOCs and the fact that in equilibrium is  $C=Y$ , we have (using conditions 9 and 10):

$$E_{t-1} \left( \frac{B_t}{P_t Y_t} \right) = \beta^{-1} \frac{B_{t-1}}{P_{t-1} Y_{t-1}} - \tau E_{t-1} (Y_{t-1}^{-1}) - \mu \left[ \frac{1 - \beta - \beta \bar{i}}{\beta \bar{i}} \right] \quad (12)$$

Equation (12) is an unstable difference equation ( $\beta < 1$ ), with the last term representing the expected constant seignorage revenues, given the policy pegging nominal interest rate. Condition (12) has a single stable solution, as:

$$\frac{B}{PY} = \frac{\beta}{1 - \beta} \left[ \tau E_{t-1} (Y_t^{-1}) + \mu \xi \right] \quad (13)$$

where  $\xi$  is the constant term in equation (12). Given the level of taxes and the nominal interest rate, equation (13) is the only value of real debt compatible with the solvency of the public sector. Implicitly equation (13) represents the net present value of expected future surpluses, therefore any movement in the present income, or taxes or interest rate will produce a movement in prices such that the inter-temporal budget constraint of the public sector is satisfied. Substituting this equilibrium value of future surpluses, called  $\Phi$ , in equation

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<sup>11</sup> If, for example, the default rate is not restricted, the properties of the model and the conclusions can be different. With such a passive fiscal policy or QTM, an interest rate peg is able to pin down consumption and inflation, while the price level cannot be determined and money growth policy will pin down consumption, inflation and the price level. However, the reason for not considering default in the exposition of the theory was mainly in order to keep the presentation focused on the main empirical implications of the theory.

(11) it is possible to express the movement in prices with respect to the other real variable in the model:

$$\frac{P_t}{P_{t-1}} = -\frac{(1+i_t)Y_{t-1}\Phi}{\Phi Y_t + \tau + (\mu\xi)} \quad (14)$$

Equation (14) shows the relationship between income and price dynamics when the government follows an exogenous fiscal policy as the one studied by Sargent and Wallace.

This negative correlation between movements in prices and the movement in real income is determined only by the particular fiscal policy followed by the government. A level of income greater than its trend value eases the pressure on the level of prices coming from the fiscal side, therefore reducing the level of prices itself. On the other hand, the fiscal authorities can influence the level of prices via changes in the tax rate with a result that is observationally equivalent to the traditional demand effects of fiscal policy of the Keynesian tradition. A reduction in taxes increases the wealth effect of the debt outstanding, thus increasing private demand and prices until the real value of debt has not come back at its sustainable value.

The mechanism behind this relationship totally depends on the wealth effect of public debt. In what way is this approach different from the traditional method in describing the determination of fiscal policy effects in a General Equilibrium Model? In building up a general equilibrium model similar to the one described above, it is usual practice to close the model with two transversality conditions, one for each agent. On one hand, a rational private agent is required to plan his consumption-leisure choice in such a way that in the limit he will use all his available resources:

$$E_t \left\{ \sum_{s=t}^{\infty} \left( \frac{1}{1+r} \right)^{s-t} C_s \right\} = (1+r) \frac{B_t}{P_t} + \frac{M_t}{P_t} + E_t \left\{ \sum_{s=t}^{\infty} \left( \frac{1}{1+r} \right)^{s-t} [(Y_s - \tau_s)] \right\}$$

On the other hand, the same condition is also imposed on the behaviour of the government derived by integrating forward with a condition like of equation (7), and imposing the final condition

$$\lim_{i \rightarrow \infty} \left( \frac{1}{1+r} \right)^{t+i} \frac{B_{t+i}}{P_{t+i}} = 0 \text{ or}$$

$$D_t = \sum_{i=0}^{\infty} \left( \frac{1}{1+r} \right)^{t+i-1} (\tau_{t+i}) \quad (15)$$

where D is the real value of debt issued by the government. As argued by Buiter (1998) "these decision rules determine, jointly with the market clearing conditions, initial conditions and other system wide constraints, the equilibrium sequences of prices. The Budget constraints must be satisfied, however, both for equilibrium and for out of equilibrium sequences of endogenous variables in order for these budget constraints to co-determine these equilibrium sequences". But in doing so, the equilibrium is imposed "ex ante", as a condition for the formulation of the model itself, and it is not the result, *ex post*, of possible disequilibrium dynamics.

In the FTPD, because the actual fiscal policy is expressed in nominal terms but the transversality condition (11) is expressed in real terms, it is possible that a disequilibrium behaviour of the government produces a movement in prices that generates a new equilibrium in which equation (11) is satisfied at a higher nominal debt and a higher level of prices. Only a policy that explicitly follows a Ricardian rule, as defined by equation (11), produces total independence of prices from fiscal dynamics.

For example, consider the case of a government following a tax policy that adjusts the level of taxes to the level of real debt, as:

$$\tau_t = -\theta_0 + \theta_1 \frac{B_t}{P_t} \quad (16)$$

Substituting this policy rule in the budget constraint (12) we obtain:

$$E_{t-1} \left( \frac{B_t}{P_t Y_t} \right) = \beta^{-1} \frac{B_{t-1}}{P_{t-1} Y_{t-1}} + \theta_0 E_{t-1}(Y_{t-1}^{-1}) - \theta_1 E_{t-1} \left( \frac{B_t}{P_t Y_t} \right) - \mu [E_{t-1}(Y_t) - \beta^{-1} Y_{t-1}]$$

or, simplifying:

$$E_{t-1} \left( \frac{B_t}{P_t Y_t} \right) = \frac{1}{[(1+\theta_1)\beta]} \frac{B_{t-1}}{P_{t-1} Y_{t-1}} + \frac{1}{(1+\theta_1)} \left\{ \theta_0 E_{t-1}(Y_{t-1}^{-1}) - \mu [E_{t-1}(Y_t) - \beta^{-1} Y_{t-1}] \right\} \quad (17)$$

a stable difference equation as long as  $(1+\theta_1)\beta$  is greater than 1. The meaning of equation (17) is pretty obvious: if taxes react to the increase in debt strongly enough, equation (17) is stable and a policy of pegging the level of prices does not conflict with the equilibrium of the public sector.<sup>12</sup>

It is clear that the above approach greatly reduces the role of the monetary authorities in determining the price level and, at the same time, casts serious doubt that the independence of the central bank should be the sole instrument for price stability. As argued by Posen (1993), Central Bank independence is not the instrument for achieving price stability by itself, but is the way in which the fiscal authorities have signaled to the market their willingness to stabilise the fiscal position, therefore achieving price stability through a change in fiscal

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<sup>12</sup> Leeper (1991), Sims (1994) and Canzoneri and Diba (1997) separately analyse all the possible rules that provide the same stability condition than (17), demonstrating that even less stringent rules than the one illustrated can provide the same "Ricardian" result (as defined by Woodford, 1995). Bergin (1997) analyses the same rules in a monetary union and concludes that the Maastricht rules are sufficient but not necessary to achieve Ricardian fiscal policies.

stance. On the other hand monetary policy independence cannot achieve price stability without a fiscal policy coherent with that objective.

### 2.3 Empirical Literature

In assessing the FTPD for a particular time period and a particular country, the plausibility of the non-Ricardian assumption becomes a key issue. According to the Ricardian assumption, governments are usually ready to adjust fiscal policy when the debt explodes, implying that the non-Ricardian assumption is not likely to arise.<sup>13</sup> But, for FTPD to be a positive theory, it is not necessary that it always holds (Woodford, 1998b). It can provide a useful characterization of actual policies in some contexts even if it does not in others.

It has also been argued that FTPD is not empirically plausible. This is because under both Ricardian and non Ricardian regimes, the inter-temporal government budget constraint is in equilibrium. What makes these two kinds of regimes to be different is the way in which this equilibrium gets satisfied without being easily observed with time series data.<sup>14</sup>

In spite of this, there are some formal ways of testing for the fiscal policy regime. Some work on the empirical validation of the existence of the Ricardian or non-Ricardian regime has been attempted, predominantly based on univariate tests. Canzoneri, Cumby and Dibia (2001a) use a bivariate VAR test for the existence of a Ricardian versus non-Ricardian regime in the United States (US). They exploit the positive dynamic correlation between primary surplus and government liabilities illustrated by the theory. An increase in surpluses might

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<sup>13</sup> According to the non-Ricardian assumption, if the real value of government debt were to grow explosively, no adjustments to fiscal and monetary policy would be made to keep it in line. Put differently, government policy is not calibrated to satisfy the intertemporal budget equation (11) for all values of  $P$ .

<sup>14</sup> As Christiano and Fitzgerald (2000) stress, "if governments directly recorded in writing what their policy is, this would help us to discriminate between the two policy regimes." The Stability and Growth Pact (SGP), in their view, is one of the examples of such an arrangement where governments commit themselves to a particular fiscal policy regime. Nonetheless, as discussed by Katter, lack of credibility can undermine the role of the SGP.

induce an increase in government liabilities (in real term) if a non Ricardian regime is present – i.e. if fiscal surplus induces a reduction in the level of prices<sup>15</sup> In a Ricardian (or monetary dominant) regime, an increase in surpluses would induce a decrease in government liabilities (in real term). They conclude in favour of the existence of a Ricardian regime, since positive shocks in the primary budget surpluses decrease the real value of the shock of public liabilities.

Cochrane (1999) also uses a VAR model with the following variables: public debt as a percentage of private consumption, the budget surplus to private consumption ratio, the consumption rate growth and the real interest rate implicit in the stock of public debt. With annual data for the US, he concludes that positive changes in the budget surplus reduce the stock of public debt. Woodford (1999) reaches the same conclusion as Cochrane (1999), with the same data and variables, with the exception that the real interest rate is discarded, on the basis that it should be implicit in the evolution of the other three variables.

Debrun and Wyplosz (1999), Melitz (2000) and Afonso (2002) provide additional empirical work related to this discussion. They estimate reaction functions respectively for the EU-12 and OECD countries using a panel data technique, in order to evaluate whether the primary budget surplus responds positively to the level of government debt. According to the results presented by these authors, there seems to be a statistically significant positive relationship between both variables. Consequently, they conclude that governments do take into account their respective inter-temporal budget constraint. In other words, fiscal policy might have been implemented according to a Ricardian regime.

Creed and Sterdyniak (2001) also adopt an approach similar to the one implemented by Melitz (2000). With a panel data and reaction function estimation, they find that fiscal policy could be characterised by a Ricardian

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<sup>15</sup> In the government liabilities are included both public debt and monetary base.

regime in Germany and in the US, and by a non-Ricardian regime in France. Additionally, another possible reading of the results presented by these two authors might be the conclusion that fiscal policy may have been, in the past, sustainable in Germany and unsustainable in France.<sup>16</sup>

Using a different approach for somehow related research, Favero (2002) jointly models the effects of monetary and fiscal policies on macroeconomic variables in structural models for France, Germany, Italy and Spain, and reports that fiscal policy reacts to increases in debt. Additionally, for the US, Favero and Monacelli (2003) and Sala (2004), report the existence of a Ricardian fiscal regime after the end (beginning) of the 1980s (1990s), while Sala concludes the existence of a non-Ricardian regime in the 1960s and 1970s.

The Emerging market economies have also attracted quite a number of studies on this issue. Tanner and Ramos (2002) evaluate whether the policy regime in Brazil can be characterised as either Ricardian (monetary dominant) or non-Ricardian (fiscal dominant). Results show some evidence of a monetary dominant regime for 1995-97, but not for the decade of the 1990s as a whole in a cross-sectional framework. The International Monetary Fund (2003) estimates a separate fiscal policy reaction function for a group of industrial and emerging market economies and finds that the response of primary surpluses to public debt is stronger in the former set of countries than in the latter.

Zoli (2005) provides a more systematic analysis of the link between fiscal and monetary policy in emerging markets. She first conducts a test of fiscal dominance employing a VAR model to assess whether primary balances are set exogenously and independently from public sector liabilities, in a sample of six emerging market countries (Argentina, Brazil, Columbia, Mexico, Poland and Thailand). Such an approach shows a regime of fiscal dominance in Argentina and Brazil during the 1990s and early 2000s, with mixed results for the other

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<sup>16</sup> Also see Afonso (2002).

countries.<sup>17</sup> In the analysis of whether fiscal variables enter significantly in the central bank's reaction function, results show that the conduct of monetary policy is not directly affected by changes in real primary balances.<sup>18</sup>

Further evidence are Mexico (Sidaoui, 2003), Columbia (Uribe et al, 2003), Chile (Marshall, 2003), Peru, Poland, Indonesia, Venezuela, Thailand (Mohanty, 2003), Israel (Sokoler, 2003) and Czech Republic (Matalk and Slavik (2003). The common characteristics of these experiences suggest that the effectiveness and credibility of monetary policy could be jeopardized by the size of fiscal imbalances, evidence of a non-Ricardian fiscal regime.

There is, however, relatively little empirical evidence regarding developing countries, particularly in Africa, where the above issues are perhaps even more pertinent. Using a standard cash-in-advance model, Fanizza and Soderling (2006) show that fiscal considerations and commitment drive inflation in the Middle East and North Africa, validating the FTPD hypothesis. They conclude that a sound fiscal position constitutes a necessary condition for macroeconomic stability in the region and that efforts to build a favourable institutional setting for monetary policy will fail unless national authorities ensure a sound fiscal position.

The study on Zambia by the International Monetary Fund (2006) employed a bivariate VAR test following Canzoneri et al (2001a) to discriminate between a monetary dominant and a fiscal dominant regime. The results show that fiscal considerations and commitment drive the choice of a monetary policy regime in Zambia for the period 1980-2004, evidence of a fiscal dominant regime.

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<sup>17</sup> Using a small short run model of the Brazilian economy, Favero et al (2004) demonstrate how a failure in fiscal backup for monetary policy leaves interest rate increases powerless to restrain inflation in Brazil between 2002 and 2003; also see Loyo (2000).

<sup>18</sup> Countries included in the sample are Brazil, Chile, Columbia, Mexico, Poland, Thailand and South Africa.

Baldini and Ribeiro (2008) also use a bivariate VAR test for the existence of a fiscal dominant versus monetary dominant regime in 22 sub-Saharan African countries. Their results show that a number of countries in the region were characterized throughout the period 1980-2005 either by chronic fiscally dominant regime, with weak or no response of primary surpluses to public debt, or by a consistent adoption of a monetary dominant regime. However, a number of countries were also characterized by lack of a clear monetary and fiscal policy regime. The study also finds that changes in nominal public debt affect price variability via aggregate demand effects. The authors then conclude that fiscal outcomes could be a direct source of inflation variability in Africa, as predicted by the fiscal theory of the price level.

The foregoing experiences suggest that a fiscal policy regime must be such that it does not allow changes in the price level to become the mechanism through which the condition for government solvency is satisfied (Moreno, 2003). In other words, the effectiveness and credibility of monetary policy should not be jeopardized by the size of fiscal imbalances. Moreover, according to Woodford (1998b), FTPD can provide a useful characterisation of actual policy in some countries even if it does not in others.

## **2.4 Conclusion**

This chapter discussed the interrelationship between fiscal and monetary policies. It presented a theoretical model in understanding the implication of the FTPD or the role of fiscal dynamics on the overall price stance. The conventional wisdom by Sargent and Wallace holds that if there is no doubt about the monetary policy commitment to low and stable inflation, then price stability is exactly what will happen. According to the FTPD, however, this overstates the monetary policy power; fiscal policy can also be the main determinant of inflation. The chapter also offered a brief review of an empirical validation of the existence of fiscal dominance or monetary dominance regime.

We argued that the FTPD is an encompassing description of the relation between fiscal policy and monetary policy in Africa. The experience of extreme macroeconomic instability in the continent could be attributed to the inability of controlling fiscal dynamics and the effect that this has on monetary policy. This therefore forms the basis for our empirical interrogation in the succeeding two chapters (chapter 3 and 4).

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## CHAPTER THREE

### 3. TESTING THE FISCAL THEORY OF PRICE DETERMINATION IN AFRICA: A VAR APPROACH

#### 3.1 Introduction

The persistent high budget deficits and unsustainable levels of debt to GDP ratios in Africa have aroused attention on the effects of fiscal policy on price stability.<sup>19</sup> Assessing in which policy regime the continent live or how fiscal and monetary policies are coordinated is important because it determines what policy tools are really effective affecting price stability. If fiscal and monetary policies are coordinated in such a way that fiscal policy becomes the dominant determinant of inflation as the Fiscal Theory of Price Determination (FTPD) predicts, then fiscal policy will have to matter in achieving price and macroeconomic stability in Africa,. Any effort to build a favourable institutional setting for monetary policy in Africa is bound to fail unless national authorities ensure a solid fiscal position.

This chapter tests the nature of fiscal and monetary policy interdependence in Africa. The main objective is to investigate whether fiscal policy is dominating monetary policy and whether fiscal instability contributes directly towards price dynamics. In other words, it examines whether some of the implications of the FTPD are indeed a feature of the African economies.

We use recursive VAR in the identification of Monetary Dominance (MD) or Fiscal Dominance (FD) regime. If a positive innovation in primary surplus to GDP ratio raises expected future surpluses and lowers liabilities in the future, then we have a MD regime, otherwise a FD regime.

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<sup>19</sup> Already discussed in chapter one.

Following Canzoneri et al (2001a), we focus on a set of impulse response functions on the Surplus to GDP and Liabilities to GDP ratios for 20 African countries whose data are available annually for the period 1980-2006. This methodology is convenient because it only requires the estimation of a relatively small number of parameters and does not impose any structure on the economy.

The rest of the chapter is organized as follows. Section 3.2 describes the econometric methodologies used to test the empirical predictions of the FTPD and to differentiate between monetary and fiscal dominance. Section 3.3 describes the dataset and discusses the results. Finally, section 3.4 concludes the chapter.

## **3.2 Econometric Methodology**

To provide robust evidence on the relative importance of fiscal and monetary policy, this section employs the following econometric approaches using recursive VAR.<sup>20</sup>

- based on the dynamic relationship between government liabilities and primary surpluses; we test how fiscal authorities respond to ensure the solvency of the public sector;
- given the role of nominal income in the FD regime, the second approach tests whether the positive response of future surpluses to current surpluses is due to lower nominal income or not,
- based on the interaction between fiscal and monetary variables, we estimate the relative importance of primary surpluses and money growth on inflation, and

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<sup>20</sup> As already discussed in chapter 2, this is one of the approaches used to test the FTPD empirically (Sala (2004), Tanner and Ramos (2002), Canzoneri, Cumby and Diba (2001a), and Christiano and Fitzgerald (2000), among others).

We now turn to explain each of these econometric approaches in relation to our analysis of the identification of fiscal and monetary regimes.

### 3.2.1 First approach

This approach follows the methodology used by Canzoneri et al (2001a), which emphasizes the role of fiscal policy in determining prices in a small open economy. The approach allows us to identify a monetary dominant (or Ricardian) regime or fiscal dominant (or non Ricardian) regime by estimating how primary surpluses respond to a temporary shock in government liabilities, and vice versa.

Canzoneri et al (2001a) rely on the response of government liabilities to primary surplus to find out which regime provides a more plausible explanation for these patterns. Specifically, they estimate a bivariate VAR model of government liabilities and fiscal surpluses. Consider the government inter-temporal budget constraint in nominal terms, i.e.;

$$B_j = (T_j - G_j) + (M_{j+1} - M_j) + B_{j+1}/(1+i_j) \quad (3.1)$$

where  $M_j$  and  $B_j$  are the stocks of base money and government debt at the beginning of period  $j$ ,  $T_j - G_j$  is the primary surplus during period  $j$ , and  $i_j$  is the interest rate for period  $j$ . Equation (3.1) says that the existing debt has to be paid off, monetized or refinanced. By expressing equation (3.1) in terms of total government liabilities,  $M + B$ , and scale the fiscal variables on GDP, after some algebra, equation (3.1) becomes:

$$w_j = s_j + \alpha_j w_{j+1} \quad (3.2)$$

where,  $w_j$  is the liabilities to GDP ratio,  $s_j$  is the surplus to GDP ratio and  $\alpha_j$  is the discount factor. It should be noted that  $s_j$  include seigniorage. Iterating equation (3.2) forward from the current period  $t$ , and taking expectations

conditional on information available in period  $t$ , we obtain the present value constraint

$$w_t = s_t + E_t \sum_{j=t+1}^{+\infty} \left( \prod_{k=t}^{j-1} \alpha_k \right) s_j \Leftrightarrow \lim E_t \left( \prod_{k=t}^{T+t-1} \alpha_k \right) w_{t+T} = 0 \quad (3.3)$$

The Fiscal Theory of the Price Level treats equation (3.3) as an equilibrium condition that must be satisfied. If the primary surplus to GDP ratio are determined by an arbitrary process (unrelated to the level of the debt), then nominal income and/or discount factors must jump in equilibrium to satisfy equation (3.3). As already noted, this is a fiscal dominant or non Ricardian regime. If on the other hand, primary surpluses are determined in such a way that equation (3.3) is satisfied regardless of the values that nominal income and discount factors assume, then, nominal income and the discount factors can be determined elsewhere in the model. And this is a monetary dominant or Ricardian regime

Table 3.1 summarizes the criteria for identifying FD and MD regimes using first approach. Consider how a positive innovation in current surpluses passes to the future liabilities. In a MD regime, the surpluses pay off some of the debt and future liabilities fall, while in a FD regime, future liabilities rise. Again, suppose an innovation in the current surpluses is not correlated with the future surpluses. In a FD regime, future liabilities should not be affected by the innovations in current surpluses. However, there is also another case to consider. Suppose innovations in current surpluses are negatively correlated with future surpluses. In this case, future liabilities would fall in either a MD or FD regime, and we have an identification problem.

**Table 3.1 Identification Criteria for Fiscal Dominance (FD) and Monetary Dominance (MD) Regimes**

Criteria	Response of future Liab to current Psurp 1 <sup>st</sup> Order	Response of future Liab to current Psurp 2 <sup>nd</sup> Order	Response of future Auto Psurp to current Psurp	Regime
C1	negative (-)	negative (-)	positive (+)	+ MD
C2	non negative (0, +)	non negative (0, +)	non negative (0, +)	+ FD
C3	negative (-)	negative (-)	negative (-)	- Unidentified (NI)
C4	negative & positive (-/+)	negative & positive (-/+)	positive (+)	- Unidentified (NI)

Note

Psurb is government revenue less its expenditure (including net federal interest payment) and divided by nominal GDP. Liab is calculated by adding the net federal debt to the money base both divided by nominal GDP.

1st VAR ordering is Psurb → Liab, which is consistent with a non Ricardian or FD regime characterized by an active fiscal policy.

2nd VAR ordering is Liab → Psurb, which is consistent with a Ricardian or MD regime characterized by a passive fiscal policy and active monetary policy. Results are however, consistent under both orderings.

The test is based on an impulse-response analysis of future total government liabilities to a shock in current surpluses. Say for example, there is a shock in the Surplus/GDP, how do both variables react? Identifying these shocks in an FD regime is straight forward because the Surplus/GDP series is assumed to be exogenous. The first equation of the VAR, which describes the evolution of Surplus/GDP, is simply a forecasting equation in which Liabilities/GDP enters because of its value in forecasting future surpluses. However, in an MD regime, Liabilities/GDP influences the setting of future surpluses.<sup>21</sup>

### 3.2.2 Second Approach

By extension and for purposes of checking robustness, the second approach analyses the role of nominal income in the FD regime. It tests whether the positive response of future surpluses to current surpluses is due to lower nominal income or not. Since the theory of FTPD implies that nominal income moves to help balance the present-value budget constraint equation, it follows that a positive innovation in Surplus/GDP would lower nominal income in the same period and raises the real value of current government liabilities. To test for this presumption, we split the numerator and denominator of

<sup>21</sup> As Christiano et al (2000) and Canzoneri et al (2001a) demonstrate, the dynamic response of a variable to a shock in surplus/GDP can be estimated by computing the impulse responses in a VAR's ordering.

Liabilities/GDP, and run a VAR on the log of nominal liabilities, Surplus /GDP and log of nominal income. This is the only ordering that makes sense in an FD regime, since the log of the liabilities is predetermined and the log of the nominal GDP is predicted to respond to the surplus innovation. Table 3.2 below summarizes the identifying criteria based on this approach.

**Table 3.2: Identification Criteria for FD and MD based on Nominal Income**

Criteria	Response of future income to current P <sub>surp</sub>	Response of future P <sub>surp</sub> to current P <sub>surp</sub>	Regime
C1	negative (-)	positive (+)	FD
C2	positive (+)	positive (+)	MD

**Note:** This is based on the sign of the impulse response function of the following VAR model; log of nominal liabilities → Surplus /GDP → log of nominal income.

### 3.2.3 Third Approach

Finally, we analyse how inflation variability is directly affected by fiscal and monetary aggregates. The FTPD predicts that, under an FD (or NR) regime the main source of changes in the price level could be explained primarily by the associated wealth effects upon private consumption.<sup>22</sup> This is because, with a non-Ricardian regime, if fiscal authorities are unable to adjust primary surpluses to guarantee solvency of the public sector, the increase in nominal public debt to finance persistent budget deficits is perceived by private agents as an increase in nominal wealth, leading to a higher demand for goods, and an increase in output gap and subsequently an increase in domestic prices. Here, we identify which of the two policy variables — namely, money growth or real primary surpluses, best explains inflation variability in Africa, after controlling for the aggregate demand channel (that is, output gap).<sup>23</sup>

In so doing, a VAR is run with the following causal ordering: nominal domestic debt growth, growth rate of money, real output gap and inflation rate.

<sup>22</sup> See Woodford (1998b).

<sup>23</sup> Output gap is estimated using Hedrick Prescott. The parameter lambda is set to a value of 100 as it is customary for annual data

This ensures that the inflation rate is the only variable responding contemporaneously to fiscal and monetary policy shocks. The real output gap is included to control for the effect of aggregate demand on inflation. Subsequently, variance error decompositions for inflation in each VAR are computed.

### **3.3 Results and Interpretation**

#### **3.3.1 Data**

Primary surplus corresponds to government revenue minus its expenditure and divided by nominal GDP for the fiscal year. Liabilities is calculated by adding the net federal debt to the money base (both measured at the beginning of the fiscal year) and dividing by the nominal GDP of the fiscal year.

Data limitation problems meant that all countries within the Economic Community of Central African States (ECCAS) had to be dropped. Therefore, we concentrated on the 20 countries in the remaining four regions of Africa, whose data are at least available annually for the period 1980-2005.<sup>24</sup>

Most of the data are extracted from the International Financial Statistics (IFS) of the IMF and World Economic Outlook (WEO). For some countries where data on government primary surplus are missing, the World Table of the World Bank (1994) and The Europa World Year Book (2004) serve as supplements. In addition, the African Development Report (2002) and Earthtrends Data Tables are used to supplement data on debt, especially for Seychelles.<sup>25</sup>

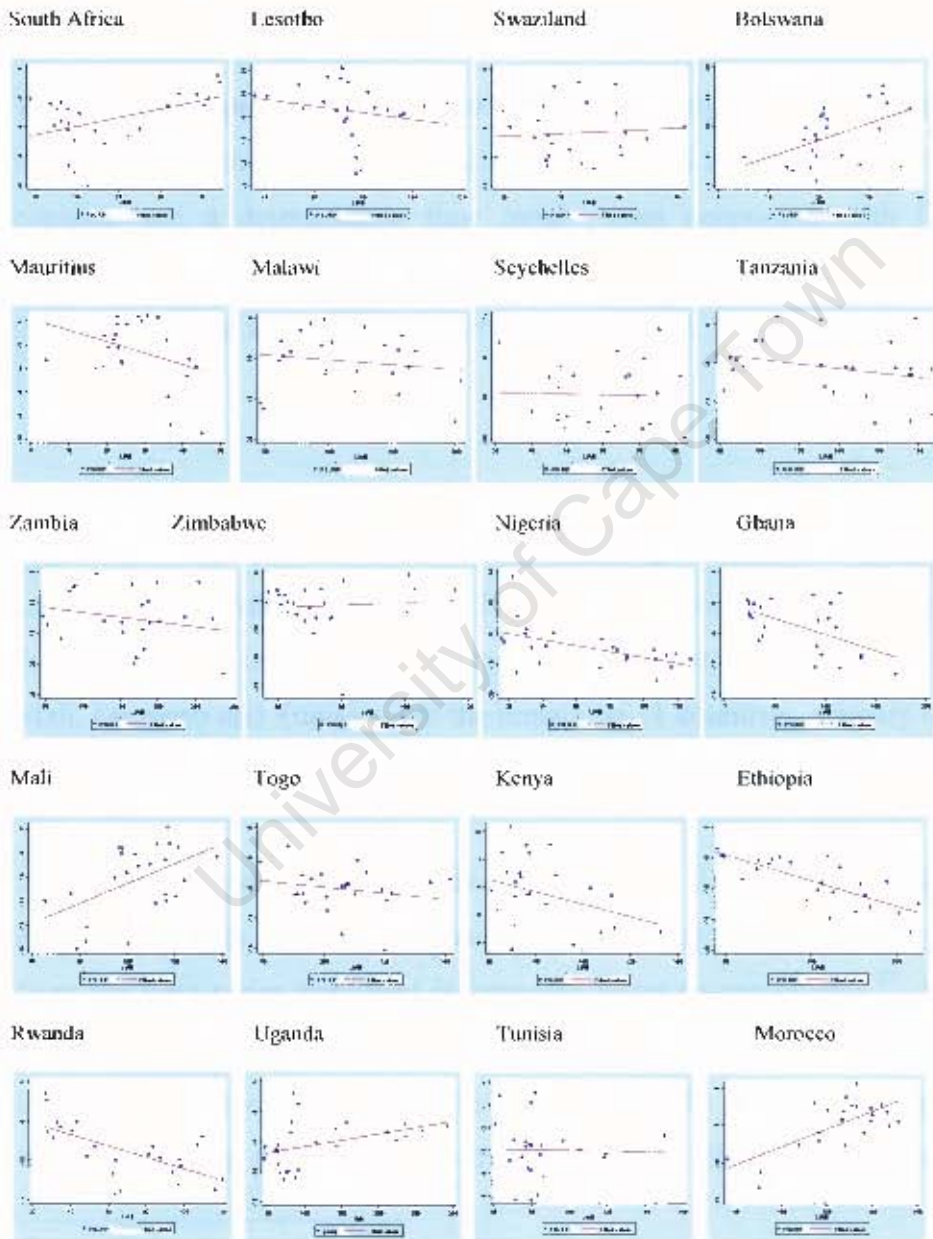
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<sup>24</sup> The 20 countries are South Africa, Lesotho, Swaziland, Botswana, Mauritius, Seychelles, Malawi, Tanzania, Zambia, and Zimbabwe (all in SADC region), Mali, Togo, Ghana and Nigeria (all in ECOWAS region), Rwanda, Uganda, Ethiopia and Kenya (all in COMESA region) and, Morocco and Tunisia (in AMU region). Note, there is overlap between COMESA and SADC members.

<sup>25</sup> The use of different data sources when extracting total debt for many countries undoubtedly reduces the statistical power of these results. However the use of different econometric tests and approaches to underpin the relative importance of monetary and fiscal determinants of inflation should improve the reliability of the results.

For a causal inspection of the underlying time series, Figure 3.1 plots the primary surpluses to GDP and government liabilities to GDP ratios for the period 1980-2006.

Figure 3.1: Surplus/GDP and Liabilities/GDP, 1982–2006



Interestingly, the scatter diagram supports the existence of a negative relationship for Lesotho, Mauritius, Malawi, Tanzania, Zambia, Nigeria,

Ghana, Togo, Kenya, Ethiopia and Rwanda. This negative correlation simply suggests that government deficits have led to the accumulation of government liabilities in many countries of the continent. However, apart from Swaziland, Seychelles, Zimbabwe and Tunisia show no correlation between both variables; South Africa, Botswana, Mali, Uganda and Morocco exhibit a positive correlation between the Surplus/GDP and Liabilities/GDP ratios.

### 3.3.2 Unit-Root Test

The integrating properties of the variables are investigated by conducting unit-root tests using the augmented Dickey-Fuller (ADF) tests. This test includes a constant and a deterministic time trend (when necessary) with four lags assumed as a starting point. The lag length in the ADF regression is selected using the Akaike and Schwarz information criterion. The results are presented in table 3.3.

The test results suggest that we cannot reject the null hypothesis of a unit root on both primary surpluses to GDP ratio and the government liabilities to GDP ratio, for South Africa, Seychelles, Ethiopia, Togo and Ghana (the t-values for the variables are inside the confidence intervals), but can do so for Botswana, Mali, Morocco and Tunisia. For the remaining 11 countries, primary surpluses are stationary while liabilities are non-stationary.<sup>26</sup>

Moreover, the issue of whether the variables in a VAR need to be stationary has not been fully resolved. Imposing stationarity by differencing may remove from the time series important information about co-movements.<sup>27</sup> Sims and others recommend against differencing even if the variables contain a unit root; they argue that the goal of a VAR is to determine the interrelationships among the variables, not the parameter estimates (Enders, 1996). Hence, we proceed

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<sup>26</sup> There is no time trend in the model for all countries (the p-value for trend variable is insignificant at all conventional levels) except for Botswana, Malawi and Rwanda (on liabilities), and Togo, Nigeria, Togo and Ethiopia (on primary surpluses).

<sup>27</sup> See, Kireyev (2000).

to the estimation both in levels and first differences of the VARs for each country in the sample.

**Table 3.3: Augmented Dickey-Fuller (ADF) Test for Unit Root**

Regions		Stationary	non Stationary
<b>SADC</b>			
South Africa	} <i>CMA</i>		Psurp and Liab
Lesotho		Psurp	Liab
Swaziland		Psurp	Liab
Botswana		Psurp and Liab	
Mauritius		Psurp	Liab
Tanzania		Psurp	Liab
Malawi		Psurp	Liab
Seychelles			Psurp and Liab
Zambia		Psurp	Liab
Zimbabwe		Psurp	Liab
<b>COMESA</b>			
Ethiopia			Psurp and Liab
Kenya		Psurp	Liab
Rwanda		Psurp	Liab
Uganda		Psurp	Liab
<b>ECOWAS</b>			
Mali	} <i>CFA Franc</i>		Psurp and Liab
Togo			Psurp and Liab
Nigeria		Psurp	Liab
Ghana			Psurp and Liab
<b>AMU</b>			
Morocco		Psurp and Liab	
Tunisia		Psurp and Liab	

**Note**

All monetary variables used in the analysis are stationary.

### 3.3.3 Analysis

This sub-section presents the results of the four econometric approaches towards the identification of fiscal dominant and monetary dominant regimes in Africa. Tables 3.4, 3.5 and 3.6 and, figure 3.2, 3.3, 3.4 and 3.5 summarize, respectively, the various approaches described above.

#### First approach

The second and third columns of table 3.4 show the sign of the responses of future real liabilities to a shock in current real surpluses in both the first and second ordering of the VAR. The fourth column shows the response of future

surpluses to current surpluses; the fifth column shows the autocorrelation sign of the surpluses, and the sixth column identifies the type of regime (whether FD or MD), based on the criteria summarized in table 3.1. The VAR of one lag and a constant is selected for all the countries (based on selection order criteria).

**Table 3.4: VAR on Psurp and Liab**

		Response of future Liab to current Psurp		Response of future Psurp to current Psurp	Auto Psurp	Regime
		1 <sup>st</sup> Order	2 <sup>nd</sup> Order			
<b>SADC</b>						
South Africa	} <i>CMA</i>	-	-	+	+	MD
Lesotho		+	+	+	+	FD
Swaziland		-	-	+	+	MD
Botswana		+	+	+	+	FD
Mauritius		-	-	+	+	MD
Tanzania		+	+	+	-	NI
Malawi		+	+	+	+	FD
Seychelles		-	-	-	-	NI
Zambia		+	+	-	-	NI
Zimbabwe	+	+	+	+	FD	
<b>COMESA</b>						
Ethiopia		+	+	+	+	FD
Kenya		-/+	-/+	+	+	NI
Rwanda		-	-	-	-	NI
Uganda		+	+	+	+	FD
<b>ECOWAS</b>						
Mali	} <i>CFA Franc</i>	-	-	+	+	MD
Togo		-	-	+	+	MD
Nigeria		-	-	+	+	MD
Ghana		-/+	-/+	+	+	NI
<b>AMU</b>						
Morocco		+	+	+	+	FD
Tunisia		+	+	+	+	FD

Out of a sample of 20 countries, eight are estimated to have followed an FD regime (Lesotho, Botswana, Malawi, Zimbabwe, Ethiopia, Uganda, Morocco

and Tunisia).<sup>30</sup> There is an identification problem in Seychelles, Tanzania, Zambia, Kenya, Rwanda and Ghana.<sup>31</sup> The remaining six countries exhibit an MD regime (South Africa, Swaziland, Mauritius, Mali, Togo and Nigeria).

The response of the Liabilities/GDP ratio in period 1 to an innovation in the Surplus/GDP ratio in period 0 is negative regardless of the ordering used for South Africa, Swaziland, Mauritius, Mali, Togo and Nigeria.<sup>32</sup> This negative response would arise naturally in an MD regime.

As already shown in table 3.1, however this negative response could also arise in an FD regime if a positive Surplus/GDP innovation ratio lowers expected future surpluses sufficiently to reduce the present value. This is not the case here. The response of future surpluses is positive and significant for these countries (the Surplus/GDP ratio in period 0 produces a surplus in period 1) so that even more of the debt is paid off in period t+1 and future liabilities fall.

Evidence is much weaker in Lesotho, Botswana, Malawi, Zimbabwe, Ethiopia, Uganda, Morocco and Tunisia. The response of the Liabilities/GDP ratio to a surplus shock is positive. As already pointed out, this positive response would arise naturally in an FD regime. However, there is an identification problem in Seychelles, Tanzania, Zambia, Kenya, Rwanda and Ghana. The results are also presented in figure 3.2 (see Appendix II).

## Second Approach

Table 3.5 summarizes the nominal income analysis results of the second approach. The second column of the table shows the sign of the response of the future log of nominal income to a shock in current real surpluses. The third column shows the response of future surpluses to current surpluses, and the

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<sup>30</sup> These findings are consistent with the similar study by Fanza and Soderling (2006), and Baldini and Ribeiro (2008).

<sup>31</sup> The identification here for six countries is less compared to thirteen countries found in Baldini and Ribeiro (2008).

fourth column identifies the type of regime (FD or MD) based on the criteria summarized in table 3.2. The VAR of one lag and a constant is selected for all the countries.

**Table 3.5: VAR on Log of Liab, Psurp and Log of Nominal GDP**

		Response of future nominal Income to current psurp	Response of future psurp to current Psurp	Regime
<b>SADC</b>				
South Africa	} <i>CMA</i>	0/+	+	MD
Lesotho		-	+	FD
Swaziland		0/+	+	MD
Botswana		-	+	FD
Mauritius		0/+	+	MD
Tanzania		0/+	-	NI
Malawi		-	+	FD
Seychelles		0/+	+	NI
Zambia		0/+	-	NI
Zimbabwe	0/+	+	FD	
<b>COMESA</b>				
Ethiopia		-	+	FD
Kenya		0/+	+	NI
Rwanda		-	-	NI
Uganda		0/+	+	FD
<b>ECOWAS</b>				
Mali	} <i>CFA Franc</i>	0/+	+	MD
Togo		0/+	+	MD
Nigeria		0/+	+	MD
Ghana		0/+	+	NI
<b>AMU</b>				
Morocco		-	+	FD
Tunisia		-	+	FD

Note

VAR Ordering is log of nominal liabilities → Psurp → log of nominal income

All countries, except Lesotho, Botswana, Malawi, Ethiopia, Rwanda, Morocco and Tunisia exhibit a positive response of the future log of nominal income to current real surpluses. This interpretation is consistent with the one given in table 3.4.

This suggests that the response that our “natural presumption” associates with an FD regime is not supported by the data for South Africa, Swaziland, Mauritius, Mali, Togo and Nigeria. Meanwhile, an FD regime in Zimbabwe and Uganda is more chronic as real surpluses generated in both countries are not used for the purpose of reducing their debt. The results are also presented in figure 3.3 (see Appendix II).

### **Third Approach**

Table 3.6 summarises the variance error decomposition results based on one lag and a constant for all the countries, suggesting that inflation variability could be mostly explained by real primary surpluses (in South Africa, Tanzania, Kenya and Rwanda), money growth (in Swaziland, Lesotho, Seychelles, Zambia, Zimbabwe, Uganda and Morocco) and by both determinants (in Malawi and Botswana).

The second column of Table 3.6 reports the regime identified by the previous approaches, while the third and fourth columns show the average percentage of inflation variability for eight periods due to real primary surpluses and money growth, respectively. Lesotho, for example, is a case previously identified under the FD regime. Under this test, the inflation variability is more likely to be associated with changes in money growth (28.9%) than changes in real surpluses (5.0%), suggesting that the type of FD regime in Lesotho could be explained by the QTM of debt monetisation.

For Malawi, however, which also functions with an FD regime, the largest variability in inflation is associated with both changes in real surpluses (23.5%) and money growth (37.6%), indicating that the type of FD regime in Malawi could be best explained by both the FTPD and QTM mechanisms.

**Table 3.6: Variance Decomposition on Inflation Variability**

Regime		Inflation variability due to psurp	Inflation variability due to money growth	
<b>SADC</b>				
South Africa	} <i>CMA</i>	MD	22.0%	5.8%
Lesotho		FD	5.0%	28.9%
Swaziland		MD	3.8%	19.0%
Botswana		FD	11.9%	15.5%
Mauritius		MD	7.3%	6.3%
Tanzania		NI	19.6%	11.8%
Malawi		FD	23.5%	37.6%
Seychelles		NI	2.6%	17.0%
Zambia		NI	3.9%	55.6%
Zimbabwe		FD	13.9%	26.0%
<b>COMESA</b>				
Ethiopia		FD	1.57%	3.51%
Kenya		NI	13.2%	1.7%
Rwanda		NI	11.3%	3.75%
Uganda		FD	0.93%	20.5%
<b>ECOWAS</b>				
Mali	} <i>CFA Franc</i>	MD	0.07%	0.13%
Togo		MD	3.26%	2.32%
Nigeria		MD	1.53%	0.28%
Ghana		NI	0.51%	1.54%
<b>AMU</b>				
Morocco		FD	6.77%	10.0%
Tunisia		FD	0.28%	2.45%

**Note**

VAR Ordering is Psurp → Nominal money growth → Real output gap → Inflation

The values displayed are average value of the variance decomposition for eight periods

Overall, these results seem to indicate that inflation variability could also be associated with changes in real surpluses in countries under an MD regime, implying that real primary surpluses matter in terms of price volatility. The results are also presented in figure 3.4.

Figure 3.4: Variance Decomposition on Inflation Variability

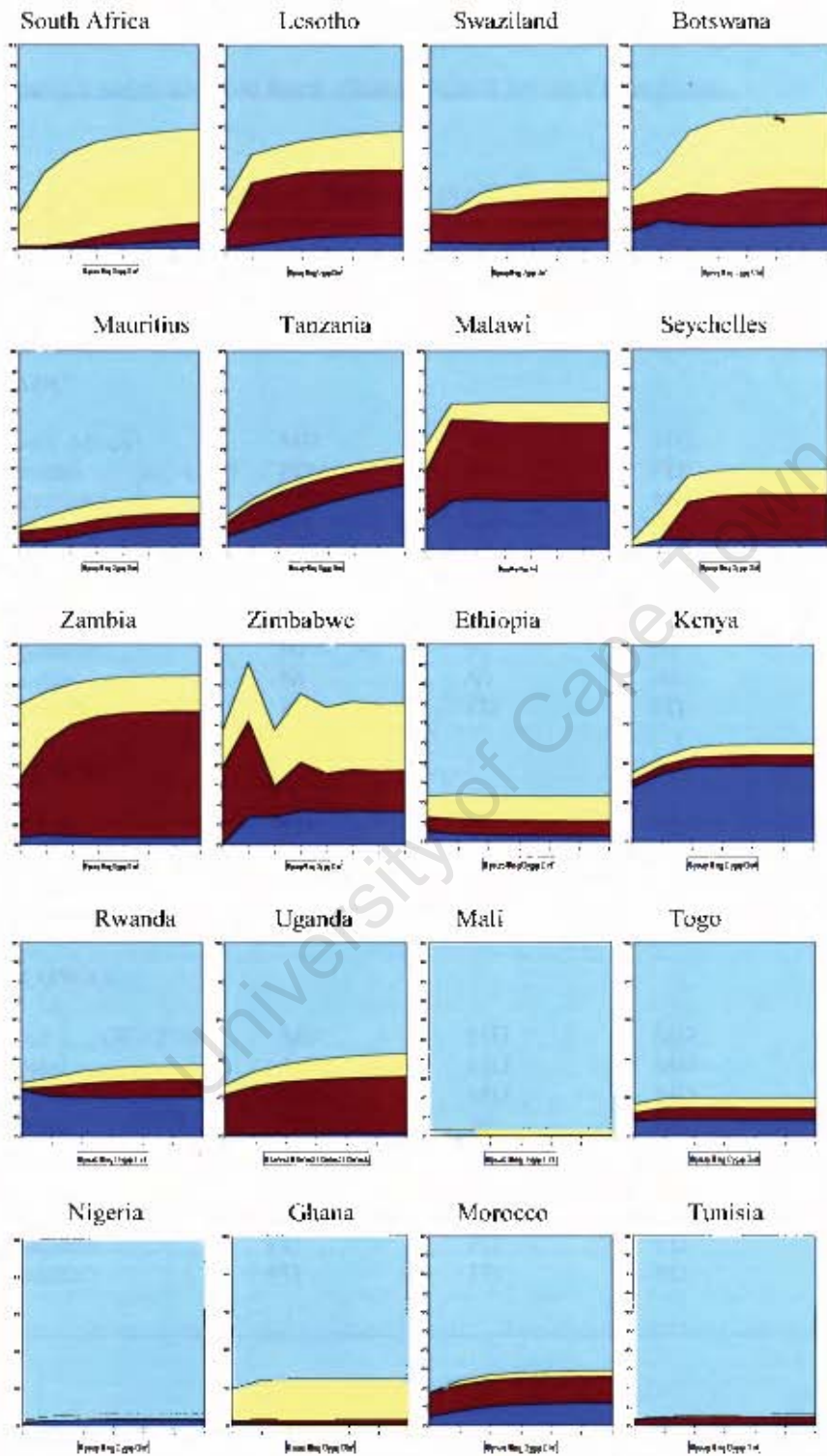


Table 3.7 presents the summary results of the three approaches side by side for all the countries. South Africa, Swaziland, Mauritius, Mali, Togo and Nigeria seem to have been characterized by an MD regime in all the approaches; while Lesotho, Botswana, Malawi, Zimbabwe, Ethiopia, Uganda, Morocco and Tunisia seem to have been characterized by an FD regime.

**Table 3.7: Summary Results of the Three Approaches**

	First Approach	Second Approach	Third Approach
<b>SADC</b>			
South Africa	MD	MD	MD
Lesotho	FD	FD	FD
Swaziland	MD	MD	MD
Botswana	FD	FD	FD
Mauritius	MD	MD	MD
Tanzania	NI	NI	NI
Malawi	FD	FD	FD
Seychelles	NI	NI	NI
Zambia	NI	NI	NI
Zimbabwe	FD	FD	FD
<b>COMESA</b>			
Ethiopia	FD	FD	FD
Kenya	NI	NI	NI
Rwanda	NI	NI	NI
Uganda	FD	FD	FD
<b>ECOWAS</b>			
Mali	MD	MD	MD
Togo	MD	MD	MD
Nigeria	MD	MD	MD
Ghana	NI	NI	NI
<b>AMU</b>			
Morocco	FD	FD	FD
Tunisia	FD	FD	FD

However, Lesotho is an interesting case because, being a small region of South Africa, the economic dynamic is dominated totally by fiscal policy because it has no control of monetary policy. The fiscal theory does not require direct monetization of debt to have a fiscal dominant regime. It just indicates that fiscal imbalances can induce macroeconomic instability (and price indetermination) even though monetary policy is fixed external. For Tanzania, Seychelles, Zambia, Kenya, Rwanda and Ghana, the evidence is less clear.

Finally, we estimate the VAR using rolling regression in government expenditure and revenue with a moving window of 5 years to check if there is any suggestion of any regime switches taking place, particularly in the recent period.. Figure 3.4 has the resultse. Notice the difference between the periods 1980-1994 and 1995-2005, for South Africa, Lesotho and Swaziland. There is more evidence of a stabilisation policy in the latter period than in the former. Movements in government expenditure and revenue are more consistent and positive from 1995.

Similarly, over the period under study, Mauritius exhibits more positive and stable movement in both variables. But, although insignificant, notice the recent negative change taking place in Botswana, Ethiopia, Morocco and Tunisia, and a very strong and significant stability that is just occurring in Tanzania, Rwanda, Ghana and Nigeria.<sup>32</sup>

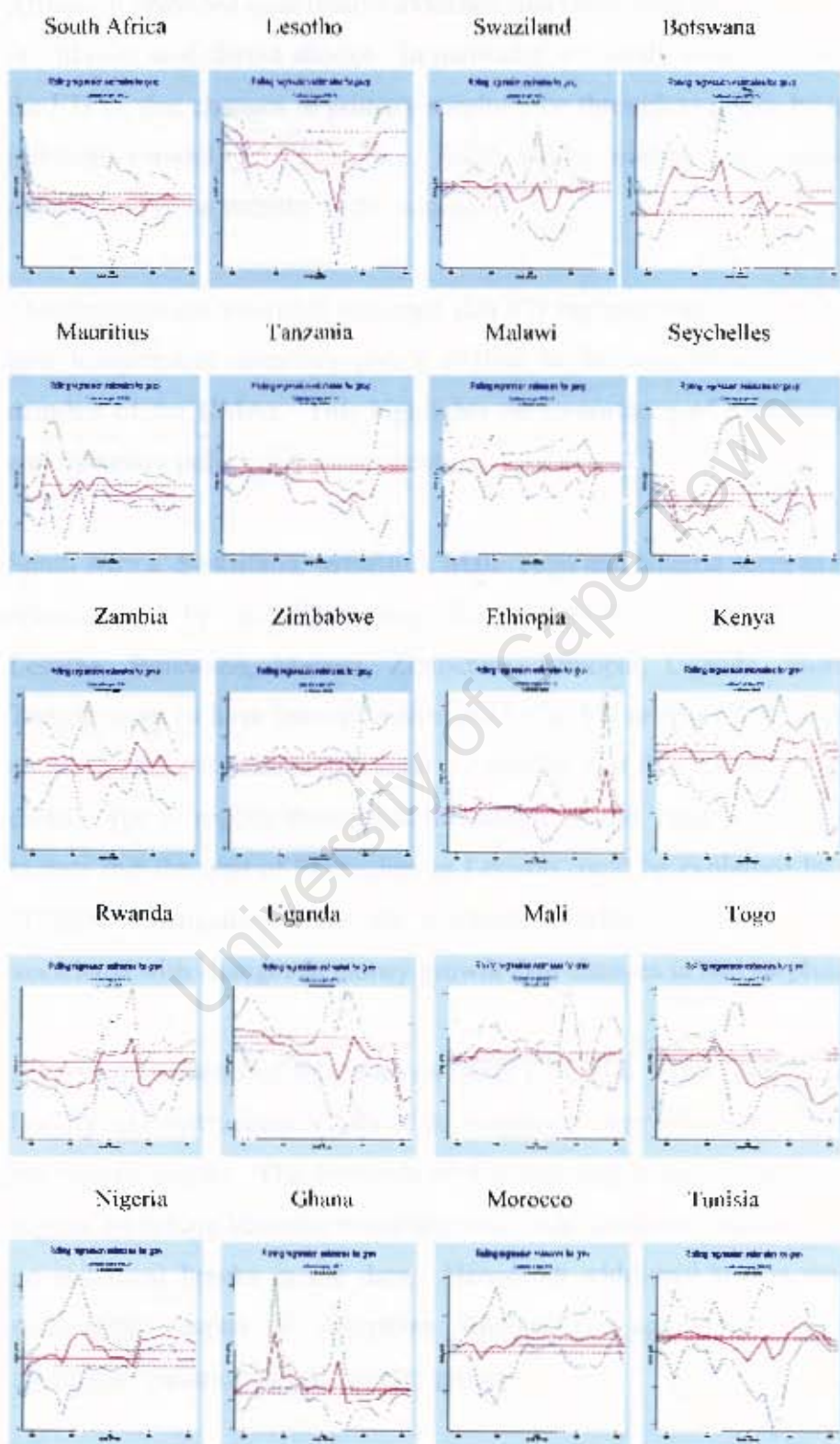
There is evidence of a destabilisation policy in Malawi, Zambia, Zimbabwe, Kenya, Uganda and Togo.<sup>33</sup> Movement in government expenditure and revenue for Seychelles is highly volatile. However, we did not attempt to formally identify statistical breaks in the data in order to confirm this, which means that one may still need more concrete evidence to support these changes.

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<sup>32</sup> The strong stability in Nigeria might be attributed to the recent oil boom, and this may also explain the reason behind an MD regime found in that country, suggesting that one may not confidently conclude that the negative relationship between liabilities and surpluses means that the country is fiscally responsible.

<sup>33</sup> Again, although insignificant, notice the recent sign of a change towards stability in Malawi.

**Figure 3.5: Rolling Regression in Government Expenditure and Revenue (% of GDP) 1980-2006**



### 3.4 Conclusion

This chapter analysed the fiscal and monetary determinants of inflation in Africa. It provided quantitative evidence that traces out the dynamic response of inflation to different shocks. In particular, the study found, as predicted by the FTPD, that changes in primary surplus pass through to prices by increasing inflation variability. Therefore, fiscal policy matters for achieving and maintaining price stability in the continent.

The chapter also provided evidence that FD regimes may arise regardless of how independent monetary policy is (like in the case of Lesotho who is a member of the CMA). This highlights the importance of coordinating fiscal and monetary policy in the continent.

South Africa, Swaziland, Mauritius, Mali, Togo and Nigeria seem to have been characterized by an MD regime throughout the period 1980-2006; while Lesotho, Botswana, Malawi, Zimbabwe, Ethiopia, Uganda, Morocco and Tunisia seem to have been characterized by an FD regime. For the remaining countries, the evidence is less clear cut to infer that they had been following a certain type of regime throughout the sample period. However, it is important to note that the type of FD regime in Lesotho could be explained by the QTM of debt monetization since the inflation variability is more likely to be associated with changes in money growth than changes in real surpluses.

Several refinements of this analysis could be useful. The present study relies heavily on nonstructural VARs of the response of key variables and inflation to the various shocks. The downside of this approach is that it does not allow for regime switching between monetary and fiscal dominant regimes as there are no statistical breaks in the data. Hence, an additional test is made in the succeeding chapter to determine whether the aggregate results hide a significant variation across country groups.

## CHAPTER FOUR

### **4. A FISCAL OR MONETARY DOMINANCE REGIME: THE PANEL FRAMEWORK**

#### **4.1 Introduction**

Another approach that can be used to test for the existence of a fiscally dominant regime in an economy is to pool the data and use panel models along with some plausible testable assumptions. This has several key advantages over the VAR estimation used in the preceding chapter. Unlike with VAR models, with a panel model it is possible to identify unobserved effects such as differences in adjustment over units. The panel approach allows the use of more observations and gives more degrees of freedom. In cases where there is limited time series data available for each country, the power of tests of hypotheses with country-specific regression may be insufficient.

Dynamic panel data models are of interest in a wide range of economic applications. Many economic models suggest that current behaviour depends upon past behaviour (persistence, habit formation, partial adjustment etc). In particular, this study looks at the dynamic interrelationship between primary surplus and liabilities across African countries. Hence, we would employ a dynamic (rather than static) panel data estimation technique.

In practice however, there are two main econometric problems in estimating dynamic panel data models. The first is that parameter estimates are known to be biased in models with fixed effects and lagged dependent variables. The second is that the homogeneity assumptions that are often imposed on the coefficients of the lagged dependent variable can lead to serious biases when in fact the dynamics are heterogeneous across the units. In this study, after controlling for both problems in our model we propose the use of a variety of estimators in order to avoid these biases.

While trying to identify fiscal dominant regimes in Africa, this chapter further assesses the empirical evidence for monetary dominant (MD) or fiscal dominant (FD) regimes in 43 African countries using unbalanced panel data for the period 1982-2006. Given the political transition and central bank independence that occurred in most countries in the 1990s, an alternative sub-sample period 1992-2006 is considered to gauge for the possibility of fiscal regime shifts.

The chapter is organised as follows. The application of dynamic panel methodology in assessing fiscal regimes in Africa is provided in section 4.2. Section 4.3 presents empirical analyses including descriptions of data and reports of results. Finally, section 4.4 presents a conclusion to the chapter.

## 4.2 Application of Dynamic Panel Data Model to Fiscal regimes

When thinking about any fiscal regime, whether FD or MD, it seems pertinent to expect a robust negative or positive response of primary balance to government liabilities. As in Afonso (2008), the following linear dynamic model, which is closely linked to the fiscal budget account identity, could give a reasonable specification for our model.<sup>34</sup> The model can be written as;

$$ps_{it} = \beta_i + \delta ps_{it-1} + \gamma b_{it-1} + \mu_{it}. \quad (4.1)$$

Where, the index  $i(i=1,\dots,N)$  denotes the country, the index  $t(t=1,\dots,T)$  indicates the period and  $\beta_i$  stands for the individual effects to be estimated for each country  $i$ ,  $ps_{it}$  is the primary surplus as a percentage of GDP for country  $i$  in period  $t$ .  $ps_{it-1}$  is the observation on the same series for the same country  $i$  in the previous period, and  $b_{it-1}$  is the liabilities to GDP ratio in period  $t-1$  for

<sup>34</sup> For more details on the dynamic panel data models, see appendix I.

country  $i$ . In addition, it is assumed that the disturbances  $\mu_{it}$  are independent across countries.

There are two reasons for using primary rather than the total surplus (Melitz, 2000). First, the interest on the debt could create a spurious relationship. Second the inter-temporal budget constraint of the fiscal authorities relates to the primary surplus. The reason for dividing the primary surplus by GDP is to make sure that the dependent variable in the equation takes the form of a ratio as do liabilities so that coefficients are easier to interpret. Since it is not easy for the government to dramatically change the fiscal policy stance in a single year, the use of the primary surplus lagged explanatory variable, which assumes that the primary surplus in period  $t$  is dependent on that in period  $t-1$ , seems reasonable.

Moreover, besides equation (4.1), one may also try to estimate the following specification for the government liabilities ratio,

$$b_{it} = \alpha_i + \eta ps_{it-1} + \psi b_{it-1} + v_{it}. \quad (4.2)$$

This specification is essentially compatible with the standard budget deficit and debt dynamics formulation. Given that the estimation is for a fixed number of countries, unobserved individual effects are less likely to be random and are likely to be correlated with regressors. Therefore, there is need to control for unobserved country heterogeneity since OLS estimates will be biased and inconsistent. This can be done using the WG fixed effects estimator which wipes out the individual effects by estimating equations (4.1) and (4.2) using deviations from a given country's mean over time.

However, there is the possibility of potential endogeneity in equations (4.1) and (4.2) with the presence of lagged dependent variables among regressors, hence

the FD2SLS estimator is more consistent when compared with the WG fixed effect estimator.<sup>35</sup>

Moreover, to improve the precision of the estimates, the one-step GMM estimator could serve as an alternative. Relative to conventional instrumental variable methods, it improves substantially on the weak instruments problem through more formal checks of the validity of the instruments and provides for potentially improved efficiency.

The first differences of the variables are employed as their own instruments both for the lagged dependent variable and also for the exogenous variables. First-differenced versions of equations (4.1) and (4.2) can be written as follows, respectively, for the primary surplus and government liabilities,

$$\Delta ps_{it} = \delta \Delta ps_{it-1} + \gamma \Delta b_{it-1} + \Delta \mu_{it}. \quad (4.3)$$

$$\Delta b_{it} = \eta \Delta ps_{it-1} + \psi \Delta b_{it-1} + \Delta v_{it}. \quad (4.4)$$

where  $\Delta ps_{it} = ps_{it} - ps_{it-1}$

and  $\Delta b_{it} = b_{it} - b_{it-1}$

First differences directly eliminate the individual effects of ( $\beta$  and  $\alpha$ ) from the models (4.1 and 4.2). However, differencing introduces a correlation between the differenced lagged dependent variable and the differenced error term, and the use of instruments is then required. Indeed the lagged values  $ps_{it-2}$  and  $b_{it-2}$  will be uncorrelated respectively with  $\Delta \mu_{it}$  and  $\Delta v_{it}$ , and can therefore be used as instrumental variables for the first differenced equations in (4.3) and (4.4). Furthermore, in order to account for the effects of the business cycle, the output gap can also be included in the specification as follows,

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<sup>35</sup> As discussed in the previous section, instrumental variable is consistent with or without endogeneity.

$$\Delta ps_{it} = \delta \Delta ps_{it-1} + \gamma \Delta b_{it-1} + \chi \Delta z_{it} + \Delta \mu_{it}. \quad (4.5)$$

$$\Delta b_{it} = \eta \Delta ps_{it-1} + \psi \Delta b_{it-1} + \Phi \Delta z_{it} + \Delta v_{it}. \quad (4.6)$$

where  $z$  is the output gap computed as the difference between the actual GDP and potential GDP as a percentage of potential GDP using Hqdrick Prescott.<sup>36</sup> Finally, equations (4.5) and (4.6) allow testing for the following hypotheses:

- (i) If  $\gamma$  is positive, then an increasing speed in the change of the primary surplus responds to an increasing speed of change in the government liabilities ratio, which may be viewed as a monetary dominant regime.
- (ii) If  $\eta$  is positive, then the change in liabilities does not respond to the change in primary surplus, which may be considered as a fiscal dominant regime.
- (iii) If  $\chi$  and  $\Phi$  are negative and positive, respectively, then fiscal policy does not respond in a stabilizing manner to a business cycle, which is evidence of pro-cyclical fiscal policy.

Using  $ps_{it-2}$  and  $b_{it-2}$  as instruments, equations (4.5) and (4.6) are then estimated. Tests for endogeneity are carried out using the Hausman test. If endogeneity is rejected, estimation based pooled OLS and WG fixed effects are used, otherwise inference should be based on the FD2SLS and GMM estimators. Nonetheless, since instrumental variable estimators are used with or without endogeneity, analysis shall then compare FD2SLS and GMM with OLS and WG estimators, if the null hypothesis of no endogeneity is not rejected.<sup>37</sup>

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<sup>36</sup> The parameter lambda is set to a value of 100 as it is customary for annual data.

<sup>37</sup> When a lagged value of the dependent variable appears as a regressor, the two-stage least squares first-differenced estimator (FD2SLS) and a one-step Arellano-Bond estimator (GMM-AB) have always been used to obtain consistent estimates (Anderson and Hsiao, 1981, 1982).

In addition, a test for over-identifying restrictions is carried out using the Sargan test from the one-step GMM estimator. The null hypothesis that the over-identifying restrictions are valid is tested against the alternative hypothesis that the over-identifying restrictions are not valid.

### **4.3 Empirical Analysis**

#### **4.3.1 Data**

We use five-year average unbalanced panel data from 1982 to 2006 for the primary surplus as a percentage of GDP and for the government liabilities to GDP ratio.<sup>38</sup> This gives a maximum observation of 5 for 20 countries and 3 for 23 countries.

Due to data limitation, Liberia,, Djibouti, Egypt, Eritrea, Sudan, Libya, Sao Tome and Principe, Sudan, Comoros and Mauritania had to be dropped and we concentrated on the remaining 43 countries on the continent (see table 4.1).

For the alternative sub sample periods, we also use five-year average unbalanced panel data from 1992 to 2006 for 43 countries in order to assess the likelihood of regime switches in the recent period. The sources of the data are the International Financial Statistics of the IMF, the SADC website and central bank websites. Table 4.2 presents summary descriptive statistics for the full sample.

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<sup>38</sup> The reason for taking 5-year averages is to offset potential cyclical effects as much as possible.

**Table 4.1: Countries Included in the Study**

Regions	Countries
Economic Community Of West African States (ECOWAS)	Benin, Burkina Faso, Cote'd Ivoire, Guinea Bissau, Senegal, Niger, Mali, Togo, Gambia the, Guinea, Sierra Leone, Cape Verde, Nigeria Ghana
Economic Community Of Central African States (ECCAS)	Congo Republic of, Cameroon, Central African Republic, Equatorial Guinea, Gabon, Burundi, Chad, Rwanda
Southern African Development Community (SADC)	South Africa, Lesotho, Swaziland, Namibia, Botswana, Mauritius,, Tanzania, Seychelles, Malawi, Zambia, Zimbabwe, Angola, Democratic Republic of Congo, Mozambique
Common Market for East and Southern Africa (COMESA)	Madagascar, Ethiopia, Kenya, Rwanda, Uganda, Malawi, Mauritius, Seychelles, Zambia, Zimbabwe
Arab Monetary Union (AMU)	Algeria, Morocco, Tunisia
<b>de facto Monetary Union</b>	
CFA Franc Zone (West African Economic and Monetary Union, WAEMU)	Benin, Burkina Faso, Cote'd Ivoire, Senegal, Niger, Mali, Togo and Guinea Bissau
CFA Franc Zone (Central African Economic and Monetary Union, CAEMC)	Congo Republic of, Cameroon, Central African Republic, Equatorial Guinea, Gabon and Chad
Common Monetary Area (CMA)	South Africa, Lesotho, Swaziland and Namibia

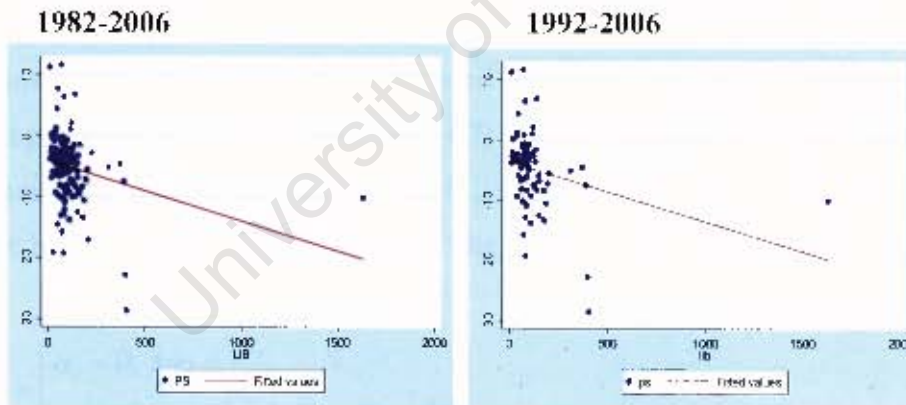
**Note:** There is considerable overlap in membership of COMESA, SADC and ECCAS. Five of the countries in COMESA also belong to SADC, and one of the countries in the ECCAS region is also a member of COMESA

Table 4.2: Descriptive statistics (full sample):1982-2006

Variable	Obs	Mean	Std.Dev
Primary surplus	140	-5.1472	5.5772
Liabilities	140	108.780	148.0697
Output gap	140	-.17830	3.62070

A first assessment of the data can be made in order to check the nature and magnitude of the existing correlation between the primary surplus and the liabilities ratios. For instance, such correlation is negative around -0.26 for the entire sample and -0.25 for the sub-sample period 1992-2006. The scatter diagram in figure 4.1 also supports the existence of a negative relationship between primary surpluses and government liabilities in Africa both for full sample and sub-sample periods.

Figure 4.1: Correlation between Primary Surpluses and public Liabilities (in % of GDP)



Although this negative relationship might be viewed indicative of the existence of an MD regime, the presence of an FD regime would also have produced the negative correlation between primary surpluses and government liabilities. This is the case if a positive surplus/GDP innovation lowers expected future surpluses sufficiently to reduce the present value. So there is an identification problem here, suggesting that simple correlations between primary surpluses and government liabilities are not very useful for the purpose of this study.

### 4.3.2 Unit Root Tests

The motivation behind panel data unit root tests as compared with the standard ADF test used in the preceding chapter is to increase the power of unit root tests by increasing the span of the data while minimizing the risk of encountering structural breaks due to regime shifts. Two alternative panel unit root tests are performed for primary surplus as a percentage of GDP and liabilities as a percentage of GDP. Levin et al (2002) proposed a test based on heterogeneous panels with fixed effects where the null hypothesis assumes that there is a common unit root process. The basic Augmented Dickey-fuller (ADF) equation is expressed as

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{k_t} \beta_{ij} \Delta y_{it-j} + \eta Z_{it} + e_{it} \quad (4.7)$$

where  $Z_{it}$  includes the exogenous variables. The null hypothesis of the unit root to be tested is then  $H_0: \alpha = 0$ , against the alternative  $H_1: \alpha < 0$ .<sup>39</sup>

Alternatively, Im et al (2003) proposed a test that allows for individual unit root processes so that  $\alpha$  in equation (4.7) may vary across cross-sections, hence relaxing the assumption that  $\alpha_1 = \alpha_2 = \dots = \alpha_N$ . The null hypothesis may in this case be written as  $H_0: \alpha = 0$  for all  $i$ . The alternative is now given by

$$H_1 = \left[ \begin{array}{l} \alpha_i = 0, \text{ for } i = 1, 2, \dots, N \\ \alpha_i < 0, \text{ for } i = N_1 + 1, N_2 + 2, \dots, N' \end{array} \right]$$

This implies that some fraction of the individual processes is stationary.<sup>40</sup>

<sup>39</sup> This type of test is particularly useful for panel of moderate size, between 10 and 250 cross sections and 25-250 time series observations per cross section, (Levin et al, 2002). This fits our data sample.

<sup>40</sup> For more detail see Phillip and Moon (2000), and Arellano and Homore (2001).

**Table 4.3: Panel unit root results**

Series	Sample	Common unit root (LLC)			Individual unit root (IPS)		
		Statistics	Probability	N	Statistics	Probability	N
PS	1982-2006	-5.76	0.001	112	-2.24	0.006	112
	1992-2006	-2.00	0.003	91	-2.48	0.005	91
LIB	1982-2006	-3.96	0.000	112	-1.76	0.181	112
	1992-2006	-2.38	0.001	91	-2.16	0.041	91
GAP	1982-2006	-8.54	0.000	112	-3.32	0.000	112
	1992-2006	-6.52	0.000	91	-3.94	0.000	91

Note: LLC — Levin, Lin and Chu. IPS — Im, Pesaran and Shin

Table 4.3 reports the results of the panel unit root tests for the primary surplus-to-GDP (PS), Liabilities-to-GDP (LIB) and output gap (GAP) series. For the entire sample and sub-sample periods, both tests reject the existence of a unit root at the 1% significance level for the PS (except for the sub sample period 1992-2006) and GAP series. On the other hand, for the LIB series, while both tests also allow the rejection of the null hypothesis for the sub-sample periods, the IPS test does not reject the unit root hypothesis for the entire sample (however, the LLC test does).

### 4.3.3 Estimation Results

The Hausman tests yield a test statistic of 2.98 (with p-value of 0.225), meaning that the null hypothesis of no endogeneity cannot be rejected at all conventional levels. A similar conclusion is also reached for the heterogeneity test (Hausman test statistics of 4.32 with p-value of 0.329). Hence, the analysis shall include OLS, WG, FD2SLS and GMM estimators.<sup>41</sup>

Table 4.4 reports estimation results for equations (4.5) and (4.6), using the four estimators mentioned above, with lagged values as instruments. The first four columns of the table report estimated coefficients relating to the specification where the dependent variable is the primary surplus, and the last four columns

<sup>41</sup> See a note under each table for the Sargan test from the one-step GMM estimator.

report estimated coefficients for the case where liabilities is the dependent variable.

According to the results, the hypothesis that the primary surplus reacts positively to government liabilities, (that is,  $\gamma > 0$ ) is rejected since the estimated coefficient is negative and statistically significant at 1 per cent (with the four estimators). In other words, the fiscal authorities in Africa seem not to act in accordance with the existing liabilities by increasing the primary surplus when liabilities increase. Worse still, real surpluses generated are not used for the purpose of reducing liabilities.<sup>42</sup>

**Table 4.4: OLS, WG, FD2SLS and GMM estimators for primary surplus and liabilities ratio (1982-2006)**

Method	Dependent variable PS				Dependent variable LIB			
	OLS	WG	FD2SLS	GMM	OLS	WG	FDS2LS	GMM
Constant	-3.85*** (0.00)	-3.77*** (0.00)	-0.35 (0.70)	0.17 (0.36)	76.79*** (0.00)	64.64*** (0.01)	-10.28 (0.78)	0.35 (0.95)
PS	-	-	0.61*** (0.04)	0.26*** (0.02)	6.79*** (0.00)	9.09* (0.06)	12.35*** (0.03)	7.25*** (0.03)
LB	-0.01* (0.07)	-0.01*** (0.02)	-0.03* (0.07)	-0.07*** (0.03)	-	-	0.07 (0.59)	0.24*** (0.04)
GAP	-0.17 (0.11)	-0.12* (0.09)	-0.05* (0.06)	-0.24** (0.05)	16.71 (0.24)	14.87* (0.07)	19.09*** (0.01)	24.67*** (0.00)
N	140	140	94	112	140	140	94	112

**Note:** The coefficient \*, \*\*, \*\*\* are statistically significant at the 10, 5 and 1 per cent level respectively. The Sargan test from the one-step GMM estimator rejects the null hypothesis that the over-identifying restrictions are valid.

This is consistent with the prevalence of a Fiscal dominant regime where fiscal policy does not adjust to the inter-temporal budget constraint. The same conclusion is also reached with the VAR estimates used in the preceding chapter.

Similarly, table 4.4 also reveals that when liabilities to GDP ratio is the dependent variable, African governments seem not to use primary surpluses to reduce the liabilities to GDP ratio. This can be seen from the fact that we

<sup>42</sup> The response of surpluses in period t to surpluses in period t-1 is positive and significant.

obtain a positive and statistically significant  $\eta$  coefficient (with the four estimators) for the primary surplus in the liabilities regression.

Interestingly, the fiscal authorities also do not respond in a stabilizing manner; there is a pro-cyclical response of fiscal policy given the negative (positive) effects on the primary surplus (liabilities) of increases in the output gap (with WG, FD2SLS and GMM estimators). This is also supported in Talvi and Veigh (2005) and Catao and Sutton (2002). Their work demonstrates that the pro-cyclicality of fiscal policy is common in many developing countries, including those in Africa (Kamminsky et al, 2004).

Next, since the political transition and central bank independence that occurred in most countries in the 1990s may have had an effect on the prevalence of the fiscal regime, an alternative sub-sample period 1992-2006 is considered to account for a regime shift. Table 4.5 reports the findings.

The responsiveness of primary surplus to government liabilities remains negative and statistically significant with FD2SLS and GMM estimators. Again this can be read as evidence of the existence of a fiscal dominant regime in Africa, even in the recent period.

**Table 4.5: OLS, WG, FD2SLS and GMM estimators for primary surplus and liabilities ratio (1992-2006)**

Method	Dependent variable PS				Dependent variable LIB			
	OLS	WG	FD2SLS	GMM	OLS	WG	FDS2LS	GMM
Constant	-3.51*** (0.01)	-3.58*** (0.00)	-0.44 (0.63)	0.44*** (0.04)	83.81*** (0.03)	79.16*** (0.01)	6.11 (0.88)	-4.23 (0.36)
PS	-	-	0.71* (0.08)	0.17* (0.06)	4.26 (0.14)	8.21 (0.12)	10.51* (0.09)	6.51* (0.09)
LB	-0.03 (0.18)	-0.09 (0.21)	-0.02* (0.07)	-0.09* (0.10)	-	-	0.09 (0.55)	0.16 (0.15)
GAP	-0.10 (0.37)	-0.05 (0.53)	-0.04* (0.06)	-0.09* (0.09)	20.02 (0.30)	18.80 (0.30)	18.99*** (0.01)	24.23*** (0.00)
N	105	105	77	91	105	105	77	91

**Note:** The coefficient \*, \*\*, \*\*\* are statistically significant at the 10, 5 and 1 per cent level respectively. The Sargan test from the one-step GMM estimator rejects the null hypothesis that the over-identifying restrictions are valid.

Importantly, one may however notice the decrease in the magnitude of the estimated  $\gamma$  and  $\eta$  coefficients, implying somehow a lesser impact of the primary surplus to government liabilities ratios. In addition, the negative relationship between primary surplus and government liabilities appears to be weakly significant. This could be read as a sign of increased efforts from the national authorities in the recent period to improve fiscal positions, although a regime shift has not yet occurred.<sup>43</sup> Again, fiscal policy remains pro-cyclical by responding in a destabilizing manner to business cycle.

Furthermore, an additional test can be made to see whether the aggregate results hide a significant variation across country groups. As already noted, data limitation problems mean that only the SADC and ECOWAS regions are considered.

**Table 4.6: OLS, WG, FD2SLS and GMM estimators for primary surplus and liabilities ratio (1982-2006)**  
SADC

Method	Dependent variable PS				Dependent variable LIB			
	OLS	WG	FD2SLS	GMM	OLS	WG	FDS2LS	GMM
Constant	-2.40 (0.21)	-3.08*** (0.02)	-0.29 (0.88)	0.04 (0.94)	64.56*** (0.00)	67.30*** (0.01)	7.73 (0.64)	8.46* (0.09)
PS	-	-	0.27 (0.69)	0.33* (0.10)	3.25* (0.07)	2.54 (0.20)	5.80*** (0.04)	2.15* (0.10)
LB	-0.03* (0.09)	-0.02 (0.14)	-0.01* (0.07)	-0.04* (0.10)	-	-	0.09 (0.55)	0.16 (0.15)
GAP	-0.34* (0.07)	-0.27* (0.09)	-0.08 (0.69)	-0.98*** (0.02)	2.37* (0.09)	1.98 (0.15)	5.29* (0.09)	2.79 (0.52)
N	56	56	24	40	56	56	24	40

**Note:** The coefficient \*, \*\*, \*\*\* are statistically significant at the 10, 5 and 1 per cent level respectively. The Sargan test from the one-step GMM estimator rejects the null hypothesis that the over-identify restrictions are valid.

<sup>43</sup>Primary surplus still react negatively to government liabilities, and government liabilities still respond positively to primary surplus, both significant with FD2SLS and GMM estimators

**Table 4.7: OLS, WG, FD2SLS and GMM estimators for primary surplus and liabilities ratio (1982-2006)**  
**ECOWAS**

Method	Dependent variable PS				Dependent variable LIB			
	OLS	WG	FD2SLS	GMM	OLS	WG	FDS2LS	GMM
Constant	-1.84 (0.52)	-2.48 (0.51)	-0.27 (0.82)	0.43 (0.30)	51.68 (0.15)	61.40 (0.21)	-8.80 (0.88)	-12.30 ** (0.05)
PS	-	-	0.11 (0.63)	0.06 (0.77)	9.68* (0.07)	8.29 (0.23)	5.41 (0.44)	9.94*** (0.03)
LB	-0.04 (0.11)	-0.04 (0.26)	-0.22*** (0.01)	-0.04*** (0.00)	-	-	0.24 (0.41)	0.31* (0.07)
GAP	-0.08 (0.66)	-0.04 (0.80)	-0.15 (0.70)	-0.38* (0.09)	0.13 (0.96)	0.72 (0.80)	12.20* (0.10)	7.70* (0.10)
N	40	40	20	30	40	40	20	30

**Note:** The coefficient \*, \*\*, \*\*\* are statistically significant at the 10, 5 and 1 per cent level respectively. The Sargan test from the one-step GMM estimator rejects the null hypothesis that the over-identifying restrictions are valid.

Still, there is no statistical evidence to support the existence of a monetary dominant regime in these regions, even if one has to be aware of the more limited number of observations (table 4.6 and 4.7). The overall prevalence of a fiscal dominant over monetary dominant regime however remains consistent from the estimation results of the primary surplus and liabilities tests.

However, the foregoing conclusion does not hold when the two longstanding monetary unions in Africa, namely, the CFA franc zones (WAEMU and CAEMC) and CMA (otherwise called de facto MU), are considered.<sup>44</sup> The response of government liabilities to primary surplus is positive and statistically significant with OLS and WG estimators (table 4.8). Primary surplus also responds negatively to liabilities. This is consistent with the prevalence of a monetary dominant regime where fiscal policy adjusts to

<sup>44</sup> The de facto monetary union comprises of: Mali, Togo, Benin, Burkina Faso, Niger, Cote d'Ivoire, Guinea Bissau, Senegal (WAEMU members), Congo Republic, Cameroon, Central African Republic, Chad, Equatorial Guinea and Gabon (CAEMC members), and South Africa, Swaziland, Lesotho and Namibia (CMA members).

guarantee solvency. However, fiscal policy remains pro-cyclical, although insignificant with all the estimators except for the GMM estimator.

**Table 4.8: OLS, WG, FD2SLS and GMM estimators for primary surplus and liabilities ratio (1982-2006)**  
*de facto Monetary Union*

Method	Dependent variable PS				Dependent variable LIB			
	OLS	WG	FD2SLS	GMM	OLS	WG	FDS2LS	GMM
Constant	-1.47 (0.28)	-1.34 (0.20)	-0.04 (0.98)	-8.69 (0.56)	81.84*** (0.01)	70.82*** (0.01)	-97.65 (0.38)	-0.03 (0.90)
PS	-	-	0.08 (0.90)	12.04*** (0.03)	-9.24*** (0.01)	-12.60*** (0.04)	-6.99 (0.63)	-0.34 (0.26)
LB	0.18* (0.10)	0.02* (0.06)	0.01 (0.50)	0.04 (0.73)	-	-	1.09*** (0.02)	-0.01*** (0.01)
GAP	-0.68 (0.20)	-0.59 (0.28)	-0.43 (0.60)	-0.65*** (0.03)	50.57*** (0.02)	45.65*** (0.02)	67.03*** (0.01)	0.61 (0.20)
N	49	49	21	35	49	49	21	35

**Note:** The coefficient \*, \*\*, \*\*\* are statistically significant at the 10, 5 and 1 per cent level respectively. The Sargan test from the one-step GMM estimator rejects the null hypothesis that the over-identifying restrictions are valid.

#### 4.4 Conclusion

This chapter derives some key stylized facts about fiscal and monetary policy interconnections in Africa. Based on unbalanced panel data estimation, it suggests the following:

- Except for WAEMU, CAEMC and CMA<sup>45</sup>, the rest of the continent is characterized throughout the period 1982-2006 by the existence of a fiscal dominant regime. Fiscal authorities do not have a tendency to use the primary surplus to reduce the liabilities or improve the former when the latter increases and this does not change even with the regional grouping of countries.

<sup>45</sup> But this is at the price of giving South Africa (France) complete control of monetary policy. In doing so, the CMA members (WAEMU and CAEMC members) are not only borrowing South Africa (France) monetary policy, but also its relative stable fiscal policy and institutions.

- The negative response of primary surplus to government liabilities in the continent tends to weaken in the period 1992-2006, implying that there has been an increased effort by the fiscal authorities to improve on fiscal outcomes in the recent period, although a regime shift has not yet occurred.
- Fiscal policy is pro-cyclical in Africa. Governments tend to spend more and incur more debts during booms. Now, when the shock elapses in the following period, primary surplus goes down and government liabilities go up.

The foregoing facts support the assertion in Aguiar et al (2005) that if government lacks the ability to commit to its policy (or is fiscally undisciplined), the best fiscal policy available exacerbates the business cycle. To this end, the important question then is what could be the reason behind this fiscal misconduct in Africa. This question is addressed in the next chapter.

## CHAPTER FIVE

### 5. DETECTING SYMPTOMS OF FISCAL INSTABILITY

#### 5.1 Introduction

From the preceding analysis, it is obvious that macroeconomic dynamics in Africa have been dominated in the past by fiscal instability. Lack of fiscal discipline resulting in persistent deficits and mounting stock of debt has often forced many central banks around the continent to implement unfavourable monetary policies, leading to macroeconomic instability. The important question then is, what are the symptoms of this fiscal instability; that is, on which side of the budget does the deficit emerge?<sup>46</sup> Are deficits followed by lower government revenues or by higher government spending? These questions call for disaggregation of the main components of deficits in order to evaluate the character of the causal relationship between revenue and spending.

There are three main competing hypotheses regarding the relationship between government revenues and expenditures. First is the fiscal synchronization hypothesis, which suggests that government revenues and expenditures are determined simultaneously. Second is the revenue-and-spend hypothesis, which argues that changes in revenues lead to changes in government spending. Third is the spend-and-revenue hypothesis, which proposes that change in spending leads to changes in revenues. In contrast to these hypotheses, there is also the institutional separation hypothesis, which suggests that no causality exists between revenue and expenditure.

In light of these various hypotheses, this chapter examines the direction of causality between government revenue and expenditure in Africa using a five-year average unbalanced panel of 43 countries for the period 1982-2006.

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<sup>46</sup> If government is not committed to maintaining fiscal solvency and/or satisfying the intertemporal budget constraint due to large and persistent deficits, any good cure should start with detecting the symptoms of such government's loss of control over public finances.

While fiscal decisions are undoubtedly political, understanding the interdependence between these two fiscal variables is an essential indicator in detecting symptoms of fiscal instability. Meanwhile, it is important to note that the theoretical framework underpinning this analysis is different from that of the preceding chapters.

We consider a recently developed technology for assessing causality in panel data models (Harlin and Venet, 2001), which recent similar studies on Africa have not exploited.<sup>47</sup> Although originally designed for pairs of lengthy time series, Granger tests are increasingly used to evaluate causal relationships in panel data. The extension of the original Granger methodology to panel data has the potential to improve upon the conventional Granger analysis for all of the reasons that panel analysis is generally preferable to cross-sectional or traditional time series analysis.<sup>48</sup>

However, the use of the cross-sectional information implies to take into account the heterogeneity across individuals in the definition of the causality relationships. Harlin and Venet (2001) explicitly address this concern by outlining the procedure for evaluating the character of the causal processes (heterogeneous or homogenous) across panel members. The methodology used in this study is therefore guided by this procedure.

This chapter is arranged as follows. Section 5.2 briefly presents government revenue and expenditure developments in Africa. Section 5.3 reviews the relevant theory and empirical literature surrounding the causality analysis between government revenue and expenditure. The new procedure for causality tests developed in Harlin and Venet (2001) is summarized in section 5.4. Section 5.5 applies this new methodology to the issue of the link between

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<sup>47</sup> The most recent similar works on Africa by Dore and Nachege (2000), Lusinyan and Thornton (2007) and Rufael (2008), used a bivariate and multivariate vector autoregressive (VAR) technique.

<sup>48</sup> The point already emphasized in the preceding chapter.

government revenue and expenditure in Africa. Section 5.6 describes the data and reports the findings. Concluding remarks on this chapter are presented in section 5.7.

## **5.2 Revenue and Spending Developments in Africa**

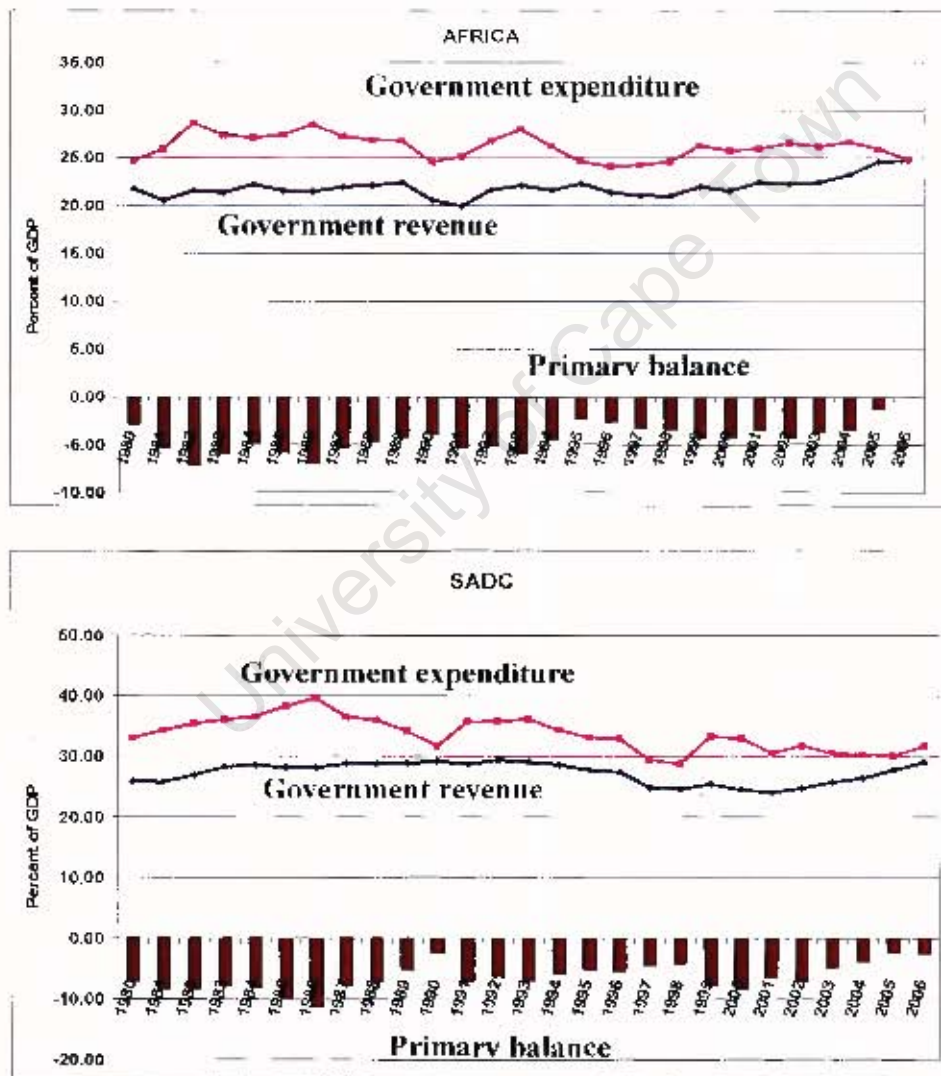
The past two decades have witnessed a persistent increase in budget deficits in Africa. In all the regions except ECCAS and AMU, public expenditure consistently exceeded revenue throughout the period 1980-2006. Until 1995, the continent had been plagued with large fiscal imbalances. Government revenues fell from an average of 25 percent of GDP during the 1980s to 21 percent in 1994. At the same time, public spending grew at an unprecedented pace to reach 28 percent of GDP on average in 1994. Consequently, primary deficits widened from 2.9 percent of GDP in 1980 to 4.6 percent in 1994 (figure 5.1). The continent recorded lower budget deficits only in 1995. However, the deficits worsened again afterwards until 2006.

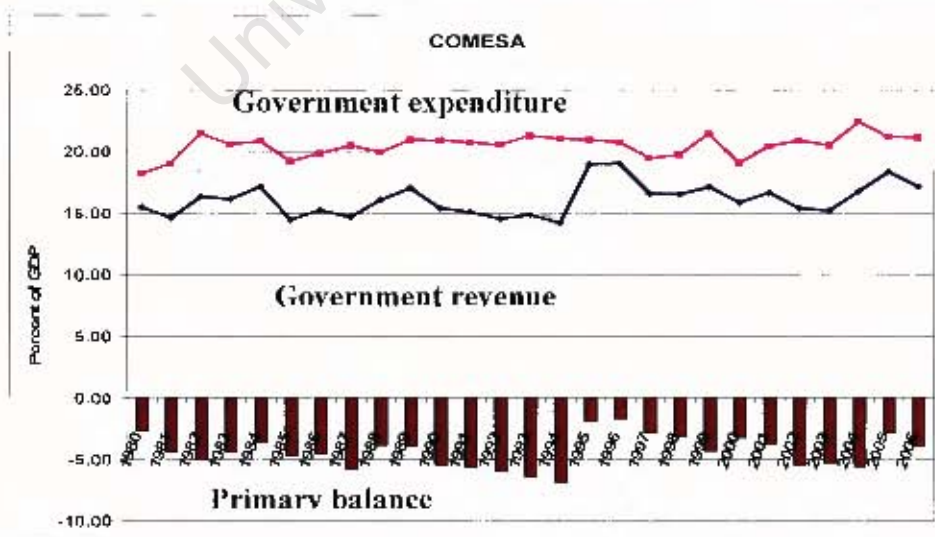
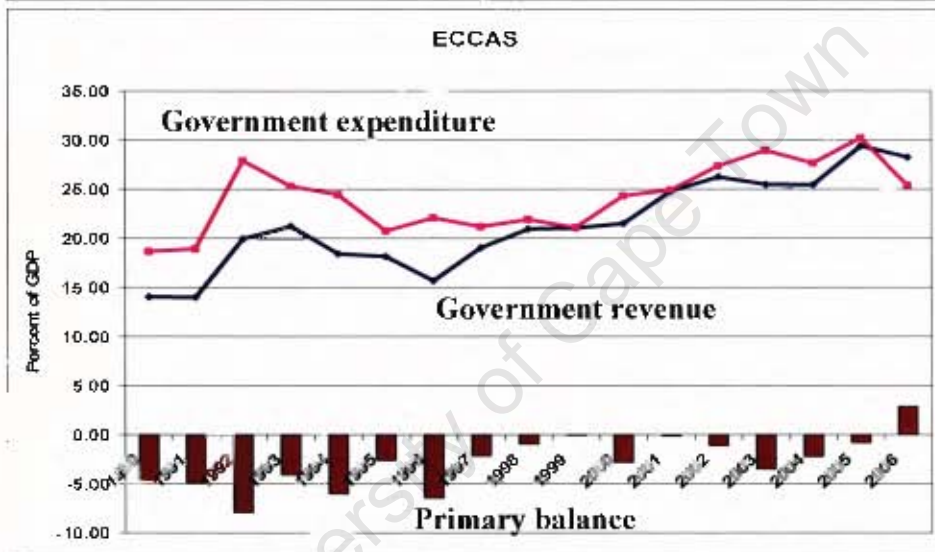
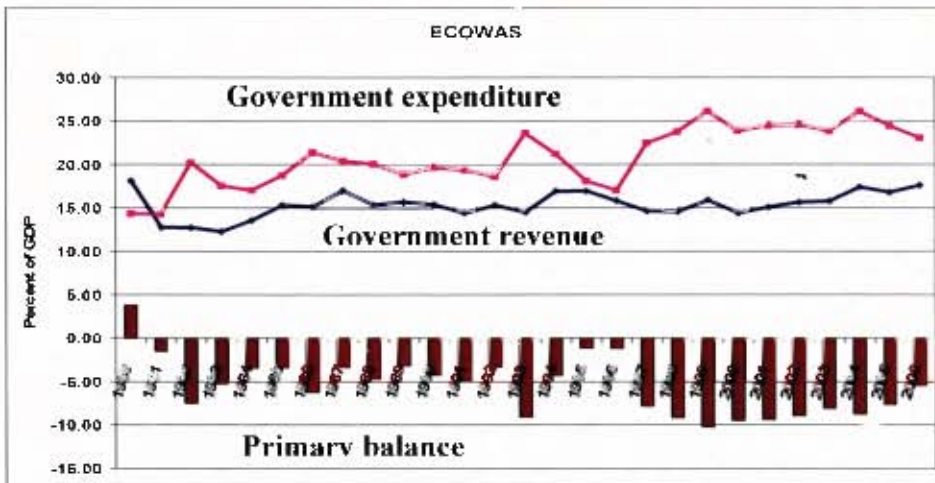
Strong economic growth and concomitant large government revenues between 1995 and 2000 were followed by rapid growth in government spending, particularly in the ECOWAS and COMESA countries. However, as revenue growth moderated between 2001 and 2003, government spending still remained considerably high, leading to persistent budget deficits.

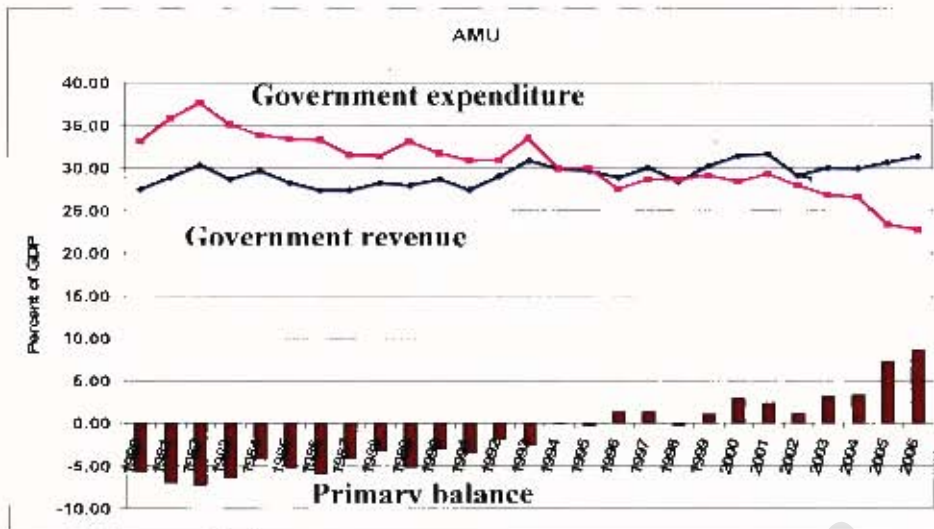
African countries are heavily dependent on highly volatile revenues (from aid, oil revenues, exports, a small tax base), making their budgets vulnerable to fiscal shocks. Oil and commodity windfalls and aid surges induce government spending that is difficult to reduce when the oil, commodity revenues and aid flows decline, distorting government budget allocation patterns, cohesion and stability and increasing deficits. If revenues are uncertain, instability is transmitted to the economy through consumption and price volatility.

There has been some form of fiscal adjustment in the latter periods though, but can it be sustained.. Given the uncertainty in government revenue and the inevitable high government spending, adverse shocks may inadvertently cause debt to accumulate again to a point where it cannot be serviced; that is, where the government is incapable of generating the primary surplus needed to stabilize, much less reduce the debt to GDP ratio.

Figure 5.1: African Fiscal Indicators (percent of GDP)  
1980-2006







### 5.3 Causal Link between Revenues and Expenditure: Theory and Evidence

As already mentioned, on the theoretical front, there are three main hypotheses on the causal relationship between government expenditure and government revenues, namely, the spend-and-revenue hypothesis, the revenues-and-spend hypothesis and the fiscal synchronization hypothesis.

The spend-and-revenue hypothesis holds that a change in spending leads to changes in revenues, implying that there is a unidirectional causality running from government expenditure to revenues, particularly during crises (Peacock and Wiseman, 1961 and 1979). Such a view is associated with the Keynesian principle of compensatory finance, whereby fiscal deficits are created to boost up the level of economic activity. Subsequently, through a built-in mechanism, the budgetary multiplier effect would itself eliminate any output gap and ensure a higher tax base, from which the extra tax revenue would be generated to offset the initially created fiscal deficit. But, this is if government is responding in a stabilizing manner to the business cycle (that is, if fiscal policy is countercyclical).

The revenues-and-spend hypothesis, however, maintains that government revenues solely determine its expenditure, suggesting a unidirectional causality running from revenues to expenditure. Friedman, (1972 and 1978), Buchanan and Wagner (1977) subscribe to this view.<sup>49</sup> This perspective is linked to the classical theory of fiscal neutrality, according to which, the budget must always balance. A strong implication of this proposition is that the government must ensure that its expenditure does not exceed its revenue proceeds. This tenet is based on the promise that any mismatch between expenditure and revenue could have distortionary effects on the smooth operation of the price mechanism.

The fiscal synchronization hypothesis mediates both extremes, a situation where the motivations to tax and to spend are determined simultaneously. It suggests that causality runs from both directions (bi-directional), spending to revenue and revenue to spending.

In contrast to the above hypotheses, advocates of the institutional separation hypothesis suggest that there is no causality between expenditure and revenue. This lack of a causal link is due to “many important actors with divergent interests and agendas” (Hoover and Sheffrin, 1992, p.246) and to the fact that the disagreement between parties or groups in the decision-making process is a cause for the growing pattern of public debt (Drazen, 2001). The greater the conflict among the interest groups, the more difficult it is to enact deficit-reducing measures. In this case, there is no causality running in any direction and the neutrality hypothesis is supported. As there is no causality between the two fiscal variables, it is possible to manipulate revenue or expenditure or both in order to reduce a budget deficit, but this may lead to further worsening of the deficit if expenditure grows relatively faster than revenue.

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<sup>49</sup> For example, Friedman argues that increases in taxes only result in increased expenditures, rather than in deficit reduction. This also finds support among supply-side economists (Roberts, 1984).

Narayan and Narayan (2006) give three reasons why the nature of the relationship between government revenues and expenditure is important. The first one states that if the spend-and-revenue hypothesis holds, revenue can be an effective instrument of the budgetary process, as raising it would not necessarily increase the level of spending. The second reason states that if the revenues-and-spend hypothesis holds, budget deficits can be avoided by adjusting government spending. Raising revenue will not be effective as this will translate into higher expenditure. The third reason is that if the fiscal synchronization hypothesis does not hold, high budget deficits will result if government expenditure rises faster than government revenue.

Recent empirical studies that test the validity of these hypotheses have focused on the U.S and other developed countries. Using Cointegration and Error-Correction models, Miller and Russek (1990), Joulfaian and Mookerjee (1990) and Bohn (1991) find a bi-directional causality between government revenues and expenditure in the U.S economy, thus supporting the fiscal synchronization hypothesis. Owoye (1995) confirms this result for the U.S, France, Germany, U.K and Canada, but not for Japan and Italy, as the direction of causality runs from revenues to government expenditures. With the same methodology, Antioch (1998) finds a bi-directional causality for Australia and a unidirectional causality from revenue to expenditure for New Zealand. Using panel framework, Afonso and Rault (2009) conclude in favour of the spend-and-revenue hypothesis for Italy, France, Spain, Greece and Portugal, and the revenue-and-spend hypothesis for Germany, Belgium, Austria and the U.K.

The study on oil producing Gulf Cooperation Council (GCC) countries by Fasano and Wang (2002) employed a cointegration and ECM estimates for the period 1975-2000. They detect a revenue-and-spend causality for the six member countries, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates. Using the same framework for the period 1964-2001, Al-Qudair (2003) indicates that there is a bi-directional causality in Saudi Arabia.

Narayan and Narayan (2006) provide evidence for a number of emerging countries. They find a revenue-and-spend causality for El Salvador, Haiti, Chile and Venezuela, while spend-and-revenue evidence is supported for Peru. Wahid (2008) also detects a spend-to-revenue direction for Turkey.

Recently, African countries have also attracted a number of studies on this issue. Dore and Nachege (2000) use a cointegration and ECM methodology to examine the direction of causality between revenue and expenditure in the seven West African Economic Monetary Union (WAEMU) member countries. Their results indicate that, in the long run, there is causality running from revenue to expenditure in Burkina Faso and Senegal, from expenditure to revenue in Benin and Togo, a bi-directional causality in Cote d'Ivoire and Mali, and no causality in Niger. Lusinyan and Thornton, (2007) in their study on South Africa support a bi-directional causality between revenue and expenditure. Further evidence in Wolde-Rufael (2008) suggests a similar direction for Mauritius, Swaziland and Zimbabwe, but a unidirectional causality from revenue to expenditure for Ethiopia, Ghana, Kenya, Nigeria, Mali and Zambia, a unidirectional causality from expenditure to revenue for Burkina Faso, and no causality for Botswana, Burundi and Rwanda.

#### **5.4 Granger Causality in a Panel Framework**

Granger testing is a common method for investigating causal relationships between two variables (Granger, 1969). For instance, by estimating an equation in which  $y$  is regressed on lagged values of  $y$  and the lagged values of an additional variable  $x$ , we cannot reject the null hypothesis that  $x$  does not Granger cause  $y$  if one or more of the lagged values of  $x$  is insignificant. Although imperfect, it is nevertheless a standard and useful tool for evaluating the character of the causal relationship between two variables.

Recently, researchers have begun to modify Granger tests so as to incorporate panel dynamics (Arellano and Bond, 1991, Hralin and Venet, 2001 and 2004;

Harlin, 2005).<sup>50</sup> Within a panel framework, Granger tests include significantly more observations, and produce more efficient results than Granger tests in the standard context. The results can help inform researchers both about the nature of causal relationships between sets of variables and the extent to which such relationships are heterogeneous or homogenous across panel members.

Applying standard Granger tests within the panel framework however is not without major challenges. There are two important inferential issues, both dealing with the potential heterogeneity of the individual cross-sections. The first is standard and comes from permanent cross-sectional disparities between individuals (that is, distinctive intercepts), and this type of variation is avoided with a fixed effects model. The second and more problematic type of heterogeneity – causal variation across units – requires a more complex analytical response.<sup>51</sup> For example, it may be possible that, for some individuals, the introduction of past values of  $x$  improves the forecasting performance of  $y$ , and that for others there is no improvement. Erdil and Yetkiner (2005) identify two distinctive literatures dealing with panel VAR.

The other strain of literature, which is based on recent work by Harlin and Venet (2001), explicitly addresses this type of heterogeneity by outlining the procedure for evaluating the character of the causal processes (heterogeneous or homogenous) within a panel framework.<sup>52</sup> Their analytical results are based on a panel Granger model of the following type, where for each of the individuals  $i$  and for all  $t$  in  $(I, T)$ :

$$y_{i,t} = \sum_{k=1}^p \gamma^{(k)} y_{i,t-k} + \sum_{k=0}^p \beta_i^{(k)} x_{i,t-k} + v_{i,t} \quad (1)$$

---

<sup>50</sup> Others include, Podrecca and Carmeci (2001), Weinhold and Nair (2001), Davis and Hu (2004) and Erdil and Yetkiner (2005).

<sup>51</sup> The literature based on early work by Hsiao (1986) and Holtz-Eakin et al (1988) largely ignores this type of heterogeneity.

<sup>52</sup> For substantive examples of the methodology described in Harlin and Venet see, Davis and Hu (2004) or Erdil and Yetkiner (2005).

with  $p \in N^*$  and  $v_{i,t} = \alpha_i + \varepsilon_{i,t}$ , where  $\varepsilon_{i,t}$  are i.i.d.  $(0, \alpha^2_\varepsilon)$ .<sup>53</sup> Contrary to panel VAR modelling, the Harlin and Venet model assumes that the autoregressive coefficients  $\gamma^{(k)}$  and the regression coefficients slopes  $\beta_i^{(k)}$  are constant for all  $k \in (1, p)$ . In addition, while the autoregressive slope coefficients are identical for all individuals, the regression coefficients are allowed to vary across individual cross-sections. Harlin and Venet identify four distinct scenarios for describing causal processes: the Homogenous Non-Causality hypothesis (HNC), Homogenous Causality hypothesis (HC), Heterogeneous Causality hypothesis (HEC) and Heterogeneous Non-Causality hypothesis (HENC).<sup>54</sup>

The HNC implies that there is no linear causal relationship between  $x$  and  $y$  for any of the individual cross-sections. Formally, the HNC is defined as one in which the following is true:

$$\forall i \in [I, N] E(y_{i,t} / \bar{y}_{i,t}, \alpha_i) = E(y_{i,t} / \bar{y}_{i,t}, \bar{x}_{i,t}, \alpha_i) \quad (2)$$

where  $E(y_{i,t} / \bar{y}_{i,t}, \bar{x}_{i,t})$  is the best linear predictor of  $y_{i,t}$  given the past values of  $y_{i,t}$  (denoted  $\bar{y}_{i,t}$ ) and the past values of  $x_{i,t}$  (denoted  $\bar{x}_{i,t}$ ).

Another case corresponds to the HC in which there are  $N$  linear causal relationships (each cross-section manifests a causal relationship). Formally, the condition of HC is defined as one in which the following is true:

$$\forall i \in [I, N] E(y_{i,t} / \bar{y}_{i,t}, \alpha_i) = E(y_{i,t} / \bar{y}_{i,t}, \bar{x}_{i,t}, \alpha_i) \quad (3)$$

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<sup>53</sup> Note that the residuals satisfy the conventional assumptions. See Harlin and Venet (2001) for more details.

<sup>54</sup> Heterogeneity arising from level differences between cross-sections is addressed by including unit-specific (fixed) effect parameters.

In accordance with Harlin's and Venet's assumption that the individual predictors ( $\bar{y}_{i,t}$ ,  $\bar{x}_{i,t}$  and  $\alpha_i$ ) are identical, the following is also true:

$$\forall (i, j) \in [I, N] E(y_{i,t} / \bar{y}_{i,t}, \alpha_i) = E(y_{i,t} / \bar{y}_{i,t}, \bar{x}_{i,t}, \alpha_i)$$

The case of HEC corresponds to the presence of at least one causal relationship (and at the most N causal relationships), and so the following is true:

$$\exists i \in [I, N] E(y_{i,t} / \bar{y}_{i,t}, \alpha_i) \neq E(y_{i,t} / \bar{y}_{i,t}, \bar{x}_{i,t}, \alpha_i) \quad (4)$$

Unlike the preceding case, the individual predictors are assumed to be heterogeneous, so we also have:

$$\exists (i, j) \in [I, N] E(y_{i,t} / \bar{y}_{i,t}, \alpha_i) \neq E(y_{i,t} / \bar{y}_{i,t}, \bar{x}_{i,t}, \alpha_i)$$

The final case HENC, refers to a situation in which at least one individual (and at the most N-1 individuals) does not manifest a causal relationship, hence:

$$\exists i \in [I, N] E(y_{i,t} / \bar{y}_{i,t}, \alpha_i) = E(y_{i,t} / \bar{y}_{i,t}, \bar{x}_{i,t}, \alpha_i) \quad (5)$$

This exhausts the theoretical underpinning behind panel Granger tests proposed by Harlin and Venet (2001). We now turn to a more detailed description of the implementation of this new methodology on the issue of the link between government revenue and expenditure.

## 5.5 Application: Government Revenue and Expenditure

We consider equation (1) in the preceding section using the Within Group fixed effects estimator. The variable  $x$  is government revenue while the variable  $y$  is government expenditure. Following Harlin and Venet (2001), this section

outlines three steps that will be followed in examining the direction of causality between government revenue and expenditure (figure 5.2).

The first step consists in testing the Homogenous Non-Causality (HNC) hypothesis. As in the standard Granger causality test, the unrestricted model includes lags of  $y_{i,t-k}$ , lagged values of the interactive terms,  $(\tilde{x}_{i,t-k})$ , and the fixed effects themselves to predict current values of  $y_{i,t}$ . Lagged values of  $y$  are constrained to equality ( $\beta_{x_{i,t-1}} = \beta_{x_{i,t-k}}$ ) for all models. In the unrestricted model, subsequent lags for within-panel slope coefficients are also set to equality ( $\beta_{x_{i,t-1}} = \beta_{x_{i,t-k}}$ ). In the restricted model, slope coefficients and lags are constrained to zero ( $\beta_{x_{i,t-1}} = 0$ ), leaving only the unit specific effects and the various lags of the dependent variable to predict current values of  $y$ .

More specifically, HNC tests the proposition that across all the members of our panel,  $x$  does not Granger cause  $y$ . In other words,

$H_0 : \beta_i^k = 0$ ; Revenue does not cause expenditure for all panel members

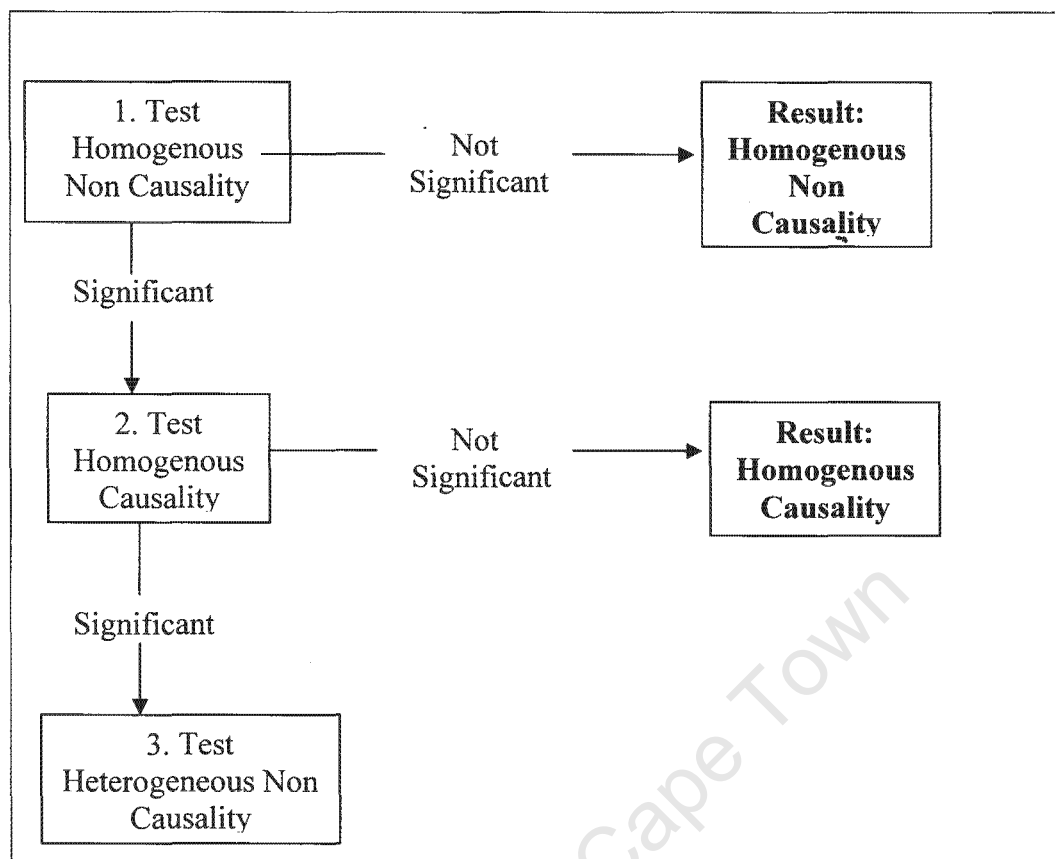
$H_1 : \beta_i^k \neq 0$ ; Revenue causes expenditure, but not for all panel members

If we accept the null hypothesis (with an insignificant F test statistic), this will mean that government revenue does not Granger cause government expenditure for Africa. The non-causality result is then totally homogenous and the testing procedure will go no further. On the other hand, if the alternative hypothesis is accepted (with significant F test statistics), then at least, in one or more African regions, revenue Granger causes expenditure.<sup>55</sup>

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<sup>55</sup> Note that rejecting HNC does not indicate the presence of the HC for the entire panel.

Figure 5.2: Granger Causality Testing for Panel Data



To check if the causality is homogenous across all the panel members, the Homogenous Causality hypothesis (HC) will be tested, and this takes us to the next step. The test corresponds to:

$H_0 : \beta_i^k = 0$ ; Revenue causes expenditure for all panel members

$H_1 : \beta_i^k \neq 0$ ; Revenue causes expenditure, but not for all panel members

Acceptance of the HC hypothesis (insignificant F test statistic) indicates that a common causal process is manifest for Africa. Hence, further testing is unnecessary as  $x$  is said to Granger cause  $y$  for the entire continent. Rejection of the HC hypothesis (significant F test statistic) would indicate that for at least one or more regions,  $x$  does not Granger cause  $y$ .

If the HC hypothesis is rejected, then the Heterogeneous Non-Causality hypothesis (HENC) is conducted for each region in the panel in order to determine which regions contributed to the finding of causality denoted by the rejection of the HNC hypothesis in the first stage.<sup>56</sup> This final step of the procedure requires testing for:

$H_0 : \beta_i^k = 0$ ; Revenue does not cause expenditure for each region

$H_1 : \beta_i^k \neq 0$ ; Revenue cause expenditure for each region

If the F test statistic is significant, then we can reject the HENC hypothesis, indicating that  $x$  does not Granger cause  $y$  for that particular region under investigation. If instead the F test statistic is insignificant then  $x$  does not Granger cause  $y$  for that particular region.

## 5.6 Econometric Investigation

### 5.6.1 Data

We use five-year average unbalanced panel data from 1982 to 2006 for government revenue as a percentage of GDP and for the government expenditure to GDP ratio.<sup>57</sup> This gives a maximum observation of 5 for 20 countries and 3 for 23 countries, making it 43 countries in all.<sup>58</sup>

For the alternative sub-sample periods, we also use five-year average unbalanced panel data from 1992 to 2006 for 43 countries. All data are collected from the International Financial Statistics of the IMF.

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<sup>56</sup> The HENC can be seen as a repetition of the first step, but this time for individual countries in the panel.

<sup>57</sup> As already indicated in the previous chapter, the use of 5-year averages is to offset white noise effects as much as possible.

<sup>58</sup> These countries include 14 for ECOWAS, 14 for SADC, 8 for ECCAS, 10 for COMESA ( 5 of the countries are overlapping with the SADC region), and 3 for AMU (see table 4.1 in the previous chapter)

## 5.6.2 Panel Unit Root Test

Before proceeding with the panel Granger tests, we need to establish that both panel series are stationary (do not contain a unit root). We utilize two different tests designed to detect the presence of a unit root, particularly in panel data. Table 5.1 presents test statistics from the Levin, Lin and Chu and the Im, Pesaran, and Shin techniques.

**Table 5.1: Panel Unit Root Results**

Test	Test Statistics	
	1982-2006	1992-2006
Levin, Lin, and Chu:		
GREV	-4.722*** (0.000)	-8.792*** (0.000)
GEXP	-22.911*** (0.000)	-8.789*** (0.000)
Im, Pesaran, and Shin:		
GREV	-1.253 (0.837)	-1.878* (0.08)
GEXP	-2.257*** (0.001)	-1.890* (0.09)

Notes: \*p<10; \*\*p<05; \*\*\*p<01

For the entire sample and sub-sample periods, both tests reject the existence of a unit root at the 1% significance level for government expenditure (GEXP). On the other hand, for the government revenue (GREV) series, while both tests also allow the rejection of the null hypothesis of a unit root for the sub-sample periods, the Im, Pesaran and Shin test does not reject the unit root hypothesis for the entire sample. Hence, we use first differences in GREV for the full sample period.

## 5.6.3 Causality Testing

The Homogenous Non Causality hypothesis (HNC) is the first test conducted. In our case, we want to know if, government revenue does not Granger cause

government expenditure and vice versa. Table 5.2 presents the results for the full sample period 1982-2006.

**Table 5.2: Homogenous Non Causality Test Statistics (1982-2006)**

Lags	F test
GREV does not Granger cause GEXP	
t-1	4.58*** (0.04)
t-2	0.79 (0.38)
GEXP does not Granger cause GREV	
t-1	0.00 (0.95)
t-2	2.21 (0.14)

Notes: \*p<10; \*\*p<05; \*\*\*p<01

The F test statistic is statistically significant at one lag (t-1), but not at two lags (t-2), allowing us to reject the HNC hypothesis collectively for Africa. So for at least one country (and possibly all), there is statistical evidence that government revenue Granger causes expenditure.<sup>59</sup>

The second half of table 5.2 details the HNC test statistics used to examine the hypothesis that government expenditure does not Granger cause revenue. At both lags (one and two lags), the F test statistic is not significant, indicating that this causal process is not at work for Africa.

In summary, while government expenditure does not cause revenue, evidence supports a unidirectional causality from revenue to expenditure; hence we proceed to determine whether this causal relationship is homogenous or heterogeneous across all the regions within the continent.

<sup>59</sup> This is also consistent with our discussion in section 5.2. Africa is highly dependent on volatile revenues, thus revenue availability may be constraining spending

The results of our tests for the Homogenous Causality hypothesis (HC) are shown in table 5.3. Again the unidirectional causality running from revenue to expenditure is examined up to two lag periods.

**Table 5.3: Homogenous Causality Test Statistics (1982-2006)**

Lags	F test
GREV Granger cause GEXP	
t-1	46.11** (0.05)
t-2	7.74 (0.33)

Notes: \*p<10; \*\*p<05; \*\*\*p<01

The HC hypothesis is rejected at one lag period. Therefore, we must conclude that the causal process in this case is heterogeneous, or does not exist across all the regions in Africa. This calls for further examination in order to determine which regions in our panel contribute to the unidirectional causality from revenue to expenditure.

We consider the Heterogeneous Non-Causality hypothesis (HENC); rejection of the HENC will indicate the presence of a causal relationship for the region under consideration. Table 5.4 presents the findings for a single lag period. The test results indicate that for the ECOWAS and COMESA countries, the revenue-to-spend hypothesis appears to hold. On the other hand, for the SADC and ECCAS+AMU regions, there does not appear to be enough statistical evidence for us to reject the HENC hypothesis.

**Table 5.4: Heterogeneous Non Causality Test Statistics (1982-2006)**

Lags	F test
GREV Granger cause GEXP	
SADC	0.94 (0.34)
ECOWAS	14.71*** (0.001)
COMESA	6.39*** (0.02)
ECCAS & AMU	3.81 (0.19)

Notes: \*p<10; \*\*p<05; \*\*\*p<01

Finally, we repeat the same procedure for the sub-sample period, 1992-2006. Again, the first test of the HNC hypothesis is that revenue does not cause expenditure and vice-versa. The results are presented in table 5.5.

**Table 5.5: Homogenous Non Causality Test Statistics (1992-2006)**

Lags	F test
GREV does not Granger cause GEXP	
t-1	0.89 (0.36)
t-2	0.56 (0.46)
GEXP does not Granger cause GREV	
t-1	2.48 (0.13)
t-2	2.84 (0.11)

Notes: \*p<10; \*\*p<05; \*\*\*p<01

Unlike in the full sample, the F test statistics is insignificant, allowing us to reject the HNC hypothesis. Similarly, the F test for the second half of the table is also insignificant, implying that there is no causality between both variables for Africa in the recent period, although one may have to be aware of the short sample period. This makes further examination unnecessary.

## 5.7 Conclusion

Not surprisingly, our results, based on a panel Granger framework, support the revenue-spending hypothesis for Africa in the full sample period. Two regions, ECOWAS and COMESA, are mainly contributing to this causal process. Government spending follows revenue, suggesting a pro-cyclical expenditure policy to variations in government revenue. Deficits are followed by lower government revenue and not spending. Higher government revenues induce government spending that is difficult to reduce when the revenue decline, increasing deficits. This may be explained by the fact that many African countries depend heavily on aid and resource revenues, thus revenue availability may be thought of in this case as constraining spending.

However, the results of the sub-sample period reveal that government revenue and spending are causally independent, implying that there may be other forces leading to budget imbalances in Africa. Following the Institutional hypothesis, weaknesses in the decision-making processes governing countries' budget could offer a useful explanation for this. But, this issue falls outside the scope of the study.

In this context, African countries could enhance the effectiveness of fiscal policy by making budget expenditure less driven by revenue availability. This would avoid the cost and instability that variation in public spending generates; compounding the boost-bust economic cycle associated with aid and resource revenues.

Fiscal rules could be adopted to constrain expenditure, the budget imbalance and/or borrowing by the government. We now turn in the next chapter to analyse the appropriate fiscal policy rules for the continent, taking into consideration the symptoms of fiscal instability.

## CHAPTER SIX

### 6. FISCAL POLICY RULES

#### 6.1 Introduction

Strong deficit and debt bias stemming from government revenue volatility poses a serious threat both to the sustainability of the African countries budget and to its macroeconomic stability.

Policies adopted in response to high debt levels among emerging and developed countries vary. Brazil and Turkey have used the fixed primary surplus rule, which fixes the ratio of the primary budget surplus to GDP (Basci et al, 2004). Argentina and Peru have applied limits to the overall balance and primary expenditure. New Zealand has rules for the operating balance as well as debt limits.<sup>60</sup> There is also the Stability and Growth Pact in the European Union, although the issue of flexibility is beginning to appear in the practical application of the constraints.<sup>61</sup>

Drawing on this literature, the chapter extends the literature on fiscal policy rules to analyse their application in the African context. In particular we will test the performances of fiscal rules in an environment with a high level of uncertainty in revenue flows.

The next section provides a brief analysis on the government budget characteristics in Africa. Section 6.3 looks at the rationale behind fiscal rules. Section 6.4 offers a discussion on the basic types of fiscal rules using country experiences and showing how rules could be a helpful policy instrument. In Section 6.5, following Basci et al (2004), we compare the performances of a fixed primary surplus rule to a variable primary surplus rule, under which the

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<sup>60</sup> See Kopits and Symansky (1998) and Kopits (2001).

<sup>61</sup> See Dixit and Lambertini (2003) for more details

primary budget surplus is explicitly defined as an increasing function of the debt-to-GDP ratio, using Monte Carlo techniques. However, since government revenues in many African countries are extremely volatile, we deviate from the existing literature by decomposing the primary surpluses into gross budgetary revenue and non-interest budgetary expenditure in order to capture not only the volatility in revenue determined by commodity price fluctuations and output shocks, but also to control for government expenditure.<sup>62</sup> In fact, for any fixed (variable) primary surplus rule, there is also the level of fixed (variable) budgetary expenditure necessary to maintain debt sustainability. The results of the numerical simulations are presented in section 6.6 and section 6.7. Section 6.8 concludes the chapter.

## 6.2 Government Budget Dynamics

As already mentioned in chapter five, Africa is heavily dependent on highly volatile revenues (from aid, oil revenues, exports, small tax base), making its budget vulnerable to fiscal shocks. Oil and commodity windfalls and aid surges induce government spending that is difficult to retrench when the oil and commodity revenues and aid flows decline, distorting government budget allocation patterns, cohesion and stability and increasing deficits and the debt stock.

Table 6.1 presents the level of variability in government revenues for 26 African countries, estimated using the coefficient of variation (CV).<sup>63</sup>

**Table 6.1: Coefficient of Variation on Government Revenue in Africa, 1990-2006**

Range	Countries
Less than 10 percent	Mauritius, Namibia, South Africa, Lesotho, Swaziland, Botswana, Mali, Tunisia, Morocco
10-20 percent	Seychelles, Tanzania, Togo, Burkina Faso, Ghana, Ethiopia, Kenya, Cameroon, Algeria
More than 20 percent	Zimbabwe, Malawi, Democratic Republic of Congo, Nigeria, Uganda, Rwanda, Chad, Burundi

<sup>62</sup> Fiscal policy rules could play a role in stabilizing expenditure programs at level consistent with the necessary medium-term deficit stability

<sup>63</sup> The coefficient of variation (CV) is measured by  $\sigma / \mu$ .

Evidence suggests that fiscal stability seems to coincide with low variability in government revenues and vice-versa. There is some form of stability among those countries whose CV is less than 10 percent. From our results in chapter three, most of these countries whose CV is less than 10 percent seem to be comparatively more fiscally disciplined than those whose CV is beyond 10 percent. If government is not able to guarantee a prudent fiscal policy, then fiscal policy rules are particularly helpful.

### **6.3 Rationale for Fiscal Rules**

Recognition of the dynamic effects of government budget deficits, the importance of policy credibility, timing difficulties associated with discretionary fiscal policy as a result of inside and outside lags, and difficulties many countries have experienced trying to reverse the large fiscal deficits have led to renewed interest in fiscal policy rules.<sup>64</sup>

A fiscal rule is a statutory or constitutional restriction on fiscal policy that sets a specific limit on fiscal indicators like the budgetary balance, debt, spending or taxation. It imposes specific and binding constraints on the government's range of fiscal policy options.

There is abundant academic literature on why unconstrained discretion over fiscal policy can erode public finances and create an unfavorable environment for monetary policy and macroeconomic stability.<sup>65</sup> The bottom line is that there is generally strong pressure to expand government expenditure, reluctance to raise taxes to the extent necessary to fully finance public

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<sup>64</sup> Fiscal policy rule means a permanent constraint on fiscal policy, expressed in terms of an indicator of overall fiscal performance, such as the government budget deficit, borrowing or debt. In other words, a rule is often expressed as a numerical target for a public budget deficit or debt as a share of GDP (Kopits and Symansky, 1998).

<sup>65</sup> Kydland and Prescott (1977), Kopits and Symansky (1998), Kopits (2001), Beetsma and Uhlig (1999), Beetsma (2001), Dixit and Lambertini (2000b, 2001 and 2003), Dixit (2000), Wyplosz (2005).

undertakings (often referred to as fiscal illusion and a deficit bias) and the possibility of an inflation bias.

Fiscal rules will, if observed, mitigate the democratic government's tendency to abandon previous policy commitment. They seek to confer credibility on the conduct of macroeconomic policies by removing discretionary interventions. Their goal is to achieve trust by guaranteeing that fundamentals will remain predictable and robust regardless of the government in power. Thus, fiscal policy rules are particularly helpful if the government is not able to guarantee a prudent fiscal policy to the economic sectors.

Fiscal policy rules are sometimes criticized for being redundant, representing an unnecessary bureaucratic obstacle or being rigid, and also for facilitating misuse through creative accounting. Nonetheless, fiscal policy rules can play a positive role. Fiscal policy rules introduce a long-term horizon to the government's often shortsighted decision making process. Fiscal policy rules also guide financial markets, the ultimate source of fiscal discipline for governments, as strict transparency requirements are identified as a common denominator of efficient rules.<sup>66</sup> Without such commitment, financial markets will lose trust in fiscal stability and interest rates on the government debt will rise.

In order to guide fiscal policy successfully, fiscal policy rules should be forward-oriented and incorporate increasing pension settlements stemming from an aging population.<sup>67</sup> Fiscal policy rules should also encompass various quasi-fiscal transfers and programs that are used to mask the true size and effects of fiscal policy. Some studies also argue that fiscal policy rules should take into account the risk of fiscal revenues and expenditures and use more

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<sup>66</sup> See Kopits and Craig (1998).

<sup>67</sup> For more details see Schmeider (1999).

sophisticated economic techniques to estimate the value at risk of a fiscal policy.<sup>68</sup>

Following Kopits and Symansky (1998), an ideal fiscal policy rule should have these properties: (i) well-defined in terms of the indicator to be constrained, institutional coverage and escape clauses, (ii) transparent regarding accounting conventions, forecasts and reporting practices, (iii) simple, (iv) adequate with respect to the ultimate goal, (v) flexible, so that in the case of an unexpected macroeconomic shock it does not hinder the achievement of the goal, (vi) enforceable, (vii) internally consistent, and (viii) reinforced by structural reforms so that the whole fiscal framework is not seriously endangered by increasing budget liabilities.

## **6.4 Existing Fiscal Rules**

Fiscal rules adopted by countries vary in design and content. Most of the time, fiscal rules have specific numeric targets which usually impose a limit to curtail spending, balance the budget and attain a sustainable level of debt. This section provides an overview by examining some examples.

### **6.4.1 Expenditure Ceilings**

There is a binding ceiling on government expenditure, based on expected revenue projection (given the desired deficit or surplus), before the process of negotiating the various expenditure proposals is initiated.<sup>69</sup> Although legislation regulates which economic activities should be taxed, and at what rate, the government does not control the level of economic activity. Revenue is, in the short run, largely outside the control of the government. An expenditure ceiling can avoid a temporary boost of revenue to be used for expanding expenditure, and can therefore function counter-cyclically in an economic boom.

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<sup>68</sup> See Barmhill and Kopits (2003).

<sup>69</sup> The rule is introduced by Corcelli and Ercoloni (2002)

A number of countries have adopted such rules, namely, Netherlands, New Zealand, Sweden, the US and the UK.<sup>70</sup> The Brazilian rule requires that the Congress should set a ceiling on spending on personnel over a medium-term period. In most cases these rules are multinational and for good reasons.<sup>71</sup> Since fiscal indiscipline is often the consequence of increased spending not matched by increased revenues, such rules tend to have a discipline effect in these countries. In fact, most lasting deficit reduction measures start with spending cuts.

However, Buti et al (2003) note that expenditure rules cannot prevent deficit and debt increases resulting from tax cuts. This is why they suggest complementing the expenditure rule with other rules.

#### **6.4.2 Budget Deficit Ceilings**

A number of countries have adopted rules that restrict the size of the budget deficit or mandate a surplus. In Chile, the rule calls for strict limits on the budget deficit, a structural surplus of 1 percent of GDP, which the country has maintained since rule's inception in 2000. Sweden has adopted a deficit target of 2 percent over the cycle. The introduction of a pre-announced primary budget balance in Brazil in 1998, together with the aggressive restructuring of sub-national debt, resulted in an increase in the consolidated primary balance from 0 to 3.5 percent of GDP in two years after the introduction of the rule, and 4.5 percent in 2004.<sup>72</sup> Furthermore, debt service burdens eased as total debt service as a percentage of exports declined from 117.8 percent in 1999 to 63.8 percent in 2003 (WDI, 2005).

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<sup>70</sup> See, Wyplosz (2005).

<sup>71</sup> See Goldfajn and Guardia, 2004.

<sup>72</sup> Brazil has a federal form of government that guarantees financial and administrative autonomy to local and state governments and account for half of public expenditure. The sub-national governments were a major source of fiscal imbalance in the 1990s as its debt grew (Goldfajn and Guardia, 2004).

Both Columbia and Peru implemented budget deficit ceilings in 2000 and experienced improved budget balances and lower debt service burdens. Colombia reduced its deficit from 7 percent of GDP in 2001 to 4.6 percent in 2003. Peru reduced its deficit from 2.9 percent of GDP in 1999 to 1.8 percent in 2003 and posted a lower debt-service-to-exports ratio from 28.2 percent in 1999 to 21.6 percent in 2003 (WDI, 2005).

The United Kingdom is also among countries that have established such a rule. The country's golden rule introduced in 1998 requires current receipts to equal current expenditure over the economic cycle so that over a cycle the government borrows only for net investment.<sup>73</sup> The rationale for focusing on the current budget is to protect investment spending.<sup>74</sup> The reason for targeting "over the cycle" is to allow automatic stabilizers to work without jeopardizing long-term fiscal sustainability (Honjo, 2007). Switzerland has also amended its constitution, which now requires that the budget be balance over the cycle.

However, some criticisms have been levelled against this rule. In many cases, the budget deficit limits are self-imposed by government, and except for the Stability and Growth Pact (SGP), in none of these countries are sanctions imposed when the deficit limits are breached. Besides, the case of Columbia has shown that the existence of two budgets with an unequal treatment in terms of deficits, as with the golden rule, might stimulate creative accounting on the part of government, and would probably negatively affect growth prospects.<sup>75</sup> Countries with a highly volatile GDP growth will be very un-operational as the volatile growth rates render any estimates of the business cycle position and long-term trends very difficult. Under a budget balance rule, it is also possible to increase expenditure during a boom or raise taxes and cut spending during a recession, both actions of which would result in a pro-cyclical fiscal policy.

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<sup>73</sup> See Balls and O'Donnell (2002)

<sup>74</sup> Public capital expenditures are excluded from the public deficits (Creed, 2003).

<sup>75</sup> See Ajala and Perotti (2005) for more detail.

### 6.4.3 Debt Ceilings

According to economists, there is no simple rule in determining whether, in practice, a government's debt is sustainable or not. The optimum level of debt varies from country to country depending on several variables such as revenue effort, effective tax rates, structure and behavior of expenditures, the debt structure, growth of the economy and degree of uncertainty.

An IMF assessment of public debt in emerging markets reveals very significant differences between the levels of sustainable debt in emerging markets, unlike industrial countries.<sup>76</sup> Using three approaches to assessing debt sustainability, the findings show that industrial countries can sustain higher debt levels. In one approach, a benchmark debt stock level is calculated based on the present discounted value of expected future primary surpluses given the fiscal policy track record of the country. The results show that the median benchmark debt stock level for industrial countries is 75% of GDP compared to 25% of GDP for emerging economies. The differences can be attributed to government revenues, trade openness and quality of domestic institutions and the nature of the political system (IMF, World Economic Outlook, 2003).

This implies that debt ceiling targets have to be evaluated by considering a country's fiscal and economic structure, and how fiscal policy responds to the level of debt. The British Code for Fiscal Stability requires that the net public debt remain at a stable and prudent level, currently understood to be 40 percent of GDP. In the US, the total nominal debt is subject to a ceiling that can only be changed by Congress, which is routinely done.

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<sup>76</sup>The IMF defines emerging markets as those that are in the Emerging Markets Bond Index at the beginning of 2002 plus Costa Rica, Indonesia, India, Israel and Jordan. Essentially, these include countries in the Middle East, Africa, and Asia (excluding the four industrialized Asian countries).

#### 6.4.4 The Growth and Stability Pact

The most popularly known fiscal rules include, the European Monetary Union's Stabilization and Growth Pact (EMU's SGP) which caps the debt-to-GDP ratio at 60 percent and the deficit-to-GDP ratio at 3 percent for European Union member countries. The deficit limit can be breached only in exceptional circumstances, defined as severe recession, estimated as an annual fall in real GDP of at least 0.75 per cent (Buiter, 2003), but not in more than two consecutive years; otherwise, sanctions apply (Wyplosz, 2005).

The possibility of sanctions underpins a highly structured surveillance process. Each country must submit every year to the EU Commission its budget forecasts for the three following years. When the deficit limit is breached, upon recommendation from the Commission, the Council of Ministers triggers a procedure that becomes increasingly binding and leads to sanctions in the form of graduated fines. In principle, the SGP affects all EU member countries but only monetary union members may be fined.

By the end of 2003, almost half of the EU monetary union member countries had excessive deficits including one of its staunchest defenders, the Netherlands. Consequently, France and Germany reached a situation where the sanctions had to be suspended by the Council of Ministers.

The SGP rules have been criticized on the grounds of inflexibility.<sup>77</sup> In contrast with most other fiscal rules, the pact does not rest upon voluntary commitments; it includes sanctions that its initiators wanted to be automatic. These sanctions tend to be fixed or rigid (and sometimes based on a falsifiable numeric). In a recession, the national government would be forced to raise taxes and cut spending in order to maintain the rules, thereby imposing an obstacle to the use of national budgets as a stabilizing tool during recessions,

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<sup>77</sup> See, Dornbusch (1997), Chari and Kehoe (1998), Cooper and Kempf (2000), Cazoneri and Dibia (2001a)

and making fiscal policies pro-cyclical. Even the historical experience of the CFA Franc Zone in Africa seems to support this point.<sup>78</sup>

What the SGP overlooked is that unforeseen circumstances may make the rule counter-productive. Africa is currently proposing the introduction of a single currency that will function in a way that is similar to that of Europe. If the issue was so difficult for a set of rich countries with highly competent bureaucracies that have cooperated closely for more than 50 years, then, realistically, the challenge for African countries in which fiscal policy is characterised by highly volatile revenues and weak institutions must be considerably enormous.

## **6.5 Fiscal Rules with Uncertain Revenues**

There is an abundant academic literature on why unconstrained discretion over fiscal policy can erode public finances and create an unfavourable environment for monetary policy and macroeconomic stability. This is mainly because there is generally a strong pressure on expanding government expenditure, a reluctance to raise taxes to the extent necessary to fully finance public undertakings (often referred to as fiscal illusion and a deficit bias) and the possibility of an inflation bias.

As a monetary policy rule intends to limit the ability of the monetary authority to act discretionally, so fiscal policy rules will – if observed – mitigate the government's tendency to abandon previous policy commitments. They seek to confer credibility on the conduct of macroeconomic policies by removing discretionary interventions. Their goal is to achieve trust by guaranteeing that fundamentals will remain predictable and robust regardless of the government in power. Thus, fiscal policy rules are particularly helpful if the government is not able to guarantee a prudent fiscal policy. It thus seems appropriate to study

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<sup>78</sup> See, Guillaume and Stasavage (2000)

the sustainability of simple fiscal rules in a case such as that of many African countries, where the first source of macroeconomic instability is certainly the dynamics of fiscal policy.

### 6.5.1 Fiscal Policy with Stochastic Revenues

We extend the analysis in Basci et al (2004), looking at the effect of being dependent on natural resource revenues on the sustainability of two rules — fixed rule and variable rule. A simple debt dynamic equation, incorporating real shocks and oil price dynamic, is constructed, and the probability of exceeding the steady state debt level is simulated using Monte Carlo technique.

One possible way of modeling fiscal policy in Africa is to consider the stochastic nature of government revenues as we have illustrated in the previous chapter. Consider, for example, a country like Nigeria where about 80 percent of government revenues come from oil. In this case, we can safely assume that total gross budgetary revenues for the Nigerian government equal to

$$GR_t = P_t \left( \bar{Q}_t \right). \quad (1)$$

Where  $GR_t$  is government revenue,  $\bar{Q}_t$  is the quantity of oil, assumed to be fixed,<sup>79</sup> and  $P_t$  is its price. Thus, primary surplus at the end of the budget year is equal to:

$$PS_t = P_t \left( \bar{Q}_t \right) - G_t \quad (2)$$

The government in each year has to plan expenditure  $G_t$  on the basis of a forecast of oil revenues for the period. If we assume that the price of oil

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<sup>79</sup> Being exogenous and determined by OPEC not the government.

follows a pure random walk,  $P_t = P_{t-1} + v_t$ , this implies that the best forecast of the oil price is equal to  $E_t(P_t) = P_{t-1}$ . Following this, the expected primary surplus at the beginning of a budget year is;

$$E_{t-1}(PS_t) = E_{t-1}\left(P\bar{Q}_t\right) - E_{t-1}(G_t) \quad (3)$$

or,

$$E_{t-1}(PS_t) = P_{t-1}\left(\bar{Q}_t\right) - E_{t-1}(G_t), \quad (3b)$$

The inability to control fiscal revenues introduces a significant element of uncertainty in the budgetary process, equal to the volatility of oil prices  $v_t$ . Any fiscal rule, in this context, should be tested using the budgetary process described by equation (3).

Once the government expenditure decision and oil prices are determined, the resulting primary surplus will give the following debt dynamic.

$$D_{t+1} = (1 + R_t)(D_t - PS_t), \quad (4)$$

where,  $R_t$  is the real interest rate in period  $t$  and  $D_t$  is the debt stock at the beginning of the period  $t$ . Both  $PS_t$  and  $D_t$  are in real terms. In order to express equation (4) in terms of the output ratio we assume a constant growth rate of output. The path of real output is then given by

$$Y_{t+1} = (1 + g_t)Y_t, \quad (5)$$

where  $g_t$  is the constant growth rate. Defining the debt to GDP ratio as  $d_t = D_t/Y_t$  and combining equations (4) and (5),

$$d_{t+1} = \left[ \frac{(1+r_t)}{(1+g_t)} \right] (d_t - ps_t), \quad (6)$$

where  $ps_t = PS_t / Y_t$ .

Assuming also, as in Basci et al (2004), that  $R_t$  and  $g_t$  have random components, we can define the random variable  $r_t + \varepsilon_t$ , the growth adjusted real interest rate, through the following decomposition:

$$1 + r_t + \varepsilon_t = \frac{(1 + R_t)}{(1 + g_t)}, \quad (7)$$

where  $r_t$  is the deterministic component of the real growth adjusted interest rate, and  $\varepsilon_t$  is a zero mean independently and identically distributed (iid) random variable which represents the interest rate, and growth shocks.

Next, we assume that the deterministic component of the growth adjusted mean real interest rate  $r(d_t)$  is an increasing function of the debt to GDP ratio.<sup>80</sup>

$$r_t = r(d_t) \text{ with } r'(d_t) > 0, \quad (8)$$

where  $r'(d_t)$  represents the first derivative of  $r(d_t)$

Combining (6), (7) and (8), we obtain,

$$d_{t+1} = (1 + r(d_t) + \varepsilon_t) (d_t - ps_t), \quad (9)$$

where  $d_t$  denotes the debt to GDP ratio at the beginning of period  $t$ , and  $ps_t$  denotes the ratio of primary surplus to GDP in period  $t$ . It is assumed that the growth adjusted mean real interest rate,  $r(d_t)$  is an increasing function of the debt to GDP ratio.

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<sup>80</sup> See Cantor and Packer (1996), Hu et al (2001) and Basci et al (2004)

Since the analysis here is limited to a developing country, a linear function of debt stock is assumed, for simplicity.<sup>81</sup>

$$r(d_t) = \rho d_t, \text{ For all } t, \quad (10)$$

where  $0 < \rho < 1$ .

Now, by defining the critical or steady state debt level ( $d_c$ ) as

$$E[d_{t+1}] = d_t = d_c \quad (11)$$

and combining (9), (10) and (11) we obtain

$$\rho d_c^2 - \rho d_c p s_t - p s_t = 0 \quad (12)$$

## 6.5.2 Fiscal Policy Rules

Given the dynamic process described by equation (9), the question we want to ask is what is the fiscal policy rule that minimizes the probability of exceeding the critical debt level in equation (12)? As in Basci et al (2004), we consider two alternative policy rules: a policy rule that stipulates a fixed primary surplus relative to GDP, and a policy rule that adjusts the primary surplus required to the level of debt accumulated.

### 6.5.2.1 Fixed Primary Surplus Rule

The fixed primary surplus rule is equal to a constant  $s$  percent of GDP at every period:  $p s_t = s$  for all  $t$ , as

$$p s_t = s = P_{t-1} \left( \bar{Q}_t \right) - G_t, \quad (13)$$

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<sup>81</sup> It is also assumed that real interest rate is independent of the fiscal rule adopted.

Now by controlling for  $G_t$ ,<sup>82</sup> our fixed expenditure rule now becomes

$$G_t = \left[ P_{t-1} \left( \bar{Q}_t \right) \right] - s, \quad (14)$$

Equation (14) is the level of expenditure necessary in order to maintain a fixed primary surplus rule. The Critical debt level for the fixed primary surplus rule<sup>83</sup> is the value of debt that solves the following quadratic equation;

$$\rho d_c^2 - s \rho d_c - s = 0, \quad (15)$$

which can be calculated as,

$$d_c = \frac{\left( s \rho + \left( \sqrt{(s \rho)^2 + 4 s \rho} \right) \right)}{2 \rho}, \quad (16)$$

as  $s, \rho > 0$  so that  $s \rho < \sqrt{(s \rho)^2 + 4 s \rho}$ .

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### 6.5.2.2 Variable Primary Surplus Rule

A variable fiscal rule adjusts the expected level of fiscal surpluses to the outstanding level of debt so that a higher fiscal surplus (a tighter fiscal policy) is set as the debt stock increases: a simple linear expression of that could be:

$$ps_t = \sigma d_t \text{ for all } t, \sigma > 0.$$

Substituting  $\sigma d_t$  for  $s$  in (14), our variable expenditure rule will look like;

<sup>82</sup> We cannot control for  $P_t(Q_t)$  due to oil price volatility.

<sup>83</sup> Obtained by taking  $ps_t = s$  into (12)

$$G_t = \left[ P_{t-1} \left( \bar{Q}_t \right) \right] - \sigma d_t, \quad (17)$$

Again, equation (17) is the level of expenditure necessary to maintain a variable primary surplus rule.

With this rule, the Critical debt level<sup>84</sup> is:

$$d_c' = \sigma / \rho (1 - \sigma) \quad (18)$$

When  $d_t > d_c$ , the debt level blows up, and when  $d_t < d_c$ , it tends to decline under both fiscal rules.<sup>85</sup>

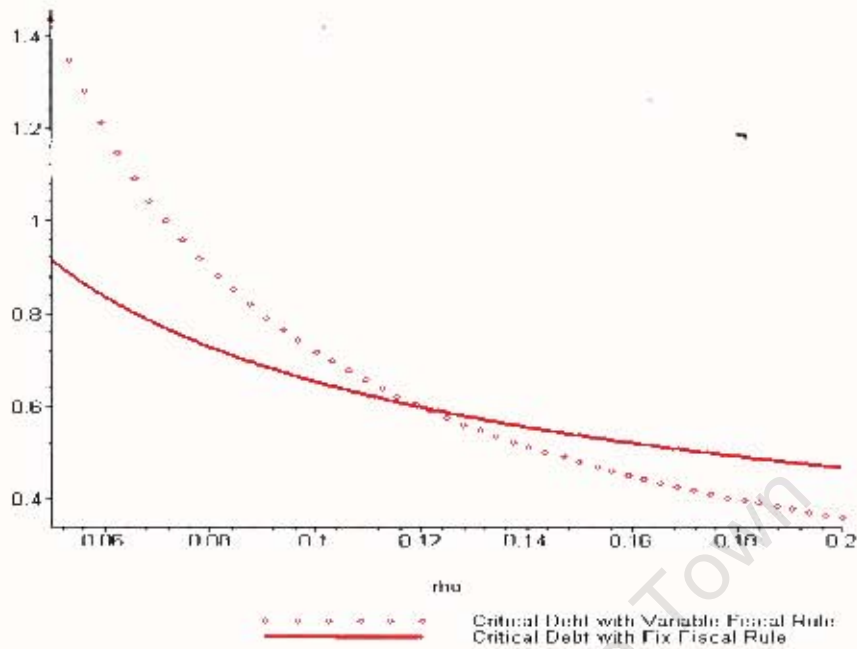
Note that the determination of the more stringent between these two rules depends critically on the level of sensitivity of the real interest rate to the level of debt  $\rho$ . As we can see from the following numerical representation of the two functions (with parameters values equal to the one used in the simulations that follows), for a low level of  $\rho$  (and consequently a low level of the real interest rate at any level of debt), a variable fiscal rule offers a much less stringent constraint to the policy maker. The opposite is true at the opposite end of the  $\rho$  range, where the fixed fiscal rule provides a less stringent rule. This is somehow paradoxical: the variable rule, with a built in adjustment mechanism, should by definition give more room of maneuver to the policy maker. At the same time the high interest rate penalizes very significantly any increase in the debt level so that the feedback mechanism in the variable rule might not be fast enough to respond to a change in direction of the debt dynamics. This is not quite intuitive and, in what follows, the simulations will help in explaining this paradox.

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<sup>84</sup> Again, obtained by taking  $ps_t = \sigma d_t$  into (12)

<sup>85</sup> See Basci et al (2004).

Figure 6.1: Critical Level of Debt and Sensitivity of Real Interest Rate to Debt Stock



## 6.6 Simulation Results

The model illustrated in the previous sections is used to conduct simulations for both fiscal rules using Monte Carlo techniques, for initial debt ratios ( $d_0$ ) ranging from 20 percent of GDP to 100 percent of GDP. To perform the simulations we calibrate the initial oil price level so that government revenues at the beginning of the simulation amount to 20 percent of GDP, which is the average amount of government revenue in Nigeria for the past 10 years. The two shocks in the model, the oil shock  $v_t$  and real rate shock  $\epsilon_t$ , are assumed to be normally distributed with zero mean and 2.5 percent variance and zero mean and 5 percent variance. The debt ratio is then calculated using equation (9), and 1000 replications of a five year horizon debt dynamic are computed. Arithmetic averages and standard deviations of these trials are used in the quantitative analysis.

In order to capture the sensitivity of both rules to real interest rate levels, the simulations are conducted with  $\rho$  at 10 percent and 15 percent; so that with a

baseline debt to GDP ratio of 60 percent, the growth adjusted real interest rates are 6 percent (low) and 9 percent (high), respectively.

For the numerical simulations, we set the parameters for both fiscal policy rules as follows:

Fixed Rule:

$$G_t = \left[ P_{t-1} \left( \bar{Q}_t \right) \right] - s, \quad s = 0.04 \quad \text{corresponding to } d_c = 0.6528$$

Variable Rule:

$$G_t = \left[ P_{t-1} \left( \bar{Q}_t \right) \right] - \sigma d_t, \quad \sigma = 0.0667, \quad \text{corresponding to } d_c = 0.7143^{86}$$

The main result of the simulation is shown in table 6.2. Starting with a 60% level of debt to GDP ratio and with  $\rho=0.1$ , the variable rule minimises substantially the risk of debt exceeding the critical value. However, the Variable rule performs very badly once  $\rho$  is increased to 0.15. The probability of exceeding the critical debt level in the next period (or medium-term) is less than 2 percent for the variable rule, but more than 15 percent for the fixed rule, when the simulation begins from an initial debt ratio of 60 percent of GDP.<sup>87</sup> However, although both rules explode from an initial debt ratio of 60 percent of GDP, at higher real interest rates (that is  $r \geq 9$  percent), the probability of exceeding the critical debt region is much higher with the variable than with the fixed rule.

Although the result shown is probably at the extreme end of the distribution, the observed inversion of the ranking of the two rules is robust to any

<sup>86</sup> The value of sigma is calibrated to make variable and fixed rules comparable, so that the primary surplus at the baseline level of debt is equal.

<sup>87</sup> We compute our probabilities using the formulae,  $Z = \frac{X - \mu_X}{\sigma_X}$ , where X is the critical debt level,  $\mu$  is the average and  $\sigma$  is the standard deviation, from the simulation results.

parametric specification as can be seen in table 6.3 for the initial level of debt of 50 percent.

This result seems at odd with intuition and with a similar contribution by Basci et al (2004). The reason for this is that in our model the probability of significant effects arising from an adverse shock is reinforced by the presence of significant uncertainty in revenue collection. In this set up, a variable rule introduces an extra element of variability in the debt dynamic that can be very penalising at high levels of the real interest rate.

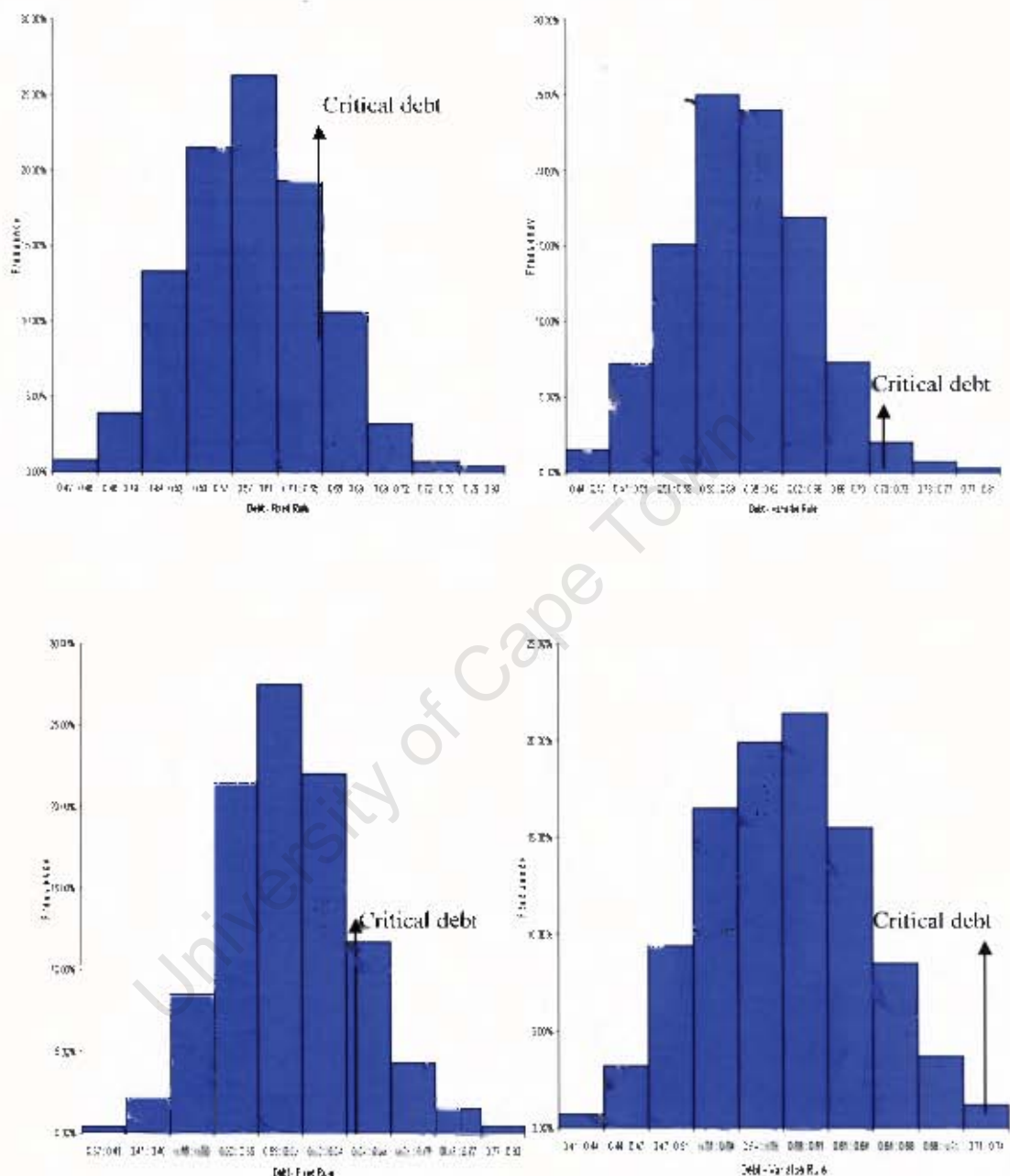
**Table 6.2: Probability Distribution outside the Critical Debt Value in the Medium-term (Initial debt ratio 60%)**

	Fixed Rule	Variable Rule
$\rho=0.1$	13%	2%
$\rho=0.15$	86%	99%

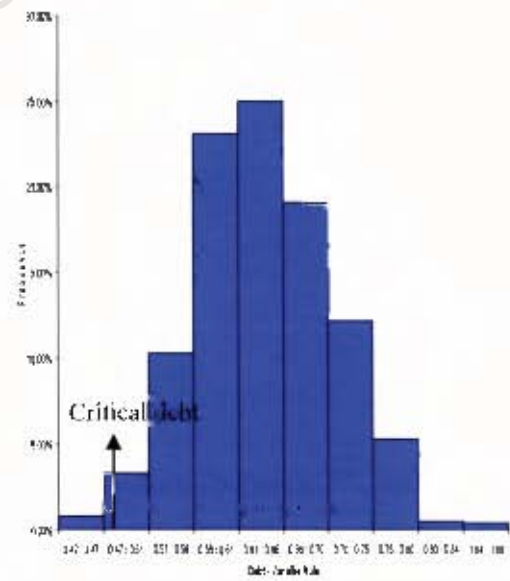
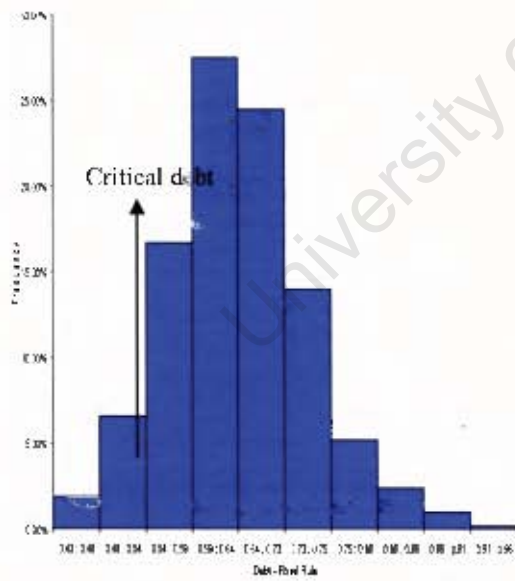
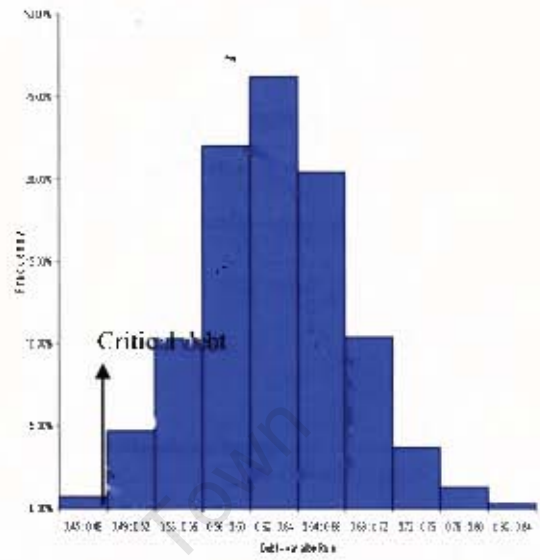
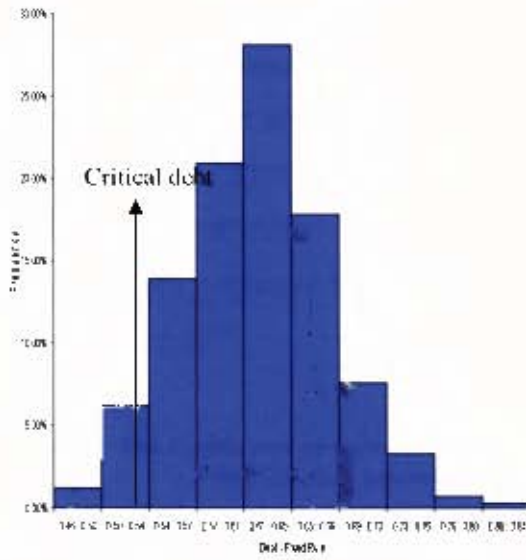
**Table 6.3: Probability Distribution outside the Critical Debt Value in the Medium-term (Initial debt ratio 50%)**

	Fixed Rule	Variable Rule
$\rho=0.1$	0%	0%
$\rho=0.15$	19%	69%

**Figure 6.2: Probability Distribution of 60% Initial Debt Ratio at Next Period and Medium Term with Low Real Interest Rate**



**Figure 6.3: Probability Distribution of 60% Initial Debt Ratio at Next Period and Medium Term with High Real Interest Rate**



## 6.7 Fiscal Rules and Expenditure Variability

In our set up, where fiscal revenues are uncertain, the focus switches to fiscal expenditure as the instrument in the hand of the government to satisfy any fiscal constraint. The nature of the two rules analysed can be better understood if we look at the volatility in expenditure plans that is required for the rule to be satisfied. Tables 6.4 and 6.5 illustrate the variability of expenditure for the two rules in the case of low or high real interest rates and for all the different levels of initial debt that we have simulated. In all cases, and naturally, the variability in expenditure generated by the variable rule is higher than the one generated by the fixed rule<sup>88</sup>

**Table 6.4: The Coefficient of Variation for both Rules in the Medium-term with Low Real Interest Rate**

Initial debt ratio	Fixed expenditure rule	Variable expenditure rule
20	0.164	0.181
30	0.169	0.179
40	0.176	0.183
50	0.170	0.179
60	0.168	0.179

**Table 6.5: The Coefficient of Variation for both Rules in the Medium-term with High Real Interest Rate**

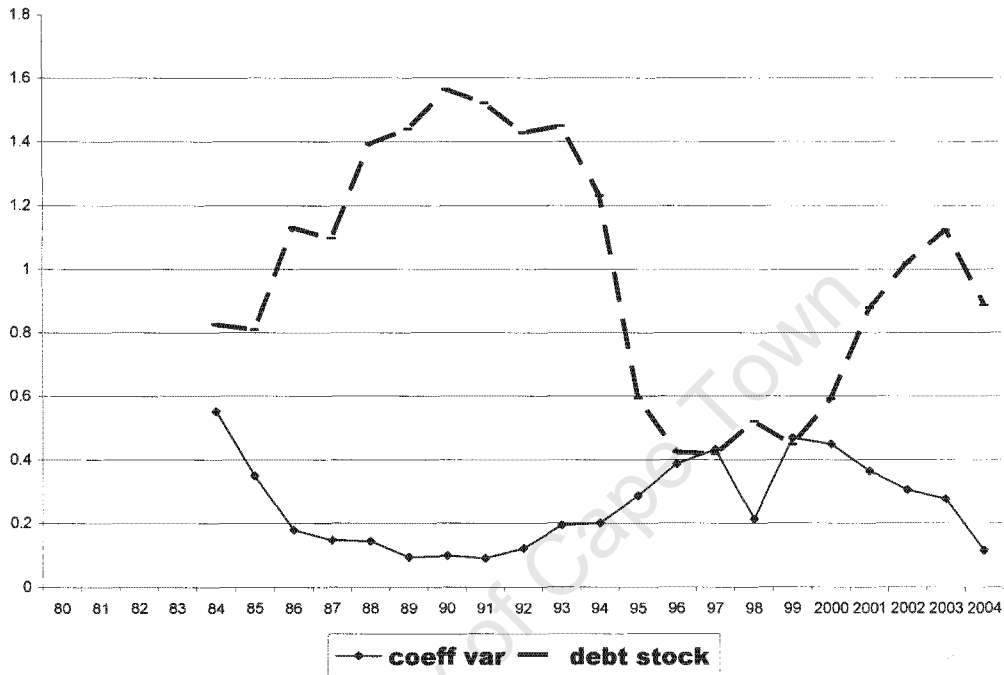
Initial debt ratio	Fixed expenditure rule	Variable expenditure rule
20	0.174	0.185
30	0.175	0.192
40	0.168	0.182
50	0.164	0.175
60	0.169	0.190

This means that higher variability in government expenditure (between 1% and 2%) is required in order to achieve and maintain the variable rule.

<sup>88</sup> The coefficient of variation (CV) for both rules is measured by  $\sigma / \mu$ , from the simulations.

Indeed, figure 6.4 confirms that for the past two decades, the lowest level of the debt to GDP ratio in Nigeria coincides with high variability in government expenditure.<sup>89</sup>

**Figure 6.4: Nigeria Debt and Coefficient of Variation on Government Expenditure (% of GDP) 1980-2004**



The stock of debt averaged from 63 percent of GDP between 1984 and 1985 (when CV on government expenditure is about 50 percent) to 118.3 and 124.2 between 1986-90 and 1990-94 (when CV ranges from 10 to 20 percent only), respectively. Between 1995 and 1997, another period of high variability on government expenditure (about 40 percent), the stock of debt averaged 55 percent of GDP. In 1999 alone, when the CV reached about 45 percent, the stock of debt is only 32.5 percent compared with 73.2 percent in 2004, with less than 10 percent variability.

<sup>89</sup> This time, measured by the same formulae but based on the Nigeria data, 1980-2004 and not on the simulation results.

This positive correlation between high variability in government expenditure and low debt stock is also applicable to other resource-intensive countries within the continent whose data is available (table 6.6).

**Table 6.6: Some Resource-intensive Countries Debt and CV on Government Expenditure (average, 1980-2006)**

Countries	Debt stock (% of GDP)	CV on government Expenditure (%)
Congo Republic	147.0	15.0
Zambia	145.5	17.0
Tanzania	118.3	18.0
Ethiopia	71.8	20.0
Chad	66.9	26.1
Ghana	61.1	38.0
Uganda	59.6	41.0

The low stock of debt in Uganda averaged 59.6 percent of GDP between 1980 and 2006, and is associated with high variability in government expenditure (about 41 percent), while the high debt in the Congo Republic averaged 147 percent of GDP and is associated with a low variability of about 15 percent.

## 6.8 Conclusion

Given the stochastic characteristics of government revenue in many African countries, this chapter has analysed the implication of introducing fiscal policy rules to control budget dynamics and promote the necessary medium-term budget deficit stability. The results from the numerical simulation show that the variable primary surplus rule, defined as an increasing function of the debt ratio, performs better than the fixed primary surplus rule, in reducing debt accumulation only if real interest rates are relatively low and if the government can make a credible commitment to a more flexible fiscal expenditure policy.

## CHAPTER SEVEN

### 7. CONCLUSION

This study analysed empirically the nature of fiscal and monetary policy interdependence and fiscal dynamics in Africa. It also looked at the possibility of implementing viable fiscal policy rules and institutions consistent with economic and monetary stability and growth.

It kicked off by reviewing the theoretical literature, looking in particular at the way economists have framed the analysis of fiscal and monetary policy interdependence. The theoretical framework provided some insights into the channels through which fiscal policy can affect price stability. Conventional theory holds that prices are determined by the demand for liquidity and its evolution over time and therefore fiscal policy can affect price dynamics in so far it can force the monetary authorities to monetize unsustainable fiscal positions. This implies that an independent monetary authority alone can guarantee price stability, regardless of fiscal policy dynamics. However, fiscal policy can have a direct effect on real and nominal outcomes through the effect that inter-temporal fiscal imbalances have on private wealth. This is the view of the Fiscal Theory of Price Determination (FTPD). The implication of the latter is that fiscal policy can be the main determinant of inflation, and that having an independent monetary authority alone may not suffice to ensure price stability. We argued that the latter is an encompassing description of the relationship between fiscal policy and monetary policy in Africa and it therefore formed the basis of our empirical analysis.

Empirical investigations of this FTPD utilised recursive vector autoregressive (VAR) model for 20 African countries. It was found that fiscal policy dominates monetary policy in many countries in the sample. It was also pointed out that a fiscal policy dominant regime may arise regardless of

monetary policy independence. This implies that fiscal policy matters for achieving and maintaining price stability, supporting the FTPD view.

An extension was made using panel data techniques on a set of 43 African countries to assess the robustness of the preceding results, and at the same time to evaluate the stabilizing or de-stabilizing characteristics of fiscal policy in the continent. The results supported the existence of a fiscal dominant regime for the entire continent. This response however seemed weaker in the sub-sample period, suggesting that there has been an effort by the fiscal authorities to improve on fiscal outcomes in recent times, although a regime shift has not yet occurred. Additionally, when we allowed for the interaction between fiscal policy and the business cycle, the evidence seemed to support a pro-cyclical fiscal policy or fiscal destabilization in Africa.

Having identified that there is fiscal instability in Africa, next we used panel Granger Causality tests to examine the direction of causality between government revenue and expenditure. Specifically, this aimed at detecting symptoms of fiscal instability deriving from the dynamic interaction of fiscal revenues and expenditures. The results supported a unidirectional causality from revenue to spending in the full sample period, and no causality in the recent period. This suggests that deficits are followed by lower government revenue and not spending. Higher government revenues induce government spending that is difficult to reduce when the revenue decline, increasing the deficits. Meanwhile, weaknesses in the decision-making process governing countries budget could explain the reason behind the no causality in the recent period, but this issue falls outside the scope of this work. Hence, African countries could enhance the effectiveness of fiscal policy by making budget expenditure less driven by revenue availability.

Finally, we analysed the appropriate fiscal policy rules for constraining expenditure and avoiding the cost and instability that variation in revenue

generates in Africa. In doing this, we used Monte Carlo simulation techniques to evaluate how the introduction of fiscal rules might affect the risk of unsustainable debt accumulation in an environment where fiscal revenues are highly uncertain, a typical characteristic of fiscal processes in Africa. Contrary to the prevalent literature, the results suggested that introducing some element of flexibility in the way fiscal expenditure is planned, with the use of flexible policy rules, might, under realistic circumstances; increase the risk of unsustainable debt accumulation because it magnifies the effect of unexpected revenues reversal. But, this is only if government can make a credible commitment to a more flexible fiscal expenditure policy.

These results are important in designing appropriate macroeconomic institutions for Africa. Since, prices are linked directly to government fiscal behaviour, any effort to build a favourable institutional setting for monetary policy in Africa (such as monetary unification project) is bound to fail unless national authorities ensure a solid fiscal position.

Since this study highlighted the need for coordinating fiscal and monetary policy in Africa, an extension of this work could be necessary. This could include developing a stylised general equilibrium model, incorporating those fiscal characteristics identified in our analysis, in order to investigate the optimal conditions for monetary and fiscal policy in Africa.

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## APPENDIX I

### Dynamic Panel Data Model

Panel (or longitudinal) data provides us with observations on cross-section ( $i = 1, 2, \dots, N$ ) over repeated time periods ( $t = 1, 2, \dots, T$ ). The inclusion of a lagged dependent variable among the regressors to the standard panel data model introduces some dynamic effects into the model.<sup>90</sup> This section briefly discusses different procedures in estimating dynamic panel data models, particularly in cases where there is a large numbers of countries ( $N$ ) whilst the number of time periods for which data is available ( $T$ ) is small. We consider a dynamic fixed effects model of the form

$$\begin{aligned} y_{it} &= \alpha y_{i,t-1} + \beta x_{it} + (\eta_i + v_{it}) \\ &= X_{it} \delta + u_{it} \end{aligned} \quad (1)$$

for  $i = 1, \dots, N$  and  $t = 2, \dots, T$ ,

$$X_{it} = (y_{i,t-1}, x_{it}), \quad \delta = \begin{pmatrix} \alpha \\ \beta \end{pmatrix}, \quad u_{it} = \eta_i + v_{it}$$

where  $y_{it}$  is an observation on some series for an individual  $i$  in period  $t$ ,  $y_{i,t-1}$  is the observation on the same series for the same individual; in the previous period,  $x_{it}$  is a vector of current and lagged values of additional explanatory variables,  $\eta_i$  is an unobserved individual-specific time invariant effect which allows for heterogeneity in the means of the  $y_{it}$  series across individuals (otherwise known as fixed effects), and  $v_{it}$  is a disturbance term.

The fixed effects model we have chosen is a common choice for macroeconomists. It is generally more appropriate than a random effects model for many macro datasets for two reasons. First, if the individual effect represents omitted variables, it is highly likely that these country-specific

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<sup>90</sup> And can also control to a large extent for many omitted variables (Weinhold, 1999).

characteristics are correlated with the other regressors. Second, it is also fairly likely that a typical macro panel will contain most of the countries of interest and, thus, will be less likely to be a random sample from a much larger universe of countries (like in our case, the panel of African countries is likely to contain all of the African countries whose data are available, and not just a random sample of them)

The model in equation (1) indeed includes a lagged dependent variable as one of the regressors. Assuming that  $y_{i,t-1}$  and  $x_{it}$  are correlated with the individual effects  $\eta_i$ , indicating the presence of unobserved heterogeneity, if we further assume that the disturbances " $v_{it}$  are serially uncorrelated", then the Ordinary Least Squares (OLS) estimator of  $\delta(\alpha, \beta)$  in (1) is inconsistent. Because the explanatory variable  $y_{i,t-1}$  and  $x_{it}$  is positively correlated with the error term  $(\eta_i + v_{it})$  due to the presence of the individual effects, and this correlation does not vanish as the number of individuals in the sample gets large.<sup>91</sup>

The Within Groups (WG) fixed effect estimator eliminates this source of inconsistency by transforming equation (1) to eliminate  $\eta_i$ . Specifically, the mean values of  $y_{it}, y_{i,t-1}, x_{it}, \eta_i$  and  $v_{it}$  across the T-1 observations for each individual  $i$  are obtained, and the original observations are expressed as deviations from these individual means. OLS is then used to estimate these transformed equations. Since the mean of the time-invariant  $\eta_i$  is itself  $\eta_i$ , these individual effects are removed from the transformed equations. However, with small T, this transformation induces a non-negligible correlation between the transformed regressors and transformed error term. This correlation does not vanish as the number of individuals in the sample increases, so that the WG estimator is also inconsistent.<sup>92</sup>

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<sup>91</sup> Nor does this correlation vanish as the number of time periods increases, so that OLS levels remains inconsistent for panels with large T.

<sup>92</sup> However, the contribution of each time period to the individual means becomes negligibly small as the number of time periods gets larger. Consequently, this correlation induced by the transformation vanishes, and WG estimator is consistent in the case of large T periods (Nickell,

However, in practice, it is useful to know that the OLS level is likely to be biased upwards, and (in short panels) the WG fixed effect estimator is likely to be biased downwards.

Several other estimators have been proposed to estimate equation (1) when  $T$  is not large. Anderson and Hsiao (1981, 1982) propose an instrumental variable procedure, the two-stage least squares first-differenced estimator (FD2SLS).<sup>93</sup> Just like in the case of the WG fixed effect estimator, to remove the fixed effect, they also first difference equation (1) to obtain

$$\Delta y_{it} = \alpha \Delta y_{i,t-1} + \beta \Delta x_{it} + \Delta v_{it} \quad (2)$$

for  $i = 1, 2, \dots, N$  and  $t = 3, 4, \dots, T$

where  $\Delta y_{it} = y_{it} - y_{i,t-1}$  and  $\Delta x_{it} = x_{it} - x_{i,t-1}$ . An important difference from the WG transformation, however, is that first-differencing does not introduce entire realization of the disturbances into the error term of the transformed equation for period  $t$ . The dependence of  $\Delta v_{it}$  on  $v_{i,t-1}$  implies that the OLS estimates of  $\alpha$ ,  $\beta$  in the first-differenced model are inconsistent, with the direction of the inconsistency being downward and typically greater than that found for the WG estimator.

However, consistent estimates of  $\alpha$ ,  $\beta$  can now be obtained by instrumenting for  $(y_{i,t-1} - y_{i,t-2})$  with either  $y_{i,t-2}$  or  $(y_{i,t-2} - y_{i,t-3})$  which are uncorrelated with the disturbance in equation (2) but correlated with  $(y_{i,t-1} - y_{i,t-2})$ . Arellano (1989) shows that using the lagged difference as an instrument results in an estimator that has a very large variance. Arellano and Bond (1991) and Kiviet (1995) confirm the superiority of using the lagged level as an instrument.

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1981). In addition, the WG, which introduces all realizations of the  $\eta_{it}$  series into the transformed error terms, is only consistent if all explanatory variables are strictly exogenous.

<sup>93</sup> The instrumental variable estimators are considered to be more attractive under much weaker assumption about regressors.

The Anderson-Hsiao estimator can be considered a special case of the GMM procedures, which also remove the individual effect,  $\eta_i$ , by differencing equation (1) to obtain equation (2). The GMM procedures,<sup>94</sup> however, gain efficiency by exploiting additional moment restrictions. They use all available lagged values of the dependent variables plus lagged values of all the exogenous regressors as instruments.

For example, maintaining that the  $v_{it}$  disturbances are serially uncorrelated, if  $x_{it}$  is endogenous such that  $x_{it}$  is correlated with  $v_{it}$  and earlier shocks, but  $x_{it}$  is uncorrelated with  $v_{i,t-1}$  and subsequent shocks, then  $x_{it}$  is treated systematically with the dependent variable  $y_{it}$ . In this case the lagged values  $x_{i,t-2}$ ,  $x_{i,t-3}$  and longer lags (when observed) will be valid instrumental variables in the first-differenced equation (2). If  $x_{it}$  is predetermined so that  $x_{it}$  and  $v_{it}$  are also uncorrelated (but  $x_{it}$  may still be correlated with  $v_{i,t-1}$  and earlier shocks), then  $x_{i,t-1}$  is additionally available as a valid instrument in the first-differenced equation (2). If  $x_{it}$  is strictly exogenous in the sense that  $x_{it}$  is uncorrelated with all past, present and future realizations of  $v_{it}$ , then the complete time series  $x_i = (x_{i1}, x_{i2}, \dots, x_{iT})$  will be a valid instrumental variable in each of the first-differenced equations.

Essentially, GMM use an instrument matrix of the form

$$Z_i = \begin{bmatrix} y_{i1} & x_{i1} & x_{i2} & 0 & 0 & 0 & 0 & 0 & \dots & 0 & \dots & 0 & 0 & \dots & 0 \\ 0 & 0 & 0 & y_{i1} & y_{i2} & x_{i1} & x_{i2} & x_{i3} & \dots & 0 & \dots & 0 & 0 & \dots & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & \dots & 1 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \dots & y_{i1} & \dots & y_{iT-2} & x_{i1} & \dots & x_{iT-1} \end{bmatrix} \quad (3)$$

where rows correspond to the first-differenced equations for periods  $t = 3, 4, \dots, T$  for the individual  $i$ , and exploit the moment conditions;

<sup>94</sup> Developed by Holtz-Eakin, Newey and Rosen (1988) and Arellano and Bond (1991).

$$E(Z_i' \Delta v_i) = 0 \text{ for } i = 1, 2, \dots, N \quad (4)$$

where  $\Delta v_i = (\Delta v_{i3}, \Delta v_{i4}, \dots, \Delta v_{iT})$

In general, the asymptotically efficient GMM estimator based on the set of moment conditions minimizes the criterion

$$J_N = \left( \frac{1}{N} \sum_{i=1}^N \Delta v_i' Z_i \right) W_N \left( \frac{1}{N} \sum_{i=1}^N Z_i' \Delta v_i \right). \quad (5)$$

Using the weight matrix,

$$W_N = \left( \frac{1}{N} \sum_{i=1}^N \left( Z_i' \hat{\Delta v}_i \hat{\Delta v}_i' Z_i \right) \right)^{-1}$$

where the  $\hat{\Delta v}_i$  are consistent estimates of the first-differenced residuals obtained from a preliminary consistent estimator. Hence, this is known as a two-step GMM estimator. Under homoskedasticity of the  $v_{it}$  disturbances, the particular structure of the first-differenced model implies that an asymptotically equivalent GMM estimator can be obtained in one-step, by using another weight matrix,

$$W_{1,N} = \left( \frac{1}{N} \sum_{i=1}^N (Z_i' H Z_i) \right)^{-1}$$

where H is a (T-2) square matrix with 2s on the main diagonal, -1s on the first off-diagonal, and zeros elsewhere. Notice that  $W_{1,N}$  does not depend on any estimated parameters. A lot of applied work using the GMM estimator has focused on results for the one-step estimator rather than the two-step estimator

(Arellano and Bond, 1991). This is because the two-step standard errors tend to be biased downward in small samples.

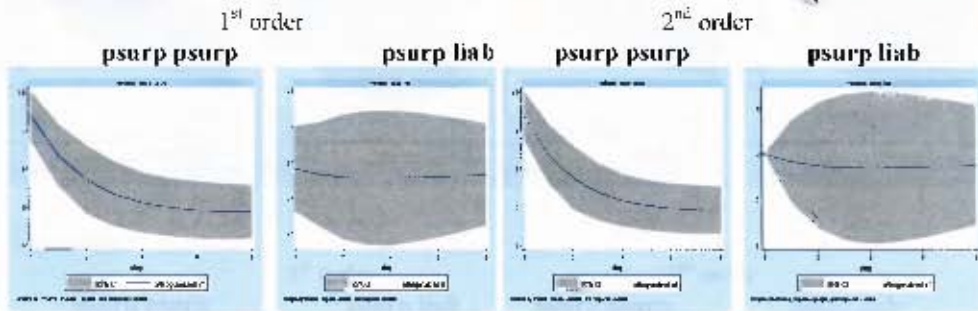
It is worth noting that the additional moment restrictions employed by the GMM estimator will be over-identifying restrictions, so that the validity of a particular assumption may be tested using standard GMM tests of over-identifying restrictions. The Sargan test is useful in this context.

In sum, although the two-stage least squares first-differenced estimator (FD2SLS) can be used to obtain consistent estimates in dynamic panel data models, they are not essentially efficient like a GMM estimator. However, the GMM estimators may be subject to large finite sample biases when the instruments available are weak. Hence, careful investigation of the time series properties of the individual series, and comparison of the consistent FD2SLS estimator and efficient GMM estimator with simpler estimators like OLS and WG, which are likely to be biased in opposite directions in the context of efficient lagged dependent variables in short T periods, can help in detecting and avoiding these biases.

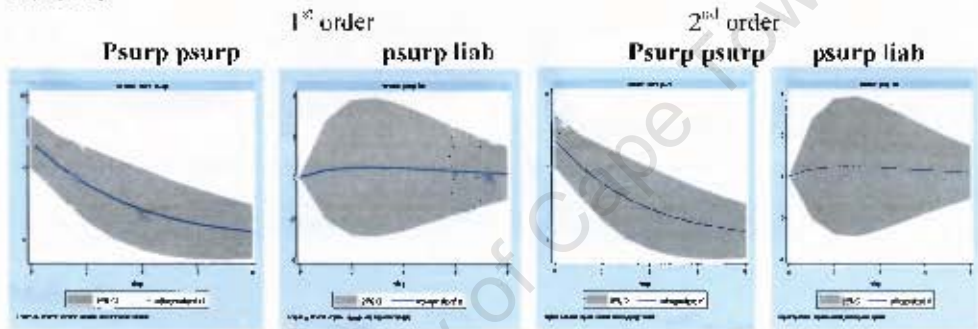
## APPENDIX II

Figure 3.2: VAR on Psurp and Liab

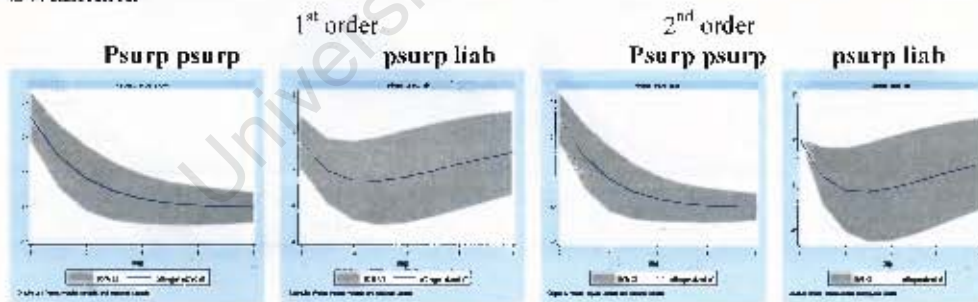
South Africa



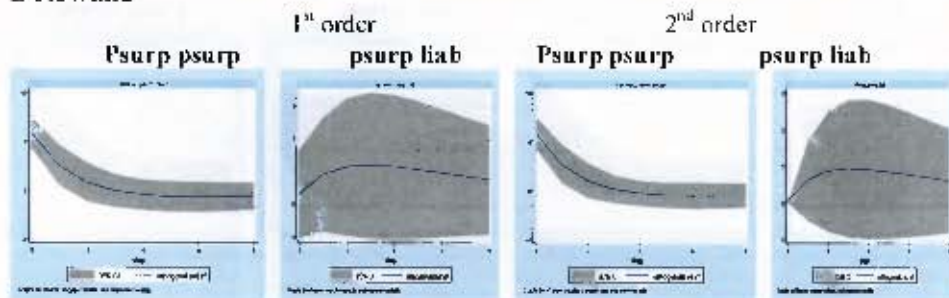
Lesotho



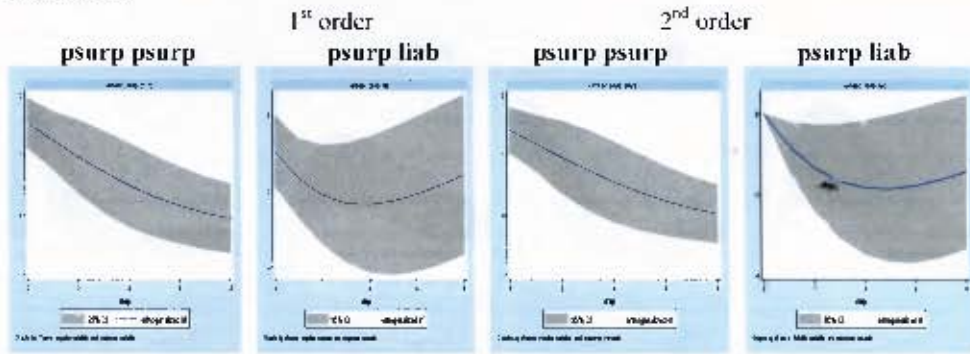
Swaziland



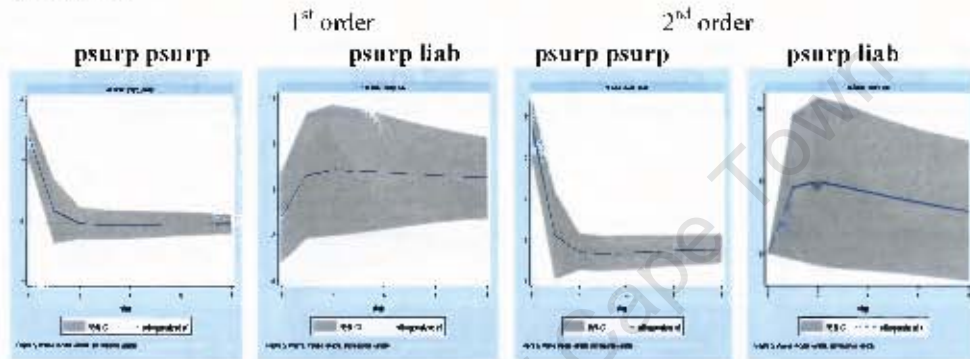
Botswana



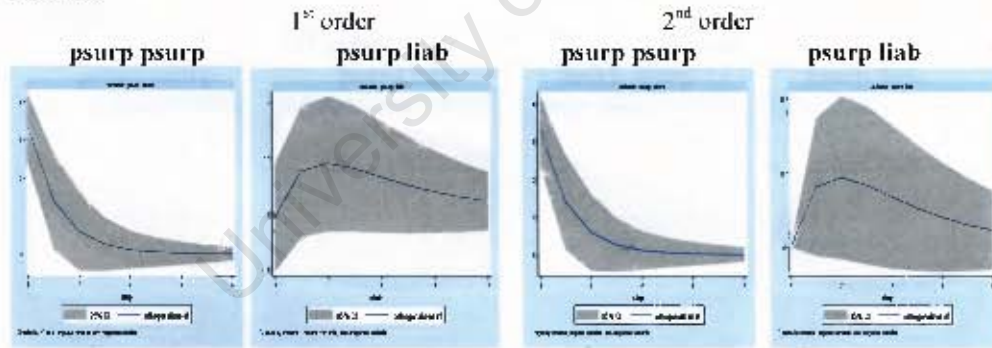
Mauritius



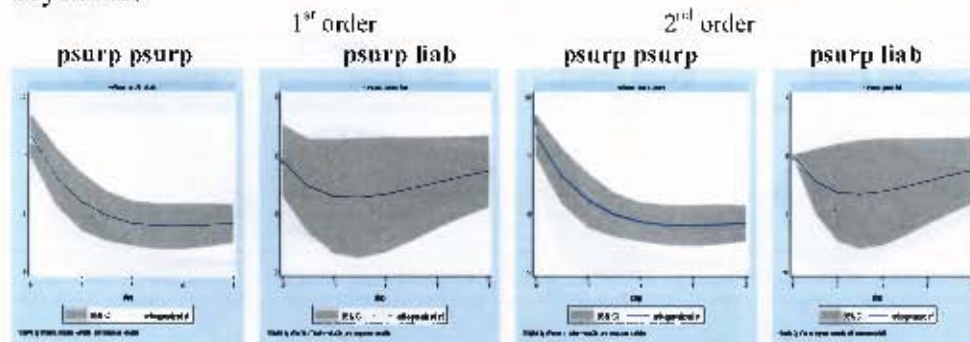
Tanzania



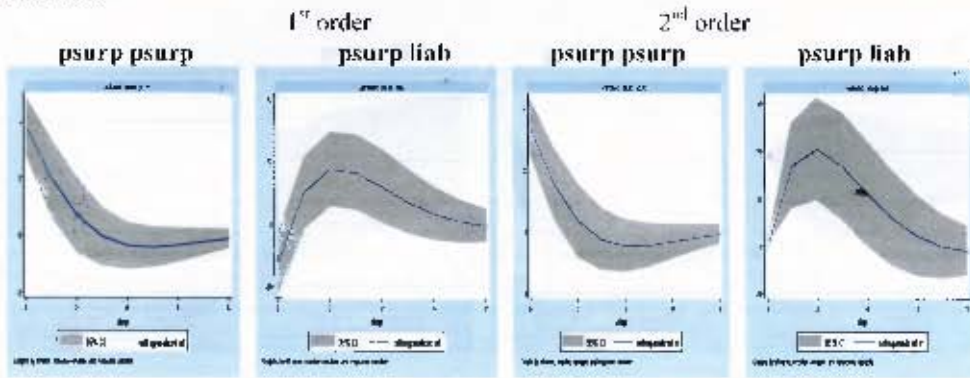
Malawi



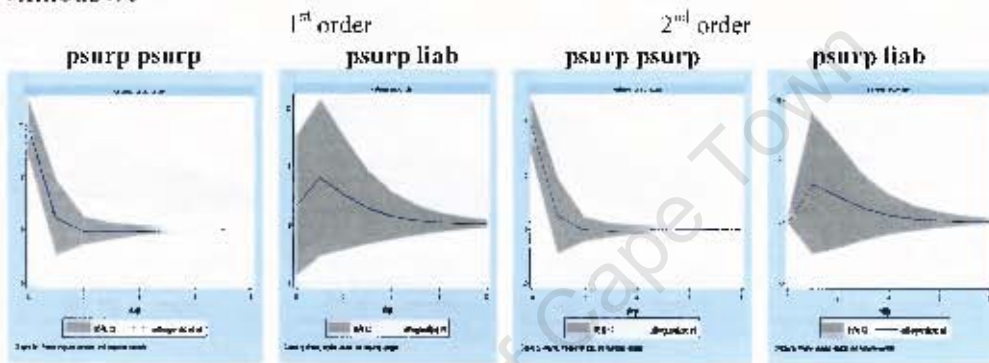
Seychelles



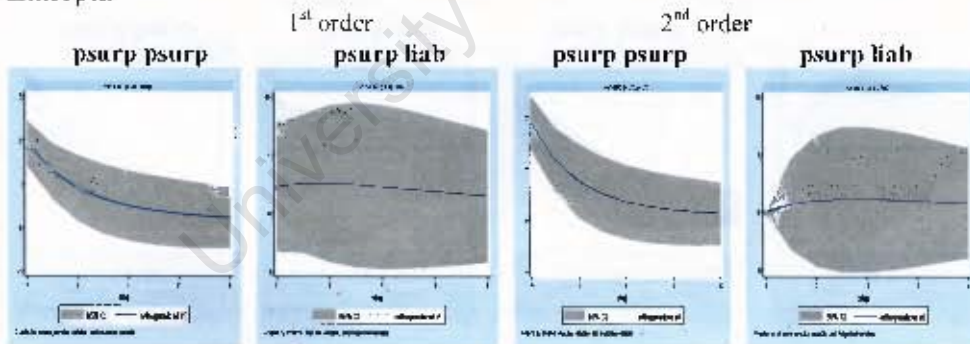
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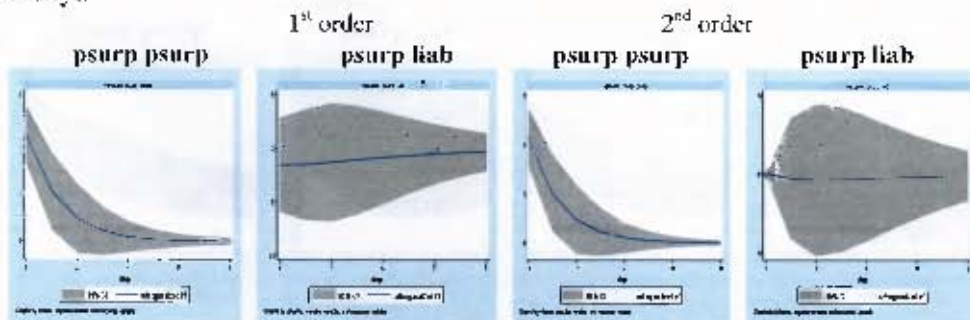
Zimbabwe



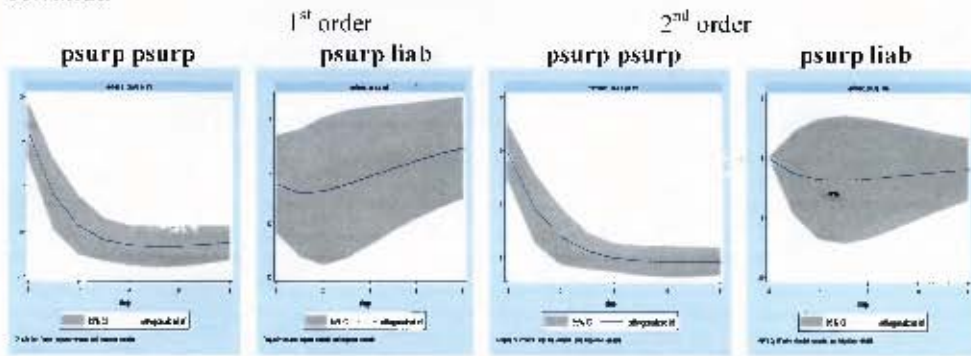
Ethiopia



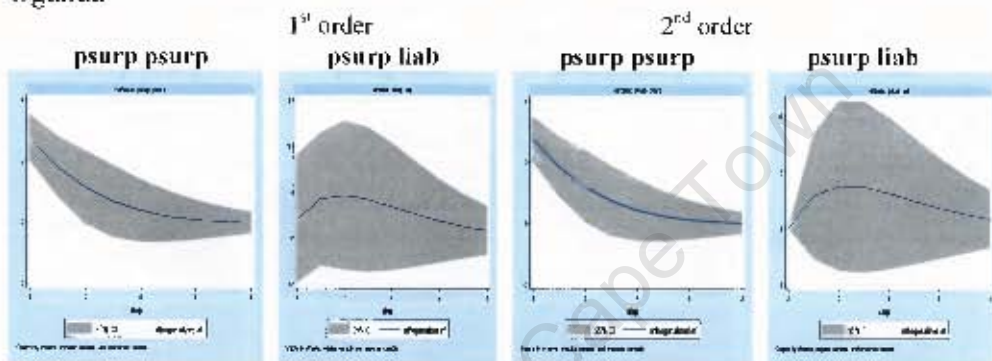
Kenya



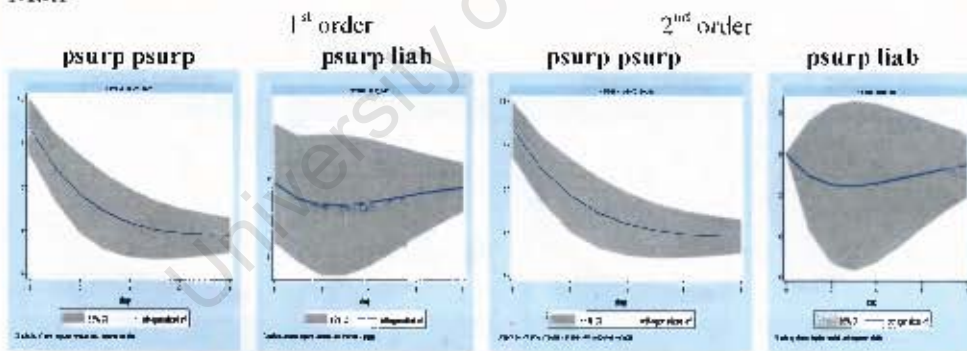
Rwanda



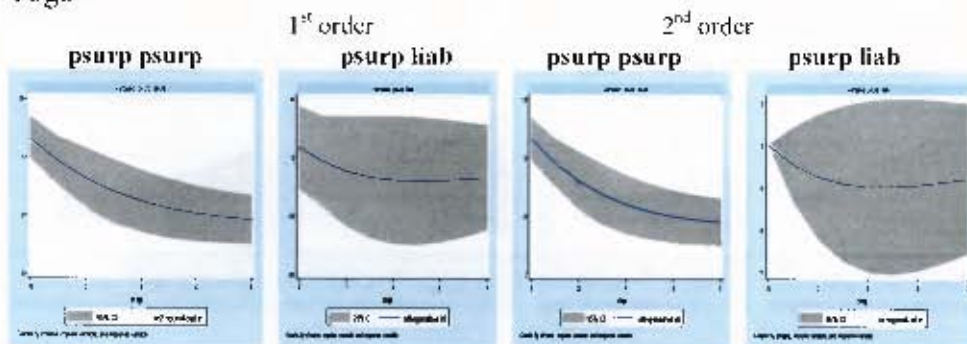
Uganda



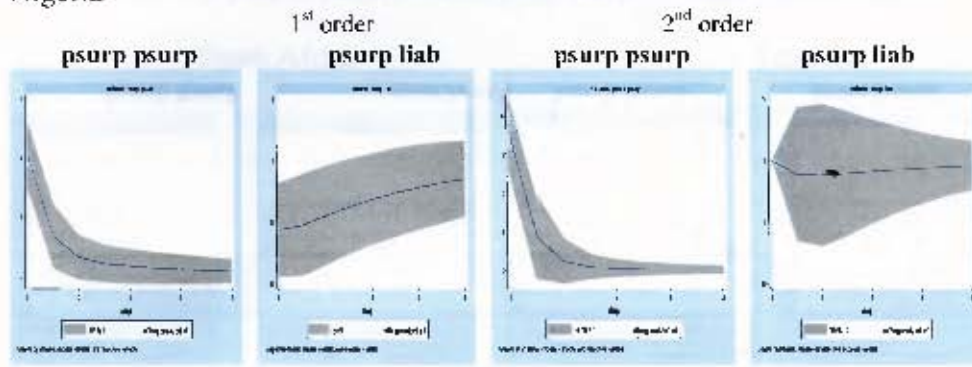
Mali



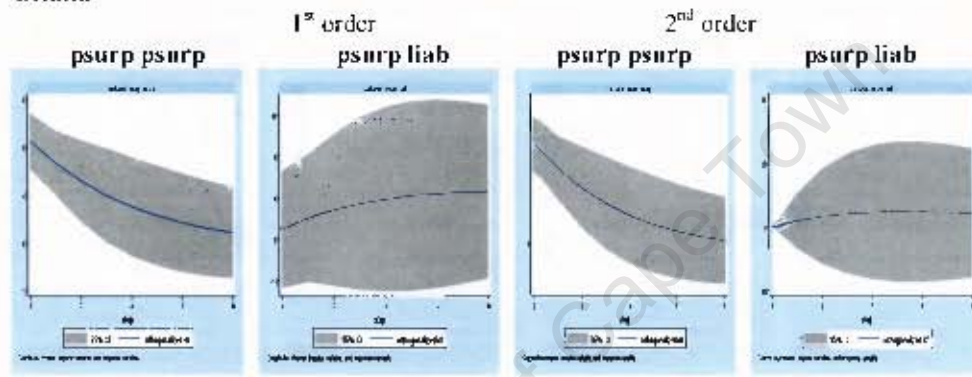
Togo



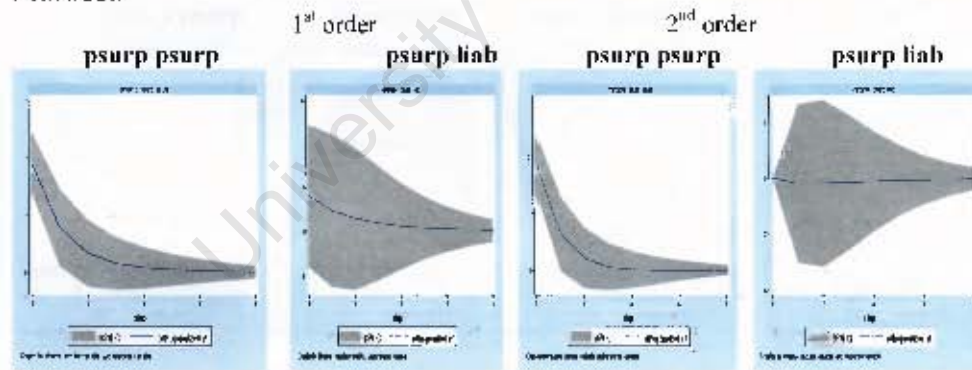
Nigeria



Ghana



Morocco



Tunisia

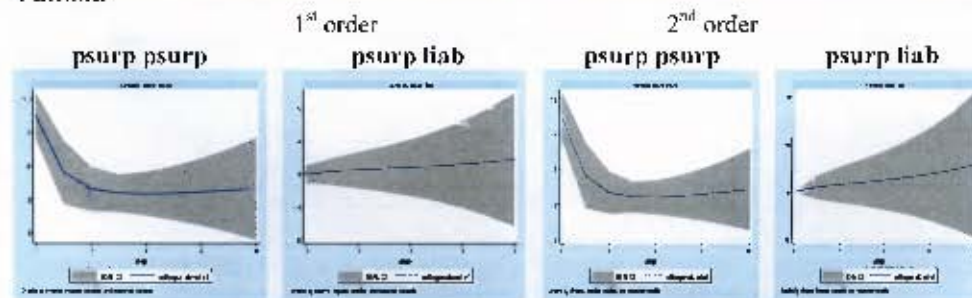


Figure 3.3: VAR on Log of Nominal Liab, Psurp and Log of Nominal GDP

