

**Effects of the Fiscal Policy Shocks under the Debt Feedback
Rule in Ethiopia: Evidence from SVAR Model**

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This is to certify that the thesis prepared by Mathewos Hanbiso, entitled: *Effects of the Fiscal Policy Shocks under the Debt Feedback Rule in Ethiopia: Evidence from SVAR Model*, and submitted in partial fulfilment of the requirements for the degree of Master of Science in Economics (Economic Policy Analysis) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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ABSTRACT

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This study investigates the macroeconomic effects of fiscal policy shocks in Ethiopia under Structural Vectorautoregressive model (SVAR). The model is built on the recent popular shock identification approach and further adjusted to account for the feedback effects of public debt. Under such specification, the intentions are to draw lessons on the dynamic responses of output, inflation, cost of debt and nominal exchange rate to the government expenditure and revenue shocks. In addressing these objectives, the impulse response functions generated through a bootstrap technique are used. Consequently, the result confirms the argument that ignoring the reactions of fiscal and macro variables to the debt level produces incorrect estimates of the effects of fiscal policy for Ethiopia. Besides, shocks in government spending have an expansionary effect on output; lead to quick rise in prices; produce small varied effect on cost of debt; deteriorate nominal exchange rate in the long run and make debt to GDP ratio increase. Alternatively, shocks in revenue have less clear cut, small positive effect on output; temporary price stabilization effect; no meaningful effect on cost of debt; and less stabilization effect on debt ratio. As a result, caution must be taken to ensure increases in spending should not lead to increased debt and inflationary pressure. Likewise, a better revenue collection effort and expanding tax bases in the country could boost growth and reduce debt more.

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DEDICATION

To

My dearly loved Mother, Hellissie Ganamo

Mom, when I remember all the ups and downs of life, all the painful situations that you have patiently passed through to bring me up and make me reach the stage of life where I am today, silence occupies my soul and tears roll down on my face for I have no words to express your gigantic roles in all dimensions of my life. For me, indeed, you are the only female hero I ever know in this world! Long Live, Mom!

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LIST OF ACRONYMS AND ABBREVIATIONS

ADF	Augmented Dickey-Fuller
ADLI	Agricultural Development Led Industrialization
AfDB	African Development Bank
AFRODAD	African Forum and Network on Debt and Development
AIC	Akaike Information Criteria
BTI	Bertelsmann Stiftung's Transformation Index
CPI	Consumer Price Index
df	degree of freedom
ERS	Elliott, Rothenberg, and Stock Point Optimal
ETB	Ethiopian Birr
PP	Phillips-Perron
GDP	Gross Domestic Product
GNI	Gross National Income
GTP	Growth and Transformation Plan
HIPC	Highly Indebted Poor Countries
HQ	Hannan and Quinn Information criterion
IMF	International Monetary Fund
IRF	Impulse Response Function
KPSS	Kwiatkowski, Phillips, Schmidt, and Shin
LM	Lagrange-multiplier
LR	Likelihood Ratio
MDG	Millennium Development Goals
MDRI	Multilateral Debt Relief Initiative
MoFED	Ministry of Finance and Economic Development

NBE	National Bank of Ethiopia
NG	Ng and Perron
OECD	Organization for Economic Commission and Development
OLS	Ordinary Least Square
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
RGDP	Real Gross Domestic Product
SDPRP	Sustainable Development and Poverty Reduction Program
SDR	Special Drawing Rights
SIC	Schwarz Information Criteria
SVAR	Structural Vector Autoregression
US	United States
USD	United States Dollar
US\$	United States Dollar
USA	United States of America
VAR	Vector Autoregression
VAT	Value Added Tax
VECM	Vector Error Correction Model

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CHAPTER ONE

INTRODUCTION

1.1. Background of the study

In recent years the issue of fiscal policy has dominated the attention of economists and policy makers. From the onset of recent global financial crisis, governments of different countries have been heard in adjusting their fiscal policies to stabilize their economy. This issue is in its hot state of debate especially in much of developed countries. The government of these countries has implemented large stimulation packages to take the economy out of its downturn. And similar approaches have been also pursued by developing countries. This has initiated economists and policy makers to examine the effects of fiscal policy on economic activity (Ilzetzki, 2011; Caprioli and Momigliano, 2011).

Fiscal policy as an instrument of macroeconomic policy can be used to stabilize the economy. It is defined as the policy that influences the size and structure of government revenues and expenditures (Rena and Kefela, 2011). According to Chukuigwe and Abili (2008), prudent and sustainable fiscal policy promotes the achievement of non-inflationary economic growth and low levels of budget deficit and government debt. It helps to attain higher growth by lowering the burden of public debt and real interest rate through better tax system and reduces the macroeconomic instability and unpredictability (Artana and Naranjo, 2003).

Understanding the effects of changes in government spending and revenue has a paramount importance for the overall guidance of the economy. Despite the existence

of much theoretical literature on the effects of fiscal policy, less attention has been given to it in applied economic research until recently. Following a recent global financial crisis, many countries were seen experiencing serious budget constraints. This has led them to rely on borrowing to finance the budget deficit which has thrown fears on economists and policy makers that the accumulation of debt would be counterproductive and retards the economy. The implication of this argument is that the effectiveness of fiscal policy depends on the size of public debt and the need to finance it (Estevao and Samake, 2013; Beetsma, 2009). Further, Beetsma (2009) has discussed that in many countries the use of active fiscal policy has failed to reduce the unemployment problem and has rather brought increasing deficits and public debts.

While much is known and the substantial agreement has been reached about the effects of monetary policy, relatively limited study could be mentioned about the effects of fiscal policy. It is even difficult for one to tell the direction of responses of macroeconomic variables to the shocks in fiscal policy. This difficulty has reflected itself in making parliaments and public to hold a hot debate in passing decision on annual government budget. This is because of such decision comprises of changes in fiscal policy which will have significant effect on the allocation of public goods, redistribution of resources and stabilization of the overall economy (Claeys, 2007). Despite these effects of fiscal policy, empirical work gives no agreed up on results on its effect on the economy. Different theoretical and empirical models used to study it produce different results in sign, magnitude and persistence (Perotti, 2002; Favero & Giovanni, 2007).

However, there has been increase over last decade in use of SVAR models to study the effects of fiscal policy though such study is limited to advanced economies (Yadav et al, 2010; Parkyn and Vehbi, 2013; Favero and Giovanni, 2007). Several suggestions

have been made by different authors to improve the usefulness of VAR models to fit for fiscal policy analysis. A novel work in this case can be called the works of Favero and Giavazzi, 2007, who have improved the common misspecification of VAR models by the explicit inclusion of feedback from debt level to the macroeconomic variables that enters government's intertemporal budget constraint. Their study conducted on US economy reveals that the misspecification in VAR model arises due to the fact that the fiscal policy shock puts a limitation on the path of taxes and government spending in the future that the VAR is unable to respond to. This argument holds true particularly in times when there is strong relationship between budget balances and debt to GDP ratio. Other studies have also indicated a serious danger of excluding stock of debt in VAR models to study the effects of fiscal policy (Chung and Leeper, 2007; Parkyn and Vehbi, 2013).

Ethiopia, after the current government took power in 1991, has witnessed a marked departure from a Command Economic System that the previous regime had been following. This has come with the vivid adoption of a market-oriented economic policy. The size of government's involvement is high in the economy and fiscal policy has become strong and essential instrument as the government is aspiring to bring accelerated economic growth (Teshome, 2006).

According to the report of AfDB (2012), high annual growth of GDP since 2004 has sustained and put a country on a high growth trajectory. However, in 2010/11 the macroeconomic management failed to reduce the sky rocketing inflation in the country. The same report released in 2004, has indicated the due significance of donor support in government's fiscal position due to its very nature of deficit balance. To finance the deficit, both foreign and domestic borrowings have been contracted by the

government (MoFED, 2011). The external debt stock has also increased rapidly and quadrupled since the debt relief was granted under the Heavily Indebted Poor Countries (HIPC) and Multilateral Debt Relief Initiatives (MDRI) in 2006 (AfDB, 2012). This indicates that the country is one of highly indebted poor country in the world and it stands behind in almost every indicators of development. Despite the mentioned debt reliefs grant, the country's debt is still high relative to GDP and the fiscal balance is also weak (AFRODAD, 2006).

Previous studies done so far on the effects of fiscal policy on Ethiopian economy are very limited. The exception to this argument is that few studies in this area can be called to the works of Teshome, 2006 and Daniel, 2012. However, these studies have not considered the feedback effects of debt to fiscal and macro variables as well as the potential responses of later variables to the debt level. Hence, this paper fills the observed gap and empirically analysis the effects of fiscal policy shocks by explicitly incorporating the feedbacks of debt on Ethiopian economy.

1.2 Statement of the problem

For any country, effective economic management depends on understanding how the shocks from fiscal policy, monetary policy and other sources affect the economy and their subsequent economic interactions. In particular, interactions of fiscal policy shocks with macroeconomic variables, fiscal policy with monetary policy, and fiscal policy shocks with other financial variables are of paramount importance for the policy makers. As pointed out in Dungey and Fry (2009) the macroeconomic stabilization role of fiscal policy has attracted much attention of international community nowadays. The global financial crisis of 2008 has induced many government of advanced countries to make use of discretionary fiscal policy measures

to take their economy out of its downturn (Cimadomo et al., 2011). Developing countries as well pursued similar stimulation packages.

In spite of such a renewed international recognition for fiscal policy and its vitality to the policy makers, the effects of shocks from it are still a subject of lively debate among policy makers and academicians. Whilst much is known and the substantial agreement has been reached about the effects of monetary policy, it is surprising that neither theoretical nor empirical studies hitherto have reached a consensus on either the qualitative or quantitative properties of most effects of fiscal policy shocks (Franta, 2012). Besides, the available empirical literatures though growing, are highly confined to the advanced economies (Blanchard and Perotti, 2002; Perotti, 2007).

On the other hand, up until the release of a seminal work of Favero and Giovazzi in 2007, the Structural Vector autoregressive (SVAR) models typically used to estimate the effects of fiscal shocks on various macroeconomic variables share two serious weaknesses. One is that they fail to keep the track of debt dynamics that arises following a fiscal shock. Second, they overlook the possibility that government spending and revenues might respond to the level of debt as the debt ratio evolves over time (see Favero and Giovazzi, 2007; Favero et al., 2011). In other words, following a fiscal shock, government spending and revenues are assumed to respond to various macroeconomic variables but not to the level of the public debt. This omission is particularly problematic in the case of countries with a serious public debt burden (Ko and Morita, 2011).

Adding to the point, given the recent wide stream of government bailouts at different countries and the increased use of fiscal measures to stimulate aggregate economic activity which have contributed to a series of large fiscal deficits and, consequently, to

the rapid accumulation of debt, failure to account for the possible feedback effects of public debt to fiscal and macro variables will lead to biased results and wrong policy generalizations (Ilzetzki, 2011; Clays, 2007; Chung and Leeper, 2007).

In view of that, our motivation to carry out this study emanates from the above mentioned debates on the topic and absence of previously undertaken study on the effects of fiscal policy shocks under the debt feedback rule in Ethiopia. To the best of our knowledge, one study done by Daniel, 2012 could be appreciated for its start. However, it fails to incorporate the feedbacks of debt. Hence, this paper aims to fill the gap in this area by incorporating the debt dynamics in SVAR model following the works of Favero and Giavazzi (2007). Besides, the inclusion of the debt feedback rule in VAR setup can help overcome the misspecification problem and provide direction toward a more relevant debt path and fiscal stance.

1.3 Objectives of the study

The general objective of this study is to empirically analyze the effects of fiscal policy shocks by the explicit incorporation of debt feedbacks on Ethiopian economy utilizing a quarterly data of the period spanning from 1999/00-2012/13.

The specific objectives are:

- ❖ Examining the extent to which government indebtedness affects the effects of fiscal policy.
- ❖ Determining the effects of government revenue and spending shocks on GDP, Inflation, exchange rate and interest rate by explicit accounting for debt feedback effects to these variables.
- ❖ Identifying the relative importance of tax policy and expenditure measures for debt stabilization and reduction purpose.
- ❖ To suggest policy recommendations.

1.4 Significance of the study

The effects of fiscal policy on the economy are still topic of empirical research and no stylized facts have been established on it yet. Many economists agree more on the effects of monetary policy than fiscal policy. Most studies of fiscal policy are concentrated on advanced economies (Heppke-Falk et al, 2006). For developing countries only limited papers could be mentioned. As to Ethiopia, few studies exist (e.g., Teshome (2006) and Daniel (2012)). However, these papers are limited in their analysis and fail to consider the effects of debt feedback to macroeconomic variables. Hence, the significance of this paper lies in filling the above mentioned drawbacks of previous literature. Moreover, it serves as the reference for further study related to the topic and provides essential information for policy makers.

1.5 Scope and Limitations of the Study

This paper mainly examines the responses of macroeconomic variables such as RGDP, inflation, interest rate, nominal exchange rate to the shocks in fiscal policy by accounting for the debt feedback in Ethiopia for the period spanning from 1999/00Q1 - 2012/13Q4. It does not examine the effects of the fiscal policy shocks on the private components of real GDP such as private consumption and private investment.

Another point that probably could be mentioned as a limitation of the paper is its use of relatively shorter observations of data, of about 56 observations. This is so due to the absence of well recorded quarterly data on some variables used in the estimation. Besides, a recently revised GDP data with the base year 2011 is only available from 1999/00 on wards.

1.6 Organization of the paper

This paper comprises of six chapters. The first chapter deals with the introduction parts of background, statement of the problem, objective, significance, scope and limitations of the study. In a chapter that follows, the review of related literature is provided. In a third chapter, the recent developments and performances of Ethiopian economy is briefed. Chapter four clarifies the datasets and model specification. In chapter five, the results of the study is discussed where as in the last chapter the conclusions and recommendations are provided.

CHAPTER TWO

LITERATURE REVIEW

In this chapter different theoretical and empirical literatures that are contemporary in areas of fiscal policy and public debt are reviewed. On the theoretical side, definitions and concepts related to fiscal policy and debt is discussed, whereas on the empirical side a brief review of literatures available at international and domestic level with focus on the effects of fiscal policy shock is provided. In doing so, a consideration is also given in reviewing the identification approaches used in isolating the fiscal policy shocks. The final section of the chapter summarizes the empirical literatures done so far on the effects of fiscal policy in Ethiopia.

2.1 Theoretical Literature Review

2.1.1 Definition and Concepts of Fiscal policy

Fiscal policy is the one of an important tool that governments‘ of all countries in the world use to influence the workings of economy. It helps to guide the economy along the stable and expansionary path. According to Rena and Kefela (2011), it is defined as the policy that influences the size and structure of government revenues and expenditures. By varying the amount of the spending and taxation, the policy makers will be in a position to influence the workings of the economy. At the various level of government organization, whether it is at a district or federal level, the government‘’s policy makers make decisions with regard to how much to spend, on what to spend and how to finance this spending (Abel et al, 2008). Government provides goods and services as well as infrastructural facility to its citizens. To address and finance these

issues, government relies on taxes, borrowings and government issued money, i.e., creating new moneys (Boyes and Melvin, 2011).

Standard macroeconomic text books indicate that in deciding the level and composition of spending, and how to finance it, governments may aim at three basic and important objectives of:

- i. Affecting resource allocation. This involves the delivery of public goods that would otherwise not be supplied in a sufficient amount, correcting externalities and other markets failures, preventing economic inefficiencies that could arise due to the presence of monopoly power.
- ii. Affecting income distribution, be it within generations and/or between generations; and
- iii. Maintaining macroeconomic stabilization by correcting business cycle fluctuations through aggregate demand and supply policies.

In influencing the workings of the economy, various types of fiscal policies can be used. It can be expansionary and or contractionary form of fiscal policies. The expansionary type may take the form of a reduction in taxes or an increase in government spending, while the reverse of this applies to the contractionary part. The economic consequence of these types of fiscal policy depends much on the specific theoretical framework one adopts. This is important to see because different schools of thought predict different effects of fiscal policy on the economic activity and macroeconomic variables.

Fiscal policy further classified into automatic and discretionary components (see Daniel, 2012 and Beetsma, 2009). The automatic component works in the absence of any active policy intervention, in which case the government spending and revenues

change automatically following the economic cycle. It changes the budget deficit/surplus automatically without an explicit action from policy makers. For instance, the public transfer payments, such as unemployment benefits, increase as the economy slows down and unemployment rises, while at the same time tax revenues fall. The opposite happens when the business cycle is improving. As Beetsma (2009) pointed out the automatic movements of the government budget as a result of the business cycle are referred to as the cyclical component of the budget.

The Discretionary part of fiscal policy refers to the purposeful change of government spending and revenue collections to promote employment, price stability and economic growth. It also comprises of two structural components: Exogenous and endogenous components (McConnel and Bruce, 2008, Daniel, 2012). The structural component is obtained when the cyclical component is subtracted from the actual fiscal budget. Also this structural component may be systematically linked to the economic cycle. For instance, the government may systematically raise tax rates whenever activity rises above potential and reduce them whenever activity falls below potential. The structural component could also be systematically linked to other variables such as the stock of outstanding public debt or inflation.

The systematic response of the structural component to economic activity or other macroeconomic variables is referred to as the endogenous structural component. The other part of the structural budget is called the exogenous component. For example, an increase in public spending to finance a war or a politically motivated extra transfer to the population prior to an election are an exogenous component of fiscal policy as mentioned in (Beetsma, 2009).

2.1.2 Notion of Debt

According to Mankiw (2010), debt is the accumulation of outstanding past borrowings of the government. This happens when government's revenue do not covers all of its spending on the provision of goods and services as infrastructural facility to its citizens. As revenue falls short of government's expenditure, then government faces budget deficit, which will be covered by borrowings. When the size of budget deficit rises, it results in national debt. Since fiscal policy deals with the issues of government's expenditure and revenue, then one can clearly understands that it is linked with the government debt via budget deficit. Once a person named Herbert Hoover, said "*Blessed are the young, for they shall inherit national debt*". This saying indicates that national debt has its own impacts on the welfare of current and future generations.

In the literature, there are different views on the economic effects of public debt. The conventional view which is held by most economists and almost all policymakers indicate that the issuance of government debt stimulates aggregate demand and economic growth in the short run but crowds out capital and reduces national income in the long run (Elmendorf and Mankiw, 1998). An alternative view of government debt known as "Ricardian Equivalence" says the choice between debt and tax finance of government expenditure is irrelevant. This is the idea of the 19th century British economist David Ricardo, who first noted the theoretical argument.

The Ricardian argument is based on the insight that lower taxes and a budget deficit today require higher taxes in the future. It however assumes rational forward looking individuals in the economy. Thus, the issuing of government debt to finance a tax cut represents not a reduction in the tax burden but merely a postponement of it. If

consumers are sufficiently forward looking, they will look ahead to the future taxes implied by government debt. Understanding that their total tax burden is unchanged, they will not respond to the tax cut by increasing consumption. Instead, they will save the entire tax cut to meet the upcoming tax liability; as a result, the decrease in public saving will coincide with an increase in private saving of precisely the same size. National saving will stay the same, as will all other macroeconomic variables.

The stock of outstanding government debt obligations resulting from government borrowings is one of the major indicators of fiscal policy. Government borrowings facilitate the smoothening of consumption and assist the development of a country by generating opportunities to finance public investment. Matthew et al., (2012) points out that if the government borrowing is not managed prudently, it could grow to be a vicious force, makes the national debt to grow. High indebtedness makes a country more vulnerable to shocks and crisis. It can reduce the effectiveness of fiscal and monetary policies. As highlighted by the debt overhang hypothesis, high indebtedness affects the behaviour of economic agents through the expectation of further increase in taxes to service debt (Benedict et al., 2003).

2.1.3 Views of Different Schools of Thought on Fiscal Policy

Different schools of thought in economics assign different levels of importance to the effects of fiscal policy on the economy¹. There are three main ways through which a government expenditure and taxation decision affects macroeconomic variables. These are (1) aggregate demand (2) government capital formation, and (3) incentive (Abel et al, 2008). Through aggregate demand, fiscal policy influences economic activity by changing the pattern of total spending. This is so due to the fact that

¹ Interested readers can refer to any standard macroeconomics text books on the views of different schools of thought in economics.

government spending is the one of the components of aggregate demand. Fiscal policy influences the economy through government capital formation if the government spending is devoted to important public infrastructures such as health, education, roads, and the likes. This boosts the economic growth of a country by improving the human capital formation. The third one works through influencing the incentives of economic agents by modifying taxes.

The Classical and Keynesian economists stand at different corners on the effects of fiscal policy. For classical economists, where prices are assumed flexible, fiscal policy has no use in influencing the economy. Supporters of this view are the advocators of what is known as –Say’s Law”, which states that supply creates its own demand. According to this group, there is no ground for the government to intervene in the economy. If government intervenes, it creates inefficiencies in the economy and its expansionary fiscal policy will result in the contraction of economy via negative impact on private investment and private consumption (Beetsma, 2009). However, for Keynesian economists, fiscal policy is an engine that drives the economy. According to their view, expansionary fiscal policy adopted via tax cuts boosts the output and private consumption whereas the reverse retards the economy. In this case aggregate demand plays an important role in determining output since price is assumed to be fixed.

When coming to the view of another school of thought, for a given fiscal expansion, say an increase in government spending or tax cut, the neoclassical and new Keynesian schools of thought predicts a rising output in the short term, but envisages different transmission mechanism. These different channels are attributed to different assumptions adopted by each school and to the corresponding responses of private consumption and the labour market. And the key point of debate between these two theoretical schools of

thought, among other things, lies on about the effects of fiscal policy on private consumption and real wage. The predictions they put forward on the responses of the two variables to fiscal policy changes depends on the various underlying theoretical assumptions. For instance, the neoclassical school predicts that an expansionary fiscal policy decreases private consumption and increases labour supply due to negative wealth effects. Consequently, an increase in labour supply causes a decline in the real wage. Contrary to this, the new Keynesian school predicts that a positive fiscal shock makes real wage to increase. This is so due to the inherent assumptions of nominal price rigidities and imperfect competition in the economy which in effect makes an expansionary fiscal policy to increase the labour demand. Thus, due to the price rigidity assumption, real wage increases.

On the other hand, the Real Business Cycle model with the assumptions of constant returns to scale, standard preferences and competitive markets, proposes that government spending shocks increase GDP and produce negative wealth effects due to the households' expectation of higher taxes in the future or because of intertemporal substitution effects due to temporarily increased interest rate (Yang, 2013). This causes consumption to decrease and labour supply to increase which in turn leads to a fall in real wages. Baxter and King (1993) show that an increase in government spending financed by non-distortionary taxes reduces the representative agent's wealth, which leads to an increase in the labour supply and a decrease in both real wages and consumption.

2.2 Empirical Literature

2.2.1 Identification of Fiscal Policy Shocks

A fiscal policy shock is a surprise change in fiscal policy. Fiscal policy encompasses a wide variety of policies: there is an endless list of types of incomes, for which the tax rules could be changed, or categories of government spending, where changes could occur (Mountford and Uhlig, 2009). However, the main problem in the empirical analysis of fiscal policy is the identification of exogenous and unexpected events. The literature has followed different approaches in this regard (Beetsma, 2009).

Nonetheless, up to date, there are five main approaches adopted for the identification of policy shocks in the literature. The first one is the recursive approach originally introduced by Sims (1980) and it essentially relies on Choleski ordering by assuming a causal ordering of variables from the most exogenous to the most endogenous so as to identify fiscal shocks. For instance, Fatas and Mihov (2001) applied this approach in studying fiscal policy and they ordered government spending first where as Favero (2002) ordered fiscal shocks last.

The second approach is the event –study approach introduced by Ramey and Shapiro (1998). This approach is particularly applied to a USA economy. It is assumed that the increase in a USA government spending related with its involvement in the Korean War, the Vietnam War and the Reagan administration fiscal expansion were exogenous to the state of economy. Thus, in those cases, there is no need to identify the structural form of the VAR model and the analysis can be based on a reduced-form VAR. Perotti (2007) and Ramey (2009) are among some to use this approach. This approach is now generally called “the narrative” approach as recently developed

by Romer and Romer (2010), and Favero and Giavazzi (2011). In a narrative approach attempts made to determine the size and the timing of truly exogenous changes in fiscal outcomes using information from policy documents.

Nonetheless, the second approach is not free from problems. Perotti (2004) pointed out that if the increases in a USA government spending related with its war involvement are truly exogenous and unanticipated, then one is only interested to in estimating their effects. There is no need to impose other potentially controversial identifying assumptions: what needed is the reduced form regression. However, this is not the case and the approach has two problems. First, the increases in government spending were not entirely unanticipated. Second, other substantial fiscal shocks, of different type or sign, might have occurred around the same time, thus polluting the identification of the fiscal shocks.

The third approach of identifying fiscal policy shocks is the sign-restriction approach. In this approach fiscal policy shocks are identified by imposing restrictions on the impulse responses. Its application to fiscal policy analysis was introduced by Uhlig (2005) and Mountford and Uhlig (2009). For example, shocks related with revenue are identified by imposing that tax revenue response increases while the government expenditure response does not, and that all responses such that both tax revenues and GDP increase identify a business cycle shock. The advantage of this approach is that it handles well an anticipated fiscal policy shocks. Also unlike the recursive approach, it does not impose a zero restriction on the initial output response to a revenue shock. As well, unlike structural VAR approach, it does not require a two-step estimation procedure. Nevertheless, it has some potential limitations. As mentioned in Perotti (2004), and Estevao and Samake (2013) by attributing a positive correlation between

output and revenue residuals entirely to business cycle shocks, the approach rules out a whole set of non-Keynesian effects of fiscal policy. A second problem of this approach is also related to its benefits: while it can better handle anticipated fiscal policy shock, it cannot pin down when the fiscal shock occurs.

The fourth approach, a popular approach at present time is developed by Blanchard and Perotti (2002) and extended by Perotti (2004). It uses a structural VAR and identification is achieved by exploiting decision lags in fiscal policy, and institutional information about the elasticity of fiscal variables to economic activity. These authors use (1) institutional information about tax, transfers, and spending programs to construct parameters, and (2) the reaction timing of policymakers to GDP shocks to identify parts of the variance-covariance matrix. They make the crucial assumption that policymakers and legislatures would take more than a quarter to learn about a GDP shock and decide which fiscal measures to take in response of a shock. However, it cannot be used with annual data. The current study also uses this approach in identifying fiscal policy shocks. Its detailed discussion will come once a review on fifth approach is closed.

The fifth and last approach is the approach that considers the long run properties of fiscal variables, economic activity and other endogenous variables within SVAR and a vector error-correction model (VECM) framework. It is an extension of the Blanchard and Quah (1989) methodology as there is a correspondence between SVARs and VECMs.

2.2.2 Effects of Fiscal policy shocks

While much is known and the substantial agreement has been reached about the effects of monetary policy, relatively limited study could be mentioned about the effects of fiscal policy. The recent financial turmoil has, however, revived the interest of academia, central bankers and governments on the role of fiscal policy (Afonso and Sausa, 2009). However, the existing literatures are confined to advanced economies and studies on the fiscal policy of developing countries are typically remained untouched. Perotti (2007) and Claeys (2007) the reasoned that limited study with regard to the effects of fiscal policy are attributed to the difficulty of having high frequency data over longer periods and the problems associated with identifying the exogenous fiscal policy shifts. Moreover, studies that incorporate debt dynamics into a fiscal VAR are new and only a few researchers tried it following the works of Favero and Giavazzi (2007, 2011).

Turning to reviewing the existing literatures, Blanchard and Perotti (2002) by using information about the elasticity of fiscal variables to identify the automatic response of fiscal policy, studied the effects of fiscal shocks on the U.S.A economy. Their finding indicates that an increase in government purchases affects economic activity positively with a multiplier that tends to be close to unity, while an increase in net taxes has the opposite effect. An increase in government purchases boosts private consumption, while both an increase in government purchases and a net tax increase exert a negative effect on investment.

Perotti (2004) constructs a VAR model with GDP, inflation, interest rate, government spending and taxes for 5 OECD countries. He finds the estimated effect of fiscal policy on GDP to be small. The effect of government spending shocks on private

consumption is significantly positive over a three-year horizon and no response of private investment. For the Spanish economy, De Castro and de Cos (2006), found a positive relationship between government expenditure and output in the short-term, while in the medium and long-term expansionary spending shocks only lead to higher inflation and lower output. In other study Kim (2007) investigated the short-term effects of fiscal policy shocks on the Korean economy and found that spending shocks decrease output, inflation and interest rate, while tax-cuts increase output and interest rate but decrease inflation.

The macroeconomic effects of fiscal policy vary from country to country depending on the level of budget constraint that each country faces (Estaveo and samake, 2013). Expansionary fiscal policy is believed to correct the negative shocks of the economy. However, these may not be the case if there is debt accumulation and hence, the appropriateness of fiscal stimulus depends on the level of public debts. Similarly, Favero et al (2011) has pointed out an international heterogeneity on the effects of fiscal policy. There is no unconditional fiscal policy multiplier. They indicated that the effect of fiscal policy on output varies depending on the debt dynamics, degree of openness and fiscal reaction function.

More importantly, Favero and Giavazzi (2007) emphasized the importance of using the debt feedback equation in analyzing fiscal policy shocks. In their study which was focused on a U.S.A economy, they have shown that overlooking the government debt results in incorrect estimates of the effects of fiscal shocks. Omitting feedback from the level of debt to fiscal policy could result in impulse responses to fiscal shocks be based on biased estimates and be computed along implausible paths for the debt-to GDP ratio. This is so because fiscal policy is subject to the budget constraint.

The macroeconomic variables like output, inflation and interest rate respond to the government spending and revenue shock. As well, these variables are inherently linked to the public debt through the government budget constraint (Clays, 2007). Other studies have also emphasised a serious danger of excluding the stock of debt in fiscal policy analysis (Chung and Leeper, 2007, Parkyn and Vehbi, 2013).

A study by Ilzetzki (2011) on fiscal policy and debt dynamics on five developing countries comprising of Brazil, Chile, Estonia, Malaysia and South Africa indicates that incorporating debt dynamics into a fiscal VAR has had a substantial effect on the estimates of the effects of taxes and government expenditure on output in countries like Brazil and Estonia. Debt dynamics has dampened the effects of fiscal policy in these two countries. Particularly, in Estonia higher debt had rendered a negative impact on economic growth. However, in countries like Chile and Malaysia incorporating debt dynamics in a fiscal VAR did not affect estimates of fiscal policy.

Using a New Zealand data, Parkyn and Vehbi (2013) investigated the effects of discretionary fiscal policies by explicitly including a feedback from the level of government debt and come up with the results that an unexpected one dollar increase in government spending would typically raise GDP temporarily, at the cost of higher interest rates and lower output in the medium to long-run. A discretionary increase in taxes has a less clear cut effect on GDP though an unexpected one dollar increase in it would lower GDP on impact and have a negative medium-term impact on GDP. Also this study shows a modest impact on inflation and, a significant and persistent increase in the nominal interest rates to a one percent increase in government spending.

Ko and Morita (2011) analyzed the effects the fiscal policy on Japanese economy found that an exogenous government spending shock has made the tax revenues, interest payments; output and inflation to increase in response to the shock and as a result of this, the burden of debt payments were reduced. Moreover, their study reveals that the dynamics of debt-to-GDP ratio under the debt feedback rule becomes stable as compared to the no feedback case. An important conclusion they addressed in their study is that the estimation of the VAR model without the inclusion of debt feedback results in an unrealistic path of debt dynamics and a wrong policy stance. This point is also supported by Cherif and Hasanov (2011). According to these authors, in debt and fiscal policy analysis, the VAR approached with debt feedback is the recommended approach to take.

2.2.3 Rationality of Including Debt in a Fiscal VAR

As raised above, government debt is strongly related to the fiscal policy variables. It determines what the size of government expenditure and revenue should be. Further, it exerts a pressure on the effects of fiscal policy on the economy. For instance, if the debt stock increases over time, it puts the limit on the effects of fiscal policy supposed to stimulate the economy. In contrast, government spending and revenue have their own influence on the level of debt. For every action taken to adjust a government debt, there is a reaction from fiscal policy variables. Similarly, for the action taken to adjust the fiscal policy, say government expenditure, there is a response from government debt. Moreover, debt has a wide impact on economic activity and macroeconomic variables such as GDP and inflation, among others (Caprioli and Momigliano, 2011).

Despite the existence of a strong relationship among the above variables, the empirical literatures done up to a near recent failed to consider it. The only exception to this point comes from an innovative work by Favero and Giovazzi (2007, 2011) who suggest a procedure to deal with them. According to these authors, a fiscal shock due to a shift in taxes or in government spending will, at some point in time, constrain the future path of taxes and spending, since the government debt eventually have to be paid. For instance, to a positive shock in government spending, the government may respect its budget constraint through adjusting taxes and spending so as to keep the ratio of debt to GDP stable. Also, it can ignore adjusting tax and expenditure, and may allow the debt ratio grow over time. It may even plan to use an inflation tax or to default. This implies that the effects of the fiscal shock on taxes, spending, inflation, and interest rates are likely to differ depending on the policy path the government chooses to adopt.

Further, since the debt to GDP ratio evolves and grows over time, the response of taxes and government spending to the debt ratio is expected . This is, particularly true for the countries with high public debt to GDP ratio (Caprioli and Momigliano, 2011). Moreover, for a given fiscal shock, there is feedback effect from debt to GDP ratio, and this has an effect on debt dynamics. The discussions in Parkyn and Vehbi (2013), Ko and Morita (2011), Ilzetzki (2011) and Favero and Giovazzi (2007) further points out that ignoring the debt variable and its feedback to the variables included in model means that this variable is included in the error term. Put differently, a VAR that excludes debt is likely to be misspecified and might eventually imply explosive paths for the debt-to-GDP ratio.

The misspecification problem in the VAR model arises since the level of debt and the variables such as government spending, government revenues and interest rates are inherently tied via the government's budget constraint. This inherent relation, for instance, could be observed, if the growth rate of the economy is not equal to the average cost of servicing the debt, then a feedback from the level of debt to fiscal variables is inevitable (Ko and Morita, 2011).

Thus, failing to include a government debt in analyzing a fiscal policy VAR means that this variable is kept in a model's error term. However, since debt is linked with the models' endogenous variables, its omission results in a correlation between the error terms and the endogenous variables, implying violation of a basic assumption of OLS estimation that the regressors and error terms should be uncorrelated (Parkyn and Vehbi, 2013). Then, the coefficients that are estimated and used to compute impulse responses will become typically biased (see Favero and Giavazzi, 2007, Favero et al., 2011).

2.2.4 Empirical Evidence From Ethiopia

Despite the existence of above reviewed fiscal literatures on other countries, to the best of my knowledge similar studies on the effects of fiscal policy in Ethiopia is very scanty. Perhaps one could mention two studies done by Teshome (2006) and Daniel (2012). However, the Teshome's study concentrated on the "Impact of government spending on Economic Growth" and come up with the conclusion that government spending do not have significant meaning to explain growth in the short run.

Daniel (2012) studied dynamic effects of fiscal policy shocks on some macroeconomic variables. He examined the impulse responses of GDP, inflation and

interest to the shocks of tax revenue and government expenditure. And he found that tax shocks have a positive impact on output but little impact on inflation, whereas government spending shocks have an expansionary effect on output and have an inflationary impact in the short run.

However, the mentioned studies are limited in their scope and fail to incorporate debt dynamics into their analysis. Nevertheless, for the reasons described in the preceding sections, failing to account for debt feedback introduces a serious problem on the estimated effects of fiscal policy. In particular, most of the impulse response functions in Daniel's study are insignificant though he continued in describing them. Hence, this paper aims to fill this gap by incorporating the feedback of public debt to fiscal and macro variables and will be the first in its kind in the country.

CHAPTER THREE

FISCAL AND MACROECONOMIC DEVELOPMENTS IN ETHIOPIA

This chapter highlights the recent macroeconomic and the fiscal developments of Ethiopian economy. Specifically, the description is given on the trends of economic growth, prices development, fiscal variables position, public debt evolution and exchange rate movements.

3.1 General Prelude

Ethiopia has entered the 21st century being identified as a low-income but a growing economy. In the world economy, it lags behind in almost every measure of economic development. Regardless of the approach one takes to examine socio-economic development, it is still one of the least developed countries in the world. Despite its lagging behind in a global economy, since the early 1990's different reform measures have been taken by the current government to guide the overall development of the country. This has come with an explicit adoption of a market-oriented economic policy which showed a marked departure from the Command Economic System that the previous regime had followed. The introduced reforms like the liberalization of the financial sector; strengthening of the role of private sector; minimising the direct participation of government in production activities; and liberalizing the export and import trade are just few among many (Mofed, 2004).

Consequently, the government has designed various policies and plans with the key objective of wiping poverty out of the country. To this effect, the development policies and strategies pursued and implemented include the Sustainable Development

and Poverty Reduction Program (SDPRP)² for a period of 2002/03-2004/05; a Plan for Accelerated and Sustained Development to End Poverty (PASDEP), with the aim of achieving the Millennium Development Goal (MDG) targets, ran from 2005/06-2009/10 and the Growth and Transformation Plan (GTP) for the period of 2010/11 – 2014/15. The GTP focuses on maintaining the fast growth of the economy realized during the previous plans period at the same time bringing better results in all sectors of the economy. Currently, GTP is at its last year of implementation.

3.2 Overview of Economic Growth

The economy of Ethiopia heavily depends on the traditional agricultural sector, with coffee and wheat serving as the main cash crops (BTI, 2012). Over 80 percent of the country's population works on this sector for its survival. It also accounts for 42 percent of the GDP and more than 85 percent of the export earnings. The service sector has recently outstripped agriculture by accounting for around 46 percent of GDP where the remaining balance of about 12 percent of GDP is accounted by the industrial sector (AfDB, 2011). The high dependency of the economy on agriculture, which in turn depends on the vagaries of nature and the country's vulnerability to the terms of trade and similar external shocks are the structural constraints the economy of Ethiopian has faced (Alemayehu, 2010)³.

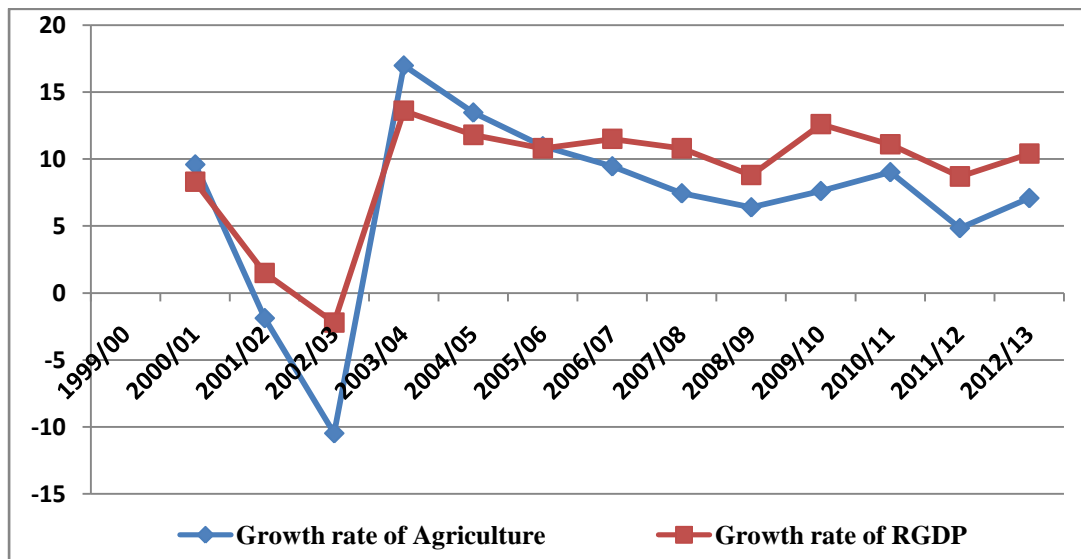
Turning to the macroeconomic performance, the Ethiopian economy is fundamentally rural and agricultural where the performance in this sector determines the evolution of

² The SDPRP is built on the four building blocks: Agricultural Development Led Industrialization (ADLI) Strategy, Decentralization and Empowerment, Justice System and Civil Service Reform, and Capacity Building for Public and Private Sector.

³ Alemayehu in his book entitled *Readings on the Ethiopian Economy* further noted that the critical role of external environment in explaining the performance of Ethiopian economy. This is, in fact, the case since the country is dependent on imported materials that are buoyant or fall victims to the availability of foreign exchange and its export sector is basically composed of primary commodities whose price is highly volatile in the world market.

major macro variables (MoFED, 2004). According to Alemayehu and Kibrom (2011), the trend in growth of real GDP and agriculture had indicated not only their rhythmic co-movement, but also the erratic nature of the two (Alemayehu, 2010). This indicates the extreme dependence of the Ethiopian economy on rain-fed agriculture and the implied lack of structural changes in the economy.

Figure 3.1: Growth rates of RGDP and Agriculture



Source: Based on data obtained from MoFED

As figure 3.1 shows the co-movement of real GDP and agriculture is a realistic story particularly up to the period of 2003/04⁴. When the weather conditions become favourable, say, a good rain and temperature season, agricultural production expands and GDP follows the suit. However, this co-movement appeared to have reversed in the post 2003/04 periods and from these periods onwards, there is an appreciable economic growth in the country. The economy started to register high annual growth of real GDP since 2004 as the report of African Development Bank indicates (AfDB,

⁴According to the reports of Africa Development Bank (AfDB) released in 2002 and 2004, the negative growth of real GDP was registered in 2002/03, see figure 3.1 above, because of the decline in agricultural production being severely affected by drought in the year. Further, the real GDP and agricultural growth were declining up to year 2002/03. This is so because of the border conflict between Eritrea and Ethiopia from 1998-2000 and the occurrence of drought in 2002/03.

2012). For the periods of 2003/04 -2012/13 the economy has grown on average by 11 percent per annum. As the above figure shows, the line that depicts the trend of real GDP growth oscillates around a value of 10 percent since 2003/04. As a result of this sustained growth of the economy for the last decade, the country become one of the fastest growing non-oil producing economies in Africa (AfDB, 2012).

3.3 Performances of Fiscal Policy

The recent government's fiscal policy has directed towards realizing the objectives of GTP and bringing the macroeconomic stability consistent with the requirements of rapid economic growth. The government put effort in strengthening domestic revenue mobilisation, reducing domestic borrowing and increasing expenditure on battling poverty to achieve a stable macroeconomic environment (MoFED, 2010). To promote the revenue mobilization, the government has taken several tax reforms like the introduction of VAT in 2002/03, which is, in fact, a measure taken before the start of GTP (AfDB, 2004). Further, a tax administration and collection, and strengthening of the large taxpayer unit reforms were introduced during the pre-GTP periods.

The table below reflects the developments in a general government revenue, expenditure and fiscal deficit. The total revenue (including grants) as a share of GDP stood at 17 percent in 1999/00 where as it amounts to 20.4 percent in 2000/01. In comparing with other years, in 2003/04 total revenue (including grants) in a ratio to GDP has registered the highest percent of 22.7 while excluding grants it showed a maximum of 16 percent in 2002/03. This is perhaps contributed to the tax reforms introduced in 2002/03. As the share of GDP, the general government expenditure recorded a maximum value of 29 percent in 2001/02 over the period of 1999/00-

2012/13. In 2011/12 and 2012/13, as a ratio to GDP, it stood at 17 and 18 percent respectively.

Table 3.1: General government revenue and expenditure (In percentage of GDP)

Year	Rev_ngr	Rev_gr	Exp	Df_gr	Df_ng	Growth in Rev_ngr	Growth in Exp
1999/00	14.81	17.13	26.57	9.45	11.77	–	–
2000/01	15.65	20.39	25.42	5.03	9.77	7.9	-2.4
2001/02	15.83	17.84	29.33	11.50	13.50	-1.0	12.9
2002/03	16.09	19.11	25.86	6.75	9.77	12.2	-2.7
2003/04	15.98	22.75	25.11	2.36	9.13	17.2	14.6
2004/05	14.67	19.89	23.57	3.68	8.90	12.8	15.3
2005/06	14.66	17.54	22.68	5.13	8.02	23.5	19.0
2006/07	12.23	18.91	18.42	-0.49	6.19	9.0	6.1
2007/08	12.24	16.88	19.08	2.20	6.84	44.5	49.6
2008/09	12.02	16.88	17.42	0.54	5.40	32.6	23.3
2009/10	13.02	16.28	19.15	2.86	6.13	23.7	25.5
2010/11	13.66	16.92	18.56	1.65	4.90	40.0	29.4
2011/12	13.96	15.70	16.94	1.24	2.97	48.8	32.8
2012/13	14.55	16.09	18.05	1.96	3.50	20.6	23.4

Source: Computed based on data obtained from MoFED

Definitions:-

Rev_ngr = Total revenue excluding grant

Rev_gr = Total revenue including grant

Df_ngr = Deficit excluding grant

Exp = Total government expenditure

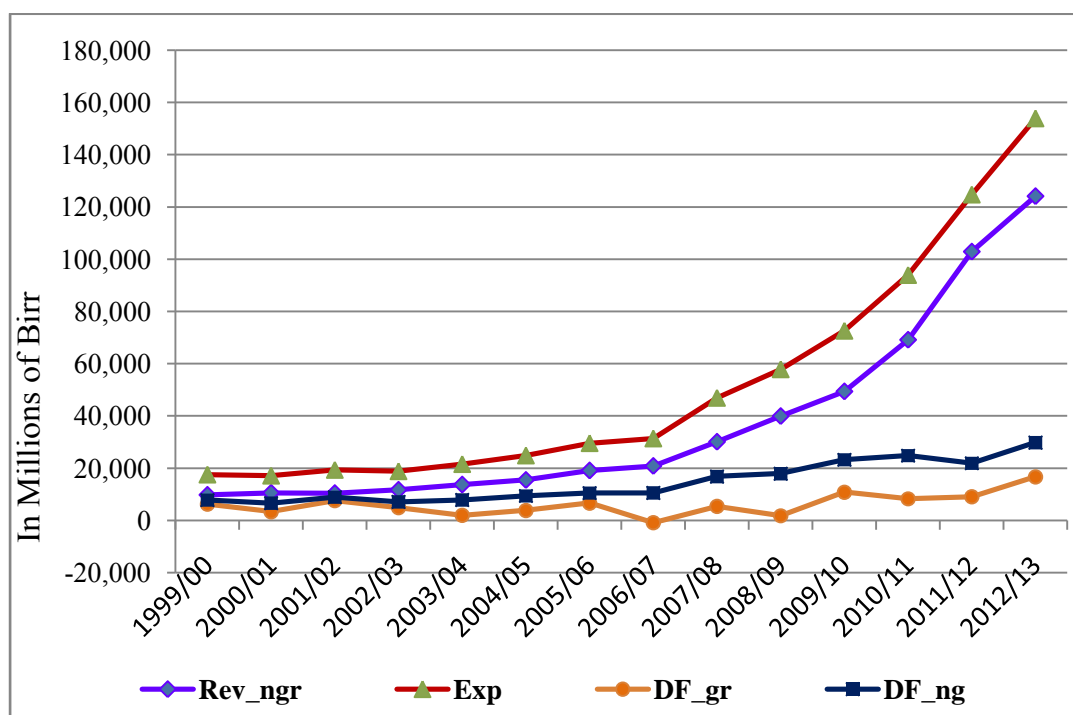
Df_gr = Deficit including grant

When we look at the developments in a deficit, it is negative throughout the period. Nevertheless, the deficit (excluding grants) declined from 6.1 of GDP in 2009/10 to 3.5 percent of GDP in 2012/13. From the level of 13.5 percent of GDP in 2001/02, it significantly decreased to 3 percent of GDP in 2011/12. Likewise, a deficit with grants has declined from 2.86 percent of GDP in 2009/10 to 2 percent of GDP in 2012/13. This improvement in the overall fiscal position indicates the government's strong fiscal management efforts in recent periods. In 2011, the government

introduced cash budgeting which will prevent the need for direct advances from the National bank to meet temporary liquidity shortfalls (AfDB, 2012).

Moreover, the growth rates of total revenue and total government expenditure reveals some improvements in conduct of recent fiscal policy in Ethiopia. Total revenue (excluding grants) depicts on average an annual growth rate of 22.4 percent over the period of 1999/00-2012/13. It showed a growth of 49 percent during 2011/12 a rate which is greater than the growth rate of a preceding year 40 percent. Total expenditure also registered an average annual growth rate of 19 percent over the period of 1999/00-2012/13. It has grown at 50 percent in 2007/08 which is the highest growth over the periods under examination. In 2012/13 and 2011/12, it grew at the rates of 23 and 33 percent respectively. The growth rate it registered in 2011/12 is twice much greater than its growth rate observed in 2001/02. This is the result of improved tax collection and administration like application of cash registration machines, enhanced capacity building, improved awareness of tax payers and economic growth (NBE, 2011/12).

Figure 3.2: Trends in total revenue (excluding grant), total revenue and deficit



Source: Own computation based on data from MoFED

As we can see from the figure, there is a significant gap between the lines that connects the values of government revenue (excluding grant) and government expenditure. This gap represents a fiscal deficit that the government usually finances through a domestic and external borrowing⁵. The deficit nature of Ethiopia's fiscal policy, to a larger extent, indicates the significance of a donor support.

3.4 Developments in Prices and Nominal Exchange Rate

Despite the continued appreciable growth of Ethiopian economy registered for the last decade, it has experienced the macroeconomic challenges with inflation pressure remain being persisted in the country, among other things. According to the analysis

⁵ For a graphical convenience, here the values of deficit are taken as positive while the negative ones are considered as surplus which is, in fact, the customary practice in some literatures.

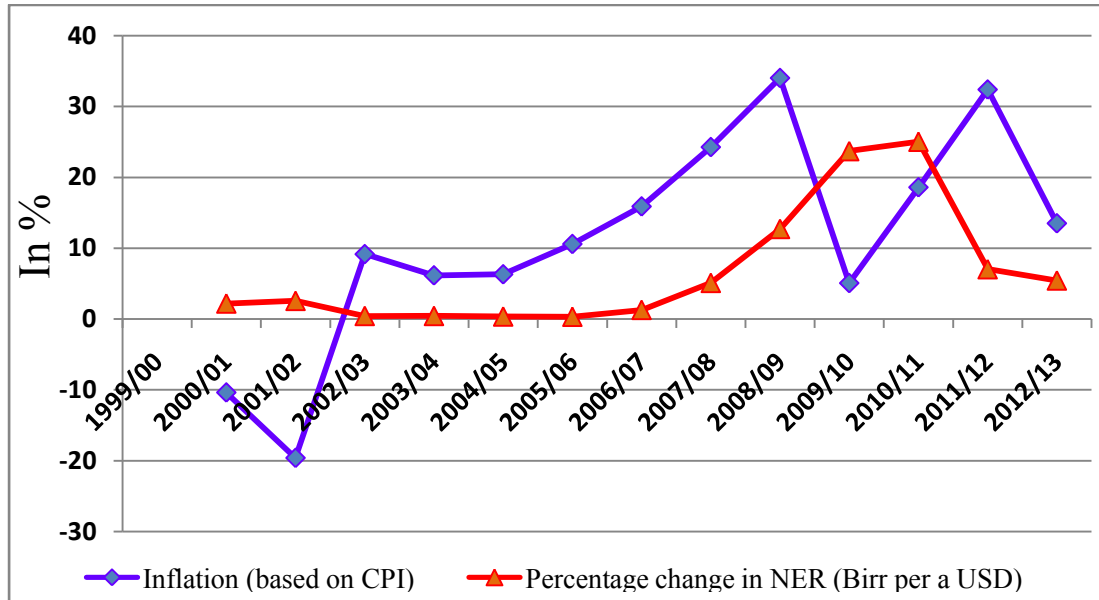
of United Nations Commission for Africa (2013), in 2011 Ethiopia experienced a notable spike in inflation peaked at 40 percent. Another study on African Economic Outlook (2013) indicates that inflation exceeded 30 % percent in 2012 in the country. Different factors had contributed for the acceleration of inflationary in the country. According to AfDB reports of 2012 and 2011, it was driven mainly by the escalating food prices. On the other hand, both domestic and exogenous factors were responsible for causing its resurgence. These include a loose monetary policy (monetization of the fiscal deficit), rising prices of imported inputs, malfunctioning of the domestic market, and supply shocks that have made the macroeconomic management to fail to correct inflation (see Alemayehu and Kibrom, 2011).

Turning to the developments in nominal exchange rate, during 2012/13, the weighted average exchange rate of the Birr in the inter-bank foreign exchange market was Birr 18.1947 per USD, depicting 5.5 percent year-on-year depreciation against the average rate of Birr 17.2536 per USD recorded in the 2011/12(NBE,2012/13). At the end of 2010/11, 2009/10 and 2008/09, it stood at Birr 16.1178, 12.8909 and 10.4205 per USD respectively. Over the periods of 1999/00 -2012/13, the nominal value of Birr depreciated on average by a 6.7 percent against USD. In 2004/05 and 2005/06, it marginally depreciated at a rate of 0.37 and 0.34 percent against the USD, which is by far lower than the average of the period under discussion (see figure 3.3 below).

On the other hand, as the figure 3.3 illustrates below Birr has showed a noticeable weakening against USD in 2009/10 and 2010/11 where it is depreciated by 23.7 and 25 percent respectively. This is a substantial depreciation at a given point in time, as compared to the gradual depreciation that has been taking place during the past nine years. The major reasons for such substantial magnitude of depreciation are meant for

export promotion and import discouragement to narrow the balance of payments deficits (MoFED, 2010/11).

Figure 3.3: Trends in inflation and nominal exchange rate (NER)



Source: Computed based on data obtained from NBE

As the figure above shows price has increased persistently over the period 2002/02 up to 2008/09 which also showed the same trend between 2009/10 and 2011/12. However, from the peak it reached in 2011/12, it started to decline which reflects the recent adoption of prudent fiscal and monetary policies of the government. On other hand, the figure indicates the stable trend in nominal exchange rate against USD, particularly, over the periods of 2002/03 up to 2005/06. Nonetheless, it started to show deterioration in its value against USD from 2006/07 up to 2010/11. It has recorded a massive depreciation in 2010/11 and from then it started to show improvement though depreciating recently.

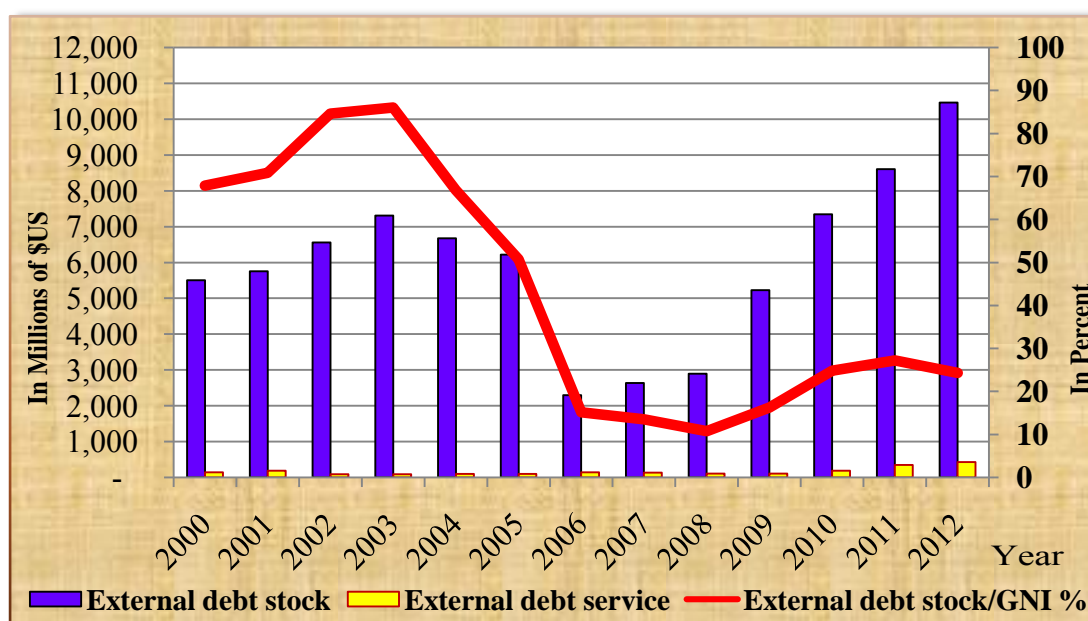
3.5 Developments in External Debt

Ethiopia is heavily dependent on international donor assistance and borrowing. Looking a bit back, the country's external indebtedness has significantly increased since 1980s which, in fact, mainly related to the arms procurement due to the internal war that was going at the time. Besides, since 1990's due to the deficit nature of the country's budget with the expenditures regularly exceeding the revenues, the shortfalls in the budget have been covered by the grants and loans from bilateral and international lending institutions. This has resulted in a huge accumulation of public debt in the country. For instance, by 1998 the total accumulated debt outstanding was about US\$9.8 billion or about one and a half times the size of the then GDP (AFRODAD, 2013).

To address the huge accumulated debt the current government started to negotiate with its creditors in 1992 and about US\$372.89 million was agreed to be both cancelled and rescheduled (AFRODAD, 2013). Thereafter, owing to its accumulated debt burden, severe poverty and willingness to carry out the prescribed reforms of its lending institutions, Ethiopia became eligible for debt reduction under the HIPC initiative and reached the decision point in 2001 and completion point in 2004 as the report on Debt Sustainability Analysis (DSA, 2012) by IMF shows⁶.

⁶ According to IMF (2012) debt sustainability analysis, Ethiopia reached the completion point of the Heavily Indebted Poor Country (HIPC) Initiative in 2004 and benefited from debt relief under the Multilateral Debt Relief Initiative (MDRI) in 2006.

Figure 3.4: Evolution of External Debt Stock and Debt service



Source: Computed from World Development Indicators, 2014

The total nominal external debt stock at the end of year 2000 stood at \$5.5 billion (67.85% of GNI) where it has reached \$7.3 billion (86.05% of GNI) in 2003 reflecting a 33 percent increase over the year mentioned. During years 2006, 2007 and 2008 it substantially decreased and stood at 2.3, 2.6 and 2.9 billion of US dollar respectively. As the figure 3.4 above shows the sharp decline in the external debt stock in these years and the improvement of the external debt-to-GNI ratio were the results of debt cancellation through the HIPC and MDRI debt relief.

However the external debt stock has continued to rise rapidly despite the several debt cancellation and restructuring initiatives that the country has gone through and benefited, indeed. By 2011 the accumulated debt stock has almost quadrupled since debt relief was granted and stood at 8.6 billion US dollar, which is obviously a fourfold of external debt prevailed in 2006. Moreover, its level in 2012 is five times as large as what it was in 2006, representing an increase of 22% as compared with its preceding year. The

cumulative debt payments amounted to US\$ 111, 103, 352 and 431 million has been serviced during years 2008, 2009, 2010 and 2012 respectively.

Furthermore since the debt relief, the external debt-to-GNI ratio shows an upward trend where it stood at 16.28%, 24.82% and 24.31% in years 2009, 2010 and 2012 respectively. The country's rising debt in recent years can be attributed to the higher borrowings by public enterprises and it also reflects the country's inability to service its debts, which has resulted in accumulated interest arrears and a widening trade balance-to-GDP ratio (AFRODAD, 2013).

3.6 Developments in Domestic Debt

Domestic debt in Ethiopia covers the debt of the central government in forms of government bonds, treasury bills and direct advances from the National Bank. Government bonds are made up of interest bearing and non-interest bearing bonds, with the latter being more dominant. Treasury bills are composed of the 28-, 91- and 182-days. As shown in table 3.2 below, the stock of total outstanding domestic debt increased marginally by 39.1% from ETB 49,765 million as of the end of the 2006/07 fiscal year to ETB 202,541 million as of end 2012/13. Government domestic debt is occasionally issued to finance government expenditures and/or to absorb excess liquidity in the banking system.

As a percentage of Gross Domestic Product (GDP), the country's domestic debt stock declined from 29.3% as of end 2006/07 to 23.75% as of end 2012/13 (see table 3.5 below)⁷. This decline resulted from the strong economic growth performance of the country which has been able to maintain double digit growth since 2003. As a percentage of the total outstanding public debt, the country's domestic debt also declined

⁷ In computing the debt to GDP ratio, a recently revised GDP data with the base year 2011 is used.

significantly from 70.22% as of end 2006/07 to 49.18% as of end 2012/113. This decline was due to the sharp rise in the country's external debt stock which has almost quadrupled since debt relief was granted under the HIPC/MDRI in 2006.

Table 3.2: Trends in Domestic Debt

Year	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
DDO	49,765	54,166	56,695	80,137.	116,570	156,012	202,541
DDS	1,031.1	1,337.1	1,517	1,842.6	2,297.8	2,227.1	2,019.6
DD/TD	70.22	66.86	53.31	51.00	46.65	49.50	49.18
DD/GDP	29.3	22.03	17.07	21.12	23.05	21.12	23.75

Source: Own calculation based on data from MoFED Publications⁸

Definitions:-

DDO = Domestic debt outstanding (In millions of Birr)

DDS = Domestic debt service (In millions of Birr)

DD/TD = Share of domestic debt in total public debt (In percent)

DD/GDP = Ratio of domestic debt to gross domestic product (In percent)

In general, Ethiopia has shown an appreciable record of economic growth for the last ten years despite the challenge of inflation in the country. The size of government is significant in the economy reflecting much importance of fiscal policy to it. Due to this, its budget balance shows the deficit nature with the expenditures regularly exceeding the revenues. The shortfalls in the budget have been covered by the grants and loans from domestic and external sources which have resulted in a huge accumulation of public debts in the country. To address the huge accumulated debt, government engaged in debt cancellation and rescheduling negotiations with its creditors since 1992. Accordingly, Ethiopia reached the completion point of the HIPC initiative in 2004 and benefited from debt relief under the MDRI in 2006. With regard to domestic borrowing, since 2011 the government introduced cash budgeting which will obviate the need for direct advances from the central bank to meet temporary liquidity shortfalls.

⁸ Compiled from Public Sector Debt Statistical Bulletin No. 7 and 13 which is prepared and published by the Debt Management Directorate, Ministry of Finance and Economic Development

CHAPTER FOUR

DATA SET AND MODEL SPECIFICATION

4.1 Data Set and Sample size

This study employs a quarterly data set of government expenditure, government revenue, real gross domestic product, public debt, inflation, interest rate and nominal exchange rate over the period of 1999/00Q1 up to 2012/13Q4, which in total gives 56 observation. The use of quarterly data offers many advantages over annual data. It allows capturing intra-year dynamics and gives the possibility for larger sample so as to avoid the vanishing degrees of freedom in estimation (Pedro, 2011). The data on inflation and nominal exchange rate is obtained from the National Bank of Ethiopia (NBE); whereas the data on all remaining variables are obtained from the Ministry of Finance and Economic Development of Ethiopia.

In defining the variables, a caution has been taken since some of the variables listed above have the potency of determining the evolution of other variables over time. The government expenditure comprises of both recurrent and capital expenditures excluding the interest payment on public debt. The government revenue includes all tax and non-tax sources excluding grant and interest receipt on government debt. Real GDP is a recently revised data with the base year 2011. However, there is no officially recorded quarterly data on this variable in the country and hence, we opt to generate its quarterly data following the approaches adopted in the previous literatures.

Public debt includes all internal and external borrowings of the country. It includes the debt that the public debt management directorate at MoFED publishes semi-annually each year⁹.

The consumer price index (CPI) data is used as the proxy for inflation. Nevertheless, some literatures in the study of fiscal policy use an implicit GDP deflator to account for inflation. For this study the choice of a CPI over a GDP deflator is made due to the absence of a quarterly data on a GDP deflator in the country. Nonetheless, these two indices can be taken as the different sides of the same coin as they basically reflect what is happening on the price level in a given country. Further, the discrepancy between them is not such high (Mankiw, 2010).

Interest rate is the average cost of debt servicing. It is constructed by taking the ratio of quarterly interest payment at time t to a quarterly debt stock at time $t-1$. Constructing it in this way is also adopted by different researchers. For instance, Ilzetzki (2011), Melecky and Melecky (2011), and Favero and Giovazzi (2007) are some who followed the same suit. The nominal exchange rate is the exchange rate between Ethiopian Birr and USA dollar where the price of a USA dollar is measured in terms of Birr.

4.1.1 Construction of Quarterly GDP Data

Having a well recorded high frequency dataset on a monthly and quarterly basis is a hardly thinkable feature of poor countries in the world. The poor data handling materials, shortage of skilled personnel, low level of budget allocation, less attention and value given to the importance of data are the contributing factors behind such

⁹ Interested readers can find more information about debt by checking the web address: <http://www.mofed.gov.et>

feature in these countries. Ethiopia is also not free from this reality in one or other way; and thus one could not find an officially recorded quarterly data on GDP for the country. This challenge has compelled various scholars to generate a quarterly data on Ethiopian GDP for their own specific study purposes (see Pedro, 2011 and Haile, 2001). To that end, they make use of non-regression based methods of generating a high frequency data series despite the existence other regression based methods. The choice of former approach over the second approach is associated with its better fit to take into account the country specific behavior which the later approach does not consider.

An example of the former approach is attempted by Haile Kibret (2001) which he, in fact, used to generate a quarterly real GDP of Ethiopia by measuring the quarterly contributions of agriculture, industry and service sectors to the annual real GDP. And because of its better fit in reflecting the characteristics of Ethiopian economy, some researchers used Haile's approach to generate a quarterly GDP for their own individual study purposes. For instance, Eden (2012) and Helen (2012) are some to mention. As well, for the current study this approach is used in generating a quarterly GDP for Ethiopia¹⁰.

4.2 Model Specification and Estimation

The empirical literature on fiscal policy can be grouped into three categories. The first category focuses on the evaluation of the macroeconomic impact of large reductions in the budget deficit. The second line of research analyzes the stabilizing capability of fiscal policy variables. The third category which examines the dynamic effects of discretionary fiscal policy on macroeconomic variables has recently been revived

¹⁰ For the detailed information, interested readers can refer to Haile Kibret (2001).

within the framework of Structural Vectorautoregressive (SVAR) models in the work of Blanchard and Perotti (2002). The current paper focuses on this third strand of literature and applies the SVAR model to study effects of fiscal policy shocks in Ethiopia. Further, the model is extended to capture the debt dynamics following the works of Favero and Giavazzi (2007, 2012).

Previously, much use of SVAR model is extensively devoted to examine the effects of monetary policy than fiscal policy. However, recently a small but growing literature has emerged that applies vector autoregressive models in the analysis of fiscal policy. As pointed out by Perotti (2004), these literatures, though small and confined to some of advanced economies, commonly investigates fiscal policy shocks by examining the response of macroeconomic variables to the exogenous changes in the fiscal policy variables.

Blanchard and Perotti (2002) in their seminal paper suggest that the SVAR approach better suits to study the effects of fiscal policy than monetary policy, for two reasons. They argue that there are many factors which contribute to the movements in budgetary variables, in other words, there are exogenous fiscal shocks, particularly with respect to GDP. In addition, decision and implementation lags in fiscal policy imply that, at high enough frequency— say, within a quarter—there is little or no discretionary response of fiscal policy to unexpected movements in economic activity. Thus, this fact, with enough institutional information about the tax and transfer systems and the timing of tax collections, lets one construct estimates of the automatic effects of unexpected movements in economic activity on fiscal variables, and, by implication, obtain estimates of fiscal policy shocks. Having identified or estimated

these shocks, one can then trace their dynamic effects on macroeconomic variables of interest, for instance say, on GDP.

The SVAR model in its structural form is written as:

$$AY_t = C_1 Y_{t-1} + C_2 Y_{t-2} + \dots + C_p Y_{t-p} + v_t \text{-----(1)}$$

Where $Y_t = (Y_{1t}, \dots, Y_{kt})'$ is a $(K \times 1)$ vector of endogenous variables and C_1, \dots, C_p is the estimated $(K \times K)$ matrix coefficients for the lagged endogenous variables in the model. v_t is a $(K \times 1)$ structural form error that is a zero mean white noise process with time invariant covariance matrix Σ_v . The invertible $(K \times K)$ matrix A allows the capturing instantaneous relations among the variables included in Y_t . Lütkepohl and Kratzig (2004) pointed out that structural shocks are the central quantities in an SVAR model. Further, these shocks are unpredictable with respect to the past of the process and are the input of a linear dynamic system generating the K -dimensional time series vector Y_t . Hence, in above equation, the structural shocks are correlated with the residuals.

Moreover, structural shocks are not directly observable; hence, it needs assumptions to identify them. One important assumption made in this regard is that structural shocks should be mutually uncorrelated (and thus orthogonal). This assumption is required to consider the dynamic impacts of an isolated shock. If the shocks are correlated, one has to take into account the relationship between the shocks and decompose them into orthogonal components. On the basis of this argument, the shocks or structural innovations denoted by e_t are assumed to be related to model residuals by a linear relations as:

$$v_t = B e_t \text{-----}(2)$$

where B is a $(K \times K)$ non-zero off-diagonal element matrix and it allows some shocks to affect more than one endogenous variable in the system. Then, equation (1) can be rewritten as:

$$A Y_t = C_1 Y_{t-1} + C_2 Y_{t-2} \dots \dots + C_p Y_{t-p} + B e_t \text{-----}(3)$$

This equation specifies the SVAR model in its structural form.

From equation (3), the reduced form representation is obtained by multiplying both sides of the equation by A^{-1} .

$$Y_t = D_1 Y_{t-1} + D_2 Y_{t-2} \dots \dots + D_p Y_{t-p} + u_t$$

where $D_j = A^{-1} C_j$, for $j = 1, 2, \dots, p$

$$u_t = A^{-1} B e_t \quad \text{or} \quad A u_t = B e_t \text{-----}(4)$$

Equation 4 relates the reduced form disturbances u_t to the underlying structural shocks, e_t . In the SVAR literature, this representation of the structural form is often called the AB model (Amisano and Giannini, 1997; Lütkepohl, 2005). Written in a compact form, the reduced form representation of the above SVAR model takes the following form.

$$Y_t = \sum_{i=1}^p D_i Y_{t-i} + u_t \text{-----}(5)$$

$$A u_t = B e_t$$

As discussed above, it is impossible to obtain the structural shocks from the reduced form and therefore, the impulse response function (IRF), i.e. the dynamic responses of endogenous variables to a unit shock in some of the variables in the system, has no meaningful economic interpretation, since reduced-form innovations u_t have no

direct economic interpretation as they are linear combinations of structural innovations.

To obtain the structural innovation from a reduced form VAR, it is necessary to impose exogenous, non-sample, restrictions. Elements of matrix A can be constructed once the instantaneous relation between structural and reduced innovations is known, while, knowing that $e_t = Au_t$, it is possible to obtain information about the structural innovations. This model is known as the A model (Lutkepohl, 2005). It is important to emphasize that restrictions on the relationship among the parameters are valid only for the initial period, and later the effect is transmitted through the VAR depending on specification. Furthermore, since u_t is assumed as the linear combination of structural shocks, $e_t \sim (0, I_K)$, it is possible to orthogonalize the variance and covariance matrix of reduced shocks, Σ_u , so that $u_t = Be_t$, a $\Sigma_u = B\Sigma_e B'$. Since the matrix of variance and covariance of structural innovations is a unit matrix, i.e. e_{kt} are uncorrelated, in time t it is possible to find a matrix B for which $\Sigma_u = BB'$. This model is known as the B model (Lutkepohl, 2005).

Based on the methodological approach discussed in Blanchard and Perotti (2002), which is further extended in Perotti (2004), the formal specification of the SVAR model employed in this study can be stated in its reduced form as follows:

$$Y_t = \sum_{i=1}^p D_i Y_{t-i} + u_t \text{-----}(6)$$

Where $Au_t = Be_t$ describes the relation between the structural disturbances e_t and the reduced form disturbances u_t . The matrix A describes the contemporaneous relation among the variables collected in the vector Y_t , whereas matrix B contains non-zero off-diagonal elements and it allows some shocks to affect more than one endogenous variable in the system. $Y_t = (g_t \ T_t \ x_t \ \pi_t \ r_t \ s_t)$ is the vector of endogenous variables which in the order they appear in the bracket include log of government expenditure, log of government revenue, log of output, inflation, interest rate and depreciation in nominal exchange rate. P is the number of lags that delivers serially uncorrelated reduced-form residuals. Without restrictions on the parameters in matrix A and B , the structural model is not identified and one cannot estimate it. Thus, the identification of model should be carried out before moving to the estimation process.

In equation (6) above, one of our data set variable, public debt is not included. Why it is not included in that equation? This variable deserves a special attention and the following paragraphs discuss how it will be analyzed with the study that focuses on fiscal policy.

4.3 Scheme of Linking Debt with a Fiscal VAR

As pointed out in chapter two, failure to include a public debt in analyzing a fiscal policy in a VAR framework means that this variable is kept in a model's error term. However, since debt is linked with the models' endogenous variables, its omission from the model results in a correlation between the error terms and the endogenous variables, implying violation of a basic assumption of OLS estimation that the regressors and error terms should be uncorrelated (Parkyn and Vehbi, 2013). Then,

the coefficients that are estimated and used to compute impulse responses will become typically biased.

Therefore, we have to introduce the debt level into the model and need to make it endogenous; otherwise the impulse response functions would be computed assuming a constant debt ratio which rules out the fundamental reason of including debt, specifically allowing the macro variables to respond to the effect of fiscal shock on the level of debt. With this connection, to fix the misspecification of the model arising from a failure to capture debt feedback, Favero and Giovazzi (2007) in their influential paper suggested making the debt ratio endogenous by appending it to the model by the equation that describes its evolution over time as a function of the path of all other variables that enters into the model¹¹. Consequently, we modify equation (6) by adding debt to it as follows.

$$\begin{aligned}
 Y_t &= \sum_{i=1}^p D_i Y_{t-i} + \sum_{i=0}^p \gamma_{t-1} d_{t-i} + u_t \\
 Au_t &= Be_t
 \end{aligned}
 \tag{7}$$

where d_t is the debt to GDP ratio. This equation is basically similar with that of equation (6) save a variable d_t added to it. And it accounts for the possible feedback effects of the debt ratio to the endogenous variables defined in equation (6). However, d_t is itself an endogenous variable that relates to current and past values of the model's endogenous variables. This means that past values of the debt-to-GDP ratio influence the current values of macroeconomic variables, which conversely influence the current value of the debt-to-GDP ratio. For this reason, Favero and Giavazzi

¹¹ In particular, the variables that enter into the government's intertemporal budget constraint are crucial in determining the dynamics of debt over time. Besides, note that the budget constraint is an identity; it does not add new parameters to be estimated nor new shocks to be identified.

(2007) suggested the following debt-accumulation identity that determines the evolution of debt dynamics of over time.

$$d_t = \frac{(1 + i_t)}{(1 + \pi_t)(1 + \Delta y_t)} d_{t-1} + \frac{Exp(g_t) - Exp(t_t)}{Exp(y_t)} \text{-----}(8)$$

where, d_t is the debt to GDP ratio as defined above; i_t is interest rate which as defined in the data definition section indicates the average cost of debt servicing; π_t is the inflation; Δy_t is the growth rate of real GDP; y_t is the log of real GDP, g_t is the log of real government expenditure net of interest payments on debt and t_t is the log of real government revenue excluding interest receipt on debt. Here the exponentials Exp are used just to indicate that the variables are expressed in logarithms. In this equation the first term on the right side indicates that past debt incurs interest, where as its ratio to GDP decreases due to GDP growth and inflation. The second part is the primary deficit as a ratio of GDP.

An important linkage of debt with the fiscal policy and other macroeconomic variables is described in equation (8). And according to it the debt stock will increase over time in the presence of a persistent primary deficit and a higher interest rate than the economic growth rate, if there are no shocks or corrective policies. If the government reacts to past debts and attempts to stabilize the debt-to-GDP ratio, then the feedback rule of government spending and revenue to the past level of debt to GDP ratio is expected as pointed out by Ko and Morita (2011). Moreover, the government spending and revenues, interest rates, real GDP growth and inflation are linked by the government budget constraint. Debt dynamics may also influence interest rates and inflation. Furthermore, debts accumulated in the past affect output

and other macro variables because debts have to be stabilized in the end. In contrast, an expansion in GDP would help to reduce the debt burden. Therefore, equation (8) given above helps to incorporate these relationships through the government budget constraint.

However, in adapting the debt accumulation equation (8) to developing countries like Ethiopia, one must take into account the impact of the exchange rate on the foreign debt component since the depreciation of the domestic currency against the foreign currency results in an increase in the debt stock denominated in the foreign currency. Therefore, the following debt accumulation identity is adapted to the case of Ethiopia and used for analysis.

$$d_t = \frac{(1 + i_t)[\alpha(1 + \Delta s_t) + (1 - \alpha)]}{(1 + \pi_t)(1 + \Delta y_t)} d_{t-1} + \frac{Exp(g_t) - Exp(t_t)}{Exp(y_t)} \quad \text{----- (9)}$$

After a bit rearrangement, this equation becomes:

$$d_t = \frac{(1 + i_t)[1 + \alpha \Delta s_t]}{(1 + \pi_t)(1 + \Delta y_t)} d_{t-1} + \frac{Exp(g_t) - Exp(t_t)}{Exp(y_t)} \quad \text{----- (10)}$$

where Δs_t is the depreciation of nominal exchange rate and α is the average share of debt denominated in foreign currency. Other variables are the same as defined in equation (8). This equation captures debt denominated in foreign currency which may accumulate also due to exchange rate depreciation. Moreover, at the time of servicing the debt, the size of interest payment on foreign debt stock increases since the depreciation in local currency increases its servicing cost.

Since a debt variable used in this study consists of domestic debt and external debt, the total debt is constructed as:

$$D_t = D_t^d + s_t D_t^f \text{-----} (11)$$

where S_t is the nominal exchange rate used to convert debt into common currency, whereas D_t^d and D_t^f represent the total domestic debt and total foreign debt respectively. Once it is converted into a common currency, then the sum of D_t^d and D_t^f gives total debt used for the current study.

In Ethiopia a substantial size of external debt is denominated in US dollar though there as some denominations in other currencies like Euro and Japanese Yen¹². Despite some changes in the currency denomination over time in the country, the currency composition of foreign debt is assumed unlikely to be related with the model's endogenous variables defined in this study in the short run. As pointed out in (Ilzetzki, 2011) it is rather determined by a foreign demand for domestic currency debt and technocratic decisions within Ministry of Finance. Therefore, in this study α is assumed constant and calculated by taking the average share of external debt over the sample period. It only then determines the evolution of debt and is not linked with any of endogenous variables entering Y_t .

Concerning the effective interest rate on debt, one can construct it by taking the weighted average of interest payments on domestic and foreign debts. This weighted average interest rate can be presented as:

$$r_t^w = (1 - \alpha_t) r_t^d + \alpha_t r_t^f \text{-----} (12)$$

where r_t^w is a weighted average interest rate on total debt, r_t^d is the ratio of debt service to domestic debt and r_t^f is the ratio of foreign debt service to foreign debt.

¹² However, a current study does not consider cross-currency changes on debt.

$1 - \alpha_t$ and α_t are the shares of domestic and foreign debt respectively. However, the interest rate used in this study is constructed by dividing total interest payment made on total debt at time t to total debt stock at time $t-1$. The difference between this interest rate and a weighted average interest rate constructed above is very insignificant. Besides, previous literatures suggest the use of an average interest rate on total debt. Also, it is this interest rate that holds the debt evolution equation (10) to hold true.

The importance of including exchange rate depreciation and average rate of debt servicing in debt accumulation equation is also suggested by IMF in its different reports on low income countries debt sustainability analysis. The discussion made in these reports indicates a nominal interest rate calculated as debt service due in the current period over the nominal debt stock in the past period reflects its effect better in the concessionality and dynamics of debt in low income countries. The real exchange rate as well affects the debt position of a country since a depreciation of the local currency is likely to worsen the debt burden. This is so since the substantial share of external debt in low-income countries is denominated in foreign currencies, which may increase over time due to exchange rate depreciation. The exchange rate movement further impacts the average cost of debt refinancing

4.4 Identification of Shocks

A small but growing literature has recently started to apply SVAR methods to the analysis of fiscal policy, though it is confined to the analysis of advanced economies. These analyses, however, essentially hinges on the approaches and assumptions used to identify exogenous fiscal policy shocks so that the impacts of these shocks could be estimated on the variables of interest. This implies that studying the impacts of fiscal

policy basically requires identifying shocks of government expenditure and revenue from the initial influence of economic conditions. This helps to address a bi-directional causality between government spending or revenue and other macroeconomic variables like output as reasoned out in Estevao and Samake (2013).

Accordingly, SVAR model uses the restrictions imposed exogenously or by economic theory to identify the shocks of interest from a variable one wants to examine so as to obtain the impulse response functions with their true economic meaning. Moreover, the most promising strand of research aimed at isolating discretionary fiscal policy shocks uses structural vector autoregressive methods (SVARs).

As mentioned earlier, the identification approach used in this paper relies on the methodology proposed by Blanchard and Perotti (2002) in their leading paper on fiscal policy SVAR analysis. This approach is further extended by Perotti (2004). Previously, it has been used to study the effects of monetary policy. However, these authors argue that this approach even better suit for the analysis of fiscal policy for several reasons. First, in contrast to monetary policy, fiscal variables move for many reasons and output stabilization is rarely the main one. In other words, with respect to output, fiscal shocks are exogenous. Second, unlike monetary policy, it takes policymakers more than a quarter to learn about a GDP shock and to react to it. This virtually eliminates the possibility of discretionary adjustment of fiscal policy in response to unexpected movements in GDP and other variables. Thus, to obtain identification of the shocks, one can rely on the information about the tax and transfer systems, to construct the automatic response of fiscal policy to unexpected movements in activity, which implies that one can identify estimates of fiscal policy

shocks. With the identification of these shocks, one can check their effect on GDP and its components.

As it follows from equation (7) and (10), SVAR model employed in this study takes the following depiction in its reduced form. All variables are as they are described in the previous sections.

$$Y_t = \sum_{i=1}^p D_i Y_{t-i} + \sum_{i=0}^p \gamma_{t-1} d_{t-i} + u_t$$

$$d_t = \frac{(1+i_t)[\alpha(1+\Delta s_t) + (1-\alpha)]}{(1+\pi_t)(1+\Delta y_t)} d_{t-1} + \frac{Exp(g_t) - Exp(t_t)}{Exp(y_t)} \text{-----} (13)$$

Following the so called AB model of Amisano and Gianini (1997), the relation between the reduced form residuals, $u_t = (u_t^g \ u_t^t \ u_t^y \ u_t^\pi \ u_t^i \ u_t^s)$ and structural shocks $e_t = (e_t^g \ e_t^t \ e_t^y \ e_t^\pi \ e_t^i \ e_t^s)$, which are the objects of interest in this study, can be expressed as follows.

$$A u_t = B e_t \text{-----} (14)$$

As defined earlier, (K x K) matrix A describes the contemporaneous relation between the variables while (K x K) matrix B defines how the structural shocks affects the variables. To investigate the impact of an isolated shock, the structural shocks are assumed to be orthogonal.

As pointed out by Blanchard and Perotti (2002) and Perotti (2004), the reduced form innovations (residuals) in the fiscal policy variables, u_t^g and u_t^t , are the linear combinations of three types of shocks. These are:

- (1) The automatic or cyclical response of government spending and revenue to macroeconomic shocks such as real output, inflation, interest rate and exchange rate shocks within a quarter.
- (2) Systemic, discretionary response of fiscal policy (reaction of policy makers) to real output, inflation, interest rate and exchange rate shocks, and
- (3) The random, discretionary fiscal policy to shocks, which are the underlying structural shocks to be identified. This refers to the structural innovations in the government spending and revenue shocks, e_t^g and e_t^r , respectively.

Hence, the reduced form residuals of government spending and government revenues can be formally written as linear combinations of the structural fiscal shocks and of the reduced form residuals of the other variables in the VAR:

$$\begin{aligned}
 u_t^g &= \alpha_y^g u_t^y + \alpha_\pi^g u_t^\pi + \alpha_i^g u_t^i + \alpha_s^g u_t^s + \beta_t^g e_t^t + e_t^g \\
 u_t^r &= \alpha_y^r u_t^y + \alpha_\pi^r u_t^\pi + \alpha_i^r u_t^i + \alpha_s^r u_t^s + \beta_t^r e_t^g + e_t^r \quad \text{----- (15)}
 \end{aligned}$$

The coefficients of α contain both the automatic response of economic activity, that is the other macroeconomic variables in the system, to government spending and revenue under existing fiscal policy and the discretionary change or adjustment of fiscal policy in response to unexpected movements in the other macroeconomic variables in the system. The corresponding β coefficients measure the response of fiscal variables to a structural shock. That is, they measure how the structural shock to a government spending or revenue affects revenue or spending on impact (but not over other horizons), respectively.

To identify the structural shocks of e_t^g and e_t^r and examine the response of variables included in the system to these shocks, it requires constructing the values of

coefficients represented by α and β . Accordingly, to fix the values of these coefficients, I follow the approach adopted by Blanchard and Perotti (2002) and Perotti (2004). These authors indicated that it takes policymakers and legislatures more than a quarter to react to shocks in macroeconomic variables. Thus, within a quarter, this virtually eliminates the possibility of discretionary adjustment of fiscal policy in response to unexpected movements in other macro variables in the system. Using a high frequency data, say for instance, a quarterly or monthly data, this assumption can be justified on the ground of decision lags in fiscal policy making which last longer than three months. The validity of this assumption can be also defended since there is an implementation lags in a policy. Consequently, the α coefficients capture only the automatic elasticity or cyclical response of the government spending and revenues to changes in economic activity.

As the structural shocks, e_t^g and e_t^t , are associated through reduced form of innovations, it not possible to estimate equations (15) by using OLS so as to construct the values of α . For this reason, the OLS regression will not generate consistent estimate of the coefficients. Thus, a choice is made to use exogenous elasticities in order to identify the shocks of interest. The use of exogenous automatic elasticities allows us to compute cyclically adjusted reduced form residuals for government spending $u_t^{g,CA}$ and revenue $u_t^{t,CA}$. This can be written as:

$$\begin{aligned} u_t^{g,CA} &= u_t^g - (\alpha_y^g u_t^y + \alpha_\pi^g u_t^\pi + \alpha_i^g u_t^i + \alpha_s^g u_t^s) = \beta_t^g e_t^g + e_t^g \\ u_t^{t,CA} &= u_t^t - (\alpha_y^t u_t^y + \alpha_\pi^t u_t^\pi + \alpha_i^t u_t^i + \alpha_s^t u_t^s) = \beta_t^t e_t^g + e_t^t \end{aligned} \quad \text{----- (16)}$$

The cyclically adjusted reduced form residuals, $u_t^{g,CA}$ and $u_t^{t,CA}$, is then used as an instrument variable as they are not correlated with other structural shocks. Thus, we

can estimate other structural coefficients in the equations of macroeconomic variables. At this point, we need to make a decision about the ordering of fiscal variables so as to identify the system. This means that one should decide which variable of fiscal policy comes first during a decision making process; is it a government spending that comes first or it is a revenue variable that comes before spending?. As indicated in Perotti (2004) there is still little guidance, theoretical or empirical, on how to sort out the two structural shocks e_t^g and u_t^g from the cyclically adjusted fiscal shocks. However, in all cases, the correlation between the two cyclically adjusted fiscal shocks is low enough that the ordering of the structural shocks is immaterial to the results. In view of this, we can assume and impose restriction that a government spending comes first; then $\beta_t^g = \mathbf{0}$, whereas if revenue decision come first, then set $\beta_g^t = \mathbf{0}$. Nonetheless, the ordering makes little or no difference to the impulse response analysis.

However, in this study the government spending is assumed to be fixed first and hence $\beta_t^g = \mathbf{0}$. Following this assumption, the cyclical adjusted reduced form residuals of equation (16) can be written:

$$\begin{aligned} u_t^{g,CA} &= e_t^g \\ u_t^{t,CA} &= \beta_g^t e_t^g + e_t^t \end{aligned} \quad (17)$$

This allows us to estimate β_g^t by an OLS regression of cyclically adjusted residuals of government revenue on the estimate of the government spending shock: Using the cyclically adjusted reduced form residuals $u_t^{g,CA}$ and $u_t^{t,CA}$, as the instrumental

variable for u_t^g and u_t^t respectively, we can estimate the remaining coefficients of the equations for the macroeconomic variables in equation (16).

Finally, we can estimate the remaining coefficients in the equation for the reduced form residual of other macro variables in the bench mark model. To do that we need to use instrumental variables to take into account the correlation between the regressors and the error term. As done in Blanchard and Perotti (2002) and Perotti (2004), we use cyclically adjusted reduced-form residuals as instruments for the fiscal variables. They may still be correlated with each other, but are no longer correlated with their own structural innovation term. These remaining equations are:

$$\begin{aligned}
u_t^y &= -(\gamma_g^y u_t^g + \gamma_t^y u_t^t) + e_t^y \\
u_t^\pi &= -(\gamma_g^\pi u_t^g + \gamma_t^\pi u_t^t + \gamma_y^\pi u_t^y) + e_t^\pi \\
u_t^i &= -(\gamma_g^i u_t^g + \gamma_t^i u_t^t + \gamma_y^i u_t^y + \gamma_\pi^i u_t^\pi) + e_t^i \\
u_t^s &= -(\gamma_g^s u_t^g + \gamma_t^s u_t^t + \gamma_y^s u_t^y + \gamma_\pi^s u_t^\pi + \gamma_i^s u_t^i) + e_t^s \text{-----(18)}
\end{aligned}$$

As already mentioned, the SVAR model used in the analysis of fiscal shocks is called the AB model, with the following appearance:

$$A u_t = B e_t \text{----- (19)}$$

Then, from this representation the A and B matrices can be constructed as:

$$\begin{bmatrix}
1 & 0 & -\alpha_y^g & -\alpha_\pi^g & -\alpha_i^g & -\alpha_s^g \\
0 & 1 & -\alpha_y^t & -\alpha_\pi^t & -\alpha_i^t & -\alpha_s^t \\
-\gamma_g^y & -\gamma_t^y & 1 & 0 & 0 & 0 \\
-\gamma_g^\pi & -\gamma_t^\pi & -\gamma_y^\pi & 1 & 0 & 0 \\
-\gamma_g^i & -\gamma_t^i & -\gamma_y^i & -\gamma_\pi^i & 1 & 0 \\
-\gamma_g^s & -\gamma_t^s & -\gamma_y^s & -\gamma_\pi^s & -\gamma_i^s & 1
\end{bmatrix}
\begin{bmatrix}
u_t^g \\
u_t^t \\
u_t^y \\
u_t^\pi \\
u_t^i \\
u_t^s
\end{bmatrix}
=
\begin{bmatrix}
\beta_g^g & \beta_t^g & 0 & 0 & 0 & 0 \\
\beta_g^t & \beta_t^t & 0 & 0 & 0 & 0 \\
0 & 0 & \beta_y^y & 0 & 0 & 0 \\
0 & 0 & 0 & \beta_\pi^\pi & 0 & 0 \\
0 & 0 & 0 & 0 & \beta_i^i & 0 \\
0 & 0 & 0 & 0 & 0 & \beta_s^s
\end{bmatrix}
\begin{bmatrix}
e_t^g \\
e_t^t \\
e_t^y \\
e_t^\pi \\
e_t^i \\
e_t^s
\end{bmatrix}$$

Each row in (19) is an equation that defines a relationship among the reduced-form residuals and structural shocks that is an interest to estimate here. However, the above system of equations is not identified and needs to be restricted to achieve identification. To make the system just-identified, $2k^2 - \frac{1}{2}k(k+1)$, 51 restrictions (where k is the number of endogenous variables in the system) should be imposed in total in both A and B matrices. Using Blanchard and perotti's identification strategy, the eight parameters in the first two rows of matrix A are identified using external information on exogenous elasticity. The next section discusses the identification of these coefficients. Since the focus of this paper is analyzing the effects of fiscal policy shocks on macroeconomic variables, then the interest is in identifying the structural shocks in the first two rows of the matrix A. Consequently, the structural non-policy shocks of e_t^y, e_t^π, e_t^i and e_t^s are identified by using a recursive ordering on the last four rows of A and B which is fairly standard in the VAR literature.

The identification of the two off-diagonal elements of the B matrix (β_t^g, β_g^t) is not straightforward and depends on our view about the functioning of fiscal policy. In this paper, however, it is assumed that the government expenditure decisions are made prior to revenue decisions. Consequently, we set $\beta_t^g = \mathbf{0}$. If this assumption is reversed by assuming that a revenue decision is decided prior to an expenditure decision, then it does not alter the result as it is justified by the literatures (see Parkyn and Vehbi, 2013; Ko and Morita, 2011; Blanchard and Perotti, 2002; Favero and Giavazzi, 2007).

It is also important to notice that the identification strategy of structural shocks does not depend on the presence of the debt-to-GDP ratio. The simple reason is that the law of motion of this ratio is deterministic. In other words, equation (10) holds as an identity and therefore, it does not add any shock to the system. This means that equation (10) plays no role in the identification of structural shocks.

4.5 Elasticity of Government Revenue and Expenditure

The full identification of the SVAR model requires exogenously determined elasticities of real net government spending and real net tax revenue with respect to each of macroeconomic variables included in the model. These variables are output, inflation, interest rate and exchange rate for which we need to determine their corresponding coefficients so as to proceed with the estimation of the model. Their coefficients, however, can be determined based on the prior assumptions we held about the workings of fiscal policy on the economy. Besides, we use the technique employed by Blanchard and Perotti (2002), Perotti (2004) and Ravnik and Zilic (2010) to estimate the contemporaneous effect of revenue and government spending on economic activity. These authors assume that within a short period of time, say within a quarter, the potency of fiscal policy on the economy is very minimal. This assumption is more realistic particularly in case of government spending as there is a decision and an implementation lag associated with it. As a result, the impact of a government spending on output within a quarter assumed to be zero. For other macroeconomic variables on which a fiscal policy has an impact, these authors used a regression analysis to calculate the associate value. Hence, this paper relies on this procedure to determine the contemporaneous value of each variable.

4.5.1 Elasticity of Spending to the Changes in Output and Price

For the fact that government spending is totally under the control of policy makers, it will not react immediately to the changes to some macroeconomic variables. Particularly, within a quarter, its effect is not automatic since its dynamics is influenced by government decisions. There is a decision and an implementation lag of the policy to affect the economic activity, and it takes more than a quarter for it to affect the workings of the economy. Therefore, the contemporaneous relationship between government spending and output within a quarter is zero.

However, unlike the zero value elasticity of government spending to the changes in output, the automatic reaction of spending to the change in price is a bit controversial. This is so because of the different responses of the different government spending categories to the changes in price. Some categories of spending are likely to respond while others are not. As discussed by Perotti (2004), the wage component of current government spending do not indexed to the price change within a quarter. Hence, he assumed the wage component of government spending to have an elasticity of -1 to the change in price. This assumption better reflects the situation in Ethiopia as the indexation of wage to the changes in price is hardly made in the country. Whereas non-wage component of government spending is likely to be effectively indexed to the price change within a quarter, it takes elasticity closer to zero. As a result, it seems reasonable to assume the elasticity of government spending to price below zero but lower than -1. Significant numbers of authors have followed this suit and used a value of -0.5 as an elasticity of government spending to price change (see Ilzetzki, 2011; Parkyn and Vehbi, 2013; Favero and Giovanni; 2007; Blanchard and Perotti, 2007). Daniel (2012) also used this value for Ethiopia and this paper as well applies it.

Furthermore, the elasticity of government spending with respect to interest rate and exchange rate is assumed to be zero. This assumption boldly holds true for the interest rate since the government expenditure data used for this study excludes the interest payments. As well, a zero value elasticity of spending to the exchanged rate is valid for the fact that within a quarter a government spending do not reacts to the change in the exchange rate and economic activity. This assumption is also held in de Castro and Fernández-Caballero (2011). These authors argue that the absence of contemporaneous response of spending to the changes in exchange rate can be justified on the grounds of popular home bias of public expenditure items, especially public consumption. Therefore, the elasticity of government spending with respect to output, price, interest rate and exchange rate can take the value of zero.

4.5.2 Elasticity of Revenue to the Changes in Output and Price

Unlike the ways and assumptions used to determine the elasticity of government spending to the output and price changes, the elasticity of tax revenue composes of the elasticity of different categories of taxes to their respective tax bases, and the elasticity of each tax bases to real GDP. Hence, the determination of exogenous elasticities of tax revenue to the changes in output and price requires carrying out a regression analysis. In order to determine the required elasticity, this paper relies on the methodology developed in Blanchard and Perotti (2002), Perotti (2004), Caldara and Kamps (2008) as well as in de Castro and de Cos (2006). These authors have followed basically the same methodology though there is a minor variation of one from another. This variation arises due to the classification of tax revenue into different categories.

One can classify tax revenue into different components based on the availability of data on each category. For instance, Blanchard and Perotti (2002) have considered the four categories of taxes: indirect taxes, personal income taxes, corporate income taxes and social security taxes to estimate the elasticity tax revenue to output and price for USA. Similarly, Ravnik and Zilic (2010) for Croatia have calculated the elasticity of tax revenue based on a five broad classifications of tax revenue: income taxes, profit taxes, social contributions, value added taxes and excise taxes. They further assigned the aggregate wages as a tax base for income taxes and social contributions, gross operating tax as a tax base for profit tax and a private consumption as a tax base for indirect taxes. The same approach is also adopted by de Castro and de Cos (2006) for Spain.

Based on these literatures, the net tax revenue for the current study is classified into three broad categories based on the available quarterly data for each category and their respective tax bases. These categories are: (1) real direct tax revenue where real GDP is taken as its tax base; (2) real domestic indirect taxes with real private consumption as its tax base; and (3) real import duties and taxes where real import is taken as the tax base. The data on direct taxes, domestic indirect taxes and import duties and taxes are obtained from MoFED, whereas a quarterly data on import is obtained from NBE. Quarterly data on private consumption is constructed by multiplying each quarterly value of nominal GDP by annual percentage of private consumption to GDP. All of these variables are changed into their real value by using a consumer price index.

Subsequently, the contemporaneous output elasticity of net taxes can be calculated based on the following formula:

$$\alpha_y^t = \sum_{i=1}^n \varepsilon_{Bi}^{Ti} \times \varepsilon_y^{Bi} \times \frac{T_i}{T} \dots\dots\dots (20)$$

Where α_y^t is the output elasticity of net tax, ε_{Bi}^{Ti} is the elasticity of each category of taxes to their respective tax bases, ε_y^{Bi} is the elasticity of each tax bases to output and $\frac{T_i}{T}$ measures the weight of type i tax in the sum of taxes, $T = \sum_i^n T_i$. To elaborate a bit more about T, it is the sum of three categories of taxes: direct taxes, domestic indirect taxes and import taxes as noted above. And $\frac{T_i}{T}$ is a simple weight of each category of tax revenue, which will multiply the output elasticity to each base and the base elasticity to the corresponding revenue, so as to arrive at a single elasticity. Besides, the weight of each tax category is calculated based on the average share of each individual tax over the sample period of 1999/00Q1 up to 2012/13Q4. Accordingly, real direct taxes, real indirect taxes and real import taxes carry a share of 34, 24 and 42 percent respectively. So as to arrive at the intended value of the elasticity, the following regression equation is used.

$$\log(C) = \beta_0 + \beta_1 \log(D) \dots\dots\dots (21)$$

Where the coefficient of β_1 measures the automatic elasticity of variable C (in our case, it is individual taxes and or tax bases) with respect to a variable D (in our case, it is each tax bases and or output). Then the intended coefficients for each tax are estimated using OLS estimation. The following table shows the summary of estimation result for all categories of taxes.

Table 4.1: Elasticity of tax revenue to the changes in output.

Revenue Category	(ε_{Bi}^{Ti})	(ε_y^{Bi})	$(\frac{T_i}{T})$	$(\varepsilon_{Bi}^{Ti} \times \varepsilon_y^{Bi} \times \frac{T_i}{T})$
Real direct tax	0.254	1.0	0.34	0.08636
Real indirect tax	0.10	2.62	0.24	0.06288
Real import tax	0.714	0.28	0.42	0.08397
				0.2332

$$\alpha_y^t = \sum_{i=1}^n \varepsilon_{Bi}^{Ti} \times \varepsilon_y^{Bi} \times \frac{T_i}{T}$$

Source: Own computation

As the table above shows, the elasticity of tax revenue to the changes in output over the sample period considered in the estimation equals to 0.233, rounded to three digits. When this value is compared with previous literatures, it is low for Ethiopia. For instance, Caprioli and Momiglian (2011) for Italy found a value of 0.3. For Newzland, Parkyn and Vehbi (2011) obtained an elasticity of 1.0. In case of Spain de Castro and de Cos (2006) have calculated a value of 0.62. Perotti (2004) in estimating the effects of fiscal policy for OECD countries found a tax elasticity of output, 1.85 for USA, 0.76 for UK, 0.81 for Australia and 1.86 for Canada. Moreover, it is lower as compared with the value of 0.55, which Daniel (2012) has estimated for Ethiopia.

Despite the above arguments, the value of 0.233 elasticity of tax revenue to output for Ethiopia is a bit greater than what Ko and Morita (2011) found for Japan. These authors have calculated the elasticity of tax revenue to output a value of 0.189 and 0.141 in pre-bubble and post-bubble periods for Japan respectively¹³. But it happens to

¹³ Pre-bubble and post-bubble periods refer to the period of 1970Q1 to 1986Q4 and 1987Q1 to 2004Q4 respectively. The authors used these classifications of time to study the changing pattern of fiscal policy for Japan.

be fairly consistent with what Estevao and Samake (2013) find for a group of HIPC in which Ethiopia is also one, a value of 0.17.

The relative low elasticity of revenue to the changes in economic activity for Ethiopia is somewhat puzzling. As Estevao and Samake (2013) pointed out a possible explanation for the observed outcome could be that while the correlation between automatic stabilizers might be large, they would have been consistently offset by discretionary tax relief (i.e., a large tax exemptions). It could also be so due to lower tax bases and widespread corruption in tax collections in the country. This explanation is further supported by a global Corruption Perceptions Index that a Transparency International computes for all countries in the world every year¹⁹. And according to its annual report released in December 2014, Ethiopia ranked as a 110th corrupt nation, out of 174 countries in the world. In the report it has been given a score of 33 points, which has also been the case for the past two years²⁰. The report has revealed that in a countries with high economic growth, the persistence of wide spread corruption is one of the factors that hinders the trickledown effect of such growth for all citizens.

The calculation of price elasticity of tax revenue follows the same procedure used to determine the output elasticity. Though there are different approaches used to determine the price elasticity of tax revenue, this paper follows a technique put forward in Perotti (2004), and de Castro and de Cos (2006). These authors assumed that the elasticity of indirect and profit taxes to the changes in price is zero. However, this assumption is not maintained in this paper and the elasticity of each category of taxes to the change in price is calculated. This means that the corresponding elasticity of each category of taxes is calculated and then inserted into the following equation:

$$\alpha_p^t = \sum_{i=1}^n \varepsilon_p^{T_i} \times \frac{T_i}{T} \text{-----} (22)$$

The contemporaneous elasticity of each category of tax is estimated based on the following regression equation.

$$\log(T_i) = \beta_0 + \beta_1 \log(CPI) \text{-----} (23)$$

Where β_1 measures the automatic elasticity of type i tax category to the change in consumer price index. Consumer price index is used as the proxy for inflation. The same weight of each category of taxes as used for output elasticity is also applied with the price. Table 4.2 summarizes the estimation result.

Table 4.2: Elasticity of tax revenue to the changes in price

Revenue Category	$(\varepsilon_P^{T_i})$	$(\frac{T_i}{T})$	$(\varepsilon_P^{T_i} \times \frac{T_i}{T})$
Real direct tax	0.094	0.34	0.03196
Real indirect tax	0.224	0.24	0.05376
Real import tax	0.139	0.42	0.05838

$$\alpha_p^t = \sum_{i=1}^n \varepsilon_P^{T_i} \times \frac{T_i}{T} = 0.144$$

Source: Own computation

The price elasticity of tax revenue for Ethiopia, as the above table indicates, found to be 0.144. This result is also lower as compared with what the literatures indicate for other countries. The value of 0.4 is obtained for Italy by Caprioli and Momiglian (2011), 0.2 for Newzland in Parkyn and Vehbi (2013), 0.78 for Spain in de Castro and de Cos (2006) and 0.89 for Crocia in Ravnik and Zilic (2010). For the period that covers 1998Q2 up to 2010Q4, Daniel (2012) found a value of 0.34 as a price elasticity

of tax revenue for Ethiopia¹⁴. The low responsiveness of tax revenue to the changes in the price could be related to the inefficiency in the collection of taxes.

The above discussion is only about the elasticity of tax revenue with respect to output and price changes. What about the elasticity of tax revenue to the changes in interest rate, average cost of debt servicing and exchange rates since these variables are also included in the benchmark model? The elasticity of tax revenue to the changes in interest rate is assumed to be zero. This assumption is valid since the interest rate included in the model is the average cost of debt servicing rather than being a market-determined rate. Had it been the interest rate that is usually observed in the financial market in the country, the earlier zero value assumption would have been made invalid. Nevertheless, this is not the case here. Moreover, the zero value elasticity of tax revenue with respect to interest rate is consistent with the assumption of Favero and Giovazzi (2007), Perotti (2004), Parkyn and Vehbi (2013) and Ko and Morita (2011).

It is also assumed that within a quarter the tax revenue will not react or respond to the changes in the exchange rate. This is so because tax policy is under the control of government policy makers. There is also a decision and implementation lag of the policy. Therefore, within a quarter the contemporaneous elasticity of tax revenue to the change in the exchange rate is set to zero. This assumption is consistent with that of de Castro and Fernández-Caballero (2011).

Finally, after all the imposed restrictions and estimated exogenous elasticities, the just identified SVAR model takes the following format.

¹⁴ One possible reason for the observed variation in the size of price elasticity of tax between what is estimated in this current paper and that of Daniel is that the share of individual taxes over different sample periods changes. Second, the classification of taxes used in this paper and in Daniel is a bit different. For more detail, interested readers can refer to Daniel (2012).

$$\begin{bmatrix} 1 & 0 & 0 & -0.5 & 0 & 0 \\ 0 & 1 & -0.233 & -0.144 & 0 & 0 \\ -\gamma_g^y & -\gamma_t^y & 1 & 0 & 0 & 0 \\ -\gamma_g^\pi & -\gamma_t^\pi & -\gamma_y^\pi & 1 & 0 & 0 \\ -\gamma_g^i & -\gamma_t^i & -\gamma_y^i & -\gamma_\pi^i & 1 & 0 \\ -\gamma_g^s & -\gamma_t^s & -\gamma_y^s & -\gamma_\pi^s & -\gamma_i^s & 1 \end{bmatrix} \begin{bmatrix} u_t^g \\ u_t^t \\ u_t^y \\ u_t^\pi \\ u_t^i \\ u_t^s \end{bmatrix} = \begin{bmatrix} \beta_g^g & 0 & 0 & 0 & 0 & 0 \\ \beta_g^t & \beta_t^t & 0 & 0 & 0 & 0 \\ 0 & 0 & \beta_y^y & 0 & 0 & 0 \\ 0 & 0 & 0 & \beta_\pi^\pi & 0 & 0 \\ 0 & 0 & 0 & 0 & \beta_i^i & 0 \\ 0 & 0 & 0 & 0 & 0 & \beta_s^s \end{bmatrix} \begin{bmatrix} e_t^g \\ e_t^t \\ e_t^y \\ e_t^\pi \\ e_t^i \\ e_t^s \end{bmatrix}$$

4.6 Impulse Response Analysis

VAR and SVAR models concentrate on analyzing shocks which can be regarded as the ultimate source of stochastic variation of the vector of variables that can all be seen as potentially endogenous. In this framework, a set of independent and relevant shocks are identified by using a meaningful theoretical and economic restrictions. After the identification of structural shocks of interest, the properties of VAR models are described by using impulse response analysis, forecasting error variance decomposition and historical decomposition (Favero, 2001). Thus, in order to describe the response of the variables in the system to the shocks of interest, this study uses an impulse response analysis.

The impulse response analysis (i.e., the propagation mechanism of the shocks) is a descriptive device in representing the reaction of each variable to shocks in the different equations of the system. It is often of interest in an applied work just to know the response of one variable to an impulse of another variable in a VAR system that involves a large number of variables (Lutkepohl, 2005). Hence, in tracing out the effect of two fiscal shocks on the variables included in the system, in this paper the impulse responses are constructed following the methodology outlined in Favero and Giavazzi (2007) as follows:

1. Generate a baseline simulation for all variables by solving (13) dynamically forward. This requires setting to zero all shocks for a number of periods equal to the horizon up to which impulse responses are needed,
2. Generate an alternative simulation for all variables by setting the structural shock of interest to one, just for the first period of the simulation, and then solve dynamically forward the model up to the same horizon used in the baseline simulation,
3. Compute impulse responses to the structural shocks as the difference between the simulated values in step 2 and 1 above¹⁵.
4. Compute confidence intervals for impulse responses. This is done by computing the one-standard deviation confidence intervals by using a bootstrap methodology (1000 bootstraps).

The whole process of computing the confidence intervals are done by going through the steps pointed out by Favero and Giavazzi (2007), and Caprioli and Momigliano (2011). After estimating equation (15) we obtain fitted residuals $\{\hat{u}_1, \dots, \hat{u}_T\}$ are normally distributed with zero mean and covariance matrix Ω . Bootstrapping requires saving these residuals from the estimated VAR and then iterating the following steps:

- i. Re-sample from the saved residuals and generate a set of observation for Y_t and d_t ,
- ii. Estimate the VAR and identify structural shocks,
- iii. Compute impulse responses going through the steps described in earlier section,

¹⁵ As Favero and Giavazzi (2007) addressed, these steps if applied to a standard VAR, they will produce standard impulse responses. However, in this paper case, they produce impulse responses that allow for both the feedback from d_{t-i} to Y_t and for the debt dynamics.

- iv. Go back to step 1 of earlier steps.
- v. By going through 1,000 iterations we produce bootstrapped distributions for impulse responses and compute confidence intervals.

4.7 Pre-estimation and Post- estimation Diagnostic Tests

4.7.1 Stationarity and Unit Root Test

One of major concerns in a time series analysis is the data property. Most of a time series macroeconomic variables contain non-stationary process, particular when considered in level. A series is said to be (weakly or covariance) stationary if the mean and autocovariances of the series do not depend on time. Any series that is not stationary is said to be non-stationary. And using non-stationary variables leads to a spurious regression. A regression result said to be spurious when it contains seemingly a high R^2 and significant t values but fails to give a true economic relationship among the variables included in the analysis.

Nevertheless, stationarity of a given series is checked by applying a unit root tests which is the formal method to check it in the literature. To this end, there are several methods of testing the presence of unit roots. Some of these tests are: Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), Kwiatkowski, Phillips, Schmidt, and Shin (KPSS), GLS-detrended Dickey-Fuller, Elliott, Rothenberg, and Stock Point Optimal (ERS), and Ng and Perron (NP) unit root tests. Despite the multiple existences of unit root tests, in this study, the ADF and PP tests will be employed.

4.7.2 Lag Length Selection

Another a critical step before estimating the VAR model is the lag length determination. There are various criteria to be employed in order to get an

appropriate lag length. These include the use of multivariate generalization of the Akaike Information Criteria (AIC), Schwarz Information Criteria (SIC), Hannan and Quinn Information criterion (HQ), Likelihood Ratio (LR) test and others. This study will use these criteria and tests. Nonetheless, whenever the autocorrelation exists, the lag length is determined using parsimonious method to eliminate the autocorrelation problem.

4.7.3 Post-estimation Diagnostic Tests

In addition to carrying out the pre-estimation diagnostic tests, the post-estimation tests should be also conducted so as to check the model adequacy. In a VAR model, there are at least three tests commonly performed to check the model adequacy. These are Lagrange-multiplier (LM) test for autocorrelations, stability test, and the test for the normality of the model.

In this study, the LM test for autocorrelation follows Johansen (1995). Under the null hypothesis of no serial correlation of order h , the LM test statistic is asymptotically distributed χ^2 with $k^2(h-p)$ degree of freedom (df) which is number of equation in the VAR system.

The model stability test is carried out by checking the stationary condition of the VAR. This formally tests that the impulse responses converge following a shock. The stability test that will be applied here is based on the inverse roots (the eigenvalues of companion matrix) of the characteristic of autoregressive polynomial. Luthkepol (2005) and Hamilton (1994) show that the estimated VAR is stable if all roots have modulus less than one and lie inside the unit circle. If the VAR is not stable, the impulse response standard errors are not valid.

The last diagnostic check that needs to be carried out is the normality of the residuals. To test the multivariate normality of the residuals, Luthkepol (2005) suggests the multivariate extension of the Jarque-Berra test on estimated residual. This tests the skewness and kurtosis properties of the residual against those of a multivariate normal distribution of the appropriate dimension under the null hypothesis of normal distribution.

CHAPTER FIVE

DISCUSSION OF THE RESULTS

5.1 Test Results for Stationarity Checks

As mentioned in the earlier chapter, the stationary test is the very first step to be carried out in time series analysis to check whether the series have a unit root or not in order to avoid spurious regression. Two versions of unit root tests are used in this study: Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test. The test results reported in appendix A1 gives the summary of both tests test statistics compared with their critical values at 5 percent level of significance. Prior to carrying out this and the subsequent tests of the model, the data is seasonally adjusted using the X12 method¹⁶.

The ADF test suggests that some variables are stationary and some are not. While inflation (P) and exchange rate (S) are stationary in levels, the interest rate (I) becomes stationary with an intercept term. Except the log of real government expenditure (G_SA) which is indicated as trend stationary, other macroeconomic variables such as log of real government revenue (R_SA), log of real GDP (Y_SA) and debt to GDP ratio (D) are non-stationary in level despite the fact that they became stationary at their respective first differences under PP test.

Despite the presence of unit roots for some variables at level, there are different views on the issue of whether the variables in a VAR model needs to be stationary. Sims (1980) recommend against differencing even if variables contain a unit root. He argues that the goal of VAR analysis is to determine the interrelationships among the

¹⁶ Among the variables under examination, an indefinable seasonality is not reflected in case of inflation rate, exchange rate, interest rate and debt to GDP ratio whereas it is found with the remaining variables for which they are seasonally adjusted and used in estimation.

variables rather than determining the parameter estimates. The main argument against differencing is that it throws away the relevant information concerning the comovements inherent in the data series (see Enders, 2004). For these reasons, it has become a common practice in a VAR literature to estimate variables in levels rather than opting to differencing them. This is a common approach in such studies of Perotti (2002), de Castro and de Cos (2006), Parkyn and Vehbi (2013), and Daniel (2012). Following the same suit, the level estimation is justified and employed for the current study as well.

5.2 Lag Length Selection

In addition to carrying out the unit root tests, it is also important to determine the appropriate lag length of the model so as to get the valid result and inference. To this end, instead of using only one particular test, several lag order selection methods are employed in this study. Appendix A2 reports the results of the test statistics. Given relatively a shorter size of sample, a-prior lag lengths are restricted to four. An important justification for this is that in a VAR analysis, allowing long lag lengths quickly consumes degrees of freedom where as too small lags make the model to be mis-specified implying the criticality of appropriate lag length selection (see Enders, 2004). Hence, it is believed that four quarters is long enough to capture the system's dynamics given the available sample size. As shown in appendix A2 each lag order selection criteria has chosen different lag lengths. While Schwarz and Hannan-Quinni Information Criteria pick a lag length of one, Final Prediction Error and Akaike Information Criteria select four lags where as a Likelihood Ratio test indicates the existence of three lags.

In spite of the various lag lengths suggested by each criterion, in small samples, FPE and AIC are found to have superior properties to choose the correct lag order more often than others (Lutkepohl, 2005). Hence, in this paper the four lags suggested by AIC is used. Besides, four lags are long enough to capture the systems dynamics given the available size of the sample¹⁷. With regard to debt ratio, it is assigned a lag length of one so as to avoid the vanishing of degrees of freedom.

5.3 Post-estimation Diagnostic Checks

Adequacy of the model for a further analysis depends on how the estimated residuals behave when checked by different post-estimation diagnostic tests so as to support the validity of the estimation results. It basically requires checking the autocorrelation problem, the normality and the model stability assumption as commonly done in the literature.

Accordingly, the Lagrange Multiplier (LM) test employed to check the autocorrelation suggests no evidence of serial correlation in the residuals up to lag four (see appendix A3). The stability condition of the model requires all roots of the characteristic polynomial to lie inside the unit circle. As the test result provided in appendix A4 shows this study has fulfilled the stability condition since all roots are found inside the unit circle.

To check the normality condition, the multivariate extension of Jarque-Berra test is employed and the result is reported in appendix A5. As the test statistic indicates the null hypothesis of residuals multivariate normality assumption could be rejected with the given information. In many cases, however, the normality assumption in a

¹⁷ Lag length and post-estimation diagnostic test results for a model with no debt feedback are provided under appendix B.

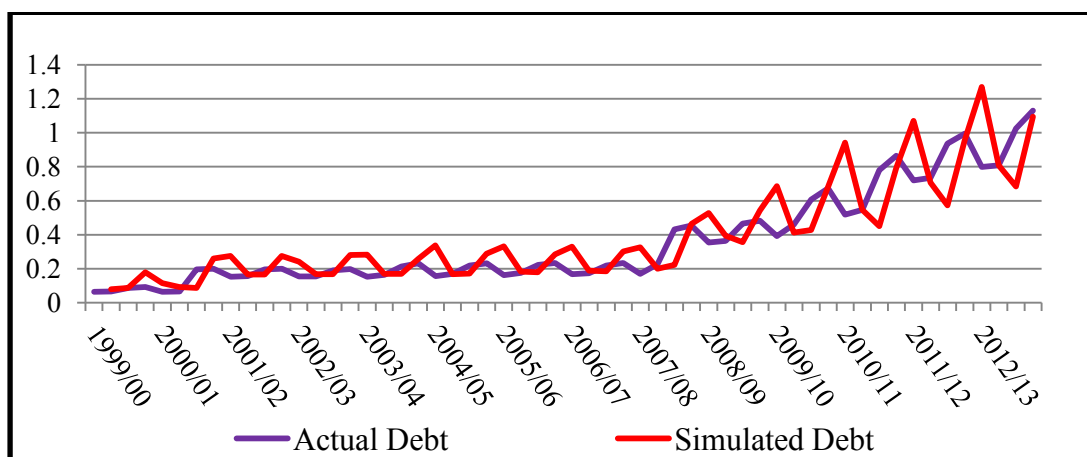
multivariate studies frequently cannot fully be satisfied. It is an asymptotic or a large sample property, and with small sample one cannot achieve it frequently. Moreover, as noted by Luthkepol (2005), the asymptotic properties of the VAR parameter estimators do not depend on the normality assumption.

Nevertheless, the small sample properties can be improved by employing a bootstrap technique. In applied work, a statistical inference with regard to impulse responses is often based on bootstrap methods. In particular, it is frequently used to construct confidence intervals for impulse responses for it produces a more reliable small sample inference that is occasionally possible with other techniques. If the bootstrap is used for setting up confidence intervals, the precise expressions of the variances of impulse response coefficients are not needed; hence, deriving the analytical expressions explicitly can be avoided (see Luptkel, 2005). Thus, since this technique is employed for the current study, then the weak evidence observed on the normality condition would not throw a danger on the results.

5.4 Comparison of Actual and Simulated debt

Figure 5.1 below compares the actual and simulated debt to GDP ratio. The simulated debt is constructed from the government budget constraint given in equation 13, taking the actual value of debt in 1999/00Q1 as an initial value, d_{t-1} . And the so constructed debt pretty much closely traces the evolution of actual debt. However, some smaller deviations observed in the graph are attributed to the way variables are used to compute it. For instance, the employed GDP data is an artificially interpolated one which may complicate the computation of the series. The same works with the interest rate as it is the average cost of debt serving.

Figure 5.1: Actual and Simulated Debt to GDP ratio



Source: Own computation

5.5 Effects of the Pure Fiscal Shocks

This section presents the results of pure fiscal policy shocks by means of impulse response functions generated through the Blanchard and Perotti SVAR identification approach. Through this approach, the responses of output, inflation, interest rate and nominal exchange rate are finely collected for an exogenously introduced shock to one of the fiscal variable (government expenditure and revenue) at a time. The responses of each fiscal variable to its own shock are further discussed.

In doing so, care has been taken to ensure that the potential impact of one fiscal variable will not constrain the possible influence of other fiscal variable shock on the endogenous variables. Each fiscal shock is set to have a size of one percent of real GDP which is, indeed, adjusted through creating a scale factor such that the final shock is 1 percent of GDP with respect to each shock. This factor is created by dividing 1 percent, say, 0.01, to a respective original fiscal shock and then multiplying

it by the ratio of real GDP and the shocked fiscal variable, where the ratio is evaluated at the sample mean.

Further, the impulse-response paths are collected for a horizon of 20 quarters (five years) which is enough for this study given relatively a shorter sample size. To give a better understanding and an easy comparison for accounting and not accounting a debt feedback in fiscal VAR, two types of impulse responses: under the debt feedback and no debt feedback cases are constructed. Accordingly, in the graphs reported below, the solid blue and red lines give the response of each endogenous variable to the expenditure and revenue shock under the debt feedback and no feedback rule respectively. The dash blue lines are the confidence bounds for impulse responses with debt feedback case, which is constructed through a bootstrap methodology with 1000 replications.

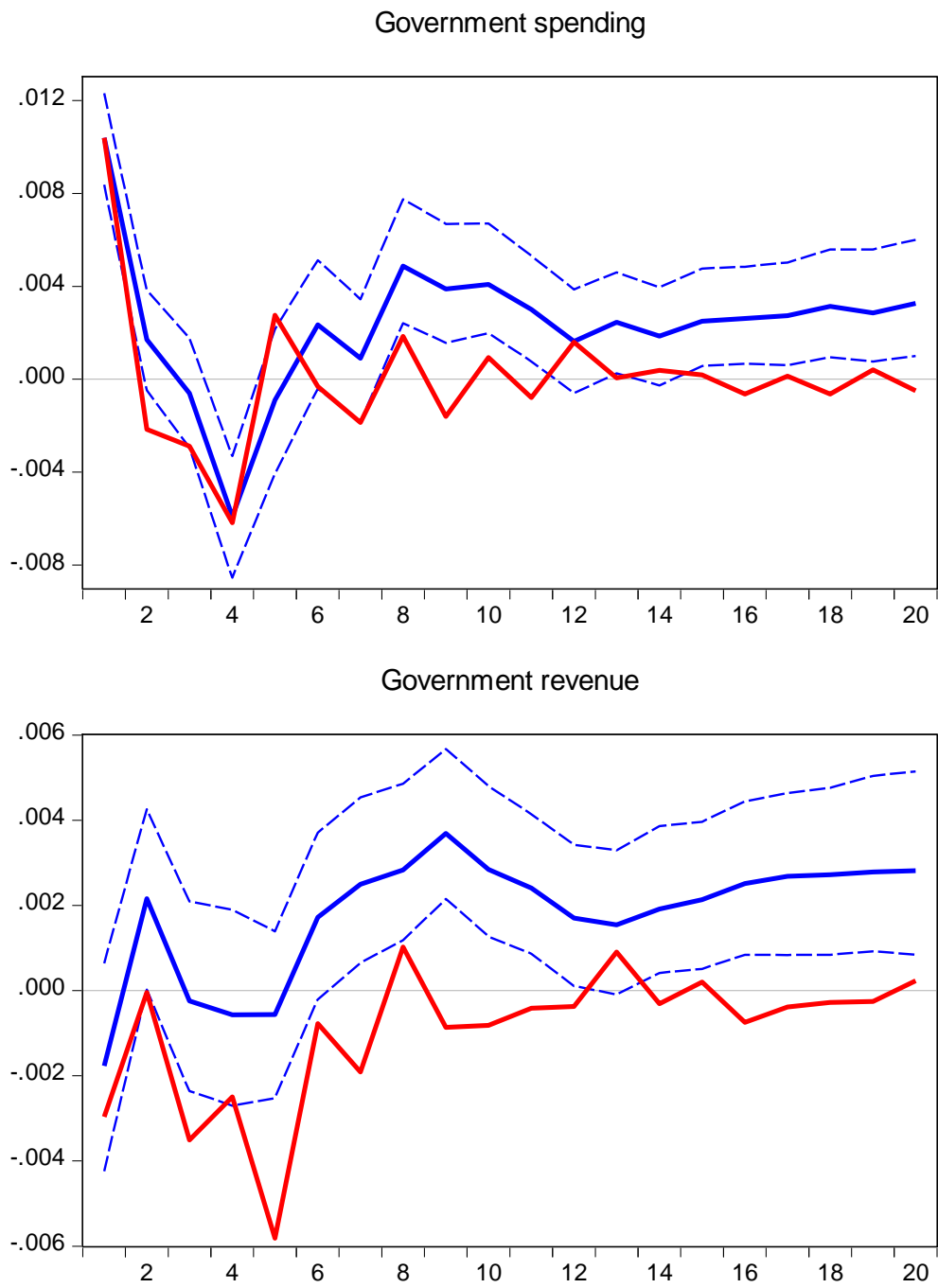
5.5.1 Effects of Government Spending Shock

Figure 5.2 below displays the responses of the six endogenous variables to a positive government spending shock. As the blue colored solid line shows, the government spending responds positively to its own shock on impact apart from a very short lived negative response observed between quarter three and five. The positive response is persistent and remains mostly significant after the first five quarters. The effect is further consistent with the evidence found by Ilzetzi (2011) for South Africa and Parkyn and Tugrul (2013) for Newzland. When such a response is constructed from a fiscal VAR that does not account for a debt feedback effect, it apparently differs from a response that we just saw with a debt feedback effect (see the red solid line on figure).

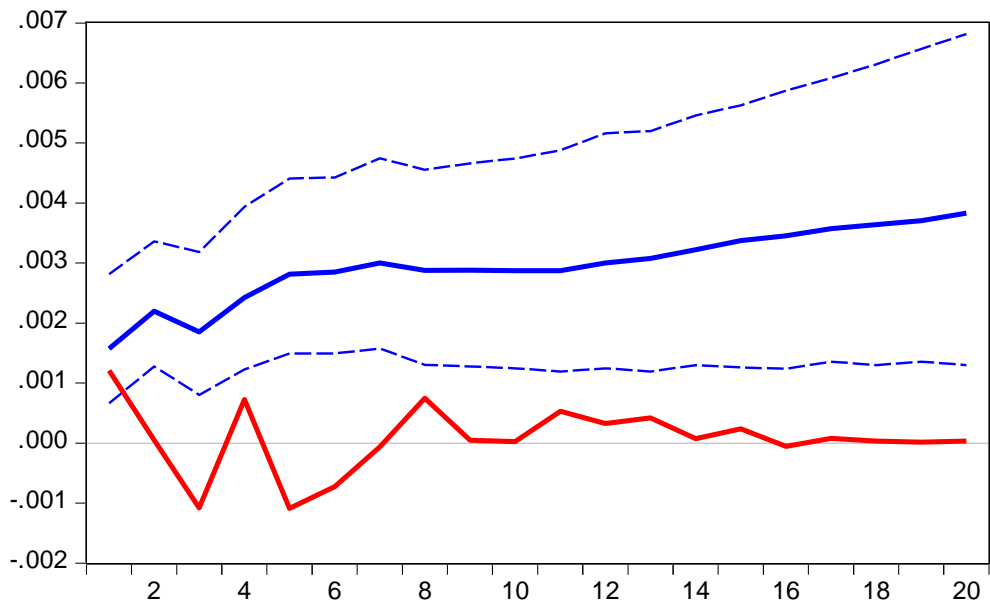
Though the responses under the two scenarios: with debt and no debt feedback rule seems roughly identical for initial periods of the response horizon, they demonstrate a clear and sustained variation after a year. After quarter seven, the response computed with no debt feedback effect even exits the indicated confidence bounds, which is essentially suggestive of incorporating a public debt in our model so as to capture the due influence of public debt on fiscal and macro variables in the country.

Following a one percent size of GDP shock in government spending, the government revenue reacts negatively for the first five quarters save the 3rd quarter. However, its estimated response after the 5th quarter turns out to be positive and significant with the due persistence in the subsequent response horizon. A possible explanation for this could be an increase in real GDP following a government expenditure shock which would create an expanded tax revenue bases. The negative and insignificant effect of revenue observed at the beginning periods of the response horizon, however, tells us its inadequacy to fully cover the government spending. This reflects the very nature of deficit position of the country that has made the government to rely on external borrowings to fill the observed financing gap. The size of the impulse response estimated without accounting for the effects of public debt turns out to be large and understates the potential effect of the variable, and thus leads to biased results.

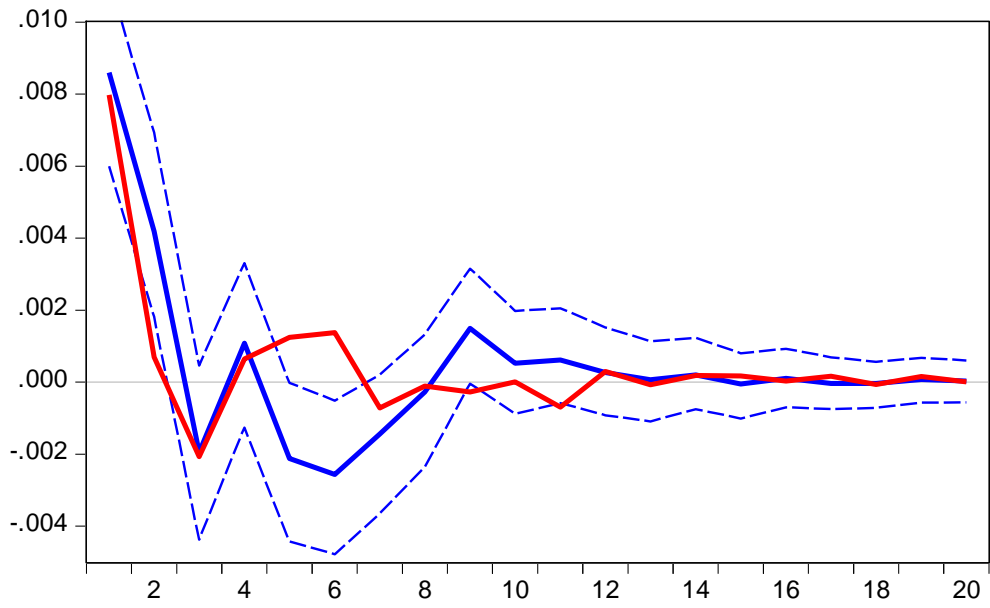
Figure 5.2: Responses to an increase in government spending



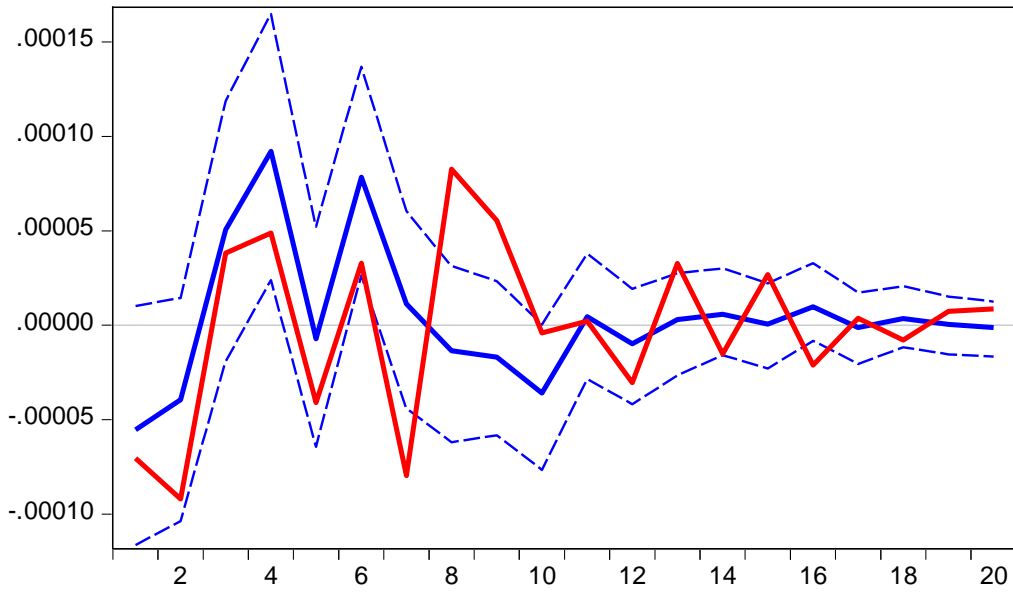
RGDP



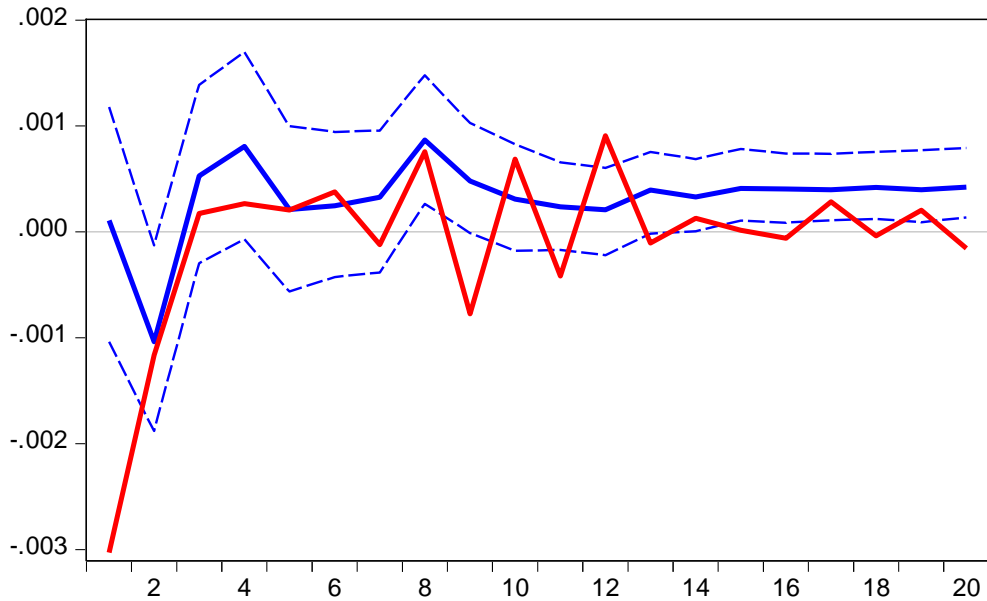
Price



Average cost of debt servicing



Exchange rate



Further, the impulse response function of output following a positive shock in spending shows a persistent and significant increase with the confidence bounds becoming wider and wider for the upcoming periods. Nevertheless, like that of the response of other two variables discussed above, the impulse response of output collected from a fiscal VAR that does not keep track of debt dynamics confers a downward biased response for the entire horizon. Thus, this calls our attention to

appreciate the due importance of capturing the potential influence of public debt in examining the effects of fiscal policy in Ethiopia.

A persistent and significant positive reaction of the output to the government spending could be defended one: on the grounds of a significant size of government involvement in the economy running huge public enterprises; second it could be so partly due to the debt cancellation under the HIPC and MDRI initiatives that has allowed the government to divert its expenditure towards a productive activities than financing the past debt burden. Moreover, the result is largely in line with previous evidence for different countries; for instance, the result found by Ilzetzki (2011) for South Africa, Mountford and Uhlig (2009) for US, De Castro and de Cos (2006) for Spain, and Parkyn and Vehbi (2013) for Newzland goes with our result.

Up on impact a government spending shock has a substantial inflationary pressure which in line with the result reported in Claeys (2007). However, price responds negatively nearly from quarter three up to quarter eight where such a response takes a marginal significance for quarters between five and seven. For the remaining response horizon, it responds positively with such effect small in size indicating stability of price in the long run which is intuitive for there would be increased supply due to an expansion in output following a shock in spending.

On the other hand, the response of price to the spending shock computed excluding public debt is almost dissimilar with the response computed accounting for a debt feedback. For instance, it leaves the confidence bound around quarter two, and between quarter five and seven. Under each case, further the response direction they take contrasts with each other (see the price figure and compare the responses between quarter 4 and 7, as well between quarter 8 and 12). Therefore, the results in

this paper support the conventional hypothesis that contractionary fiscal shocks help to ease inflationary pressures in the country.

The interest rate (average cost of debt servicing) is found to have a cyclical response following a shock in spending where the effect is barely significant up on impact. Despite the small size of the response, it slightly picks up a significant positive response around 4th and 6th quarter, and thereafter the effect remains statistically insignificant. A possible explanation for this result is the fact that the interest rate used under examination is the one implied from interest payments on debt rather than a market interest rate. This is quite clear because whether the expansion in government spending increases the debt stock immediately or not; it will affect the actual interest payments on debt only with a lag which is, in reality, a long run phenomenon.

On the other angle, the reported impulse response of the interest rate computed from the standard VAR that do not takes into account the debt dynamics differs in magnitude and direction at times from a response constructed with debt dynamics following the same size of shock in spending. And from this, we can draw an inference on the possible danger of failing to account the feedback effects of public debt to macroeconomic variables in Ethiopia.

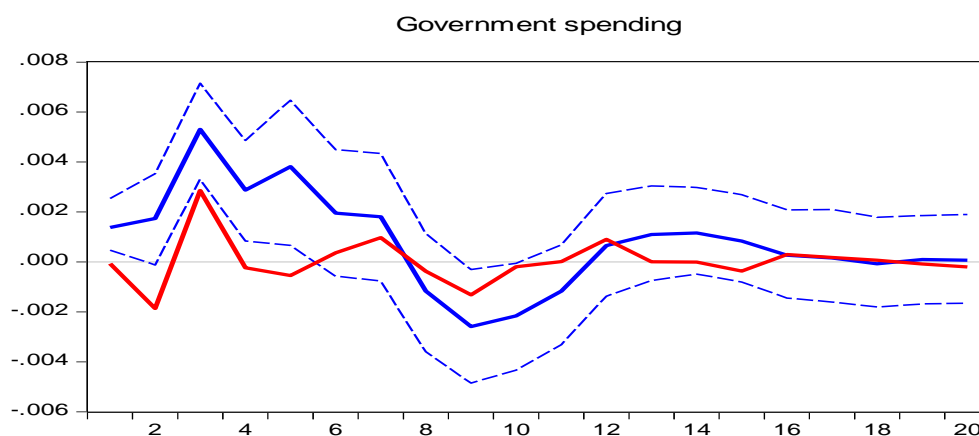
The nominal exchange rate shows an improvement roughly for the first year of the response period following an increase in expenditure. However, this is not the case for the subsequent forecast periods for it has showed deterioration. This means that an expansion in public spending causes a deterioration of nominal exchange rate in the long run. This is probably holds true given the heavy reliance of the country on imported goods.

5.5.2 Effects of Government Revenue Shock

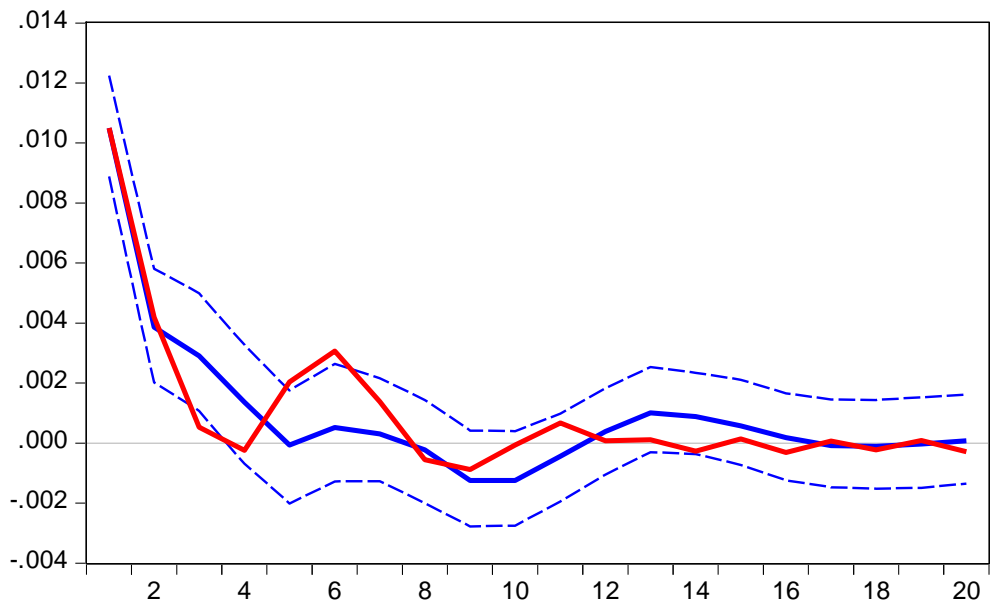
Figure 5.3 below as well provides the responses of the variables treated as endogenous to the shock in government revenue. A one percent of GDP shock to government revenue has resulted in a significant increase in government expenditure up to quarter six with the highest response occurring in the 3rd quarter. Expect a short lived negative response observed between 8th and 12th quarter, the positive response prevails for the rest of forecast horizon though the reported response turns out to be hardly significant. This effect is intuitive given the significant size of the government involvement in the economy. Besides, higher revenues allow a greater government spending in the future which is very important for countries like Ethiopia.

The size of government expenditure response estimated under no public debt feedback rule apparently differs from what is estimated under a debt feedback rule. Right up to quarter six, it exits the confidence bounds of impulse response collected taking into account the debt feedback effect. Thereafter, the response quickly fades away towards the end of response horizon. The so constructed response, however, potentially hides important information of the variable and creates a room for biased results and wrong policy conclusions to be drawn from it.

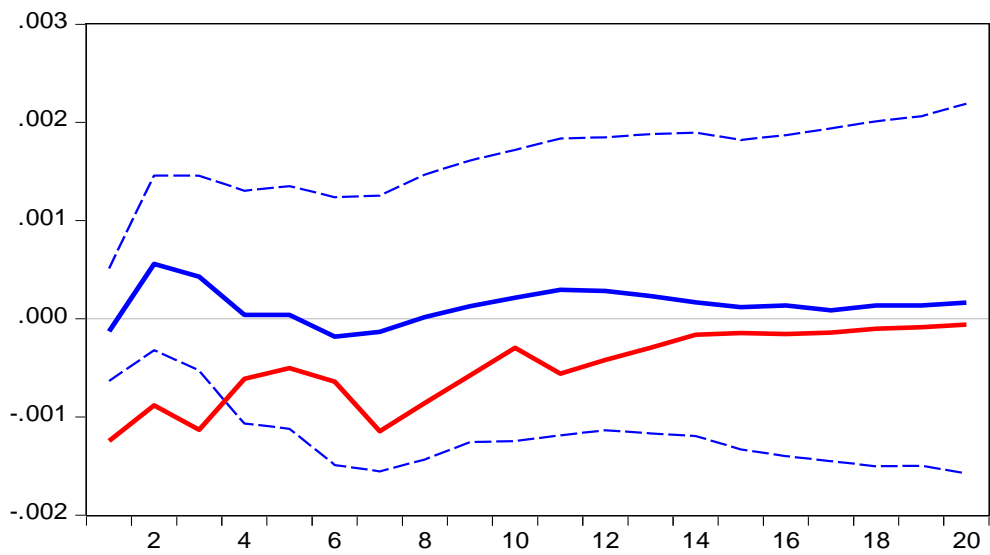
Figure 5.3: Responses to an increase in revenue



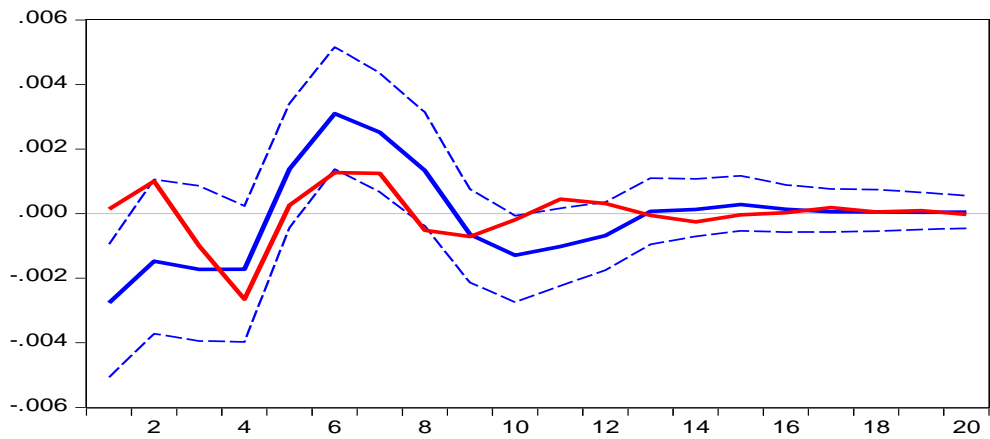
Government revenue

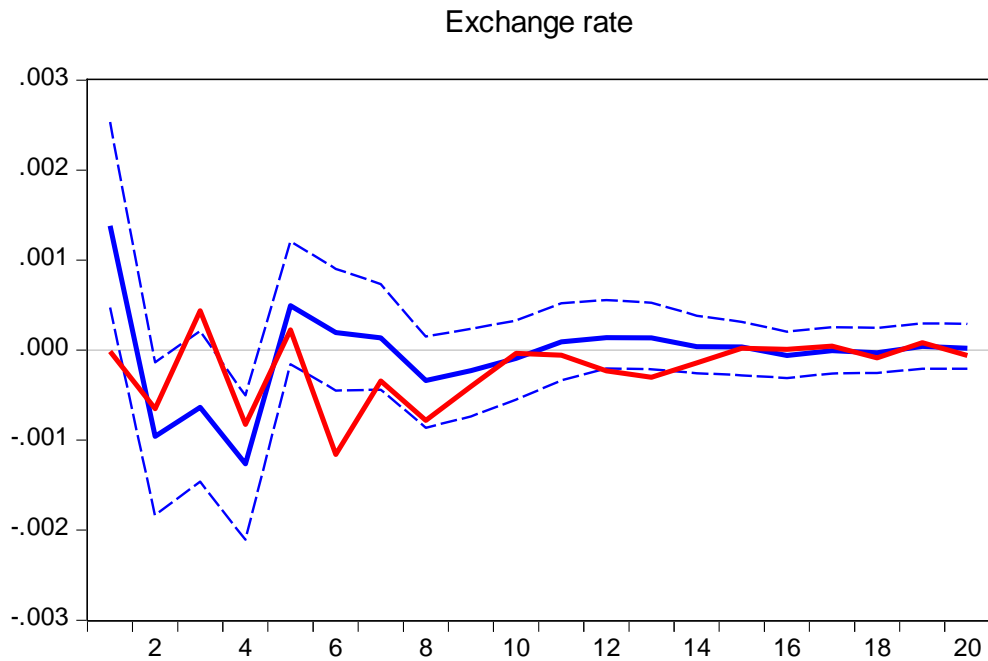
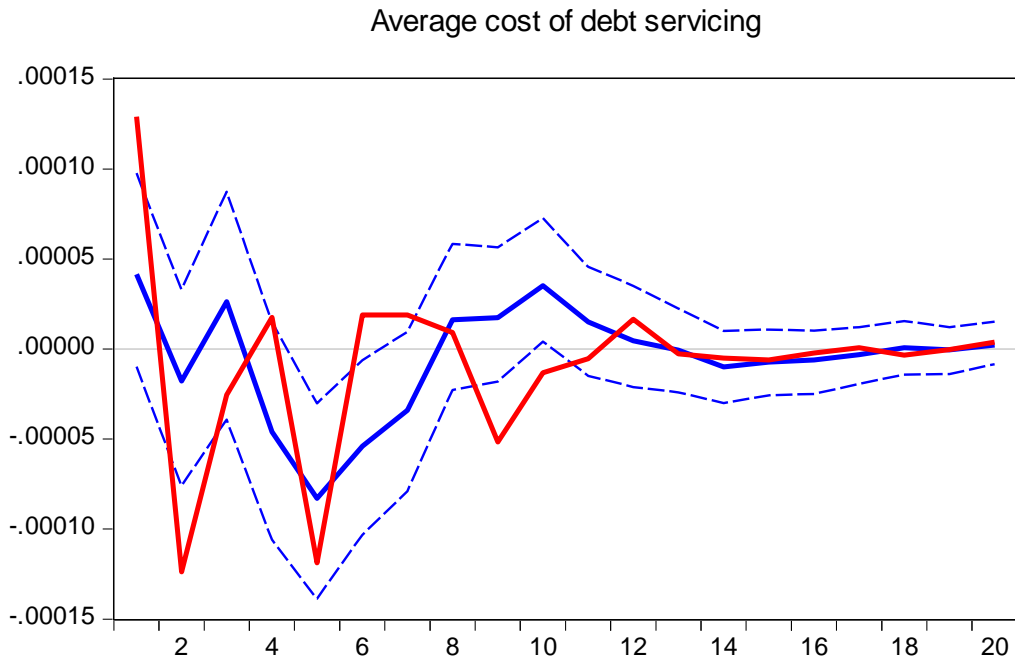


RGDP



Price





Following its own shock, government revenue responds positively up to quarter seven and then it shows a negative reaction between quarter eight and eleven. Its positive and significant effect observed for the first four quarters might be linked with the considerable growth of the economy observed for the last decade. An insignificant response seen towards the end of the forecast horizon, however, could probably be a

sign of economic distortion that an exogenous increase in government revenue might bring in the long run.

For initial periods, the response of government revenue reflects a sort of similarity under debt and no debt feedback rule following its own shock whereas a variation is observed in the middle of the response horizon.

The reaction of output to the positive shock in revenue is almost positive, small in size, i.e., roughly close to zero and statistically insignificant for the entire response horizon. The result is consistent with what Ilzetki (2011) found for South Africa and Dungey and Fry (2009) for Newzland, where the later two individuals using a sign approach of shock identification found a small but positive impact of revenue increase on output both in the short and long run. Besides, there is some uncertainty associated with its response¹⁸. This pattern of output response could probably be linked with the inefficiencies in tax revenue collections and administrations, and it might be an evidence for the prevailing corruption in the country. It could also partly make sense for the response of revenue following its own shock stays for a short time which, I argue, would seem to make the revenue shock to barely have a noticeable, significant influence on output. This explanation further seem partly convincing for a possible reason that a government might be using an increase in revenue to finance a past debt accumulation than diverting it to stimulate output.

More importantly, the result is highly sensitive to the size and choice of the elasticity of revenue to output, and to the alternative means of identifying revenue shocks. It

¹⁸ The wider confidence interval indicates the uncertainty associated with the response of GDP which makes our conclusion about the long run effect rather weak.

would, therefore, be a useful area for further work which, in fact, hinges on the availability of longer high frequency data sets in the country.

The response of output computed without accounting for a debt feedback remains being negative almost for the entire forecast horizon. This result is hardly acceptable and does not give an intuition given an encouraging growth of output observed for the last ten years in the country. Given this growth in output, we would arguably expect a positive reaction of output to be replicated at least for some quarters of the forecast horizon. However, this did not materialize under no-debt feedback scenario.

A positive shock to the government revenue has played in pressing inflation down upon impact. Nevertheless, very shortly price appears to go up with the peak response falling in the sixth quarter. Around this quarter, it is shown that the response takes a hump-shaped pattern with its clear statistical significance. It then turns out to be stable towards the final periods of response horizon.

The observed effect of price is quite intuitive for it partially explains the limited role of revenue and or taxation measures in bringing the price stability in the country. To assure the price stability a taxation measures should be complemented with other measures, say, making the supply side factors work well. The response computed with no debt dynamics, like the other variables, varies in direction and size roughly up quarter fifteen as compared with the response collected augmenting the model by a public debt.

Following a shock to the revenue, the average cost of debt servicing takes a positive response at some quarters where as it takes a negative response at other quarters though such responses turn out to be insignificant with the exception between quarter four and six. Moreover, the computed response is small and eventually vanishes

towards the end of a forecast horizon. The effect could probably be connected with the way this variable is used and defined for the analysis. As explained earlier in the paper, it is the average cost of debt servicing and the same reasons put forward for its reaction to the spending shock would normally hold here, too. It would give a pronounced effect at longer horizons or with significant lags.

Turning to a nominal exchange rate reaction to the revenue shock, it deteriorates upon impact. Then it appears to improve between a second and fifth quarter. For the remaining response horizon, nevertheless, the effect eventually fades away, playing around zero. Though the observed outcome could arguably be taken as an indicative of a country's huge demand for foreign currency, it would be noteworthy to carry out additional study in this area. This makes sense for the different components of government revenue, say for instance, export tax revenue, import tax revenue, etc will have their specific influence on the exchange rate.

On the other hand, the importance of accounting for debt feedback effect is further become apparent with the response of average cost of debt servicing and exchange rate following the government revenue shock. It is evident that the effects of these variables have showed a significant variation in size and magnitude as they are regressed with and without debt-to-GDP ratio.

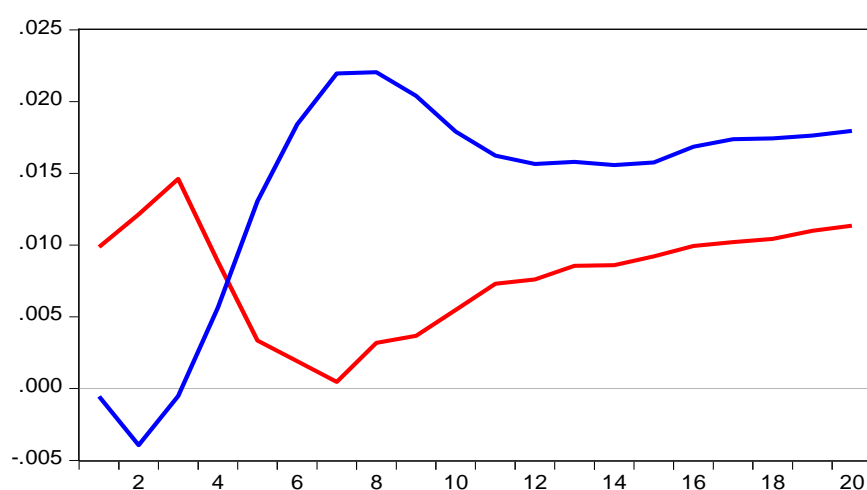
5.6 Responses of Debt ratio to Spending and Revenue Shock

This section presents the impulse responses of the debt to GDP ratio following the shocks in government expenditure and revenue. Investigating the reaction of debt to these shocks help us to identify the relative importance of expenditure and revenue measures for its stabilization and/or reduction purpose. In view of that, figure 5.4

below gives the accumulated response of debt to GDP ratio following each shock. The response path reported by the red line indicates a debt ratio reaction to expenditure shock whereas a blue colored line applies for its response to the revenue shock

As can be seen from the figure, a positive discretionary increase in government expenditure is estimated to increase the debt-to-GDP ratio for the entire horizon which is also in line with the economic theory. The effect is moderate in magnitude indicating a discretionary government expenditure increases have introduced less volatility into debt to GDP dynamics. This could perhaps indicate less of a deleterious effect of debt to GDP changes on the economy. As we notice from a preceding discussion, a significant expansion of output following a shock to the government expenditure could further somehow support less of a disruptive effect of debt in the country. This effect might also make sense due to a significant debt cancellation made to the country.

Figure 5.4: Accumulated response of debt-to-GDP ratio



When we turn to see what revenue shock procedures on debt dynamics, it decreases a debt ratio at impact. However, the duration of this response is only short lasting and

debt ratio subsequently embarks on to take a positive response. This positive response of debt ratio further appears to a bit larger in magnitude as compared to its response associated with the expenditure shock.

From the above outcome, we could essentially draw a lesson that a less disruptive influence of debt ratio associated with the expenditure shock should not be taken for granted in the long run. This is because the introduced revenue increase is evidenced in bringing no or less stabilization in debt ratio for upcoming periods. Though in some way the outcome reflects the deficit nature of a country's fiscal position, it calls for adjustments in fiscal stance that might be more effectively implemented on the expenditure side. This helps to play down what would be a deleterious effect of debt on the real economy from its possible accumulation.

CHAPTER SIX

Conclusion and Policy Implications

6.1 Conclusions

Recent years have seen a gradual resurgence in the emphasis given to fiscal policy as a tool for achieving macroeconomic stabilization. Motivated by this renewed recognition for its impact on the aggregate economy and little previous literatures on it in Ethiopia, in this paper we studied the effects of fiscal policy shocks under a debt feedback setup on Ethiopian economy by using a Structural Vector Autoregressive (SVAR) model for a period covering 1999 - 2013 by exploiting a quarterly data. To address the identification problem of shocks, a recent popular approach proposed by Blanchard and Perotti (2002) is employed, through which each shock is identified by exploiting decision and implementation lags of policy; and institutional information about the elasticity of fiscal variables to the economic activity.

From the computed values of exogenous elasticity of fiscal variables to the economic activity, the elasticity of government revenue to the output is found to be relatively low and somewhat puzzling. A possible explanation behind this outcome, however, could be associated with while the correlation between automatic stabilizers might be large; they would have been consistently offset by discretionary tax reliefs. It could also be so due to the lower tax bases and widespread corruption in tax collections in the country.

Besides, a remarkable contribution of the paper over the recent literature is its explicit accounting for the possible feedback effects of public debt. Consequently, the results

of both government expenditure and revenue shocks confirm the argument that ignoring the reactions of fiscal and macro variables to the public debt and vice versa can produce incorrect estimates of the effects of fiscal policy for Ethiopia. And, the finding is consistent with the evidence Ilzetzki (2011) found for Brazil and Estonia, Caprioli and Momiglian (2011) for Italy and Parkyn and Vehbi (2011) for Newzland.

The empirical result that comes out from the above framework further indicates a positive government spending shocks, in general: (i) have an expansionary effect on output; (ii) lead to a quick rise in prices; (iii) have a small varied effect on average cost of debt refinancing; (iv) deteriorate nominal exchange rate in the long run; and (v) lead to increase in debt-to-GDP ratio.

On the other hand, a discretionary increase in government revenues in general: (i) have a less clear cut, small positive effect on output; (ii) bring a temporary price stabilization effect; (iii) entail no meaningful effect on average cost of debt servicing; (iv) improve nominal exchange rate temporarily; and (v) have a less stabilization effect on debt-to-GDP ratio.

6.2 Policy Implications

Based on the empirical findings of the paper the following policy implications are drawn.

- ✓ While a discretionary increase in government spending entails an output expansion, it should not be taken for granted due to its immediate inflationary impact.
- ✓ Due to a less persistent response of revenue, a caution must be taken to make sure that an expansion in spending should not lead to an increased debt accumulation.

- ✓ To ensure the improvement of a nominal exchange rate of Birr, the country's export potential must be increased.
- ✓ A less clear cut positive response of output to the revenue shock suggests a better revenue collection and administration effort could boost growth even in the long run. Expanding a tax revenue bases could further help to address this issue.

6.3 Further Research Area

The results discussed in this study, in general, are informative; however, they have to be cautiously interpreted. This is because one, they are slightly sensitive to the, in relative speaking, low number of observations available for the analysis; second, the result will also be sensitive to the alternative shock identification approach and exogenously determined elasticity of fiscal variables; third, estimating the correct effects of fiscal policy essentially requires non- interpolated time series data. Nevertheless, in this study due to the absence of official quarterly data on some variables, interpolating these variables data is undertaken for which it would not be free from econometric issues associated with such interpolation.

Therefore, a possible future extension of the current work would be replicating it under longer data set. As well, since the output elasticity of government revenue is an important input in determining the structural relationships among the variables, its precise measure requires a future work. Likewise, it would be useful to assess the effects of fiscal shocks through other alternative methods of identifying such shocks. By the same token, it would be appealing to investigate the effects of fiscal shocks on the private components of GDP, say private investment and private consumption so as to disentangle the crowding out effects of government spending.

REFERENCE

- Abel, A., Bernanke and Croushore (2008) *Macroeconomics*. Sixth Edition, Pearson Education, Inc.
- AfDB (2002) 'African Economic Outlook', African Development Bank, pp. 131-140.
- AfDB (2004) 'African Economic Outlook', African Development Bank, pp. 133-146.
- AfDB (2011) 'Inflation Dynamics in selected East African countries: Ethiopia, Kenya, Tanzania and Uganda', *African Development Bank Brief*.
- AfDB(2012) 'African Economic Outlook', African Development Bank, pp. 1-12.
- AfDB (2013) 'African Economic Outlook: Structural Transformation and Natural Resources', *OECD Publishing*.
- Afonso, A., and Sousa, R., (2009) 'The Macroeconomic Effects of Fiscal policy', *European Central Bank Working Paper Series*, No. 991.
- AFRODAD (2006) 'The Challenges of Debt Sustainability in Africa: The Case of Ethiopia', African Forum and Network on Debt and Development, Harare, Zimbabwe.
- AFRODAD (2013) 'Ethiopia Country Profile', African Forum and Network on Debt and Development, pp. 1 -13, Harare, Zimbabwe.
- Alemayehu, G., (2010) *Readings on Ethiopian Economy*. Addis Ababa University Press, Addis Ababa.

Alemayehu, G., and Kibrom, T., (2011) 'The Galloping Inflation in Ethiopia: A Cautionary Tale for Aspiring 'Developmental States' in Africa', *IAES Working Paper*, No. A01-2011.

Amisano, G., and Giannini, C., (1997) *Topics in Structural VAR Econometrics*. 2nd ed, Springer-Verlag, Berlin.

Artana, D., and Naranjo, F., (2003) 'Fiscal Policy Issues in Jamaica: Budgetary Institutions, the Tax System and Public Debt Management', *Inter-American Development Bank Economic and Sector Study Series*.

Baxter, M., and King, R.G. (1993) 'Fiscal policy in general equilibrium', *American Economic Review*, 83, pp. 315-334.

Blanchard, O., and Perotti, R. (2002) 'An empirical characterization of the dynamic effects of changes in government spending and taxes on output', *Quarterly Journal of Economics*, 119, pp. 1329-1368.

Blanchard, O., and Quah, D., (1989) 'The dynamic effects of aggregate demand and supply disturbances', *American Economic Review*, 79, pp. 655-673.

Beetsma, R., (2009) 'A survey of the effects of discretionary fiscal policy', *Working Paper*, University of Amsterdam.

Benedict, C., Bhattacharya, R., And Nguye, Q., (2003) 'External Debt, Public Investment, and Growth in Low-Income Countries', *IMF Working paper*, WP/03/249.

Boyes, W., and Melvin, M., (2011) *Macroeconomics*. 8th ed., Macmillan Company.

BTI (2012) 'Ethiopia Country Report', *Bertelsmann Stiftung*, Gütersloh, pp. 1-40.

- Caldara, D., and Kamps, C., (2008) 'What are the Effects of Fiscal Policy Shocks? A VAR-based Comparative Analysis', *ECB Working Paper Series*, 877.
- Caprioli, F., and Momigliano, S., (2011) 'The effects of fiscal shocks with debt-stabilizing budgetary policies in Italy', *Banka D'Italia Eurosystema working paper*, No. 839.
- Cherif, R., and Hasanov, F., (2012) 'Public Debt Dynamics: The Effects of Austerity, Inflation, and Growth Shocks', *IMF Working Paper*, WP/12/230.
- Chukuigwe, C., and Abili, D., (2008) 'An econometric analysis of the impact of monetary and fiscal policies on non-oil exports in Nigeria: 1974-2003', *African Economic and Business Review*, Vol. 6, No. 2.
- Chung, H. and D. Leeper, (2010) 'What has Financed Government Debt?', *National Bureau of Economic Research Working Paper*, 13425.
- Claeys, P., (2007) 'Estimating the effects of fiscal policy under the budget constraint', *Research Institute of Applied Economics Working Paper*, 2007/15, 45 pages.
- Cuaresma, C., Eller, M., and Mehrotra, A., (2011) 'The Economic transmission of fiscal policy shocks from Western to Eastern Europe', *BOFIT Discussion Paper*, 12.
- Daniel A. (2012) *Empirical Characterization of the Dynamic Effects of Fiscal Policy Shock on Key Macroeconomic variables in Ethiopia*. MSc thesis, Addis Ababa University.
- De Castro, F., and de Cos, H. (2006) 'The Economic Effects of Exogenous Fiscal Shocks in Spain a SVAR approach', *European Central Bank Working paper series*, No. 647.

- De Castro, F., and de Cos, H. (2008) 'The economic effects of fiscal policy: the case of Spain', *Journal of Macroeconomics*, 30, pp. 1005-1028.
- De Castro, F., and Fernández-Caballero, L., (2011) 'The Effects of Fiscal Shocks on the Exchange Rate in Spain', *Bancomadespana Documentos de Trabajo*, No. 1121.
- Dungey, M., and Fry, R. (2009). 'The identification of fiscal and monetary policy in a structural VAR', *Economic Modelling*, 26(6), pp. 1147-1160.
- Eden, S., (2012) *Modeling Inflation Volatility and its Effect on Economic Growth in Ethiopia*. MSc thesis, Addis Ababa University.
- Elmendorf, D., and Mankiw, G., (1998) *Government Debt*. Hand Book of Macroeconomics.
- Enders, W., (2004) *Applied Econometric Time Series*. John Wiley & Sons: Singapore.
- Estevao, M., and Samake, I., (2013) 'The Economic Effects of Fiscal Consolidation with Debt Feedback', *IMF Working Paper*, WP/13/136.
- Fatás, A., and Mihov, I., (2001) 'The Effects of Fiscal Policy on Consumption and Employment: Theory and Evidence', *CEPR Discussion Paper*, No. 2760.
- Favero, C., (2001) *Applied Macroeconometrics*. Oxford University Press.
- Favero, C., (2002) 'How Do European Monetary and Fiscal Authorities Behave?', *CEPR Discussion paper*, No. 3426.
- Favero, C. A., and F. Giavazzi, (2007) 'Debt and the Effects of Fiscal Policy', *NBER Working paper*, No.12822.

Favero, C., Giavazzi, F., and Perego, J., (2011) 'Country Heterogeneity and the International Evidence on the Effects of Fiscal Policy', *NBER Working Paper*, No. 17272.

Franta, M., (2012) 'Macroeconomic Effects of Fiscal Policy in the Czech Republic: Evidence Based on Various Identification Approaches in a VAR Framework', CNB working paper series, 13.

Haile, K., (2001) *Monetary Policy and the Monetary Approach to Balance of Payment in Ethiopia*. MSc thesis, Addis Ababa University.

Helen, B., (2012) *Exchange Rate Pass-through to Import and Consumer Prices: Evidence from Ethiopia*. MSc thesis, Addis Ababa University.

Heppke-Falk, K.H., Tenhofen, J. and Wolf, G.B., (2006) 'The Macroeconomic Effects of Exogenous Fiscal Policy Shocks in Germany: a Disaggregated SVAR Analysis', *Deutsche Bundesbank Economic Studies Discussion Paper Series*, 1, No. 41/2006.

Hamilton, J., (1994) *Time Series Analysis*. Princeton University Press.

Ilzetki, E., (2011) 'Fiscal Policy and Debt Dynamics in Developing Countries', *World Bank Policy Research Working Paper*, No. 5666.

IMF (2012) 'Debt Sustainability Analysis: The Federal Democratic Republic of Ethiopia', *International Monetary Fund and the International Development Association*.

Johansen, S., (1995) *Likelihood-based Inference in Cointegrated Vector Autoregressive Models*. Oxford University Press.

Kim, S. (2007) 'The economic effects of government spending and taxes in Korea: A structural VAR approach', *Korean Journal of Public Finance*, 22, pp. 3-33.

Ko, J., and Morita, H., (2011) 'Fiscal Policy under the Debt Feedback Rule: The Case of Japan', *Economics Bulletin*, Vol. 31(3), pp. 2373-2387.

Lütkepohl, H., (2005) *New Introduction to Multiple Time Series Analysis*. Berlin: Springer.

Lütkepohl, H., and Krätzig, M., (2004) *Applied Time Series Econometrics*. Cambridge University Press, Cambridge.

Mankiw, G., (2010) *Macroeconomics*. Seventh Edition, Worth publishers.

Matthew, D., Eggertsson, B., and Sophia, G., (2012) 'Deficits, Public Debt Dynamics, and Tax and Spending Multipliers', *Federal Reserve Bank of New York*, No. 551

McConnell and Brue (2008) *Macroeconomics*. Seventeenth Edition.

Melecky, A., and Melecky, M., (2011) 'Analyzing the Impact of Macroeconomic Shocks on Public Debt Dynamics: An Application to the Czech Republic', *MPRA Paper*, No. 34114.

MoFED (2004) 'Millennium Development Goals Report: Challenges and Prospects for Ethiopia, Volume 1: Main text', Ministry of Finance and Economic Development Addis Ababa, Ethiopia.

MoFED (2010) 'Growth and Transformation Plan, 2010/11-2014/15, Volume I: Main text', Ministry of Finance and Economic Development, Addis Ababa, Ethiopia.

MoFED (2011) 'Macroeconomic Developments in Ethiopia', *Annual Report*, Ministry of Finance and Economic Development, Addis Ababa, Ethiopia.

MoFED (2012) 'Ethiopia's Medium Term Debt Management Strategy (2013-2017)', Ministry of Finance and Economic Development, Addis Ababa, Ethiopia.

Mountford, A., and Uhlig, H., (2009) 'What are the effects of fiscal policy shocks? ', *Journal of Applied Econometrics*, 24, pp. 960-992.

NBE (2011/12) 'Annual Report 2011/12', National Bank of Ethiopia, Addis Ababa, Ethiopia.

NBE (2012/13) 'Annual Report 2012/13', National Bank of Ethiopia, Addis Ababa, Ethiopia.

Parkyn, O., and Vehbi, T., (2013) 'The Effects of Fiscal Policy in New Zealand: Evidence from a VAR Model with Debt Constraints', *New Zealand Treasury Working Paper*, 13/02.

Pedro, Martins., (2011) 'Fiscal Daynamics in Ethiopia: The co-integrated VAR Model with Quarterly Data', *Credit Research Paper*, No.10/05.

Perotti, R. (2002) 'Estimating the effects of fiscal policy in OECD countries', *CEPS working paper*, No. 15.

Perotti, R. (2004) 'Estimating the effects of fiscal policy in OECD countries', *CEPR discussion paper*, 4842.

Perotti, R. (2007) 'In search of the transmission mechanism of fiscal policy', *NBER working paper*, 13143.

Ramey, Valerie (2009) 'Identifying Government Spending Shocks: It's All in the Timing', *National Bureau of Economic Research working paper series*, 15464.

Ramey, A., and Shapiro, D., (1998) 'Costly Capital Reallocation and the Effects of Government Spending', *Carnegie-Rochester Conference Series on Public Policy*, 48, 145- 194.

Ravnik, R., and Zilic, I., (2010) 'The Use of SVAR Analysis in Determining Fiscal Policy Shocks in Croatia', *Journal of Financial Theory and Practice*, 35 (1), pp. 25-58.

Rena, R., and Kefela, T., (2011) 'Restructuring a fiscal policy encourages economic growth – a case of selected African countries', *Journal of Economics and Business*, XIV (2), pp. 23-39.

Romer, C. and Romer, D., (2007) 'The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks', *NBER*, WP 13264.

Sims, C. A. (1980) 'Macroeconomics and Reality', *Econometrica*, 48(1), pp. 1-48.

Teshome K. (2006) *The impact of government spending on Economic Growth in Ethiopia*. MSc thesis, Addis Ababa University.

Transparency International (2014) 'Global Corruption Perceptions Index', <http://www.transparency.org>.

Uhlig, H., (2005) 'What Are the Effects of Monetary Policy on Output? Results from an Agnostic Identification Procedure', *Journal of Monetary Economics*, 52 (2), pp. 381-419.

UN Commission for Africa (2013) 'Tracking Progress on Macroeconomic and Social Developments in the Eastern Africa Region, Towards High Quality Growth and Structural Transformation in the Eastern Africa Region', *Sub-regional Office for Eastern Africa*.

Yang, W., (2013) *Macroeconomic Effects of Fiscal Policy*. A Doctoral Thesis, Brunel University.

Appendix A: Diagnostic Test Results for a Model with Debt feedback

A1: Unit Root Test

H ₀ : Variable has unit root		ADF and PP Test Statistics and Critical Values			
		Level	Intercept	Trend	First difference
G_SA	ADF	1.990770 (-1.946996)	-0.502562 (-2.916566)	-4.637757(-3.493692)	
	PP	3.094823(-1.946878)	-0.150823 (-2.915522)	-4.633918 (-3.493692)	
R_SA	ADF	3.522601(-1.947248)	2.853007(-2.925169)	-0.439291(-3.508508)	-0.580466 (-1.948313)
	PP	4.694890 (-1.946878)	1.866836(-2.915522)	-1.935231(-3.493692)	-7.820866(-1.946996)
Y_SA	ADF	7.885579 (-1.946878)	1.466932(-2.915522)	-2.103511(-3.493692)	-0.928425 (-1.947381)
	PP	8.187715(-1.946878)	1.466932 (-2.915522)	-2.103511(-3.493692)	-4.473902(-1.946996)
P	ADF	-2.967232 (-1.947248)			
	PP	-4.818332 (-1.946996)			
I	ADF	-1.235653 (-1.947381)	-6.581772 (-2.916566)		
	PP	-2.156291 (-1.946996)			
S	ADF	-2.255183 (-1.947119)			
	PP	-4.080062(-1.946996)			
D	ADF	2.680187(-1.947520)	1.726250 (-2.921175)	-0.900374 (-3.508508)	-0.402026 (-1.947975)
	PP	4.763452 (-1.946878)	1.775627(-2.915522)	-1.532265 (-3.493692)	-6.400519 (-1.946996)

Note: - The null hypothesis of unit root is rejected if the test statistic is less than the test critical values corresponding to the significance level. The figures in the bracket in each cell are the test critical values at 5 percent significance level for both tests. The bold highlighted values indicate the stationarity of the variables.

A2: Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	699.3043	NA	1.27e-19	-26.48252	-25.57343	-26.13513
1	770.6845	114.7681	3.27e-20	-27.86998	-25.59724*	-27.00150*
2	799.5111	39.56594	4.79e-20	-27.58867	-23.95229	-26.19910
3	847.0966	54.11683*	3.83e-20	-28.04300	-23.04298	-26.13235
4	902.1727	49.67647	2.85e-20*	-28.79109*	-22.42742	-26.35934

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

A3: Serial Correlation LM Tests

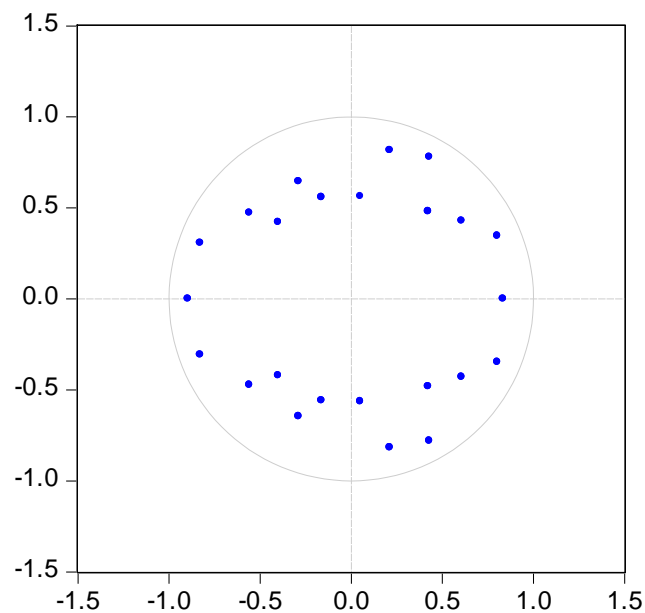
Null Hypothesis: no serial correlation at lag order h

Lags	LM-Stat	Prob
1	34.74890	0.5280
2	25.89598	0.8933
3	37.69510	0.3916
4	37.86777	0.3841

Probs from chi-square with 36 df.

A4: Model Stability test

Inverse Roots of AR Characteristic Polynomial



A5: Residual Normality Test

Orthogonalization: Cholesky (Lutkepohl)

Null Hypothesis: residuals are multivariate normal

Component	Jarque-Bera	df	Prob.
1	7.383640	2	0.0249
2	1.582195	2	0.4533
3	34.58251	2	0.0000
4	0.814087	2	0.6656
5	67.61966	2	0.0000
6	7.271694	2	0.0264
Joint	119.2538	12	0.0000

Appendix B: Diagnostic Test Results for a Model with no Debt Feedback

B1: Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	663.6169	NA	3.22e-19	-25.55360	-25.09906	-25.37991
1	747.4467	141.3601	5.01e-20*	-27.42928	-25.61110*	-26.73450*
2	780.3978	47.81139	6.06e-20	-27.30972	-24.12789	-26.09385
3	823.6369	52.56518*	5.46e-20	-27.59361	-23.04813	-25.85665
4	869.6276	45.08885	5.32e-20	-27.98539*	-22.07628	-25.72735

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

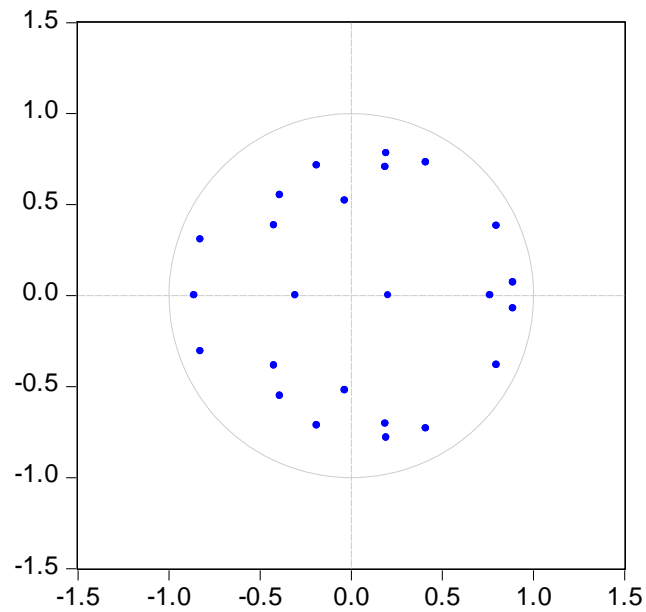
B2: Serial Correlation LM Tests

Lags	LM-Stat	Prob
1	40.29538	0.2859
2	35.09872	0.5113
3	44.59071	0.1542
4	34.79632	0.5257

Probs from chi-square with 36 df.

B3: Model Stability Test

Inverse Roots of AR Characteristic Polynomial



B4: Residual Normality Test

Orthogonalization:Cholesky(Lutkepohl)

Null Hypothesis: residuals are multivariate normal

Component	Jarque-Bera	df	Prob.
1	0.207304	2	0.9015
2	1.619405	2	0.4450
3	45.30524	2	0.0000
4	1.974178	2	0.3727
5	75.75882	2	0.0000
6	20.02235	2	0.0000
Joint	144.8873	12	0.0000

Declaration

I declare that this thesis is my original work and has not been presented for a degree award in any other university, and that all sources of materials used for the thesis have been duly acknowledged.

Declared by: _____ Signature: _____

Date: _____

Confirmed by Advisor: _____ Signature: _____

Date: _____

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