Impact of Government Expenditure Shock on Private Investment in Ethiopia: A Recursive Dynamic CGE Analysis

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This is to certify that the thesis prepared by Haile Regassa Badassa, entitled: **Impact of government expenditure shock on private investment in Ethiopia: A recursive dynamic computable general equilibrium analysis** and submitted in partial fulfillment of the requirements for the Degree of Masters 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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Haile Regassa Badassa

Ethiopian government targeted sustainable economic growth with stable macroeconomic environment through expanding government expenditure, revenue and private investment. But the relationship between government spending and private investment is source of controversy in both theoretical and empirical perspective. This study examines the impact of government expenditure specifically (human capital, electricity and public consumption) shock on private investment using a recursive dynamic CGE model with the recent SAM of the country. To see the impact of each categories of spending we use four source of finances which include shift of resource from public administration, tax, foreign saving and tax and foreign saving for both human capital and electricity spending but one source which is tax for public consumption spending. Under all sources of finance, human capital and electricity spending exert positive impact on variables under consideration including private investment which easily reconciled with Keynesians argument. But the size of impact of each spending under each source is different. Both human capital and electricity financed via foreign saving bring a greater positive impact on private investment in Ethiopia. In contrast to this, public consumption financed via tax imposes negative impact on all variables including private investment which can be reconciled with neoclassical view. Therefore, financing human capital and electricity spending via foreign saving and decreasing public consumption is sound to bring private investment to desired place in the country

Key words*: Government expenditure, Private Investment, SAM, CGE*

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List of Acronyms

CES	Constant Elasticity of Substitution
CGE	Computable General Equilibrium
ECB	European Central Bank
EDRI	Ethiopian Development Research Institute
EIA	Ethiopian Investment Commission
ETB	Ethiopian Birr
GDP	Gross Domestic Product
GTP	Growth and Transformation Plan
GTP I	Growth and Transformation Plan One
GTP II	Growth and Transformation Plan Two
GW	Giga Watt
IMF	International Monetary Fund
KM	Kilometer
MoFEC	Ministry of Finance and Economic Cooperation
MDG	Millennium Development Goal
MW	Mega Watt

NBE	National Bank of Ethiopia
NPC	National Planning Commission
OECD	Organization for Cooperation of Economic and Development
RGDP	Real Gross Domestic Product
ROW	Rest of the World
TFP	Total Factor Productivity
SAM	Social Accounting Matrix
VAR	Vector Autoregressive
VEC	Vector Error Correction

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

One of the fundamental questions of all countries is how to attain vigorous, faster and sustained economic growth. Among a number of alternative factors, that boosts economic growth, investment plays critical role.

Investment spending determines rate at which economy adds to its stock of capital and thus helps to bring economy's long run growth and productivity performance (Dornbusch and Fischer, 2004). Investment is important part of economic development. Through investment, several of production facilities will be provided, thus will give optimal production output and value added, as a result can improve the economy (Suhendra and Anwar, 2014). Investment can be made either by public or by the private sector; however, the growth effect has been more consistently positive for private capital **(**Lofgren and Robinson, 2004**).**

The private sector is seen as the efficient and driving force for economic growth and development compared with the public institutions and therefore clearing their way and expanding private sector participation especially in developing countries through privatization programmes, liberalization policies and other policies are flourishing (Badawi, 2005).

Private investment increases the productive capacity of an economy, drives job creation, brings innovation & new technologies, and boosts income growth. Unfortunately, policymakers do not tend to give much practical attention to such a link between investment and socio-economic progress (Sima, 2007). Thus, the amount of private

investment, particularly in Africa and other developing economies, falls short of development needs and the benefits of investment in emerging and transition economies are much better reaped than those by the African Nations (IMF, 2009).

According to Sackey (2007) private investment rate moved per capita income growth rate from negative to positive therefore the perception on investment climate constraint needs to be integrated into policy strategies being mapped out to encourage private sector performance in Africa.

The idea of developing private sector as an alternative development strategy to improve economic growth and reduce poverty in developing countries emerged in late 1980's. The International Monetary Fund and World Bank through International Financial Corporation are the forerunners of this strategy in many developing countries (Abdulsemed, 2011).

In addition to private investment, government investments are also critical in determining the rate of economic growth, the levels of private investment and the magnitude of credit to the private sector (Udah, 2010).

Minale (2002) objective of the fiscal policy was to strengthen public sector savings, with the twin aim of making available additional domestic and foreign reserves to develop the private sector and of supporting. But the direction of relationship between the two investments is the not common throughout countries in the world. That means government expenditure may have crowd in effect in one period and crowd out effect in other period in the same country and also it is different across countries.

With the renewed interest in the role of the private sector as an engine of economic growth, the examination of the relationship between government expenditure and private

investment is given further impetus and became controversial issue that demand further research from time to time.

According Muhdin (2016) and IMF (2014**)** to promote private sector investment, needs to improve real income of people; maintain macroeconomic stability and make public investment in basic infrastructures and institutions that are fundamental to promote private investment however public investment should be slow than private.

Due to government inefficiency to bring vigorous economic growth over the period in which government played the leading role in the economy, there was a change in the direction through which the change will come by minimizing role of government in economy. To this end, market oriented structural reform programs such as privatization and deregulation were come to existence to ensure a reduction in the role of government in the economy. The guiding principle in this redefined role of government was that government should concentrate its resources in areas that compliments rather than crowd-out private sector investment, thereby creating an enabling environment for the private sector investment (Frew, 2014).

The Ethiopian economy is a mixed system in which the government and the private sector co-exist. The two could play complimentary roles to enhance economic growth. Thus, it is in line with this that the use of government expenditure to enhance private investment is being advocated.

To tackle the less productiveness in public expenditure management and consolidate share of private sectors in economy, Ethiopian government has been introducing broad range of policies and institutional reforms, particularly since 1992 when the structural adjustment program was implemented. One of the major objectives of the reform

program was to rectify the fiscal ills via reorientation of government expenditure, and at the same time enhancing revenue performance with the support of International Monetary Fund and the World Bank as well as other multilateral and bilateral donors (MoFEC, 2010).

According to World Bank (2010) recent developments indicates a trend of increasing government expenditure, especially expenditure on priority sectors of education, health and roads. Total government expenditure as share of GDP has increased to 33.5 percent annual average in 2001/02-2004/05 from 28.8 percent during 1991/92-1995/96 periods. And it is also emphasized that on the evolution of the private sector as an engine of growth with competition as a driving force. Despite increase in government expenditure, the private sector's contribution towards the economy of the country has remained very poor by international standards, when compared with Sub-Saharan countries. The country's domestic private investment to GDP is low; the resource gap between savings and domestic investment is very high. For instance, the resource gap between savings and investment in 2009/10 was 19.4 % which is very high in comparison to the international standard (MoFEC, 2010). This study intends to assess the impact of government shock expenditure on private investment in the country using a dynamic computable general equilibrium (CGE) model.

1.2 Statement of Problem

Fiscal policy is one of the key instruments towards ensuring macro-economic stability for rapid and sustainable economic growth (NPC, 2015). The relation between government expenditures and private investment has been investigated broadly in the literature; however direction of its impact is left without consensus.

Neoclassical arguments mainly focus on the substitutability or complementarity relationships between government expenditure and private investment. The substitutability hypothesis is derived from the view that higher government expenditure on capital goods will raise the rate of capital accumulation beyond the optimal level, as judged by private agents, and this will cause private agents to cut their investment in order to reestablish the optimal rate of capital accumulation in the economy and distortion of tax to finance expenditure also cause private investment to decrease (Barro and Redlick, 2010). Therefore, as the substitute, government expenditure on capital goods will crowd out private investment. In contrast, the complementarity hypothesis emphasizes that government spending on infrastructure and human capital is likely to raise the marginal productivity of private capital and therefore induce more private investment, i.e., it may lead to a crowding-in effect. An important implication of the substitutability and complementarity hypotheses is that the different categories of government expenditure may produce different effects on private investment (Wang, 2004).

But the Keynesian economists argued that increased government expenditures bring about better infrastructure, health and education stimulating private investment (Hussain *et al*, 2009). The government sector can afford costs of large scale investments which

require long time to become profitable and beyond capacity of private sector. Spillovers effects of such investments may be valuable to increase productivity of private sector through reducing production cost (Atukeren, 2005). In this context, government expenditures may encourage private investment which is crucial for better economic growth of a country. The increased government expenditures increase private investments which is called "crowding-in" hypothesis. Public investment in infrastructure unifies fragmented markets, decrease production and information cost then by raising return to private investments but in developing countries public investments in non infrastructure (like public consumption) discourages private investment (Shibeshi, no year). In addition to growth-enhancing investments that complement private sector production, public investment also has included growth-retarding investments that compete with more efficient private sector investments (Lofgren and Robinson, 2004).

These contrasting views gave an interest for researchers to empirically investigate the relationship between government spending and private investment by decomposing government expenditure into different categories to provide insights on the relationship between different forms of government expenditure and private investment because according (Maranhao, 2011) disaggregating government expenditure is best to see its effect on macroeconomic variables in which private investment the one.

Ethiopian government have been used different economic policy and development strategies like gross transformation plan so as to increase private investment to boost economy of the country but use of these mechanisms did not bring a desired result **(**NPC, 2015). Still now, the private sector has been taking a smaller share of a shrinking cake (World Bank, 2016). This revealed as government dominated the economic activities of

the country by changing the expenditure level which is financed through domestic and foreign borrowing which decrease credit to private sector to GDP from 16% in 2004 to 11% in 2014.

According to NBE (2014/15) and MoFEC (2011/12), total government expenditure is witnessed 24.3 percent annual increase where recurrent expenditure share is 45.2 percent while capital expenditure is 54.8 percent. The share of capital expenditure to total expenditure increased from 40 percent in 2003/04 to 54.2 percent in 2014/15. While the share of recurrent expenditure to total expenditure declined from 58 percent in 2003/04 to 45.2 percent in 2014/15. According to IMF (2013) the involvement of the public sector in productive activities and credit allocation may need to be circumscribed and its investment profile made consistent with sustainable financing and the avoidance of crowding out of the private sector.

In Ethiopia government spending and public investment should be lower than private investment to encourage private sector (IMF, 2014). For example public investment in 2011/12, 2012/13, and 2013/14 as percent of GDP was 25.0, 24.6 and 21.75 percent, respectively while private investment as percentage is 8, 8.4, and 8.5 percent, respectively.

There are a number of researchers who have studied on same topic (Fikadu, 2014/15; Frew, 2014) however they have used partial model which focus on single market. But government spending is one core policy instrument which country use to stabilize the economy and this instrument influences other macroeconomic indicators directly or indirectly. Therefore, to fill this gap, this study intends to establish empirically the impact of government expenditure (human capital, electricity and public consumption) shocks on

private investment in Ethiopia using a recursive dynamic computable general equilibrium which is most recommendable policy model and capable of capturing direct and indirect impact of public spending.

1.3 Objective of the Study

1.3.1 General Objective

The main objective of the study is to analyze the impact of government expenditures shock on private investment in Ethiopia.

1.3.2 Specific objective

The specific objectives includes the following

- ☞ To analyze the trend of government expenditure and private investment in Ethiopia
- ☞ To analyze the impact of each component of government expenditure(human capital, electricity and public consumption) financed from different source on private investment

1.4 Significance of the Study

Sustainable economic growth have been core components of development objective and hence among the highest priorities of the government of Ethiopia. Increasing private sector is the basic means of achieving such objectives. However, government spending either encourages or discourage depending on what components it allocates. Thus, this study use very crucial policy model which is rarely employed by different researchers on the same issue, a recursive dynamic computable general equilibrium to provide Ethiopian policy makers with the empirical evidence they need to create priorities for their public

resources spending to strength private investment of the country. By comparing effect of the simulation result of alternative spending strategies on private investment, the study could inform policy-makers with the best strategies which in turn support policy decision on government spending that uphold this core contributor to economic growth.

1.5 Scope of the Study

The scope of this study has been limited to an empirical analysis of the impact of government expenditure on private investment by using recent national SAM of 2009/2010 to project the impact up to 2025. The major focus was given to impact of government expenditure shock on private investment by disaggregating government expenditure into human capital, electricity, and public consumption spending.

1.6 Organization of the Paper

The study is organized as follows. The first chapter discusses background, statement of the problem and objective of the paper which is the heart of it. The second chapter reviews various related literature including theoretical and empirical literature on government expenditure and private investment. Chapter three elaborates different components of government expenditure and private investment in Ethiopia in detail. The fourth chapter introduce about data that used which is social accounting matrix (SAM) and specifies equation and theoretical framework for the CGE models. The fifth chapter simulates the impacts of reforming government spending on private investment in Ethiopia using a dynamic computable general equilibrium. Finally the study provides conclusions and implications.

CHAPTER TWO

REVIEW OF LITERATURE

According to economic theory, investment defined as the per-unit production of goods, which have not been consumed, but will however, be used for the purpose of future production. Examples of this type of investment are tangible goods like constructions of factories or bridge and intangible good like six months of on-the- job training. In terms of national production and income, GDP has an essential constituent, known as gross investments. Investment spending determines rate at which economy adds to its stock of capital and thus helps to bring economy's long run growth and productivity performance **(**Dornbusch and fischer, 2004). Investment is important part of economic development, especially on increase of economic growth. Through investment, several of production facilities will be provided, thus will give optimally production output and value added, as a result can improve the economic growth (Suhendra and Anwar, 2014)

2.1 Theoretical Literature

Theories of investment are varied and immense. There exists a considerable variation in thought among economists as to what determines investment. One reason can be the complex nature of the subject itself. Another reason can be disparities among societies in their institutional and structural setting, which makes the development of universal theory of investment impossible. Here it has to be noted that investment in physical stock of capital (Haavelmo, 1960**;** Lim, 2014). Having this in mind, some of the theories of investment are briefly rived as follows.

2.1.1 Theories of Investment

2.1.1.1 The Classical Theory of Investment

According to classical economists, the capitalist make investment because they expect to earn profit in the future depends on good they produce now. Among the classical economists, the founder one is Adam smith. For example, Adam smith (1776) in his book "The wealth of the nations" elaborates this fact by arguing that, investment were made because the capitalist expected to earn profit and the future expectation with regard to profit depend up on the present climate of investment as well as the actual profit (Eklund, 2013)

2.1.1.2 The Keynesian Theory of Investment

Keynes (1936) was probably the first person who systematically analyzes the issue of investment by considering of saving and rate of interest to increasing the employment opportunities in the country. In this, book "The general theory of Employment, interest and money." Keynes has observed that quantity of desired investment depends on the prospect or marginal efficiency of investment or capital relative to some interest rate, reflecting the opportunity cost of invested funds. On the basis of this, Keynes analysis, the factor that governing the output and employment was explained by using the saving and interest rate. As the marginal propensity of consumption of the people declining, it leads to rising in marginal propensity of saving. That has the consequences of expansion in investment because many credits available for the investors. This investment has multiple effects on the economy of the nation like expansion of output and increase in the opportunity of employment.

2.1.1.3 Neo Classical Theory of Investment

Jorgensen in 1967, Hall, and Jogeenson in 1971 criticize the acceleratory model pointing to its static assumptions and developed on other the neo – classical model that put, net investment as being proportional to the gap between the actual and desired capital stock, which is given by:

$$I_t = k_t - k_{t-1} = \beta(k^* - k_{t-1})$$

Where

I_t= is net investment

k_t= the existing capital stock at the end of current period

k_{t-1}= is capital at the end of the presiding period.

k^*= is desired level of capitals stock

β= measures the fraction of the gap between the actual and the desired level of capital stock. Here the desired capital stock (k^*) is positively related to the expected level of output (y) and negatively related to rental costs of capital which in turn depends on interest rate expected rate of inflation and investment tax credit (Eklund, 2013).

2.1.2 Fiscal Policy and Economic Growth

A subject of intense debate for economists has been whether the government should intervene to correct for short-run fluctuations in economic activity. Different schools of economic thought have forwarded their respective view regarding the impact of government through fiscal policy on economic activity. For example, classical economists are against government intervention in the economy through its fiscal policy while the Keynesian school of thought advocates the use of fiscal policies to boost

economic activity in times of recessions. Classical economists believe that market forces swiftly bring the economy to long-run equilibrium through adjustment in the labor market, while Keynesians allege that the assumed self-regulating mechanisms in the economy fail to lead the economy back to equilibrium mainly due to rigidities in the labor market. Thus, Keynesians prescribe expansionary fiscal policies to avoid long recessions (Mankiw, 2001).

According to the neoclassical growth models, such as the ones by Solow and Swan (1956)**,** the share of government expenditure in output, or the composition of expenditure and revenue does not affect the long-run growth rate of an economy. In these models, tax and expenditure measures show that influence in the savings rate or the incentive to invest in physical or human capital ultimately affect the equilibrium factor ratios rather than the steady-state growth rate (Barro *et.al,* 2001).

Classicals and Neoclassicals consider fiscal policies ineffective because it brings crowding-out effect on economy, how? First as public spending rises, public goods are substituted for private goods, thus causing lower private spending on education, health, transportation and other goods and services. Second when governments borrow heavily to fund spending, pressures in the credit market result in higher interest rates which hamper private investment.

In practice, the effectiveness of fiscal policies may be hindered by the relatively long time lags from recognizing a need for action until realizing the results of the policies (Acemoglu, 2007).

Unlike the Neoclassical growth model as formulated by Solow (1956), which did not lay down the channels through which government spending may influence long-run economic growth, the new growth theorists suggest that there is both a temporary effect from government intervention during the transition to equilibrium, and a possible long-term effect from government spending on economic growth (See Romer (1986); Lucas (1988)).

According to Poot (2000) in order to understand the role that government played in the economy, it is crucial to pinpoint the main areas and channels through which government actions can affect economic growth by means of economic activity. Government actions may be beneficial to the economy because: 1) the government supplies pure public goods that constitute a sizeable component of the aggregate demand; 2) the government may own or operate enterprises and institutions that provide quasi-public or private goods; 3) regulations and controls imposed by the government can facilitate the protection of property rights and enhance allocative efficiency in the presence of externalities; 4) income taxes and transfer payments affect income distribution and may create a more equitable society; 5) governments often act as facilitators in markets with asymmetric and imperfect information.

The government through fiscal policies can contribute to macroeconomic stability via moderating short-run fluctuations of output and employment, aiming to shift aggregate demand in order to move the economy closer to potential output (Maranhao, 2011). In the other hand Afonso *et al.* (2005) banning the role of all government spending in economy as unproductive is impossible, because there is some governmental activity and related public spending that is essential for the performance of economy. This “core”, or

"essential", or "productive" spending may be as important to growth as private capital and labor.

2.1.3 Human Capital and Economic Growth

Human capital investment is a productive investment in people, such as skills, values, and health resulting from expenditures on education, on-the-job training programs, and medical care (Todaro and smith, 2012). According to traditional neoclassical growth model which was originally developed by Solow (1956) and Ramsey (1982), the key determinant of economic growth is process of capital accumulation. In the other words, physical capital accumulation is the driving force of economic growth, driven by higher investment shares in GDP, is generally related with higher per capita income growth rates.

Recently, this model has been supplemented by endogenous growth models that include knowledge and human capital as a source of increasing returns in a different form of aggregate production function and ratified as engine of economic growth . For example, the critical study by Romer (1986) who established through the empirical analysis of over 100 countries with a given initial level of real per capita GDP, growth in real per capita GDP is related to an increased level of schooling (human capital), low inflation (price stability) and improvements in trade (free trade externalities) (Mankiw, 1992), Similar assumptions are established by (Barro, 2001) economic growth was mostly explained through increases in human capital.

According to Oosterbaan *et al* (2002) ,and Fleisher and Zhao (2010), human capital is key feature of endogenous growth models and it positively affects the productivity of all

other factors of production and may also generate innovative opportunities or products that support technological progress. Endogenous growth models suggest that sustained growth is achieved through assuming the endogeneity of technological progress. This differs from the Solow (1956) growth model which assumes the level of technology to be exogenously determined, instead emphasing the role of physical capital accumulation and progressive economic policy to achieve sustained economic growth.

Following these theoretical arguments, a considerable amount of research has been devoted in developing economies to investigate the impact of increased public capital formation on private investment. There is a broadly held belief that public investment may not only encourage economic growth directly, but also indirectly via promoting private investment.

2.1.3.1 Why Public Spending on Human Capital is needed?

The belief that human capital as an engine of growth rests on the implementation of quality and quantity of resources devoted to that sector in the economy, as it stands out as generally acclaimed impetus for the actualization of sustainable growth and development in an economy. The developed nations and a few Asian countries have, for long realized the importance of human capital as a strategic catalyst for sustainable development and have been investing hugely in that area (Owolabi and Okwu, 2010). More than half a century ago has witnessed an unprecedented growth and development in human capital in both the developed and developing countries, while in most measures they have improved more dramatically in developing countries. As a result of that, there has been some international convergence in these measures (Todaro and Smith, 2012).

On the hand, Afonso *et al.* (2005) agree that public spending can increase human capital and contribute to innovation and technological progress through spending in research and development. Thus, public spending on education (human capital), and research and development (innovation) enhances labor productivity and, therefore, growth.

Lawanson (2009) revealed as both health and education are two closely related human capital components that work together to make the individual more productive. Government expenditure on health and education raises the productivity of labor and capital which increase private investment and then increase the growth of national output.

As agreed by number of researchers, the causal factors responsible for the impressive growth of the economy of most developed and the newly industrializing countries are significant commitment to human capital formation (Nehru, 1995; Adedeji and Bamidele, 2003). This impressive growth in industrialized and newly industrialized countries was largely achieved through increased knowledge, skills and capabilities acquired through education and health by all the people of these countries. Hence it is important to assign greater emphasis on the role of human capital as a major contributor to sustainable economic growth and development in the African economies.

2.2.4 Government Expenditure and Private Investment

Effect of government expenditure on private investment is positive or negative from theoretical side, for example the standard real business cycle model argues that an increase in government spending will have negative effect on private consumption but positive effect on private investment. That is, an increase in government spending lowers present value of after tax income and will induce a rise in labor employment at given

wage, if sufficiently persistent, will lead to a rise in the expected return to capital, therefore triggering a rise in private investment (Gali *et al*, 2002). This is again contrary to the IS-LM model, which predicts that investment will decline in response to positive government spending shocks. An increase in government spending (if not followed by a corresponding increase in money supply), leads to an increase in interest rate, which in turn will lead to a decrease in investment (Rebelo, 2005).

Government expenditure is financed by revenue which come from tax, grant, foreign borrowing, domestic borrowing, and by assistance from international institution and different developed countries. A large budget financed largely through foreign borrowing affects the debt levels and increases the debt burden. Domestic borrowing to finance the expenditure may adversely affect private investment by reducing savings and crowding-out private investors from the domestic capital market as financial institutions prefer lending to the government. It is intuitive that if there is sufficient liquidity in the financial system, then public borrowing (debt financing) may not affect private investment negatively as interest rates will not be affected significantly. If expenditure is tax-financed, then high taxes reduce the after tax returns to private investment, and thus affect private investment negatively **(**David and Scadding, 1974; Seater, 1993; Bo, 2007)

Sundararajan and Thakur (1980) government expenditure has both crowd in and crowd out effect on private investment depending on what the government spending.

Firstly, public investment competes with the private sector for scarce physical and financial resources, there by exerting a negative influence on private investment, at least in the short-run. For example large part of public capital formation in developing

countries is undertaken by state owned enterprise and the output of public enterprises, in the form of capital goods industries, constitutes an essential input for investment in the private sector. In this case, expanding the capacity of public enterprises could also lead to an increase in private investment undertaken for the purpose of satisfying additional demand. However, the overall net effect is theoretically less established and changes across countries in terms of both sign and magnitude. On the one hand, it is argued non-infrastructure investment tends to exert a negative influence on the private capital formation. It is also argued, in a case of provision of goods by public enterprises that these relevant sectors are more competitive rather than complementary (for example in the manufacturing, mining and tourism sectors) as these activities require substantial funds, making private investors reluctant to invest in these sectors and compete (Montiel, 2011).

Second, public investment raises aggregate output and savings, supplementing the economy's physical and financial resources, thus offsetting at least a part of any initial crowding-out effect on private investment

Third, public investment compliments private investment by creating infrastructure like (road , electricity , education and health) and then those infrastructure raising productivity of the capital stock, and reduces the cost of doing business thus crowding-in private investment.

Undoubtedly, in many developing countries the insufficiency of infrastructure is a substantial obstacle to private capital formation. There are clear economies of scale from the provision of public goods and services, such as power plants, roads, communication

utilities, irrigation, social services, etc., from which private sector can achieve significant (Feakachukwu *et al*, 2013). This is most likely to be true in those developing countries where the existing stock of infrastructure capital is inadequate (Ghura, 2000). However, in countries that have large levels and a high quality of public infrastructure, the argument that public investment is complementary to private investment is less likely to hold. In this context, there could be greater advantages to the private sector if public expenditure improves the efficiency of infrastructure, as opposed to increasing its quantity. Ghura and Goodwin, (2000) revised the Solow growth model, suggesting the possibility of differential effects from private and public investment on economic growth over time and across countries and private capital formation has a higher marginal productivity and encourages economic growth to a greater extent than public investment. In addition, human capital and macroeconomic stability were seen to significantly influence economic growth within their model. According to ECB (2001), the main objective of government spending in order to promote economic development is to improve the marginal productivity of the private sectors physical capital and labor which cause private investment to increase.

2.3 Empirical Literature

There are many empirical studies on impact of government expenditure on private investments that carried out in different countries even in the same country however their conclusion are different with regard to the relationship between government expenditure and private investment. There are various studies that focused on developing countries, and developed countries either as individual country studies or as cross country studies.

Sineviciene (2015) examines the relationship between government expenditure and private investment in the case of small open economies using data from Bulgaria, Estonia, Latvia, Lithuania and Slovenia during 1996 – 2012. Using the cross-correlations and Granger causality tests she found a negative impact of government expenditure on private investment offsets positive impact of it in all country under study except Bulgaria.

Aschauer (1989b) empirically investigated the effect of public capital accumulation on private investment from a neoclassical perspective using a Cob-Douglas production function. He employed an econometric model to estimate the impact of government investment on private investment, where private capital depends on the marginal productivity of private capital, government investment and government consumption. He found that government investment has a negative impact on private investment.

Rossitor (2000) investigated the relationship between public investment and private investment for United States data using structural co-integration approach. He found that the results support the infrastructure hypothesis and that public investment in structures has a weak crowd-in effect on private investment, while the public investment in equipment has a negative effect on private investment in equipment showing the crowding-out effect of public investment.

Alesina (2002) evaluated the effects of fiscal policy on investment using a panel of 18 OECD countries using fixed effect model and found a sizable negative effect of public spending on private investment

Pereira (2001) examined the impact of public investment on private investment based on impulse response analysis. The empirical results indicated that public investment crowds-in private investment in United States for the period 1956-1997.

Laopodis (2001) investigated the effect of military and non-military public expenditures on gross private investment of four newly industrialized European countries, namely Greece, Ireland, Portugal and Spain over the period 1960-1997. He employed the co-integration and the error-correction analysis. The empirical results were mixed for the sample countries and the defense spending exerts no effect on private investment.

Mamatzakis (2001) investigated the impact of government investment on private investment for Greece over the period 1950-1994. He employed the co-integration analysis of multivariate system of equations, and applied the impulse response function and variance decomposition. The estimation results showed that public investment has a positive impact on private investment, while the government consumption has a negative effect on private investment.

Erdal (2004) investigated the impact of disaggregated measures of government expenditures (Government consumption and public investment) on the private investment in Turkey over the period 1968-2000. He utilized the co-integration analysis in order to estimate the long-run relationship between different measures of government spending and private investment. Moreover, the impulse response function and variance decomposition are estimated. The estimated results showed that there is a crowding out effect on private investment. But Başar *et al* (2011) found crowd in and crowd out effect of government spending on transfer payments and government investment on private

investment, respectively using quarterly data and VAR model. On the other hand, study by Wag (2004) on the relationship between government expenditures and private investment in Canada during the period 1961-2000, co-integration and error-correction framework revealed positive effect of government expenditure on human capital but reverse for government capital and infrastructure spending. The other expenditure categories, has no significant effects on private investment. Even using different model Al-Abdulrazag (2009) and Abdulrazag (2003) revealed crowd in effect of government investment on private investment in Jordan. Using pooled time series of 23 developing countries (Asia, Sub-Saharan, Africa and Latin America), Greane and Villanueva (1991), found crowds-in effect of government investment on private investment. According to Bahal.*et.al* (2015) study on the relationship between public-capital accumulation and private investment by using Structural Vector Error Correction Models (SVECMs) with quarterly data, public investment is complement and substitute with private investment in short run and long run, respectively. Sallahuddin (2011) investigated the validity of the public capital hypothesis that a positive relationship exists between private and public investment is examined by using a panel time series analysis on agriculture, industry and trade, transportation, communication and construction sectors of the Malaysian economy. Data covering the period 1976-2006 is used to perform co-integration analysis. Results indicate that public investment has a positive effect on private investment in all sectors except agriculture.

In Pakistan Ghali (1998) using Vector error correction model and Bint-e-Ajaz and Ellahi (2012), using vector autoregressive model, both findings show crowd out effect of public

investment on private investment in different period of time especially when source of finance is internal and external borrowing while internal has minimal contribution.

Ricardo and Furceri (2009) analyzed the impact of government spending on the private sector, assessing the existence of crowding-out versus crowding-in effects. Using a panel of 145 countries from 1960 to 2007 with fixed effect model, the results suggest that government spending produces important crowding-out effects, by negatively affecting both private consumption and investment.

Suhendra and Jandi (2014) used time series data from 1990 to 2011 with ordinary least square (OLS) model in Indonesian and found positive relationship between government investment and for private investment.

On the other hand Samuel (2011) studied on the relationship between public investment and it's financing on private investment in Kenya for the period 1964-2006 using an error correction framework and confirmed the positive effect of public investment (infrastructure) on private investment, while domestic debt, external debt, and tax negatively related with private investment however Gitahi (2014) which employs VAR technique using time series data indicated both recurrent and development expenditure enhanced private investment with attaching source of finance.

Ouattara (2004), investigated the determinants of private investment in Senegal and found that public investment, real income and foreign aid flows affect private investment positively. The impact of credit to private sector and terms of trade were negative. Study in Benin, by Issouf (2008) using structural VAR, found a significant effect of public investment and private investment on growth. From above finding, he concluded that, the

relationship between government investment and private investment still remains an empirical issue.

Badawi (2003) examined the relationship between public capital and private sector investment activities in Sudan over the period 1970-1998 in a neoclassical growth framework. By employing a co-integrated VAR model, the study result show that the crowding-out categories of public sector investment have been large enough to off-set any crowding-in effects. Kilindo (2016) used impulse response functions and variance decomposition to evaluate the dynamic interrelationship among the variables and the relative importance of various shocks and affirms the crowding-in effect of public investment on private investment in Tanzania.

Utilizing an error correction modeling procedure Philip *et al* (2013) showed recurrent and government final consumption expenditure crowd-in private investment while capital expenditure crowd-out private investment in Nigeria. Dahlin (2005), **s**tudied the role of human capital accumulation in economic growth and show as an investment in education is very beneficial to the society, both at the micro level as well as macro level and affects the economic growth both directly and indirectly through increasing efficiency of private sectors.

Chiranga *et al.* (2010) employ annual data spanning 1970-2007 to examine the direction of causality and effects of private and public investment on each other using VEC model, the estimation result shows an insignificant and a unidirectional relationship is verified. The results are in support of the notion that private investment precedes public investment. Ramey (2012) examined whether increases in government spending stimulate

private activity using quarterly data with structural VAR approach. The result indicated that on balance government spending does not appear to stimulate private activity.

From above empirical review of developed and developing countries, the relationship between government expenditure (government investment and government consumption) is mixed this may be due to limitation of model. This may call for new model that is better than time series model which is repetitively used by research. On other hand, existences of mixed result between countries make the relationship an empirical issue.

2.4 Empirical Literature in Ethiopia

In Ethiopia, there are also a number of works on link between public spending and private investment. For example, Demilie and Fikru (2014) investigated the effect of monetary policy on private investment in Ethiopia using time series data for the period 1975-2011 with auto regressive distributive lag (ARDL) approach. The study disclosed that private investment is positively and significantly influenced by public investment, money supply, and a real output but negatively and significantly by real exchange rate in short run while, real interest rate is found to have insignificant and has a negative sign in line with macro-economic theory.

Hailu (2013) investigated the determinant of private investment in Ethiopia using time series data from 1981 to 2010. He employed ordinary least square model to identify direction of impact of those factors on private investment. The regression results show that public investment, real GDP per-capita, and external debt have significant positive long run effect on private investment, while lagged private investment (proxy for investment climate) has significant negative long run effect. In the short run, real GDP

per-capita and external debt have significant positive contribution to private investment, while inflation has significant short run negative effect on private investment after two lags. Frew (2014) examined the effect of government expenditure on private investment in Ethiopia over the period 1980-2012, using VAR and VEC model. The empirical findings revealed that the government capital expenditure crowd in private investment while the recurrent part of government expenditure shows a mixed effect of complementary hypothesis and substitutability hypothesis. Fikadu (2014/15) examined effect of government spending on private investment in Ethiopia employing annual time series data of 38 years using ordinary least square (OLS) model. The study emphasized on how various types of government spending in terms of capital and recurrent expenditures are related to private investment. By disaggregating capital and recurrent expenditures in terms of economic development, social development and general or administrative spending, the separate impact of each subgroup on private investment was examined. The study reveals that both recurrent and capital expenditure crowds-in private investment in Ethiopia. Esubalew (2014) examined the macroeconomic determinants of domestic private investment in East Africa region with the panel data set from the period of 2000- 2012.using both fixed effect and pooled OLS model. Estimation result divulged as domestic private investment has positively associated with financial development as availability of credit to the private sector and human capital development and reverse with public investment.

From the above review of empirical literature, the impact of public expenditure on private investment is inconclusive. This could be related to differences in country context, methodology and data sources. Previous studies rely on partial equilibrium or sectoral

approach to assess the relationship between government expenditure and private investment. Given that public expenditure has economy wide effect, partial equilibrium could result in either overestimation or underestimation of impacts. This requires assessing the impact of government expenditure shocks on private investment by using dynamic computable general equilibrium model built around consistent (e.g. social accounting matrix). This study intends to fill this.

CHAPER THREE

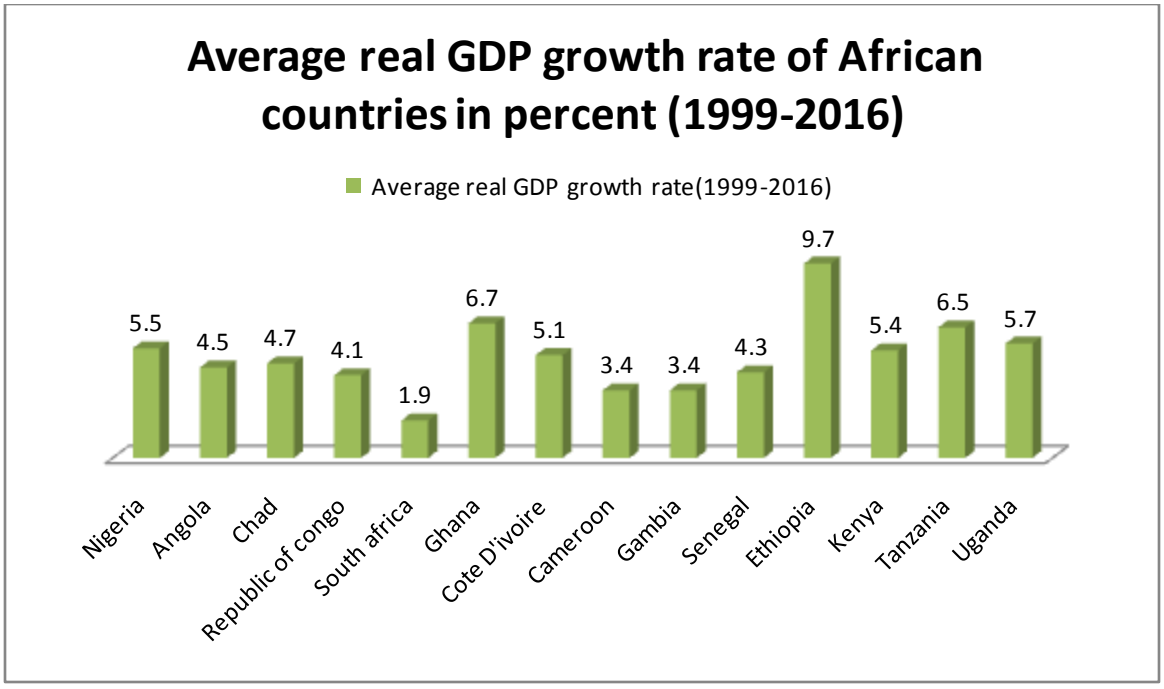
OVERVIEW OF GOVERNMENT EXPENDITURE AND PRIVATE INVESTMENT IN ETHIOPIA

3.1 Trends of Government Expenditure

3.1.1 Total Government Expenditure and Growth in Ethiopia

The growth trend of the Ethiopian economy for most of the recent past is characterized by its moderate level of performance and its nature of high volatility. And it is on good condition as compared to other Sub-Saharan African country.

Figure 3.1: Average real GDP growth rate of Sub-Saharan Africa

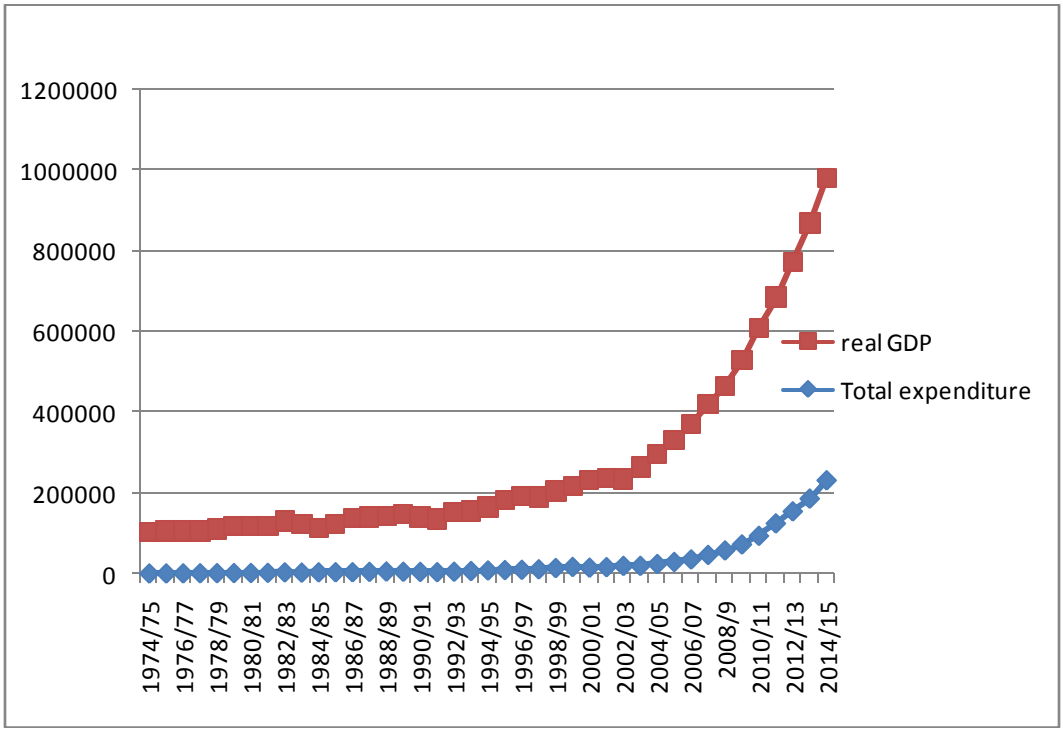


Source: IMF (2017)

Total government expenditure has its own share in economic growth of the country. When we observe, total government expenditure has shown an increasing trend especially since 1997/98 and 2006/07 compared with the Dergue regime. Real GDP of the country reflect an oscillating trend especially during Dergue regime because of intensive internal conflict and war with Somalia (1974-78) and continuously increase since almost from

1991 onward, this may be the result of policy and program that Ethiopia has implemented to achieve desired millennium development goal (fig 3.2). This shows that real GDP and total government expenditure have increased over time suggesting positive correlation between the two

Figure 3.2: Total government expenditure and real GDP of Ethiopia (in million ETB)

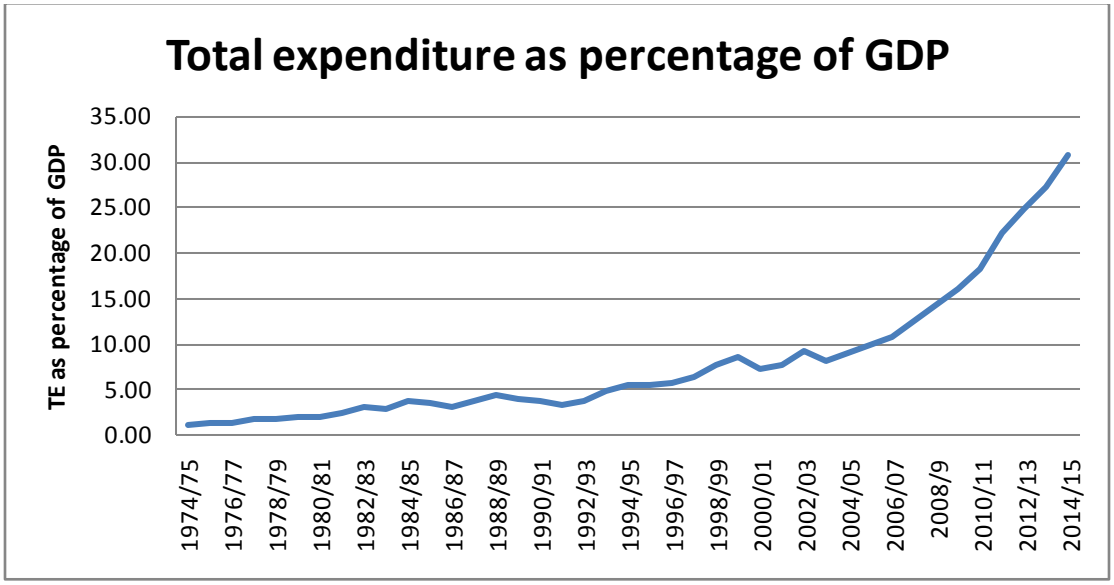


Notice: ETB- Ethiopian birr.
Source: Own graph using MoFED and NBE data

Extent of government participation in economic management in Ethiopia has been following the 1974 revolution. This factor is estimated by share of total government expenditure in GDP which shows an increasing in the late 1980s (Shibeshi, no year). The share of total government expenditure in economy of the country increased on average by 1.78% between 1974/75 and 1982/83 due to war that the country faced but also it shows cyclical shape between 1983/84 to 1986/87 due to existence of drought in the country (fig 3.2). Not surprisingly highest share of government expenditure during Dergue was public

administration. The total government expenditure in GDP was 2.55% and 11.30% in Dergue and current government of Ethiopia respectively. There is remarkable difference in the contribution of government expenditure to GDP between two governments of Ethiopia.

Figure 3.3: Total government expenditure as percentage of GDP



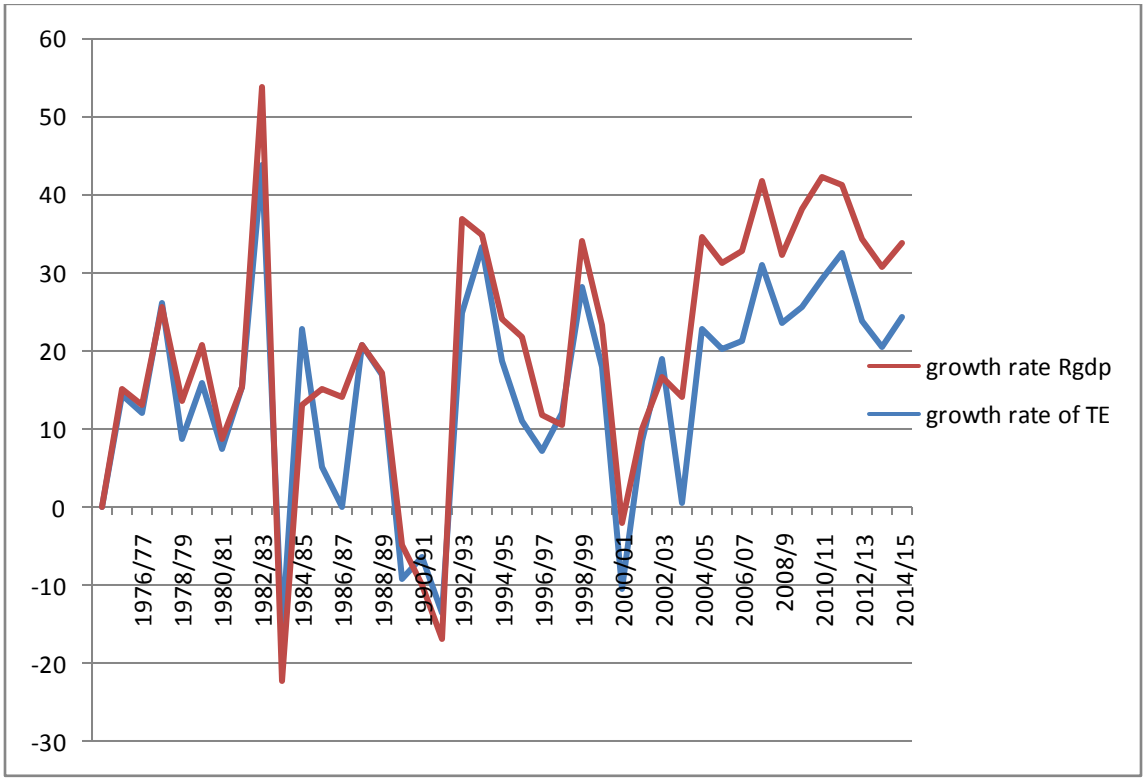
Source: Own graph using MoFEC and NBE data

3.1.2 Growth Rate of Total Government Expenditure and Real Gross Domestic Product

Growth rate of both total government expenditure and real gross domestic product has more or less similar shape which is very much cyclical because of the intensive internal and external conflict and drought. Growth rate of the total government expenditure and real GDP of the country reach its peak during 1982/83 because this period was a recovery period as result of the so called Zemecha when all out efforts was made to boost production on the basis of annual development campaign. Though, the two components

reached their maximum during this year in consecutive year that means 1983/84 their growth rate declined further due catastrophic drought and famine (Eshetu *et al*, no year) in which government expenditure and real GDP decreased by 16.01% and 6.30 % respectively. Both also declined in 1984/85 (fig 3.3). When compared the growth rates of both variables, in majority case growth rate in real GDP has been less than that of total government expenditure.

Figure 3.4: Growth rate of real GDP and total government expenditure

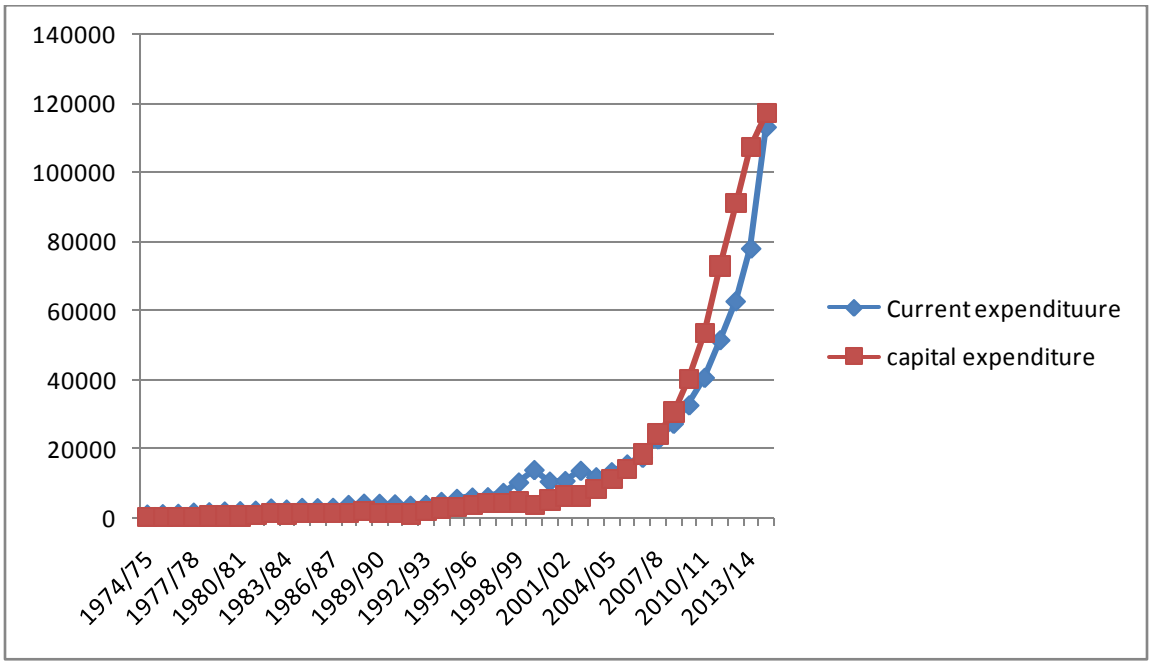


Source: Own graph using MoFEC and NBE data

3.1.3 Composition of Public Expenditure in Ethiopia

Government expenditures can be differentiated according to their impact on the steady-state rate of growth. If they have a direct effect on growth rate, they are classified as productive which is capital expenditure; if they have not, then they are classified as unproductive expenditures which is current expenditure. The restructuring of public expenditure towards a productive spending generates a positive effect on growth rate without creating distortions in the economy that adversely affect growth (Zagler and Durnecker, 2003). Therefore, government expenditure is composed of two broad elements; current expenditure and capital expenditure. Current government expenditure consists of general service, economic service, social service and capital expenditure also consists of economic development, social development and the other. Both expenditures are increasing on average during the recent two regime of Ethiopia. During the full period of Dergue regime current expenditure is greater than capital expenditure. During this regime share of public administration expenditure was very high because most institutions are under control of government. The government during the time spends high proportion of income on defense. This condition also continues in current government regime especially up to 2006/07 and the difference between two expenditures reach maximum during the year of 1999/00 (fig 3.4). But from 2006/07 onward capital expenditure has been greater than current expenditure which implies as current government diverts expenditure from unproductive sector to productive sector due to different development program and strategies the country following to stand near low middle income country by 2025.

Figure 3.5: Trends of current and capital expenditure in Ethiopia (in million ETB)

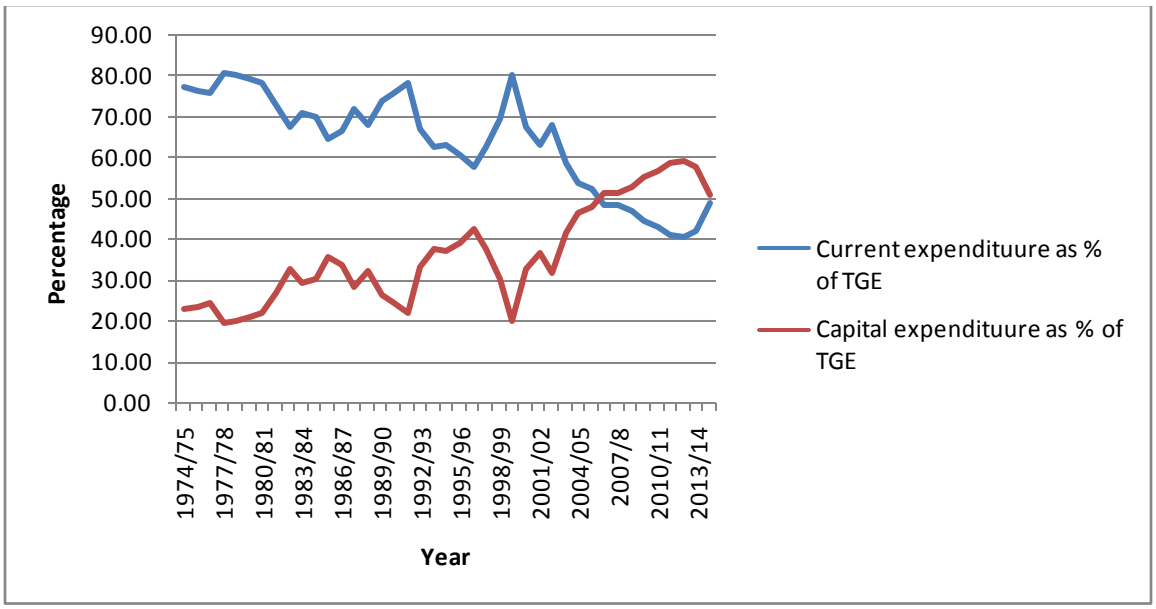


Source: Own graph using MoFEC and NBE data

The percentage shares of current expenditure and capital expenditure from total government expenditure have cyclical shape during both regimes of Ethiopia under consideration. The gap between both expenditures are very high during Dergue in 1977/78 because during this period government spends more resource on war which is unproductive due repetitive war of the time in which current expenditure and capital expenditure as percentage of total government expenditure was 80.59% and 19.41% respectively (Fig 3.6). Between 1992/93 and 2014/15, current expenditure and capital expenditure as percentage of total government expenditure were 79.67 % and 20.03%, respectively. Large share of current expenditure continues up 2006/07 because government prioritized unproductive sector but beyond that point share of capital expenditure has remained high.

Even though, there is difference between current expenditure and capital expenditure in both regimes, the difference is smaller during current government of Ethiopia.

Figure 3.6: Percentage share of current and capital expenditure from total government expenditure (From 1974-2015)



Notice: TGE- total government expenditure
Source: Own graph using MoFEC and NBE data

3.1.4 Distribution of Government Expenditure

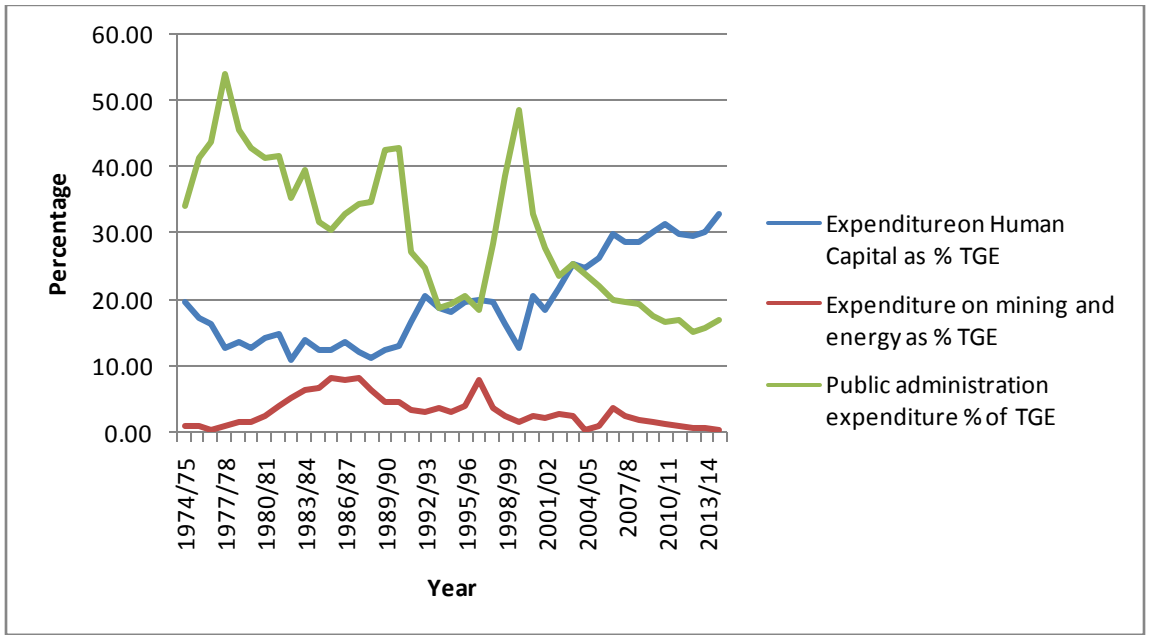
Government allocates its budget to different sectors in the country. The main sectors include economic sector, social sector and public consumption which cover public administration. Under each category, government budget is distributed to defense which is included under public administration expenditure, agriculture, natural resource, energy and mining, education and health. In Dergue regime and current government on average 57.65% and 44.84% of current government expenditure go to public administration (see Appendix A). From this (Appendix A), the amount of money that goes to public administration was greater in Dergue than current government. However, on average

6.63% and 10.94%, 20.15% and 28.15%, 15.56% and 16.14 % of current expenditure was allocated to economic service, social and various services in Dergue and current government respectively. This ratify that large amount of money in current regime goes to economic service, social service which include provision of school service and health service for the people and others like paying debt service in compared to Dergue regime which give much attention for less productive public administration which is more or less unproductive. Under capital expenditure on average 87.75%, 10.53% and 1.73 % of it was allocated to economic development, social development and general service respectively during Dergue period while 69.96%, 23.34% and 6.64% of it go to economic development, social development and general service, respectively, in current government period.

3.1.5 Sectoral Distribution of Government Expenditure

Under the two major component of government expenditure, total government expenditure is often distributed to different sectors including education, health, energy, and public administration which is core part of public consumption. From these all sectors expenditure on public administration consist large share of total government expenditure than human capital expenditure up to 2003/04 but greater than energy. But from 2003/04 on ward the share of government expenditure allocated to human capital has been greater than public administration and energy (Fig 3.7).

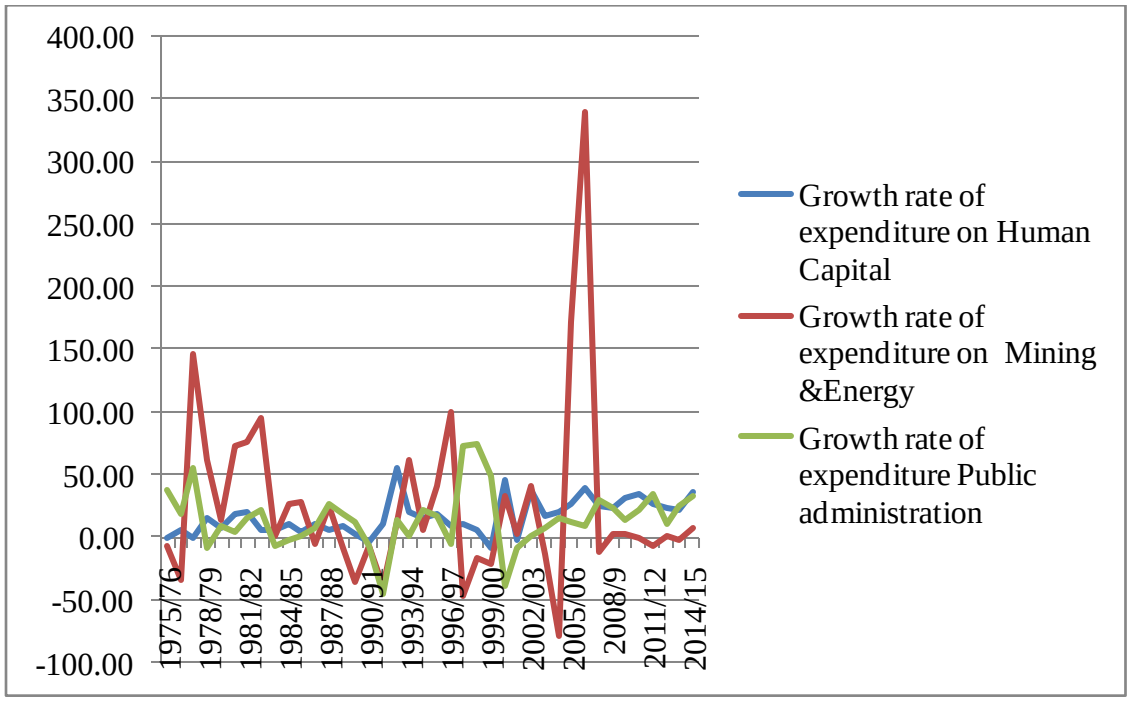
Figure 3.7: percentage share of expenditure on public administration, mining and energy and on human capital from total government expenditure.



Source: Own graph using data from MoFEC and NBE

Similar to their share from total government expenditure the annual growth rate of sectors are quite different. Annual growth rate of the three sectors reflects cyclical in nature. However, all growth rates of expenditure oscillates, the growth rate of expenditure on energy is more or less greater than others. In particular, in 2006/07 it reached its peak because the country has started to construct great renaissance dam (see fig 3.8). But the annual growth rate of expenditure on human capital is greater than public administration between 1999/00 and 2013/14.

Figure 3.8: Growth rate of human capital, energy and public administration expenditure



Source: Own graph using MoFEC and NBE

3.1.6 Energy Infrastructure

Developing the renewable energy sources and strengthening the capacity to administer the energy infrastructure are the key focus areas in the sector in economic infrastructure (MOFEC, 2013). From energy infrastructure electricity is the focus. According to the second generation growth and transformation plan (GTP II, 2015/16-2019/2020) electricity infrastructure is indispensible to support the efforts to accelerate rapid and sustainable economic growth. To assure this goal government spends large share of its budget on electric infrastructure energy. Government has planned to increase the power generating capacity of the country from 2000MW in 2009/10 to 8000MW by the end of GTP I period. In terms of delivery, total electricity generating capacity reached 4,180MW by 2014/15 and the average performance of all power projects stood at 52%. During

GTPI implementation period, the total length of power transmission line increased from 11,440 km in 2009/10 to 16,018 km (against the target of 17,000 KM) in 2014/15. The additional newly constructed transmission line was 4,578 km.

During GTP I period, 40,929km power distribution lines were constructed (against the target of 132,000Km). Consequently, the total length of power distribution lines has increased from 126,038km in 2009/10 to 166,967 km by 2014/15. As a result, electricity service coverage increased from 41% in 2009/10 to 60% in 2014/15. In 2009/10, about 2.03 million customers accessed electricity service. This figure increased to 2.31 million in 2014/15.

However, almost half of the planned power generation left without attainment during the first growth and transformation period, government has targeted to increase the power generating capacity of the country from 4,180MW in 2014/15 to 17,208MW by 2019/20 during GTP-II period; of which, 13,817MW is planned to be generated from hydro-power, 1224MW from wind power, 300MW from solar power, 577MW from geothermal power, 509MW from reserve fuel (gas turbine), 50MW from wastes, 474MW from sugar and 257MW from biomass. Increase electricity coverage from 60% in 2014/15 to 90% in 2019/20(NPC, 2015)

3.1.7 Education

According to GTP II, education is one among the social infrastructure. It plays a great role in advancing economic growth of a country. To assure the role of education in economic growth, the educational sector of the country ample of plan was to raise the quality of education and consolidate the expansion of the education service coverage. To

achieve the objective the government had the host of activities have been carried out on teacher`s development program, curriculum improvement, school improvement and expansion and improvement of information and communication technology. As a result, the share of qualified teachers of primary education (grade 1-8) has increased from 38.4 percent in 2009/10 to 71.37 percent by 2014/15 and the share of qualified teachers of secondary education has increased from 77.4 percent in 2009/10 to 87.3 percent during the same period (NPC, 2015).

3.1.8 Health

Ethiopia achieved remarkable results in health sector during the GTP I period. The country has become exemplary in meeting the MDGs ahead of time in the health sector. To translate these investments in health infrastructure and health personnel into better health outcomes, extensive community mobilization and engagement was unleashed to ensure community ownership of the health system.

Thus, during the GTP II period, the on-going efforts need to be continued with an increased momentum to further improve on the progress made so far. Concerted and coordinated effort should be exerted to improve the quality of primary health care delivery and hospital treatment services. In this regard, it is necessary to expand health infrastructure, develop human resource, improve health institutions, leadership capacity and working system, to strengthen pharmaceutical supply and logistics management, and to build community engagement and ownership. Finally, it is planned to develop sustainable financing system. In order to realize this, the health insurance policy already enacted by the government should be implemented. Although the health insurance proclamation has been approved and the responsible institution established, the social

health insurance system could not be effected during the GTP I period. Thus, it is important to give special attention for the implementation of the social health insurance system and for the improvement of quality health service delivery during the period of GTP II.

3.1.9 Financing Government Expenditure

Similar to other developing country, the source of government expenditure is both domestic and foreign. Domestic source of finances include different kind of tax like direct and indirect tax, domestic financial institution from where government borrow to finance expenditure and the like and foreign sources are like loan, grant, assistance and borrowing from international institution like world bank(WB), international monetary fund(IMF) and the like. The following table discusses average total revenue, total expenditure, budget and source of finance during Dergue and current government of Ethiopia.

Table 3.1: Average total revenue, total expenditure, budget deficit and source of finance

	Dergue Regime			Current Government				
Year	1974/75-1978/79	1979780-1983/84	1984/85-1989/90	1990/91-1994/95	1995/96-1999/00	2000/01-2004/05	005/06-2009/10	2010/11-2014/15
Total Revenue	1119.1	2161.7	21796.4	4309.7	9900.7	15450.2	42642.3	139235.6
Total government Expenditure	1410.7	2797.7	27718.4	5949.0	12663.7	20275.0	47333.1	157634.0
Budget deficit	-291.7	-636.0	-5922.0	-1639.3	-2762.9	-4824.8	-4690.9	-18398.4
External borrowing (net)	106.8	280.9	2698.2	875.4	1114.9	3549.3	2104.2	14080.0
Domestic borrowing(net)	184.9	355.0	3223.8	763.9	1648.0	1275.5	2667.4	7529.0
External borrowing as percent of budget deficit	36.6	44.2	45.6	53.4	40.4	73.6	44.9	76.5
Dom borrowing as percent of budget deficit	63.4	55.8	54.4	46.6	59.6	26.4	56.9	40.9

Source: own computation from MoFEC and NBE data

As can be seen from the table 3.1, the average total revenue and total expenditure increases in both regime. For example on average total revenue during Dergue increased from 1119.1 million birr in 1974/75-1975/76 to 21796.4 million in 1984/85-1989/90, while current government increased on average from 4309.7 million birr in 1990/91-1994/95 to 139235.6 million birr in 2010/11-2014/15. But rate at which both total revenue and government expenditure increase is not the same. Budget deficit also increased because the available tax revenue including grant couldn't fit expenditure of the government. Due to incapability of revenue generated from tax and grant, government in two regimes obligated to rush for loan from domestic financial institutions which in turn decrease availability of credit for domestic private sector especially in current government. During Dergue regime, external borrowing as source of finance for budget was increased on average by 36.6% in 1974/75-1978/79 to 45.6% in 1984/85-1989/90

while domestic borrowing as a source of finance decreased on from 63.4 %1974/75-1978/79 to 54.4 % 1984/85-1989/90 but large part of budget deficit was financed by domestic borrowing. This shows government substituted foreign borrowing for domestic borrowing. But domestic and foreign borrowing as percentage of budget deficit was volatile. It didn't increase persistently. For example on average 53.4% of budget deficit was financed by external borrowing in the first five year of current government while in the second five year 40.4 % of budget deficit financed by it which was less than the first five year life of the government. Again, it increased to 73.6% in the third five year which is increased by more than half and came to 44.9 % in 20052005/06-2009/10 and 76.5% in 2010/11-2014/15. The same is true for domestic borrowing as percentage of budget deficit in current government.

3.9 Government Expenditure and Financing Projection

According to GTP II public expenditure is planned to significantly address infrastructural bottlenecks; with a focus on investing on growth enhancing pro-poor sectors consistent with the strategic direction; and on investments that enhance capital accumulation. The plan emphasizes the need to concentrate on spending in development expenditure. Thus, overall expenditure is projected to reach 22.6 percent of GDP by 2019/20 (Table 3.3).

Table 3.2: Government expenditure and revenue projection (in billion ETB)

	Base year	**Projections**				
Description	2014/15 performance	2015/16	2016/17	2017/18	2018/19	2019/20
Total revenue including grants	199.9	241.3	294.1	375.5	479.1	620.6
Domestic revenue	186.6	226.8	279.5	360.7	463.6	603.3
Tax revenue	165.3	203.9	250.7	327.9	415.1	542.8
Non tax revenue	21.3	25.4	33.4	40.1	48.6	60.6
Grants	13.0	14.5	14.6	14.7	15.5	17.3
Total government expenditure	230.5	277.7	338.4	426.1	543.9	713.8
Recurrent expenditure	113.4	129.4	152.6	186.1	225.9	292.4
Capital expenditure	117.1	148.3	185.8	240.0	318.0	421.3
Human capital expenditure	33.4	42.3	53.0	68.4	90.6	120.1
Electricity expenditure	25.3	32.0	40.1	51.8	68.7	91.0
Poverty oriented expenditure	152.9	192.7	242.8	305.9	385.5	485.7
Government saving	73.2	100.7	131.2	181.9	247.6	310.9
Budget deficit	-30.9	-39.4	-51.0	-61.4	-79.4	-93.1
Deficit financing	30.9	39.4	51.0	61.4	79.4	93.1
External borrowing	18.7	19.1	20.4	22.4	26.9	37.0
Domestic borrowing	18.5	20.3	30.6	39.0	52.5	56.1

Source: NPC (2015)

During this period, spending on pro-poor sectors and capital investment will be given priority accounting for 68 % and 59% of total government expenditure, respectively. Total government expenditure is projected to reach Birr 713.8 billion by the end of GTP II period. Of this, recurrent expenditure is projected at Birr 292.4 billion. Moreover, budget deficit as percent of GDP will be maintained below 3%. Gross government saving is projected to increase from Birr 73.2 billion in 2014/15 to Birr 310.9 billion by 2019/20 while its share in GDP will increase from 5.9 percent in 2014/15 to 9.9 percent by 2019/20 (NPC, 2015). This shows that the expenditure budget will be financed by large from domestic resources.

Financial resource requirements for the plan period takes into account the total financing capacity of the nation. Growth enhancing and poverty reducing sectors will be given priority and are taken into consideration in the financial plan. Taking into account government service expansion in the next five years and non-inflationary financing capacity, recurrent expenditure is expected to be financed through domestic revenue. With regard to capital expenditure, priority will be given to on-going mega projects as well as new priority projects with focus on financing infrastructure and human development that stimulate growth of the productive sectors of agriculture and manufacturing.

Table 3.3: Growth rate of government expenditure and revenue (in percent)

	Growth rate of the projection					Average
Description	2015/16	2016/17	2017/18	2018/19	2019/20	
Growth rate of total revenue	20.71	21.88	27.68	27.59	29.53	25.48
Growth rate of domestic revenue	21.54	23.24	29.05	28.53	30.13	26.50
Growth rate of tax revenue	23.35	22.95	30.79	26.59	30.76	26.89
Growth rate of non tax revenue	19.25	31.50	20.06	21.20	24.69	23.34
Growth rate of grants	11.54	0.69	0.68	5.44	11.61	5.99
Growth rate of total government expenditure	20.48	21.86	25.92	27.65	31.24	25.43
Growth rate of recurrent expenditure	14.11	17.93	21.95	21.39	29.44	20.96
Growth rate of capital expenditure	26.64	25.29	29.17	32.50	32.48	29.22
Growth rate of human capital expenditure	26.6	25.3	29.2	29.2	32.5	29.2
Growth rate of electricity expenditure	26.6	25.3	29.2	32.5	32.5	29.2
Growth rate of poverty oriented expenditure	26.03	26.00	25.99	26.02	25.99	26.01
Growth rate of government saving	37.57	30.29	38.64	36.12	25.57	33.64
Growth rate of budget deficit	27.51	29.44	20.39	29.32	17.25	24.78
Growth rate of deficit financing	27.51	29.44	20.39	29.32	17.25	24.78
Growth rate of external borrowing	2.14	6.81	9.80	20.09	37.55	15.28
Growth rate of domestic borrowing	9.73	50.74	27.45	34.62	6.86	25.88

Source: Own computation from GTP II data

According to GTP II projection of government expenditure the growth rate of total government expenditure is 25.43 % on average. But growth rate of recurrent expenditure, capital expenditure, and poverty oriented expenditure are 20.96 %, 29.22% and 26.01%

on average, respectively. This shows government allocates large amount of resource on capital expenditure rather than recurrent expenditure with difference of about 9 percent growth rate in between. Also government plans to improve social infrastructure by allocating more budget, increasing expenditure with 26.01%. However, government saving is growth rate is 11.02% which is better than the previous and will contribute to the capital formation (Table 3.3).

As presented in (Appendix B) which is based on public finance revenue and expenditure projection for the plan period of (2015/16-2019/20), 87.4 percent of government expenditure is to be financed through domestic revenue and external grants. This results into an average overall deficit of 13.6 percent during the plan period. Of this, 5.3 percent will be financed through foreign loans, and the remaining 8.3 percent will be generated from domestic borrowing (borrowing from NBE and selling treasury bills).

According to the revenue and expenditure projections, total government expenditure is projected to reach ETB 2.2998 trillion (ETB 1.3133 trillion for capital expenditure) which is about 56.4% on average and ETB 0.9864 trillion for recurrent expenditure) during the plan period which is about 43.6% on average. Given the government's focus on infrastructure expansion; capital expenditure on infrastructure sector accounts for about 27.3 percent on average from total capital expenditure which accounts for 56.4 percent of total government expenditure. Within this, the share energy infrastructure is projected to account 5.9 percent for the plan period. From 56.4 percent of capital expenditure, human resource development and technological capacity building sector account for 16.1 percent which reveal as one priority objective of government is to

develop human capital the country play a significant role to accumulate capital formation and push out the country from poverty.

To arrive at different composition expenditure (energy, human capital, public administration, etc during planning period, government also projected different source of finance like total revenue, domestic revenue (tax revenue and non tax revenue), internal borrowing and external source of (which include external borrowing and grants). During this period 87.4 % of total government expenditure will be financed using total revenue including grants. But from this 83.7 percent, 75.4, 9.2 percent, 3.7 percent, 5.3 percent, and 8.3 percent is financed by domestic revenue (tax and nontax), tax revenue, nontax revenue, grant, external borrowing and internal borrowing, respectively. When we come to each category's of government expenditure, from 56.4 percent of capital expenditure, 52.2 percents will be financed from domestic resource mobilization and the rest i.e. 4.2 percent are financed by foreign resource which includes grant and external borrowing and from 43.6 percent, 40.2 percent will be financed from domestic resource mobilization and the which is very percent s financed via external resource.

Expenditure on human capital and energy is core parts in social and economic infrastructure, respectively. They captured the greater share in capital expenditure (56.4 percent) during planning period which is about 16.1 and 12.2 percent, respectively. With regard to their source of finance, from 16.1 percent human capital spending 6.9 and 0.8 will be financed via tax revenue (which include direct and indirect) and external resource (grant and external borrowing), respectively and the rests are financed through non tax revenue and internal borrowing. Of 12.2 percent energy expenditure 5.2 and 0.6 percent will be financed by tax revenue and external, respectively.

Generally, the projections of government revenue and expenditure during planning horizon tell as more than 80 percent of government expenditure financed via domestic resource mobilization rather than external source of finance which will expect to keep deficit GDP ratio below 3 percent and bring desired objective to feasible.

3.2 Trend of Private Investment in Ethiopia

Different institutional arrangements and policy regime have influenced the development of private investment sector differently. Private investment is among others, a function of policy regime. As such, the type of policy environment directly or indirectly affected evolution of the investment sector in the country.

3.2.1 Investment Development Strategy during the Imperial Period

The Ethiopian economy after the war with Italy was described as a mixed economy in which the private and public sectors worked hand-in-hand to achieve economic progress. The private sector was having good ground during this period since there was no any law that limited the private business. In this period, Proc. No 60/1944 and 107/1949 were enacted to promote foreign investment in Ethiopia. In 1950, the Minister of Finance gave an income tax exemption notice with a view to encouraging investment. But up to this year means 1950's there was no deep effort made towards developing a modern industry sector that help to increase participation of private sector. It was only in the this year, when development plans (three five years plans) began to formulate that the development plans of the sector began to be shagged (thick) by policies and strategies pertinent to the sub–sector. The main agents for expansion of investment during this period were foreign national residing in Ethiopia. To growth and expansion of investment sector, the government issues development programs and policies. A number of proclamations were

declared to encourage foreign investment. For example, in 1956, the Income Tax Decree which provided for income tax emption to encourage investment was promulgated. However, this Decree was replaced by the Income Tax Proclamation of 1963. This Decree was the first proper law to regulate investment transaction in Ethiopia. After three years, i.e. in 1966, the Investment Proclamation No. 242/1966 was enacted. What is special to those laws was that they did not provide investment areas for the government. Thus, investors could invest in all areas of the economy with no restriction. During the latter years of imperial era, the main strategy for industrial development was import substitution. Therefore government employed different mechanism like investment incentives which included: import and export income tax exemptions, income tax holidays, credit on favorable terms and others to encourage domestic investors as well. It was also possible for foreign investors to own land required for their investment. The government has placed much faith on private foreign investment and it had undergone to considerable lengths to attract it. As result of the existing policies and enabling investment environment, a number of investors who established manufactures created. There was, however, obvious of neglect of small-scale industries during that period as investment incentives benefited only the medium & large-scale manufacturing establishment. Though the private sector was in good condition, the share of the domestic investors was very small due to lack of entrepreneurship (Samson and Tadele, 2002).

3.2.2 Private investment during Dergue period

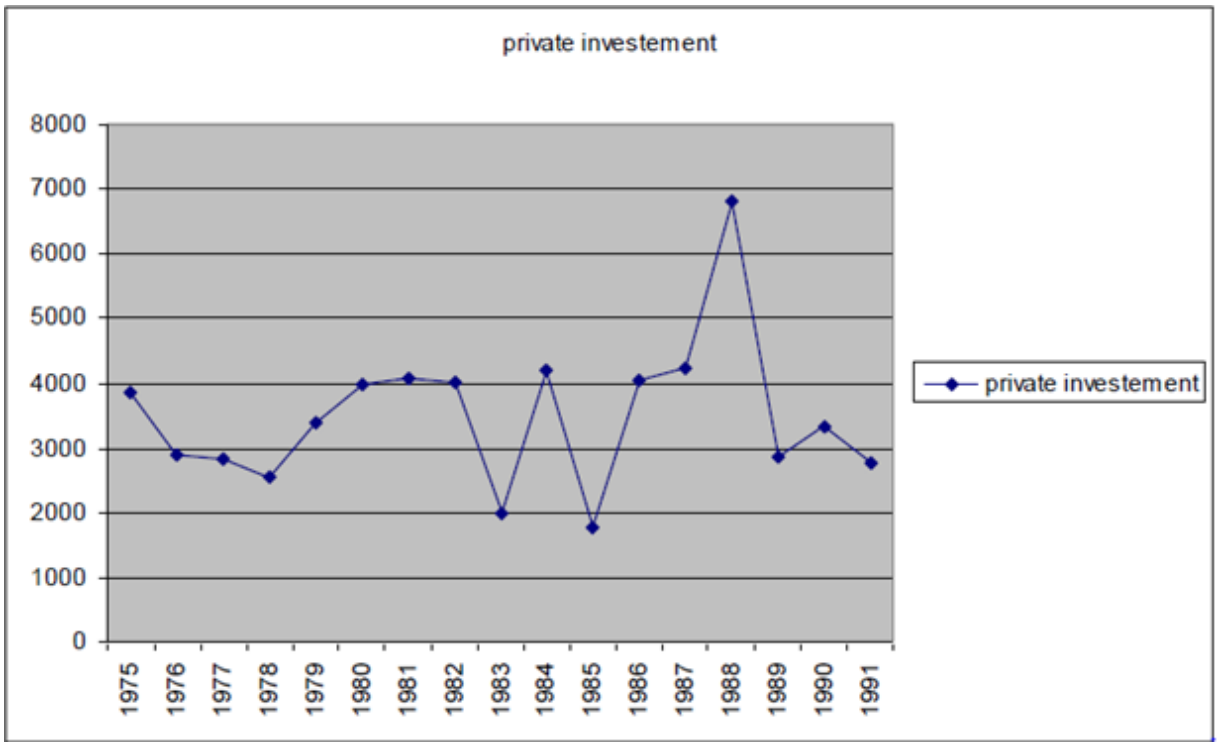
After the downfall of Imperial government, the provisional Military Government of socialist Ethiopia changed the course of development from market-oriented mixed economy to command economy which in turn overwhelms the concept of private

property including private investment. This retarded the development of the sector. The policy of the Dergue was favorable to public economy. The investment had undergone through a radical change in the structure of ownership and management. Proclamation No 26/1977 heralded the start of nationalization. The proclamation clearly stated that it was necessary to transfer to government ownership all resources that were crucial for economic development.

As a first step in his process, it nationalized almost all medium and large-scale private enterprises in 1975. It also imposed capital ceiling on private sector investment capital up to 500,000 and investors were not allowed to have license for more than one line of business. These undermined any possible revival of private sector in medium and large-scale hands-craft activities and restricted to small industrial activities. The tax structure was also very harsh which was about 89% for Business income over birr 36,000 per annum, which was introduced with a view of income redistribution. Interest rate was also high for private borrowers relative to public enterprises and cooperatives. In addition, the major change under taken by the Dergue government was, abolition of private ownership of land in rural and urban areas nationalization of extra dueling, major enterprises in manufacturing industries, banking and insurance and so on. These policies hampered the potential for expansion of the manufacturing sector during the Dergue by devastating the private sector activity. Later on, the ten year perspective plan (1984/85 – 1993/94) formulated to promote the production of intermediate and capital goods and expansion of small-scale industries. The state took the responsibility in developing and managing the medium and large-scale industries with wide linkages and capital goods providing investment that can be used to develop other manufacturing industries. The intention of

the government was to introduce capital know-how, and technology into the country. But the law was taken as a disincentive to the private investors since the share of the government could grow from 51-99% while that of private investors could fall down from 49-1 %.(Samson and Tadele, 2002).

Figure 3.9: Trend of private investment (in ETB) during Dergue regime



Source: EIA

As we see from the fig 3.9 the trend of private investment during Dergue regime shows that private investment does not play a great role in determining national output due to unfavorable investment policy and climate. However, after 1985 it started to increase due to economic change i.e. mixed economy and started to decrease due to high taxation on imported good since 1988.

3.2.3 Investment during current government

After collapse of socialist government, the Transitional Government, which was established in 1991, adopted an economic and investment policy directly opposite to that of the Dergue regime.

The policy emphasized the role of private investment in the development of the Ethiopian economy. In 1992, Ethiopia embarked up on the market-oriented economic policy which is deemed to be a favorable condition for investment. To implement this policy, the Transitional Government enacted Investment Proclamation No. 15/1992 to open the door to private investment. The proclamation also reserved some sectors such as large scale electric power and postal service to the government. It also provided for joint investment with the Ethiopian government. The current government also has made numerous pronouncements indicating its interest to attract private investment

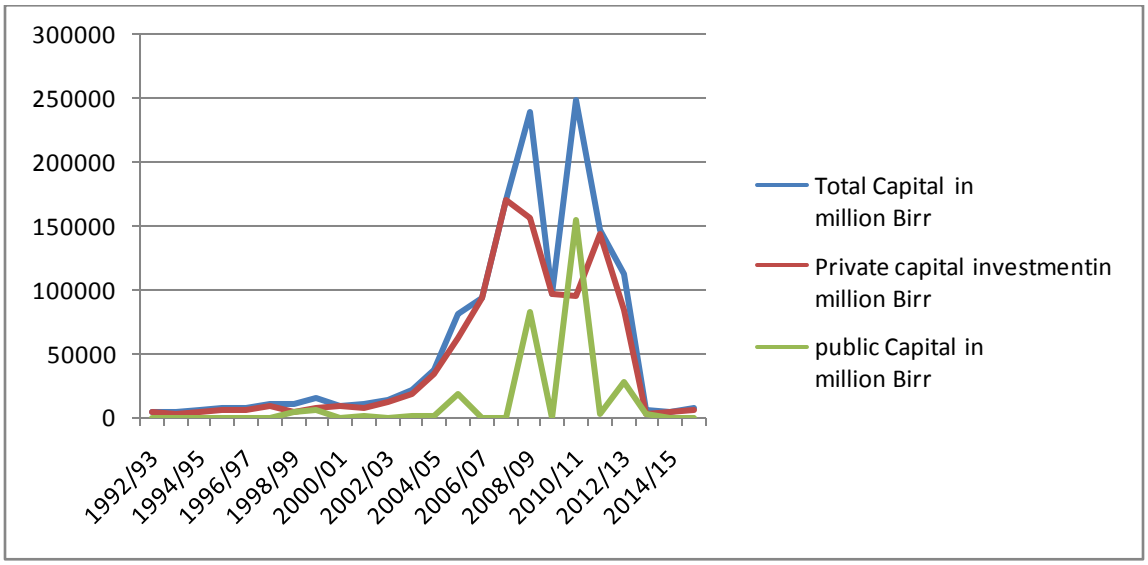
3.2.4 Trend of private investment in Ethiopia since 1992/93

The Ethiopian Investment Agency and Regional Investment offices licensed about 70,503 investment projects with an aggregate capital of Birr 1,353,369 million in the period between 1992/93 – 2015/16. Of these projects, 59,997 (85.10 percent) were domestic, 10381 (14.72 percent) foreign and 125 (0.18 percent) are public. In terms of capital, Birr 525872 million (38.86 percent) was from domestic investors, Birr 522000 billion (38.57 percent) from foreign investors and Birr 305496 million (22.57 percent) from the public sector (See appendix C).

From the licensed investment project total of 20404 (28.94 of total project in the series) with capital of 524188 million (38.73 percent of total capital) were licensed by Ethiopian Investment Agency and Regional Investment Offices. Of the total project with capital investment approved by these office during GTP period (2010/11-2015/16) 17937(29.90%) with capital of 14384 million (27.36 %), 2437(23.48 percent) with capital of 193174 million (37.01) and 30(24) with capital of 187159 million (61.26) is licensed by domestic, foreign and public sector respectively. During this period large investment is made by public next to foreign in terms of capital. This implies that capital investment of foreign investor is higher than other types of investment while domestic investor capital is lower than all others. However, numbers of project owned by domestic investor are higher than the others (See appendix C).

When we compare the trend of gross capital formation which is combination of both public and private investment, in the first seven year of current government it is more or less the same with private investment which is summation of domestic and foreign investment but from that year on it holds an 'M' shape up to 2013/214. It reached its peak during first year of GTP I period and public investment consists high share in compared to private investment during the period. It is only in this period that the contribution of public investment is greater than that private investment. But from eight years of its life onward both private and public investment leaning up to 2013/14 even though they rose up from 2014/15 on ward (See fig 3.10).

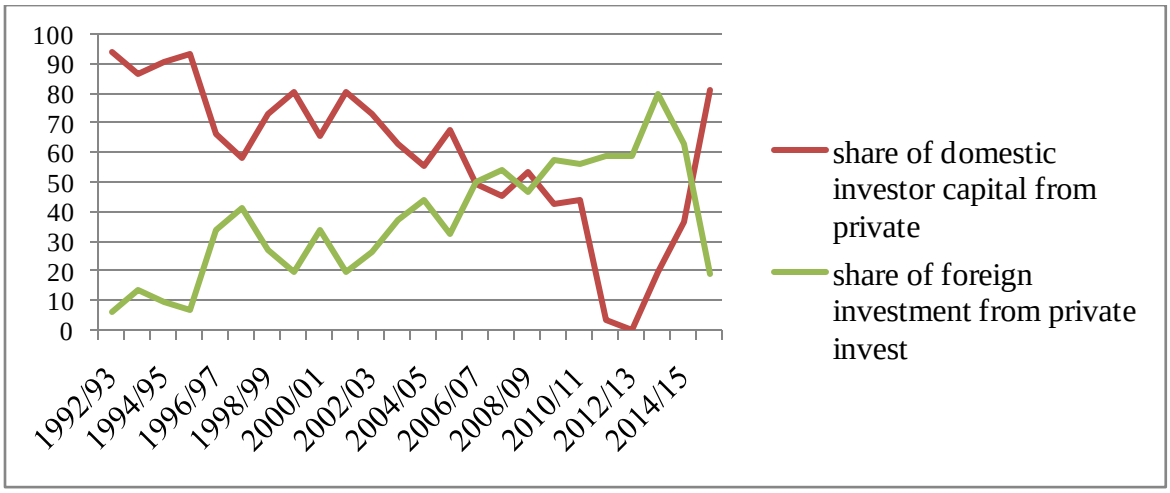
Figure 3.10: Total capital, private capital and public capital investment in million ETB



Source: Own graph from EIA data.

Private investment is composed of domestic and foreign investment. Share of both investments from private investment is opposite to each other (See fig 3.11). Since 1992 share of domestic investor capital from private investment is cyclical and decreasing up to 2013/14 and then starts to rise but reverse true for share of foreign investment which increase up to 2013/14 and decline starting from that year (see figure 3.11)

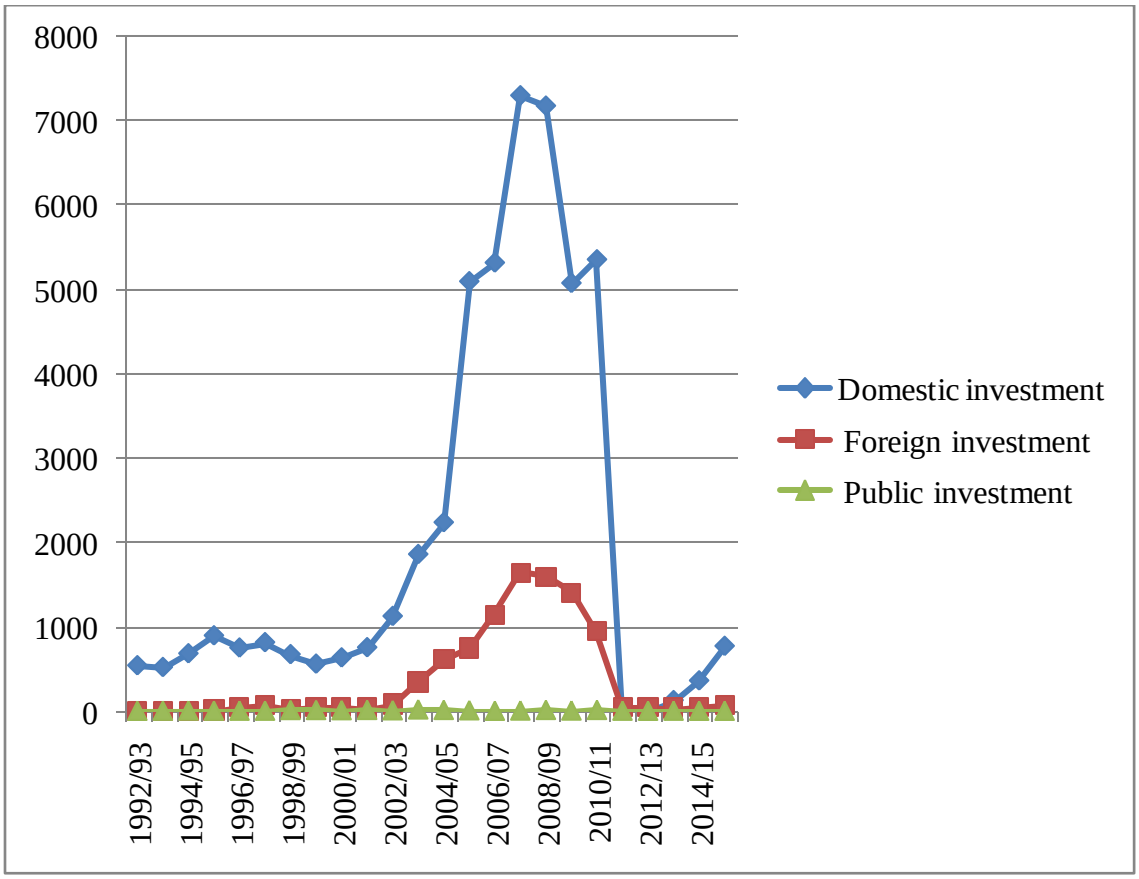
Figure 3.11: Share of domestic and foreign investment from total private investment



Source: Own graph using EIA data

Number of investment project owned by foreign investors is higher next to that of domestic investor since 1992/93 both number reached their maximum number of project during 2007/08 in which 7307 and 1651 is licensed by domestic and foreign investors respectively (see figure 3.12)

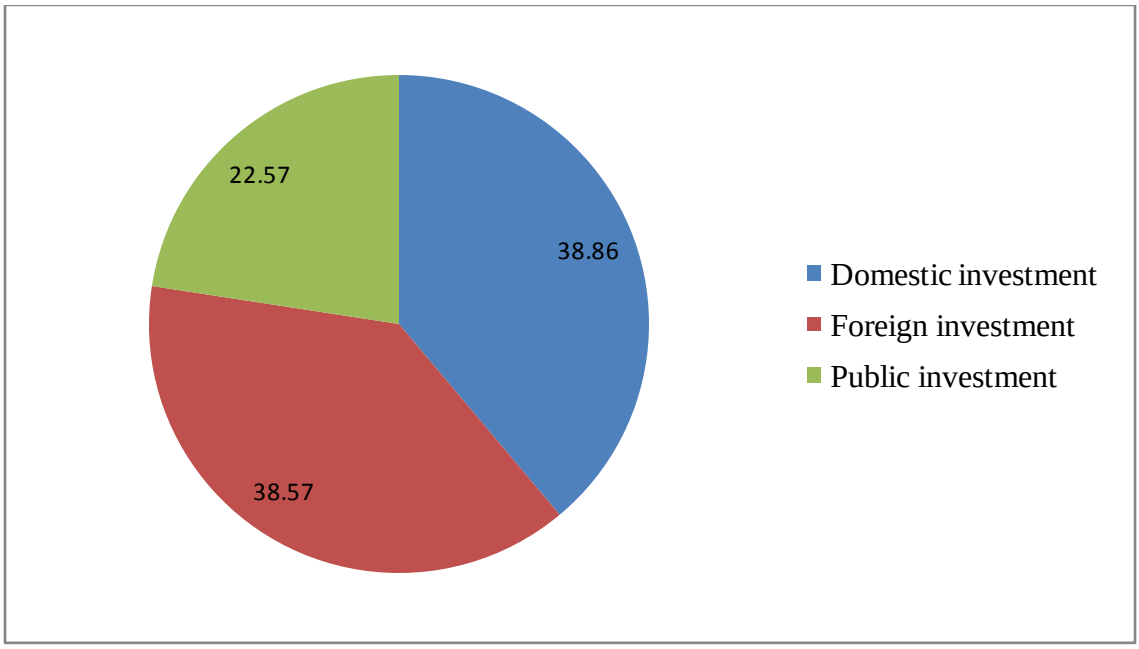
Figure 3.12: Approved investment project by source (from 1992/93-2015/16)



Source: Authors graph from EIA data

With regard to percentage composition of capital investment of domestic investment, foreign investment and public investment since 1992/93 large percentage of capital is captured by domestic private investment (38.86%) followed by, foreign investment(38.57%) and public investment (22.57%)(See fig 3.13).

Figure 3.13: Percentage distribution of investment project capital in percent (1992/93-2015/16)



Source: EIA data

3.3.2 Sectoral distribution of private investment.

Distribution of private investment across the three major sectors in Ethiopia is not equal. Share of projects that started operation is increasing through the year but increment in share of project on service sector is greater than projects in other sectors which is 43.51%, 53.77%, 47.16 % and 63.4 in 1992/93-2004/05, 2005/06-2007/08,2 008/09-2011/12 and 201/13-2015/16 respectively.

Table 3.4: Sectoral distribution of private investment

Year	1992/93-2004/05		2005/06-2007/08		2008/09-2011/12		2012/13-2015/16	
Types of sector	No of Projs.	Capital in 'million' Birr	No of Projs.	Capital in 'million Birr	No of Projs.	Capital in 'million' Birr	No of Projs.	Capital in 'million' Birr
Agriculture	1734	11.559	3974	58617.68	5162	174577.5	155	657.8
Industry	4095	36.409	5869	165688.14	9166	431823.3	388.9	10619.3
Service	4490	62.582	11449	103887.88	12789	139223.0	942	6710.2
Grand total	10319	110.55	21292	328193.7	27117	745623.77	1485.9	17987.3
Percent Agri	16.80	10.46	18.66	17.86	19.04	23.41	10.43	3.66
Percent indu	39.68	32.93	27.56	50.48	33.80	57.91	26.17	59.04
Percent servi	43.51	56.61	53.77	31.65	47.16	18.67	63.4	37.31

Source: EIA

But share of project that start operation in industry sector is volatile that means it take increase and decrease turn by turn while that of agriculture increases up to 2008/09-2011/12 and then decline. This implies as the country is focusing on other sector rather than agriculture during GTP period which show structural transformation. From the side of capital that invested through year, capital invested on industry is increasing from time to time which is 32.93%, 50.48%, 57.91% and 59.04% from the year 1992/93-2004/05, 2005/06-2007/08, 2008/09-2011/12, and 2012/13-2015/16 respectively which prove provocation of government to increase share of industry from the GDP the country.

CHAPTER FOUR

METHODOLOGY

4.1 Sources and Types of Data

To successfully complete this thesis, secondary data has been used including the recent social accounting matrix (2009/2010) obtained from the Ethiopian Development Research Institute and International Food Policy Research Institute.

4.2 The Social Accounting Matrix

A social accounting matrix (SAM) is a comprehensive, economy wide data framework, typically representing the economy of a nation. More technically, a SAM is a square matrix in which each account is represented by a row and a column. Each cell shows the payment from the account of its column to the account of its row. Thus, the incomes of an account appear along its row and its expenditures along its column (Lofgren *et al*, 2002).

According Thurlow (2007) a SAM is a consistent data framework that captures the information contained in the national income and product accounts and the input-output table, as well as the monetary flows between institutions and it is an ex-post accounting framework since, within its square matrix, total receipts must equal total payments for each account contained within the SAM.

SAMs are economy-wide databases that are used in conjunction with analytical techniques to strengthen the evidence underlying policy decisions (Hartley *et al*, 2016).

A social accounting matrix (SAM) can be defined as an organized matrix representation of all transactions and transfers between different production activities, factors of

production, and institutions (households, corporate sector, and government) within the economy and with respect to the rest of the world. SAM has multiple accounts for activities, commodities, factors, and domestic non-government institution. A key advantage of a SAM over the existing supply and use tables lies in the fact that it can be applied to a disaggregated household sector for the purpose of modeling the impact of exogenous changes on the system.

Most SAMs have four major types of accounts: activities, commodities, factors of production, and institutions (households, government and the Rest of World), including an aggregate savings-investment account. The activity accounts show the value of commodities (goods and services) produced by each activity and the cost of inputs into each production activity consisting of intermediate input purchases along with payments to primary factors of production.

Commodity accounts show the components of total supply in value terms (domestic production, imports, indirect taxes and marketing margins) and total demand (intermediate input use, final consumption, investment demand, government consumption and exports). Factor accounts describe the sources of factor income (value added in each production activity) and how these factor payments are further distributed to the various institutions in the economy (households of different types, government and the Rest of World). Accounts for institutions record all income and expenditures of institutions, including transfers between institutions. Savings of the different institutions and investment expenditures by commodities are given in the savings-investment account (EDRI, 2009).

Structure of Standard SAM consist the followings. First, activities (the entities that carry out production) and commodities account. The receipts are valued at producer prices in the activity accounts and at market prices (including indirect commodity taxes and transaction costs) in the commodity accounts. The commodities are activity outputs, either exported or sold domestically, and imports. This separation of activities from commodities is preferred because it permits activities to produce multiple commodities any commodity may be produced by multiple activities.

In the commodity columns, payments are made to domestic activities, the rest of the world, and various tax accounts (for domestic and import taxes). This treatment provides the data needed to model imports as perfect or imperfect substitutes vis-à-vis domestic production.

Second, transactions (trade and transportation) costs also referred to as marketing margins. For each commodity, the SAM accounts for the costs associated with domestic, import, and export marketing. For domestic marketing of domestic output, the marketing margin represents the cost of moving the commodity from the producer to the domestic demander. For imports, it represents the cost of moving the commodity from the border (adding to the c.i.f. price) to the domestic demander, while for exports; it shows the cost of moving the commodity from the producer to the border (reducing the price received by producers relative to the f.o.b. price). A services activity, like other commodities, may be purchased for intermediate use by activities and for final use by institutions. These special accounts are paid by the accounts for marketed agricultural and industrial commodities. Thus the total value of each commodity includes these transaction costs.

The standard CGE model will also work with SAMs without this treatment of (and these accounts for) transaction costs (Lofgren *et al*, 2002).

Third, as noted, the government is disaggregated into a core government account (government transfer, government final consumption and government saving) and different tax accounts (like direct tax and indirect tax). This disaggregation is often necessary because the economic interpretation of some payments may otherwise be ambiguous. In any given application, the SAM may exclude any (or all) of the individual tax accounts. In the SAM, payments between the government and other domestic institutions are reserved for transfers.

Fourth, the domestic nongovernment institutions in the SAM consist of households and enterprises. The enterprises earn factor incomes (reflecting their ownership of capital and/or land). They may also receive transfers from other institutions. Their incomes are used for direct taxes, savings, and transfers to other institutions. As opposed to households, enterprises do not consume. Assuming that the relevant data are available, it is preferable to have one or more accounts for enterprises when these have tax obligations and a savings behavior that are independent of the household sector. The enterprise sector should be disaggregated in a manner that captures differences across enterprises in terms of tax rates, savings rates, and the shares of retained earnings that are received by different household types. Technically, the standard CGE model requires that the SAM have at least one household account; enterprise accounts are not necessary.

Fifth, the SAM distinguishes between home consumption, which is activity-based, and household's marketed consumption, which is commodity- based. Home consumption, which in the SAM appears as household payments to activities, is valued at producer

prices that is, without marketing margins and the sales taxes that may be imposed on marketed commodities.

Household consumption of marketed commodities appears as payments from household accounts to commodity accounts, the values of which include marketing margins and commodity taxes. The standard CGE model also accepts a SAM without (explicit) home consumption.

Sixth, the savings-investment (S-I) account should be seen as representing the "loanable funds" market. The account collects savings from various sources (government, private, and foreign) and spends the accumulated savings on capital goods (I). The SAM provides no information about who "owns" the capital goods or in which sectors they are installed. Investment demand in the SAM is by sector of origin, not sector of destination, so the SAM cannot provide information about changes in sectoral capital stocks, or their valuation (Lofgren *et al*, 2002).

When we come to Ethiopia the first SAM was developed in 2005/06 and also the first comprehensive economy wide dataset (EDRI, 2009). As the current structure of the Ethiopian economy is different from 2005/06 on which the existing SAM is based, it was updated in 2009/10. This study is used the updated version of 2005/06 SAM. The updated SAM is produced in different level of aggregations. It is disaggregated into 113 activities (with 77 agricultural activities by agro ecological zones, AEZs), 64 commodities, 16 factors (by AEZs except capital), and 13 institutions including 12 households. The SAM also has different taxes, saving-investment, inventory, and rest of the world accounts to show the interaction of different economic agents. It integrates regionally disaggregated agricultural production and income generation for the four main agro-ecological zones of

Ethiopia (Humid, high land cereals, drought prone and pastoralist zones). But there is no macro SAM for this recent SAM of Ethiopia. Therefore, researcher has constructed the macro SAM in a way that is suitable for study according their homogeneity into 17 and 17 activities (cereal, noncereal, livestock, mining, food processing, chemical, machinery, manufacturing, utility, construction, trade, hotel, transaction, public administration, health education, and other service) and the same is true for commodities , respectively, 4 factors of production (land, labor, capital and livestock) ,4 households (rural poor household, rural non poor household, urban poor household and urban non poor household) and enterprise, 3 tax(sales tax, import tax and direct tax) , S-I and Government.

4.3 The Computable General Equilibrium (CGE) Model

CGE models are a standard tool of empirical analysis, and are widely used to analyze the aggregate welfare and distributional impacts of policies whose effects may be transmitted through multiple markets and are the primary tool for analyzing the impacts across multiple markets of changes in one or more policy variables (Sue, 2004).

According to (Lofgren and Robinson, 2004; PP 9-10) the dynamic CGE literature includes two strands, dynamic recursive models and optimal growth models. In recursive models, all agents (private and public) make their decisions on the basis of past and current conditions, with no role for forward-looking expectations about the future. Agents are myopic, so they do not care about the future, or ignorant — nobody can or does know anything about the future, so all behavior must be based on information from the past. Alternatively, one can assume that the economy is on a stable (balanced) growth path, and hence agents can simply assume that the future will be “like” the present, and need

no other information to behave rationally. A recursive dynamic model can be divided into a "within-period" model (in essence a static CGE model) and a "between-period" model that links the within-period modules by updating selected parameters (typically including factor supplies, population, and factor productivity) on the basis of exogenous trends and past endogenous variables. Information from past solution can also be used in the between-period model to generate expectations about the future, which might be used to affect agent behavior in later within-period modules. Dynamic-recursive models can be, and often are, solved recursively and the within-period modules are solved separately in sequence, and the between-period modules are solved to provide parameters needed for the within-period model in the succeeding period. Recursive models are used extensively in empirical policy analysis while inter-temporal optimal growth models that can be solved analytically are more important in the theoretical literature. Both modeling traditions (as well as many static models) have incorporated features highlighted by the growth literature, including endogenous determinants of productivity growth. Since they are too complex to solve analytically, CGE models in both traditions have to be solved empirically and are used in simulation analysis. In its current formulation, our model belongs to the class of dynamic-recursive models: agents have no knowledge about the future. In the absence of empirical support for the assumption that private agents act on the basis of perfect foresight, a dynamic recursive formulation is certainly plausible (reasonable) for simulation analysis. We do not explicitly specify the factors that prevent private agents from realizing inter-temporally optimal patterns of savings and investment (e.g., market imperfections, credit constraints, and/or the belief that any knowledge about the future is too uncertain to act on), but we do explore the potential gains from different

policy strategies, given that agents do not have perfect foresight. The model is solved for a finite horizon and is used to explore the properties of a "growth episode" characterized by initial conditions, particular dynamic forces at work, growth linkages, agent behavior, institutional constraints, and the length of the time period.

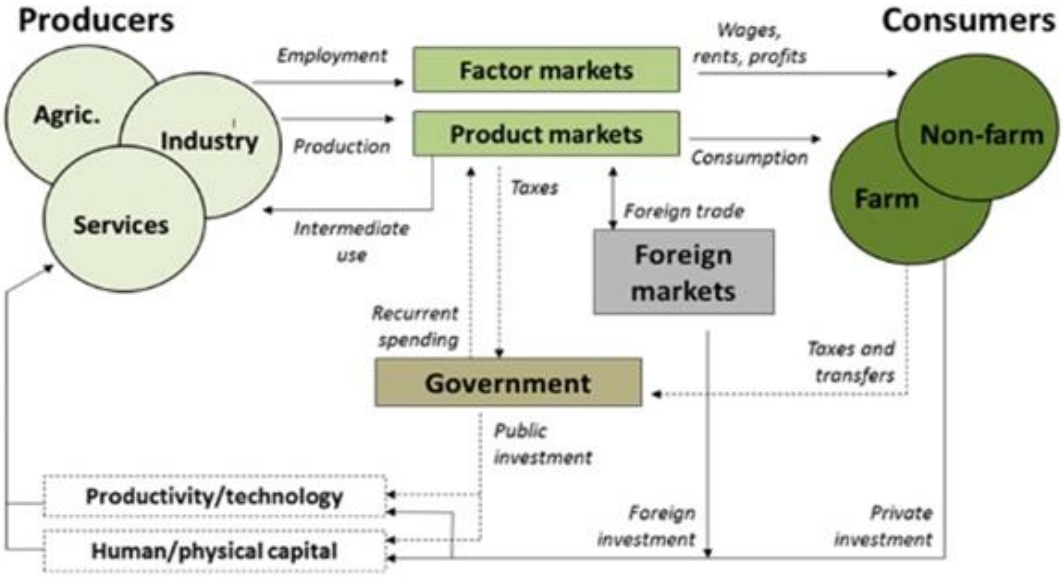
The standard CGE model explains all of the payments recorded in the SAM. The model therefore follows the SAM disaggregation of factors, activities, commodities, and institutions. It is written as a set of simultaneous equations, many of which are nonlinear and also there is linear. There is no objective function. The equations define the behavior of the different actors (Lofgren, 2002).

It has played an important role on policy impact analysis. It is widely used model for policy analysis both in developing and developed countries since it take into consideration the multiple market.

CGE model has a number of advantages over other model since its foundation is micro level and it tries to model whole economy incorporating all behavioral aspects of economic agents in all markets, commodities and factors (Burfisher, 2011). The main strength of CGE analysis is that it models the whole economy explicitly, capture the market mechanism, interlinking between sectors and transactions between economic agents despite being under restrictive assumptions. A clear microeconomic structure with links between micro and macro aspects of the economy makes it the soundest tool for quantitative policy analysis and CGE models allow simulating behavioral responses and adjustments on several markets, while enabling some flexibility in setting macroeconomic rules to assess the impact of different government revenue allocation

policies. CGE use general equilibrium model which shown by circular flow diagram of the economy as follows:

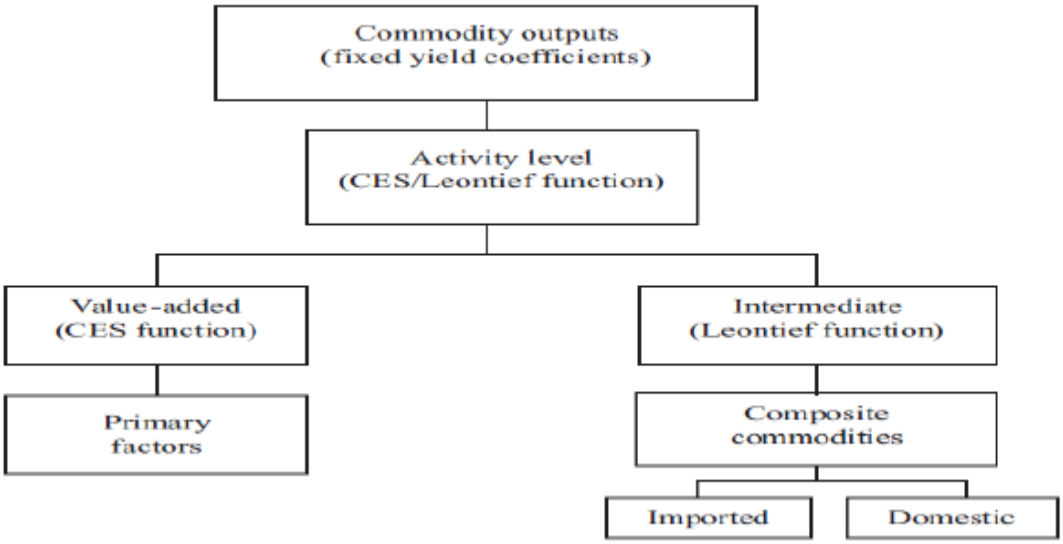
Fig 4.1: Conceptual framework of government expenditure in economic wide model.



Source: Thurlow (2008)

In CGE model each producers are represented by an activity, and Production and consumption behaviors of each producer and consumer respectively are captured by first order optimality condition; the system includes producers' profit and consumers' utility maximization subject to technology and income constraints respectively. A different market and macro aggregates constraints, which has to be satisfied by the system, are also included in the equations. A technology is specified in the model by a constant elasticity of substitution (CES) or a Leontief function of the quantities of value-added and intermediate input (Lofgren *et.al.*2002).

Figure 4.2: Production technology of the CGE model



Source: Lofgren *et al*, 2002

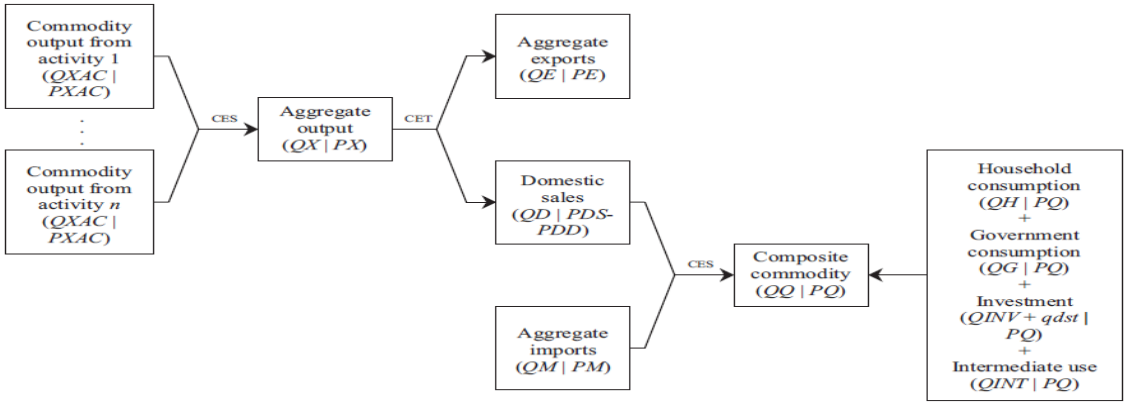
Commodity flow

It shows the flow of a single commodity between economic agents (i.e. from producer to producer, households, ROW and government). The main features are follows:

The supply of a particular commodity from each producer is combined to derive aggregate commodity output. The aggregate commodity output is governed by a CES function which allows demanders to substitute between the different producers supplying a particular commodity, in order to maximize consumption subject to relative supply prices. The decision of producers is governed by a constant elasticity of transformation (CET) function, which distinguishes between exported and domestic goods, and by doing so, captures any time or quality differences between the two products. Profit maximization drives producers to sell in those markets where they can achieve the highest returns. Domestically produced commodities that are not exported are supplied

to the domestic market. Substitution possibilities exist between imported and domestic goods under a CES Armington specification. It takes place both in final and intermediates. The Armington elasticities vary across sectors, with lower elasticity's reflecting greater differences between domestic and imported goods. Small country assumption, Ethiopia is assumed to face infinitely elastic world supply at fixed world prices. The final ratio of imports to domestic goods is determined by the cost minimizing decision-making of domestic demanders based on the relative prices of imports and domestic goods (both of which include relevant taxes.

Figure 4.3: Flow of marketed commodity



Source: Lofgren *et al*, (2002)

The model also includes equations for closures that adjust the economy to ensure equilibrium. There are two types of CGE the first one is static CGE while the other is dynamic CGE. The static CGE consider the within period study while the dynamic one consider between two period study. Also their equation is different from one another.

4.3.1 The Static Equation (Within Period Equation)

The CGE model is a system of simultaneous, nonlinear equations. The model is square that is, the number of equations is equal to the number of variables. In this class of models, this is a necessary (but not a sufficient) condition for the existence of a unique solution. Here the equations classified in to four blocks: prices, production and trade, institutions, and system constraints (Lofgren *et al*, 2002).

4.3.1.2 Price Block

The price system of the model is rich, primarily because of the assumed quality differences among commodities of different origins and destinations (exports, imports, and domestic outputs used domestically). The price block specifies equations for the endogenous model prices that are linked to other endogenous or exogenous prices and to non-price model variables (see Appendix E).

4.3.1.3 Production and Trade Block

Production in the economy carried out by activities which are assumed to maximize profits subject to their technology taking prices as given and act in a perfectly competitive setting. The production technology chosen from two specifications permitted in the model, these are the constant elasticity of substitution and Leontief function at the top level of technology nest the activity level is either CES or a Leontief function of the quantity of value added and aggregate intermediate input use. In this study, the Leontief technology is at the top level of the technology nest. The production function for activity is a function of the quantities of aggregate value added and intermediate inputs that yield commodity outputs in the production process. The quantity of value-added is a CES

function of disaggregated primary factors. The demand for aggregate value added and intermediate inputs are formulated as fixed share of activity level (Appendix E).

4.3.1.4 Institutional Block

Institutional block contains the income and expenditure of the four major institutions (households, government, enterprises and ROW). Household and enterprises obtain their income from payment of factors made by each activity and transfers from other institutions. Households expend their income for consumption, saving, directs tax and transfer to other household and institution. With the exception of consumption and tax (enterprises do not consume and pay indirect tax), the expenditure pattern of the enterprises is similar to that of the households. Government revenue is collected from taxes, factors payment and transfer from the ROW. Its expenditure is confined to consumption, saving and transfers to domestic institution. The total income of each factor is defined as the sum of activity payments. Mathematically,

A. **Factor Income**

$$\boldsymbol{YF_f = \sum_{a \in A} WF_f . \overline{WFDIST_{fa}} . QF_{fa} \quad f \in F} \qquad \textbf{(1)}$$

Where, YF_f denotes factor incomes, WF_f denotes the average factor price, $WFDIST_{fa}$ denotes the wage distortion factor, and QF_{fa} denotes the quantity demanded of factor f from activity a .The wage distortion factor measures the deviation from the average wage. It is fixed because for each factor in the model, the deviation is the same.

B. **Institutional Factor Income**

It is distributed among domestic institution in fixed shares after payment of direct factor taxes and transfer to the rest of the world.

$$\boldsymbol{YIF_{if} = shif_{if} . \left[YF_f - trnsfr_{rowf} . EXR\right] \qquad i \in INSD} \qquad \textbf{(2)}$$

Where, *i* stands for institutions which is an element of INDS representing a set of domestic institutions, YIF_{if} represents institutional factor income, $shif_{if}$ represents the share of domestic institution *i* in income of factor f, and $trnsfr_{rowf}$ represents transfer from factor *f* to institution *i*.

C. Government Revenue

The government revenue is the sum of different types of taxes, factor payment and transfer from the ROW. It uses the income to purchase commodities for its own consumption (fixed in real term) and to make transfer to other institutions. Mathematically, it is described as follows:-

$$\boldsymbol{YG = \sum_{i\in INSD} TINS_i . YI_i + \sum_{f\in F} tf_f . YF_f + \sum_{a\in A} tva_a . PVA_a . QVA_a +}$$

$$\boldsymbol{\sum_{a\in A} ta_a . PA_a . QA_a \sum_{c\in CM} tm_c . pwm_c QM_c . EXR \quad \sum_{c\in CE} te_c . pwe_c . QE_c . EXR +}$$

$$\boldsymbol{\sum_{c\in C} tq_c . PQ_c . QQ_c + \sum_{f\in F} YIF_{govf} + trnsfr_{govrow} . EXR} \qquad \textbf{(3)}$$

To clarify in theory

[Government revenue]= [direct tax from institution] + [direct tax from factors] + [value added tax] + [activity tax] + [import tariffs] + [export tax] + [sales tax] + [factor income] +transfer from Row]

Where, *YG* is government revenue, $TINS_i$ is direct tax rate for institution *i*, YI_i is income of institution *i*, tm_c is import tariffs, pwm_c is world price of import, QM_c is quantity of import, tq_c is indirect sales tax, PQ_c is composite commodity price, QQ_c is composite supply, YIF_{govf} is transfer from institution to the government, $trnsfr_{govrow}$ is transfer from the ROW to the government, and *EXR* is exchange rate.

D. Government Expenditure

When we put government expenditure in mathematics:-

$$EG = \sum_{c \in C} PQ_c \, QG_c + \sum_{i \in INSDNG} trnsfr_{i\,gov} \, . \overline{CPI} \; ` \qquad (4)$$

Where, EG stands for government expenditure, PQc stands for composite price, QGc stands for government consumption demand for commodity, $trnsfri_{gov}$ stands for transfers from government to institution i, and CPI stands for consumer price index.

4.3.1.5 System Constraints Block and Macroeconomic Closure

This block constitutes formulation of the system closures which equilibrate the model (keeping the equality of equations and endogenous variables) by fixing some variable for the model to have a solution. According to Lofgren *et al* (2002) there are factor market and macroeconomic closure (external balance, saving investment balance and government balance). The choice of closure affects all simulations other than the base simulation. The selected closures in this study are those applicable for the country under the study. The first closure in the standard CGE model is for factor markets. It equalizes the total quantity demanded and supplied for each factor in the factor market. Mathematically this can be shown as follows:

$$\sum_{a \in A} \boldsymbol{QF_{fa}} = \overline{\boldsymbol{QFS_f}} \;\; \boldsymbol{f \in F} \qquad \textbf{(5)}$$

Where, QFS_f denotes quantity supply of factor *f*. An economy wide wage variable is free to vary to assure that the sum of demands of factors from all activities equals the quantity supplied. Each activity pays an activity-specific wage that is the product of the economy wide wage and an activity-specific wage distortion term which is fixed for this closure.

In this study, labor in the model is disaggregated in to skilled, semi-skilled and non-skilled. Factor market closure where skilled and semiskilled labor is fully employed and non-skilled labor is unemployed and mobile across sectors; land is fully employed and

mobile across sectors and capital is fully employed and activity specific is used in this study. The implication of full employment of skilled, semiskilled labor, land and capital is the fixation of their quantity. But for the case of unskilled labor since there is a room for unemployment, its employment is flexible and wages are fixed in real terms hence, supply adjusts itself to match demand. The mobility of labor and land across sectors implies that they can be employed in different activities, whereas capital is activity specific as it is immobile across sectors in Ethiopia. Current government balance imposes equality between current government revenue and the sum of current government expenditures and savings. Government balance has two closures, the first is flexible governments saving (GSAV) with fixed direct tax rates and the second closures is direct tax rates of domestic institutions are adjusted endogenously to generate a fixed level of government savings and fixed government savings and scaled direct tax rates for selected institutions. But for this study flexible government saving and fixed direct tax rate is selected. For external balance there are two closures: those are exchange rate is flexible, foreign savings are fixed and exchange rate is fixed, foreign savings are flexible. For this study the first closure is chosen because foreign saving is one of the options to finance component of government of expenditure which include both consumption. For saving investment balance also there are closures but the critical difference between the various closures for the savings-investment balance lies in whether savings are assumed to be investment-driven or whether investment is considered to be savings-driven. Therefore, closures are either investment is saving driven (investment adjust) or savings is investment driven (saving adjusts) but we choose investment is saving driven. Accordingly, the sum of savings from the government, domestic non-government

institutions and the ROW are equated with the sum of public investment, private investment and foreign investment which is again equal with fixed capital formation. Finally, the consumer price index is chosen as flexible numéraire such that all prices in the model are relative to the weighted unit price of households' initial consumption bundle.

Mathematically, it is expressed as follow:-

A. Composite Commodity Markets:-

$$QQ_c = \sum_{a \in A} QINT_{c\,a} + \sum_{h \in H} QH_{c\,h} + QG_c + QINV_c + qdst_c + QT_c \qquad (6)$$

Where, qdstc = is quantity of stock change the above equation imposes equality between quantity supplied and demanded of composite commodity.

B. Current Account Balance

$$\sum_{c \in CM} \boldsymbol{pwm_c} . \boldsymbol{QM_c} + \sum_{f \in F} \boldsymbol{trnsfr_{rowf}} =$$

$$\sum_{c \in CE} \boldsymbol{pwe_c} . \boldsymbol{QE_c} + \sum_{i \in INSD} \boldsymbol{trnsfr_{i\,row}} + \overline{\boldsymbol{FSAV}} \qquad (7)$$

Where, $\boldsymbol{FSAV}$ **is foreign saving (FCU) exogeneous varaiable**

$$\boldsymbol{YG = EG + GSAV} \qquad \textbf{(8)}$$

The government balance imposes equality between ceurrent government revenue and the sum of current government expenditure (not including the invetsment) and saving may be negative

C. Direct Institutional Tax Rates

$$\boldsymbol{TINS_i} = \overline{\boldsymbol{tins_i}} . (\mathbf{1} + \overline{\boldsymbol{TINSADJ}} . \boldsymbol{tins01_i}) + \overline{\boldsymbol{DTINS}} . \boldsymbol{t} \qquad \boldsymbol{i \in INSDNG} \qquad \textbf{(9)}$$

$\boldsymbol{TINS_i}$= rate of direct tax on domestic institutions i

$\overline{\boldsymbol{tins_i}}$. = exogenous direct tax rate for domestic institution i,

$\overline{\boldsymbol{TINSADJ}}$ = direct tax scaling factor (= 0 for base; exogenous variable)

$\boldsymbol{tins01_i}$ = 0–1 parameter with 1 for institutions with potentially flexed direct tax rates

$\overline{\boldsymbol{DTINS}}$ = change in domestic institution tax share (= 0 for base; exogenous variable).

Equation (9) defines the direct tax rates of domestic non government institutions. For the basic model version, all variables on the right-hand side are fixed, in effect fixing the values for the direct tax rate variable for all institutions. In this setting, government savings is the endogenous variable that clears the government balance.

D. Institutional Saving Rate

Equation (28) defines the saving rate of domestic institution

$$\boldsymbol{MPS_i = \overline{mps_i}.(1 + \overline{MPSADJ}.mps01_i) + DMPS.mps01_i \ , \ i \in INSDNG} \quad \textbf{(10)}$$

Where,

$\overline{mps_i}$ = base saving rate for domestic institution i.

$MPSADJ$=saving rate scaling factor (=0 for base).

$mps01_i$= 0-1parameter with 1 for institution with potentially flexed direct tax rates.

$DMPS$ = change in demostic institution saving rate(=0 for base ,exogeneous varaiable).

E. **Saving Investment Balance**

This equation states that total saving and total investment have to be equal .Total saving is the sum of saving from domestic nongovernment institutions,the government , and rest of the world with the last item converted to domestic currency. The total invetsment is the sum of values of fixed invetsment (gross fixed capital formation) and stock changes .

$$\sum_{i \in INSDNG} \boldsymbol{MPS_i}.(\mathbf{1} - \boldsymbol{TINS_i}).\boldsymbol{YI_i} + \boldsymbol{GSAV} + \boldsymbol{EXR}.\overline{\boldsymbol{FSAV}} = \sum_{c \in C} \boldsymbol{PQ_c}.\boldsymbol{QINV_c} + \sum_{C \in C} \boldsymbol{PQ_c}\, \boldsymbol{qdst_c} \quad \textbf{(11)}$$

4.3.2 Dynamic Model (Between the Period Models)

In the previous section we have described the within-period or static component of the model. However, the impact of policy-changes includes dynamic aspects, such as the inter-temporal effects of changes in investment and the rate of capital accumulation. A dynamic CGE model provides a good framework for incorporating the linkages that economic theory and empirical analysis consider important (Lofgren and Robinson, 2004). In order to investigate in more detail the relationship between policy changes and factor accumulation the static model is extended to a dynamic recursive model. In the extended part of the model labor supply will be determined exogenously (updated by the population growth rate, i.e. as population grows, the total labor supply increases at the same rate) while capital accumulation is determined endogenously (In a given time period the total available capital is determined by the previous period's capital stock and investment spending). Then new capital will be distributed among sectors based on each sector's initial share of aggregate capital income (Thurlow, 2004).

Average capital rental share rate:

$$AWF_{ft}^{a} = \sum_{a}\left[\left(\frac{QF_{fat}}{\sum_{a'} QF_{fa't}}\right).WF_{ft}.WFDIST_{fat}\right] \quad (12)$$

Share of new capital

$$\eta_{fat}^{a} = \left(\frac{QF_{fat}}{\sum_{a'} QF_{fa't}}\right).(\beta^{\alpha}\left(\frac{WF_{ft}.WFDIST_{ft}}{AWF_{ft}^{a}} - 1\right) + 1) \quad (13)$$

Share of new capital by sector

$$\Delta K_{fat}^{a} = \eta_{fat}^{a}\left(\frac{\sum_{a} PQ_{ct}.QINV_{ct}}{PK_{ft}}\right) \quad (14)$$

Unit price of capital

$$PK_{ft} = \sum_c PQ_{ct} \frac{QINV_{ct}}{\sum_{c'} QINV_{c't}} \quad (15)$$

Average capital rental rate =

$$QF_{fat+1} = QF_{fat} . (1 + \frac{\Delta K^a_{fat}}{QF_{fat}} - v_f) \quad (16)$$

Average capital rental rate =

$$QFS_{ft+1} = QFS_{ft} . (1 + \frac{\sum_a \Delta K_{fat}}{QFS_{ft}} - v_f \quad (17)$$

4.3.3 Advantage of CGE

CGE modeling offers a systematic method for predicting both the direction and approximate sizes for the impacts of policies on different agents. According Lofgren and Robinson, (2004); Lofgren *et al* (2015) and Sue (2004) the followings are the advantage and disadvantage of CGE model.

First, given that it is country-specific, it provides a tool that policymakers in a specific country can use to deepen the debate on the impact of various policy interventions. Second, it requires less data than cross-country studies.

Third, it is a 'prediction-by-theory', which means that the impact of an intervention can be traced in a consistent way from the macro level to the micro unit included in the analysis. It enables analysts to simulate the effects of different estimated linkage elasticities and incorporate different analytic specifications that theory indicates might be important

Fourth, it is capable to measure policies' ultimate impact on aggregate welfare in a theoretically consistent way, by quantifying the change in the income and consumption of the representative agent that result from the interactions and feedbacks among all of the markets in the economy.

4.3.4 Drawbacks of CGE Model

With the same to other economic models CGE model has its own criticism even though reflection of its merit offset its draw back. Those limitations are

First, the model is dependent on a number of parameters and elasticities that may be unstable and difficult to estimate, among other reasons due to a lack of data; the details vary between countries and depend on model disaggregation and specification.

Second, validity of the model structure and the assumptions that it embodies; in practice, it is very difficult to go beyond relatively limited informal validation tests. For example, questions may be raised about the validity of structural assumptions related to producer and consumer objectives (typically profit maximization and utility maximization).

But compared to the others models, it has been substantially augmented to capture impact of public spending on the economy.

CHAPTER FIVE

SIMULATION AND RESULTS

5.1 Simulation

The major macroeconomic policy of Ethiopia are targeted to sustainable, rapid and inclusive economic growth within stable macroeconomic environment through expanding government expenditure and revenue that play crucial role in consolidating human capital development, energy supply, enhancing the share of investment and gross domestic saving in GDP (NPC, 2015). As the result of the objective sited in GTP II, emphasis will given to strengthening domestic resource mobilization through efficient tax administration and also planned to strengthening infrastructural bottle necks; focus investing on growth enhancing pro poor sector (like human capital and energy) that are consistent with the strategic direction and investments that encourage capital accumulation in general and private investment in particular (NPC, 2015). But, is what planned regarding composition of public expenditure and revenue will bring what desired on private saving and then private investment is the fundamental question that researcher want to answer using updated social accounting matrix of Ethiopia and the preferable policy model which is dynamic CGE. In this chapter, efforts are made to assess the impacts of government policy shocks on private investment in Ethiopia using a dynamic CGE model. In the CGE modeling framework, it is indispensable to establish a baseline scenario that is counterfactual for comparing against the outcome of a policy shock.

5.1.1 Base case scenario (SIM1)

The base case scenario is established to serve as a counterfactual in the absence of any policy shock and serves as a benchmark for policy evaluation in the period under consideration (2011-2025). Thus, the result of the base line simulation is used as the yardstick to compare the values of different variables after the policy shocks.

5.1.2 Non base case scenario (SIM2-SIM10)

The non base case scenarios are informed by government policies and plans and help, to see the brunt of policy shocks on private investment in Ethiopia in comparison with the base case scenario. To finance different composition of expenditure, government uses different sources that it assumes sympathetic to achieve its desired objective. Standing on this, in each policy shocks different sources of finances are identified to see the preferable sources of finance for each category of government expenditure including human capital, electricity and public consumption expenditure. In the recent social accounting matrix constructed for Ethiopia the only government expenditure included under government account is recurrent expenditure which is composed of government consumption and transfer expenditure and capital expenditure is included under saving investment account. Therefore, the only way we can see impacts of human capital and electricity spending on whole economy in general and private investment in particular is through changing total factor productivity (TFP). In doing so the elasticity of each government spending needs to be taken into account. This elasticity of each government spending reveals the response of each sector output for a change in components of government spending. For example, output of all sectors responded by 2.25 percent increase, for 1 percent increase in government expenditure on human capital (Table 5.1).

Table 5.1: Elasticity of public spending

Composition of public spending	Elasticity of government expenditure	Linkage channel
Human capital	0.0225	TFP in all sectors
Public administration	0.0266	TFP in all sectors
Electricity	0.1, 0.055 and 0.075	TFP in industry, service and construction, respectively

Source: Eshete (2014) for human capital and public administration; Gebre (2012) for electricity spending

Given the difficulty of finding elasticity, for each spending categories (e.g. due to inadequate data), it is advisable to use values of elasticity used by other researchers for classes of each public spending of the country. For this study, elasticity of human capital, public administration, and electricity spending used by other researchers have been employed (Eshete, 2014; Gebre, 2012). Next, the following policy shock scenario with their respective source of finance.

SIM2 (PAD_HC): This scenario considers an increase in human capital spending by 29.2 percent (Table 3.3) which is financed through shifting resources from public administration spending to human capital.

SIM3 (PAD_ELE): In this scenario, we simulate increase electricity spending by 29.2 percent (Table 3.3) which is financed through shifting resource from public administration to it.

SIM4 (TAX_HC): This scenario is similar to SIM2 but considers different sources finance. In particular, the scenario considers an increase in human capital spending by

29.2 percent (Table 3.3) when 19 percent is financed by indirect tax (where 10.5 percent is financed by import tax and 8.5 percent is financed by sales tax) and 10.2 percent financed by direct tax. Note that between 2009/2015/16, indirect tax account about 65 percent of tax revenue and the rests are from direct tax. Within this, about 55 percent and 45 percent is import and sales tax, respectively.

SIM5 (FSAV_HC): unlike other scenarios for human capital, this scenario sees increased in human capital spending by 29.2 percent (Table 3.3) which is entirely financed by foreign saving

SIM6 (BOTH_HC): This scenario considers a mix of domestic and foreign sources of finances. Rise in human capital spending by 29.2 percent (Table 3.3), when 2.92 percent financed by foreign saving and the rest is financed via tax. This is because grant and loan holds only 10 percent of capital expenditure during the GTP-II period.

SIM7 (TAX_ELE): This scenario is similar to SIM3, but it considers a mix of financing mechanisms. Specifically, we consider an increase in electricity spending by 29.2(Table 3.3) when 19 percent is financed by indirect tax (where 10.5 percent is financed by import tax and 8.5 percent is financed by sales tax) and 10.2 percent financed by direct tax.

SIM8 (FSAV_ELE): In this scenario, we simulate an increase in electricity spending by 29.2 percent (Table 3.3) which is financed by foreign saving.

SIM9 (BOTH_ELE): This scenario takes into account different financing options of an increase in electricity spending by 29.2 (Table 3.3) when 2.92 percent is by foreign saving and rests are through tax.

SIM10 (PAD_INC): In this simulation scenario, an increase in government consumption by 20.96 percent (Table 3.3) which is financed via tax.

These all are policy scenarios that have been designed to glimpse its impact on private investment in Ethiopia. As indicated earlier, the stated growth rate of policy scenarios are based on policy document which is second growth and transformation plan and assumed to be extended to 2025. Under each simulation (SIM2-SIM9) TFP are expected to grow. For SIM2, SIM4, SIM5 and SIM6 the growth rate of TFP is assumed to be 0.66 percent for all sectors, while for other scenarios (SIM3, SIM7, SIM8 and SIM9) TFP is assumed to grow at 2.92, 1.61 and 2.19 percent for industry, service and construction sector, respectively.

5.1.2.1 Impact on macroeconomic variables

Table 5.2 shows impact of composition of government spending financed by different sources on major macroeconomic variables. The sources of finance for those components of expenditures are shift of resource between unproductive (Afonso *et al, 2005*) and productive expenditure, tax revenue and foreign saving which include loan and grant obtained from external source like international financial institution, and bilateral and multilateral institution. As the simulation results indicate, increased human capital and electricity spending financed by tax revenue (e.g. direct tax and indirect), foreign saving and shifting resource from public administration has positive impact on macroeconomic indicators but public consumption financed by tax revenue has negative impact on macroeconomic variables. However, these all policy simulations have positive and negative impact; the size of it is quite different from one another even for the same variable financed from different source. For example, impact of increase in human capital

expenditure which is financed by shifting resource from public administration, tax, foreign saving and both tax and foreign saving increases growth rate of absorption by 0.08, 1.04, 0.85 and 1.05 percent (See table 5.2. On the other hand, increase in expenditure on electricity has very large impact on macroeconomic variables in comparison to other components of government expenditure this is consistent with work of (Ferede *et al,* 2015) which affirm policy measure to increase investment in the electricity sector is likely to stimulate economic growth in the country. As the simulation result reveals, absorption would grow by 1.28, 2.14, 1.92 and 2.15 percent due to increased electricity spending financed by public administration, tax, foreign saving and both tax and foreign saving respectively (See table 5.2). Impact of electricity spending on this variable is greater than that of human capital expenditure through increasing private consumption and fixed investment of the country. Generally, increase in government expenditure on both human capital and electricity under all simulation scenarios has positive impact on fixed investment. But from all policy scenarios, those components of public spending financed through both tax and foreign saving bring large impact on macroeconomic indicators like absorption, export and import and GDP of the country.

Table 5.2: Impact of simulation on macroeconomic growth rate (deviation from base in percent)

	BASE	PAD_HC	PAD_ELE	TAX_HC	FSAV_HC	BOTH_HC	TAX_ELE	FSAV_ELE	BOTH_ELE	PAD_INC
ABSORP	8.31	0.08	1.28	1.04	0.85	1.05	2.14	1.92	2.15	-3.72
PRVCON	8.34	0.23	1.22	1.00	1.02	1.00	1.82	1.82	1.82	-3.77
FIXINV	9.60	-0.20	1.65	1.33	0.63	1.34	3.16	2.42	3.16	-4.17
GOVCON	1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
EXPORTS	13.67	0.13	3.16	1.53	1.20	1.54	4.69	4.33	4.69	-5.76
IMPORTS	9.70	0.10	2.71	1.30	1.02	1.30	4.05	3.74	4.06	-4.60
GDPFC	9.36	0.08	1.53	1.13	0.92	1.13	2.51	2.26	2.52	-4.10

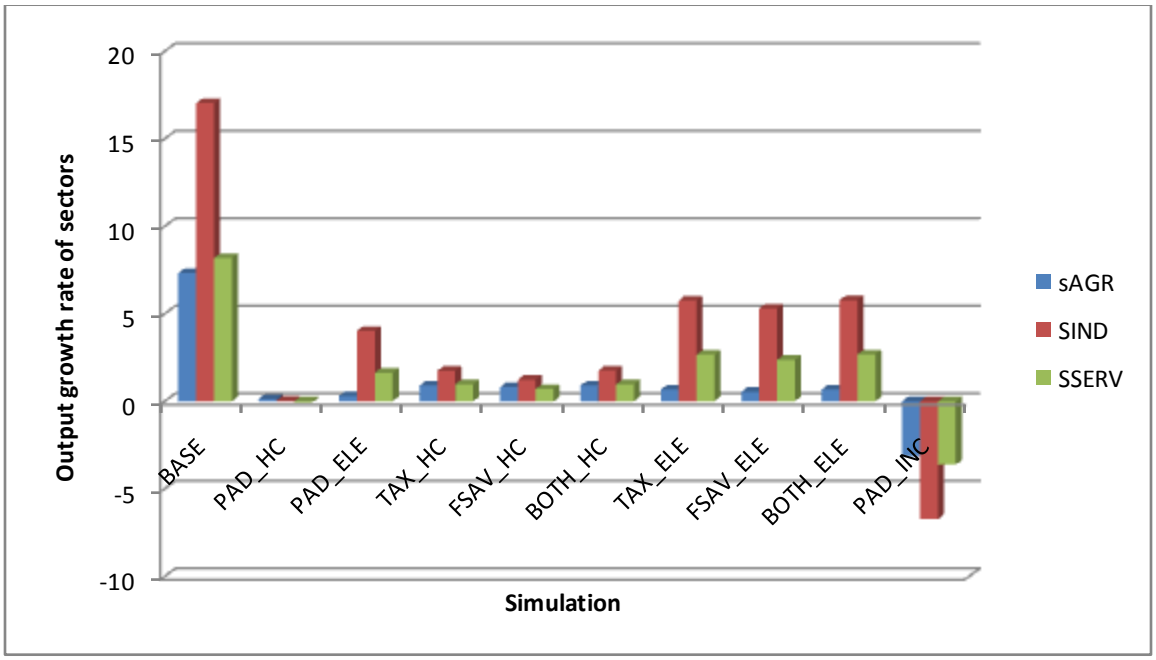
Notice: ABSORB- Absorption PRVCON- Private Consumption
FIXINV-Fixed investment GOVCON-Government consumption
GDPFC- Gross domestic product at factor cost.
Source: simulation results

5.1.2.2 Sectoral Impact

Change in government expenditure also has its own effect on growth rate of sectoral output. All simulation scenarios of human capital and electricity spending have positive impact on agriculture, industry and service sectors as compared to the base case scenario (Fig 5.1). Among the sectors, industry has benefited in comparison with other sectors followed by service. This is in support of the industrialization effort of the country. Even though the policy shock has positive impact on output share of each sector under each simulation, the relative impacts of scenarios vary. From alternative scenarios, human capital and electricity expenditure financed by both tax and foreign saving bring large change on share of all the sectors under consideration. However, the last simulation which focuses on increases in public current consumption expenditure, would adversely affect sectors because increase in government consumption expenditure requires increase

in tax revenue which in turn discourage desire to produce large amount of output by sectors. Therefore, these justify the mechanism through which increase in government consumption expenditure negatively affects sectors output which is consistent with neoclassical approach to fiscal policy.

Figure 5.1: Impact of simulations on sectors output growth rate (deviation from base) in percent



Notice: SAGR- Share of agriculture sector SIND- Share of industry sector
SSERV - Share of service sector
Source: Own graph from simulation results

5.1.2.3 Impact Simulations on Factor Income

Factors of productions are inputs that are used to produce goods and service. Those factors are labor, capital, land and entrepreneurship. Each factor has their respective remuneration which is income for the owner and expense for demanders (Mankiw, 2003). In this study, four factors of production are considered: labor, land, livestock and capital. With the exception of an increase in public consumption expenditure, both human capital

and electricity spending increase positively affect factor income because public investment increases efficiency of other inputs which in turn increase their income. Among the factors, labour income would benefit the most compared with other factors followed by capital. Again human capital and electricity spending financed via tax and foreign saving are the most preferred because it has large impact on growth rate of all factoral incomes (Table 5.3).

Table 5.3: Impact of simulation on factor income growth rate (deviation from the base) in percent

	BASE	PAD_HC	PAD_ELE	TAX_HC	FSAV_HC	BOTH_HC	TAX_ELE	FSAV_ELE	BOTH_ELE	PAD_INC
Flab	10.52	0.18	1.48	1.15	1.06	1.15	2.28	2.16	2.29	-4.31
Flnd	8.72	0.24	0.76	0.98	1.00	0.98	1.21	1.21	1.21	-3.66
Fliv	8.83	0.21	1.50	0.99	0.98	1.00	2.29	2.21	2.29	-3.83
Fcap	9.26	0.20	1.56	1.05	1.02	1.06	2.16	2.13	2.17	-4.14

Source: simulation results

NB. Flab- Labor Flnd-Land Fliv- Livestock Fcap- Capital

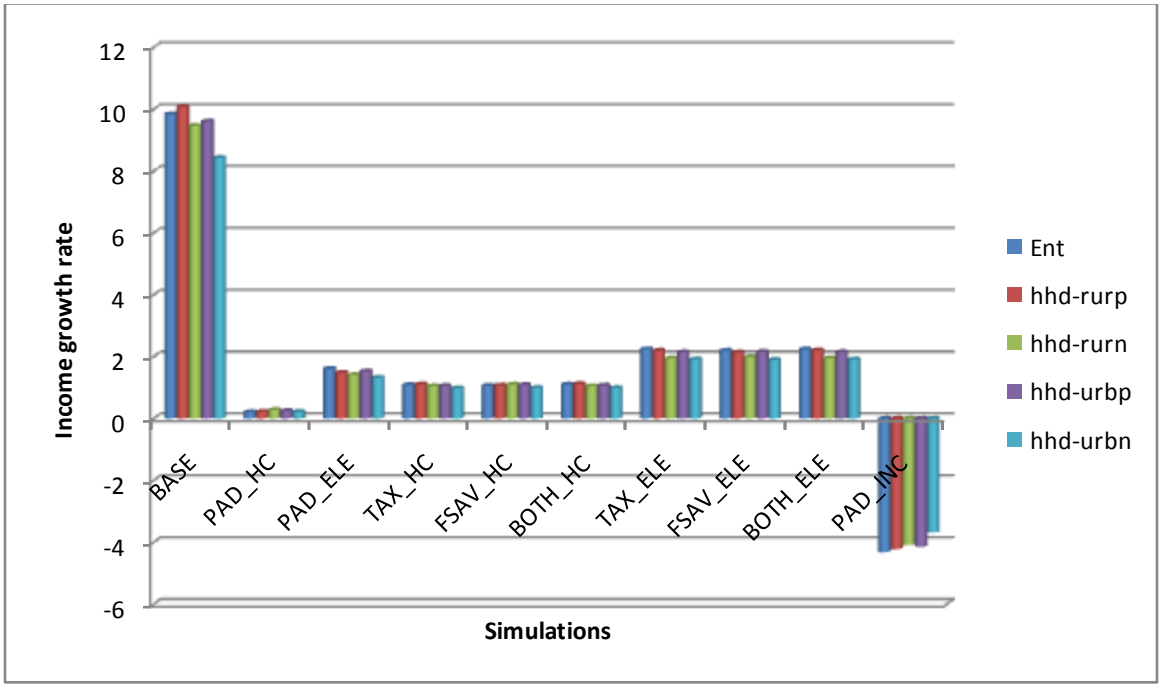
5.1.2.4 Impact on Income of domestic non government institution

Households earn incomes from sale of factors of production like labor and capital to industries, but they also receive transfer payments from the government (in the form of safety net assistance, social security paychecks, and pensions) and from the rest of the world (in the form of remittances) (EDRI, 2009). All scenarios under consideration have positive effect on the income growth rate of domestic non government institutions.

But the effect size of the same simulation on income of different categories of domestic non government institutions (e.g. enterprise, rural poor household, rural non poor household and the like) and different simulation scenario on the same categories of non government institution are not equal due their multiplier difference in simulation scenario. For example in fig 5.2 SIM2 (PAD_HC) net impact of human capital expenditure on income growth rate of rural non poor households (0.28 percent) is higher than that of enterprise (0.21 percent), rural non poor household (0.22 percent), urban poor household (0.25 percent) and urban non poor households (0.22 percent). This implies that shifting resource from public administration to human capital benefit more rural non poor household than others. This can been seen from two side one it increase their net income increase because finance shifted between sectors which save them from burden of tax and on the other hand expansion of human capital increase their productivity by keeping them healthy and educated via providing health center and schools. In SIM3 (PAD_ELE) the net impact of electricity spending on income growth rate of enterprise, rural poor households, rural non poor households, urban poor households and urban non poor households are 1.61, 1.48, 1.41, 1.53, and 1.32 percent, respectively. This simulation scenario favoured enterprises and greater impact on growth rate of enterprise income followed with urban poor households' income compared to others. In SIM4 (TAX_HC) tax financed human capital expenditure also has differentiated effect on income of each categories of domestic non government institution which is 1.09, 1.11, 1.05, 1.06 and 0.98 percent for enterprise, rural poor households, rural non poor households, urban poor households and urban non poor households, respectively. This would benefit more rural poor households compared to others. In SIM5 (FSAV_HC) foreign saving financed

human capital would have larger positive impact on income of rural non poor household and least positive impact on urban non poor household which is 1.1 and 0.99 percent, respectively. In SIM6 (BOTH_HC) human capital spending would likely to increase the income of rural poor household and to some extent urban non poor household which are 1.12 and 0.99 percent, respectively but its influence on urban non poor is very meager as compared to others (See fig 5.2).

Figure 5.2: Impact of simulation on income of domestic non government institution growth rate (deviation from the base) in percent



Notice: Ent- Enterprise hhd-rurp- rural poor household
hhd-rurn- rural non poor household hhd-urbp- urban poor household
hhd-urbn- rural non poor household

Source: Own graph from simulation result

On the other hand, under SIM7 (TAX_ELE) electricity spending plays a crucial role in increasing income of enterprises by 2.24 percent. The least benefited household group is urban non poor households, which has been about 1.91 percent increase in income

compared to the base line scenario while the same is true under SIM8 (FSAV_ELE) and SIM9 (BOTH_HC) though their percentage is different. In SIM2-SIM9, the results reveal positive impact of human capital and electricity investment on income of those institutions. However, SIM10 (PAD_INC) would negatively affects incomes of domestic non government institutions and would experience a fall in the growth rates of their income by about -4.32, -4.22, -4.09, -4.15, and -3.68 percent of enterprises, rural poor households, rural non poor households, urban poor households and urban non poor households, respectively. The most affected is enterprise under this simulation because the high government consumption leads distortion tax in which large part of it come from enterprise, decrease output and then net income of enterprise. This is consistent with neoclassical theory (See fig 5.2).

5.1.2.5 Impact on domestic non government saving

From the SAM, saving of the country has three components in which domestic non government is the one. In all simulations with the exception of the last simulation scenario private savings would increase. In SIM2 (PAD_HC), households and enterprise saving would increase, but this policy scenario has large impact on enterprise saving compared to households saving and least impact on saving of rural poor household. On the other hand, under SIM3 (PAD_ELE) saving of enterprise and households would increase but saving of enterprise tend to outweigh compared with others. This implies that increase in government expenditure on electricity consolidate private investment through increasing private income and then strengthen private saving. In SIM4 (TAX_HC) when human capital expenditure is being financed by tax, it would affect enterprise saving most compared to the others. In SIM5 (FSAV_HC) also increase in

government expenditure on human capital financed by foreign saving would increase private saving because disposable income of domestic non government institutions would increase through specified year under the study. In SIM6 (BOTH_HC) enterprise, rural poor household, rural non poor household, urban poor household and urban non poor household saving would increase from ETB 44.45, 10.65, 10.53, 11.03 and 27.60 billion to ETB 53.20, 12.83, 12.62, 13.04, and 33.09 billion, respectively. This result reveals that all simulations except the last would have positive impact however its impact is high on enterprise saving in the country than different components of households. Under SIM7 (TAX_ELE) enterprise, rural poor households, rural non poor households, urban poor households and urban non poor households saving would increase from ETB 44.45, 10.65, 10.53, 11.03, 11.03, 27.60 billion to ETB 63.90, 15.25, 14.64, 15.54 and 38.87 billion ETB, respectively. In SIM8 (FSAV_ELE) which foreign saving is used as main financing electricity expenditure, saving of households and enterprise saving increased. But the extent of change between households and enterprises saving from their base are quite different. This implies that, as change in public spending over electricity will not bring same size impact on society saving. For example, enterprise, rural poor household, rural non poor household, urban poor household and urban non poor households, would increase from ETB 44.45, 10.65, 10.53, 11.03, 27.60 billion to ETB 65.15, 15.10, 14.73, 16.82, 38.93 billion, respectively. In SIM9 (BOTH_ELE) all enterprises and household savings are positively affected. Similar to the other simulations, the impact of this scenario on enterprise saving would be relatively large. But the last policy scenario which is financed by tax SIM10 (PAD_ELE) has different impact on saving of enterprise

and household savings. SIM2-SIM9 has positive impact on domestic non government institution while the last simulation SIM10 has a negative savings of institutions.

In general simulation results of the model indicate that all policy scenarios with the exception of the last scenario (PAD_INC) have positive effect on enterprise and households savings which in turn support growth of private investment of the country which is indispensible for economic growth.

Table 5.4: Impact of simulation on domestic non government saving (deviation from base) in billion ETB

	Base	PAD_HC	PAD_ELE	TAX_HC	FSAV_HC	BOTH_HC	TAX_ELE	FSAV_ELE	BOTH_ELE	PAD_INC
Ent	44.45	2.56	14.87	8.72	9.75	8.75	19.46	20.70	19.48	-26.23
hhd-rurp	10.65	0.40	2.96	2.17	2.10	2.18	4.60	4.45	4.61	-6.08
hhd-rurn	10.53	0.52	2.87	2.08	2.20	2.09	4.11	4.20	4.12	-6.06
hhd-urbp	11.03	1.23	4.18	2.00	3.11	2.01	4.51	5.79	4.52	-6.44
hhd-urbn	27.60	1.27	7.63	5.47	5.64	5.49	11.27	11.33	11.29	-15.62

Notice: Ent- Enterprise hhd-rurp- rural poor household
hhd-rurn- rurar non poor household hhd-urbp- urban poor household
hhd-urbn- rurar non poor household

Source: Own computation simulation results

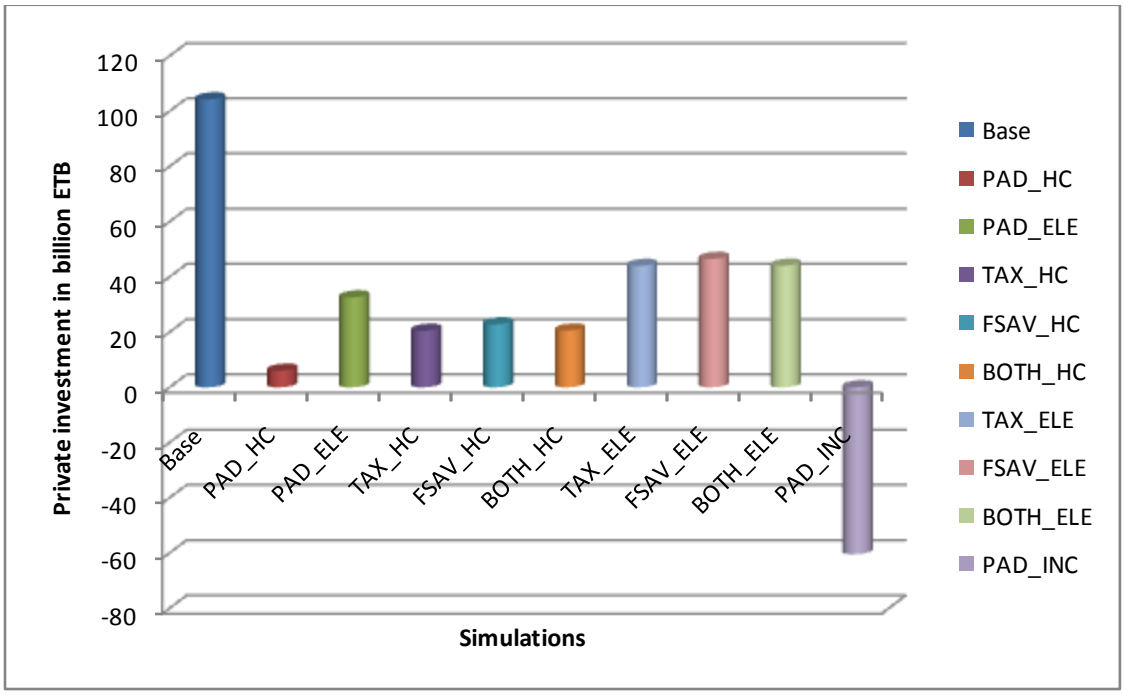
5.1.2.6 Impact on private investment

Growth in capital formation is the key determinant for economic growth. It is composed of public investment, domestic private investment and foreign investment. A total investment of the country is determined by total saving. On the other hand, total saving of the country is composed of public saving, domestic private saving and foreign saving.

According to the national SAM there is no separate account for private, public and foreign investment and all are captured under single account which is total investment. But private, public and foreign investment equals private saving (household and enterprise), public saving and foreign saving respectively (EDRI, 2009). This implies that every change in private saving needs to be reflected with a change in private investment. Private investment is considered as the engine of growth and transformation. Due to its indispensability for economic growth, the Ethiopian government tries to support the growth of private sector. However, the share of private investment in economy remained small. This may be due to inability of policy makers to use the appropriate policy instruments to guide the development of private sector in Ethiopia. Different policy scenarios have also been designed to assess their impact on private sector investment.

In all policy scenarios with the exception of public consumption financed by tax have positive impact on private investment.

Figure 5.3: Impact of simulation on private investment (deviation from base)



Source: Own graph from simulation results

The impact of the different scenarios on private investment varies depending on means of financing sources. For example from simulation, government spending on human capital development financed through different sources including shift of resource from public administration (PAD_HC), domestic source which is tax (TAX_HC), external source like foreign loan (FSAV_HC) and both domestic and external source (BOTH_HC). Private investment would increase by ETB 5.98, 20.44, 22.80 and 20.52 billion on average financed by shift of resource between public administration, domestic source, external source, and both domestic and external source respectively. Above all, human capital spending financed via foreign saving has greater impact on private investment compared with the other alternative sources of finance, while spending financed through shift of resource between sectors has least impact compared with other sources of finance.

Investment in electricity financed via foreign sources (FSAV_ELE) has greater impact on private investment and contribution of public investment in this sector to private investment is greater than all simulation under consideration because (Escribano *et al*, 2009) almost 80 percent of infrastructure contribution to private productivity is from electricity. These simulations suggest that government borrowing from external source to finance human capital and electricity spending would support growth of private investment in Ethiopia since this financing source will not have crowd-out effect because still the benefit of debt on generation is greater than its curse in the country and country has untouched resources that would be made productive through debt financed spending. On the other hand, deficit in the country is meager and therefore according to (Afonso *et al*, 2005) small deficits prevent the absorption of a considerable portion of private savings to finance the public sector (crowding out), which, consequently, benefits private investors via lower interest rates and raising the capital stock. Ultimately impact of government investment on private investment is consistent with Keynesians. In contrary to government investment on human capital and electricity, increase in public consumption financed via tax deteriorates private investment in the country in period under study. As to result from the above (Figure 5.3), increase in public consumption decrease private investment by 60.43 billion ETB. This policy scenario contradicts the objective of the country because of its devastation of private sector which they desired to empower during their overall planning period. This may in one hand increase in government consumption demand adds to government expenditure which increase government internal borrowing and shift IS curve outward which in turn increase cost of borrowing to domestic investors. On the other hand when public consumption increase

chased with increment of tax which is the main source of government revenue to finance, this in turn discourage desire to work and save which would bring crowd out effect on private investment in the country. This is the proponent of theory which say, increases in taxes and increases in government unproductive spending have a strong negative effect on private investment spending (Blanchard and Perotti, 2002; Ramey, 2013; Bedard, 2016) because raising taxes has the effect of creating distortions in the private sector of the economy through reducing purchasing power, and discourage productive activities. And also its multiplier effect is high which in turn offset minimal contribution of government consumption that ultimately crowd out private sector. This can be reconciled with neoclassical approach of public spending.

CHAPTER SIX

CONCLUSIONS AND IMPLICATIONS

6.1 Conclusions

It is undeniable that meticulous private investment is very crucial for sustainable and persistent economic growth of all developing countries in general and our country Ethiopia in particular. In Ethiopia, the private sector has been taking a smaller share of a shrinking cake from her economic growth rate (World Bank, 2016). Regardless of the country plan to advance private investment, the brought change in private investment is not as much as desired and makes their plan mere wish especially during the first growth and transformation plan (NPC, 2015). This incapability to hit the target point from the side of this sector reveals that there are factors that slug behind. Therefore, this study focuses on assessing impact of government expenditure particularly on human capital, electricity, and public consumption shock on private investment. In line with this the following objectives are designed. First, analyze trend of government expenditure and private investment in Ethiopia. Second, analyze impact of each component of public spending shocks financed from different sources on private investment in the country. In order to arrive at objectives we designed secondary data and recent SAM with a dynamic CGE model has been used. To observe the brunt of public spending, the researcher developed different scenarios which based on different source of finance used for additional government expenditure

From trend analysis, total government expenditure increased and domestic private investment was erratic with the same pattern as the growth rate of human capital, energy and public administration in current government.

During the GTP II period, spending on capital investment and pro-poor sectors will be given priority accounting for 59 and 68 percent of total government expenditure, respectively and the rests are left for recurrent expenditure (NPC, 2015/16). During the same period growth rate of public spending on human capital, electricity and public consumption anticipated are 29.2, 29.2 and 20.96 percent, respectively.

In this study ten simulation scenarios are incorporated including base case simulation (SIM1) which serves as counterfactual with which we compare impact of policy shocks in study period.

In exception of last simulation which is increase in public consumption all simulation scenarios (SIM2-SIM9) improve growth rate of almost all macroeconomic indicators including GDP at factor cost while the last simulation (SIM10) worsens all of macroeconomic indicators and GDP at factor cost. This substantiates unproductiveness of government consumption. However, the change that would be brought by each simulation scenarios is different.

On the other hand, impact of all policy simulation on sector output, factor income, domestic nongovernment institution income and saving, and private investment are more or less similar with that of macroeconomic variables. With the exception of the last simulation scenario (SIM10), all exerts positive pressure on those variables though size of impact under simulation is different.

For example increase in human capital expenditure financed via resource shift from public administration, tax revenue; foreign saving and both would increase growth rate of real GDP at factor cost on average by 0.08, 1.13, 0.92 and 1.13 percent, respectively. In addition to these, increases in human capital expenditure financed via both tax and foreign saving increase sectoral output more than other ways of financing. Regarding its impact on domestic non government saving, expenditure financed through both tax and foreign saving will bring a greater impact. However being financed through both tax and foreign saving has not convey equal change in saving of each group of society. Human capital expenditure financed through foreign saving increase enterprise, rural poor household, rural non poor household, urban poor household and urban non poor household by ETB 9.75, 2.10, 2.20, 3.11 and 5.64 billion, respectively. This source of finance would be preferable to increase domestic non government institution saving and private investment which would be increased by ETB 22.80 billion than the other alternative. In case of government spending on electricity financed via four different sources, all macroeconomic variables including real GDP at factor cost growth rates are positively affected. Despite the positive impact of these part of government expenditure under different sources, both tax and foreign saving exert greater positive impact than other sources of finance. On the other hand tax, and both tax and foreign saving financed has the same impact on domestic non government income while foreign saving financed electricity spending provide greater impact on each groups of domestic non government saving in general and private investment (which increase by ETB 46.67 billion) in particular which shall make the desire to be realistic in 2025. In contrast to above simulations which are government investment on productive sectors, increase in

government consumption expenditure financed by tax exacerbate all macroeconomic variables including real GDP at factor cost, sectoral output, factor income, household income, household saving and private investment. According to the simulation result, SIM2-SIM9 and SIM10 would have crowd in and crowd out effect on private investment in the country, respectively.

6.2 Implications

The study has forwarded the following policy implication

First, the government of Ethiopia designed three types of growth and transformation plans to coup up the near low middle income countries. In each planning it targeted to balance its expenditure towards human capital and energy sector and increase share of private investment in the country. Expanding of spending on those sectors improves economy of the country in general and private saving and private investment in particular. As a result the concerning body should strength effective implementation of the plan

Second, from alternative source of finance since foreign saving financed human capital and electricity expenditure consolidate private investment than others, it is good for the government to increase foreign loan and grant and finance spending on the specified sectors.

Third, since increase in public consumption financed through tax deteriorate all economic variables, it is better for the policy maker to decrease growth rate of public consumption expenditure and shift to productive sectors which positively affect private investment.

Fourth, this study concerned only with impact of government expenditure shock financed from different source on private investment in Ethiopia. But the different policy scenarios

affect directly or indirectly other socioeconomic variables such as welfare, employment, income distribution, etc. Therefore, future work could take a detailed assessment of the impacts of the various policy scenarios on these variables.

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Appendices

Appendix A: Average current and capital government expenditure for two regimes in Ethiopia (1974-2009/10)

	Dergue regime				Post 1990/91				
Current expenditure									
Year	1974/75 - 1977/78	1978/79 - 1981/82	1982/83 - 1985/86	1986/87 - 1989/90	1990/91 - 1993/94	1994/95 - 1997/98	1998/99 - 2001/02	2002/03 - 2005/06	2006/07 - 2009/10
public administration	590.1	952.6	1275.9	1842.1	1497.7	2170.7	5906.8	5516.2	10062.5
public administration as percent ACE	59.2	59.8	55.0	56.5	42.4	37.4	58.0	45.3	41.1
Economic service	80.7	102.4	141.2	193.8	311.5	627.2	894.3	1555.7	3306.8
Agriculture &natural resource	24.4	37.3	54.6	102.2	170.1	402.5	592.7	1080.9	2395.7
Mining & Energy	6.4	11.0	15.5	12.0	14.6	19.1	29.4	38.9	52.4
Industry, trade & tourism	4.6	11.2	15.7	19.5	24.4	40.1	74.6	157.2	332.7
Road construction, transport & communication.	45.3	42.8	55.4	60.1	102.5	165.5	197.6	278.6	525.9
Economic service as percentage of ACE	8.1	6.4	6.1	5.9	8.8	10.8	8.8	12.8	13.5
Social services	210.0	309.7	486.7	624.1	902.1	1509.1	2258.6	3817.6	9424.3
Education & Training	136.1	194.8	310.3	416.7	570.6	989.3	1458.8	2918.6	7336.4
Public Health	44.6	69.5	93.0	121.8	187.5	342.6	460.7	644.3	1598.3
Others	39.6	54.3	125.4	105.9	156.3	177.3	339.2	254.7	489.6
Social services as percentage of ACE	21.1	19.4	21.0	19.1	25.5	26.0	22.2	31.3	38.5
various expenditure	115.2	228.6	417.8	599.6	923.6	1494.4	1116.7	1300.8	1747.8
Debt Servicing	52.9	87.3	203.8	376.5	515.7	878.9	1041.0	1090.8	1303.3
Others	62.3	141.3	214.0	223.1	358.8	615.5	75.8	210.0	371.9
various expenditure as % ACE	11.6	14.3	18.0	18.4	26.1	25.8	11.0	10.7	7.1
TOTAL	996.0	1593.2	2321.6	3259.7	3531.9	5801.3	10176.4	12190.3	24468.6
external ass and social	33.0	131.2	234.5	303.3	220.4	213.9	1022.8	1224.1	445.6

safety net									
Average total current Expenditure	1029.0	1724.4	2556.1	3563.0	3806.2	6015.2	11199.2	13414.4	24914.2
Capital expenditure									
Economic development	236.6	426.2	1065.3	1339.5	1352.2	2629.2	2785.9	7049.8	19513.3
Agriculture	98.1	128.9	340.7	333.0	302.9	325.8	583.0	2263.3	4222.0
Natural resources	31.9	70.7	179.9	245.7	247.8	466.2	367.8	850.5	2531.0
Mining & energy	5.7	46.6	243.5	300.7	189.2	467.0	338.5	333.3	1191.2
Trade, Industry & Tourism	4.4	40.0	122.1	237.2	246.7	266.6	31.7	188.0	639.6
Road construction, transport & communication.	96.5	140.0	179.1	222.9	320.9	1012.1	1465.0	2972.2	9492.8
Economic development t as percent of ACaE	84.6	85.6	90.8	90.0	79.4	71.8	65.7	67.3	65.6
Social development	41.3	65.0	80.9	109.0	295.9	769.1	980.7	2766.1	8572.3
Education expenditure	18.5	28.7	40.2	45.0	148.2	392.5	502.7	1764.4	4771.5
Health expenditure	14.8	18.6	22.8	39.6	51.1	200.7	288.2	464.7	1982.2
Others	8.0	17.7	17.8	24.3	96.5	176.0	189.8	537.0	1818.6
Social development as percentage of ACaE	14.8	13.1	6.9	7.3	17.4	21.0	23.1	26.4	28.8
General service & compensation payments	1.8	6.7	27.3	39.8	55.1	261.5	472.5	656.0	1645.6
General service & compensation as percentage of ACaE	0.6	1.3	2.3	2.7	3.2	7.1	11.1	6.3	5.5
Average capital expenditure	279.6	497.9	1173.4	1488.3	1703.2	3659.7	4239.1	10471.8	29731.2

NB. ACE- average current expenditure & ACaE- Average capital expenditure
Source: own computation from MoFEC data

Appendix B: Financial plan of growth and transformation plan II

	Base year	Projections					
Description	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	Average
Total revenue including grants	199.9	241.3	294.1	375.5	479.1	620.6	
Domestic revenue	186.6	226.8	279.5	360.7	463.6	603.3	
Tax revenue	165.3	203.9	250.7	327.9	415.1	542.8	
Non tax revenue	21.3	25.4	33.4	40.1	48.6	60.6	
Grants	13	14.5	14.6	14.7	15.5	17.3	
Total government expenditure	230.5	277.7	338.4	426.1	543.9	713.8	
Percentage of TGE financed by total revenue including grant	86.7	86.9	86.9	88.1	88.1	86.9	87.4
Percentage of TGE financed by domestic revenue	81.0	81.7	82.6	84.7	85.2	84.5	83.7
Percentage of TGE financed by tax revenue	71.7	73.4	74.1	77.0	76.3	76.0	75.4
Percentage of TGE financed by non revenue	9.2	9.1	9.9	9.4	8.9	8.5	9.2
Percentage of TGE financed by grant revenue	5.6	5.2	4.3	3.4	2.8	2.4	3.7
Percentage of TGE financed by EXB	8.1	6.9	6.0	5.3	4.9	5.2	5.3
Percentage of TGE financed by IB	8.0	7.3	9.0	9.2	9.7	7.9	8.3
Recurrent expenditure	113.4	129.4	152.6	186.1	225.9	292.4	
RE as percentage of TE	49.2	46.6	45.1	43.7	41.5	41.0	43.6
Percentage of RE financed by total revenue	42.7	40.5	39.2	38.5	36.6	35.6	38.1
Percentage of RE financed by domestic revenue	39.8	38.1	37.2	37.0	35.4	34.6	36.5
Percentage of RE financed by tax revenue	35.3	34.2	33.4	33.6	31.7	31.2	32.8
Percentage of RE financed by non tax revenue	4.5	4.3	4.5	4.1	3.7	3.5	4.0
Percentage of RE financed by grant revenue	2.8	2.4	1.9	1.5	1.2	1.0	1.6
Percentage of RE financed by external borrowing	4.0	3.2	2.7	2.3	2.1	2.1	2.5
Percentage of RE financed by internal borrowing	3.9	3.4	4.1	4.0	4.0	3.2	3.7

Percentage of RE financed by external finance	6.8	5.6	4.7	3.8	3.2	3.1	4.1
Capital expenditure	117.1	148.3	185.8	240	318	421.3	
CE as percentage of total expenditure	50.8	53.4	54.9	56.3	58.5	59.0	56.4
Percentage of CE financed by total revenue	44.1	46.4	47.7	49.6	51.5	51.3	49.3
Percentage of CE financed by domestic revenue	41.1	43.6	45.3	47.7	49.8	49.9	47.3
Percentage of CE financed by tax revenue	36.4	39.2	40.7	43.3	44.6	44.9	42.5
Percentage of CE financed by non tax revenue	4.7	4.9	5.4	5.3	5.2	5.0	5.2
Percentage of CE financed by grant revenue	2.9	2.8	2.4	1.9	1.7	1.4	2.0
Percentage of CE financed by external borrowing	4.1	3.7	3.3	3.0	2.9	3.1	3.2
Percentage of CE financed by Internal borrowing	4.1	3.9	5.0	5.2	5.6	4.6	4.9
Percentage of CE financed by external finance	7.0	6.5	5.7	4.9	4.6	4.5	5.2
Poverty oriented expenditure	152.9	192.7	242.8	305.9	385.5	485.7	
POE as Percentage of total expenditure	66.3	69.4	71.7	71.8	70.9	68.0	70.4
Percentage of POE financed by total revenue	57.5	60.3	62.4	63.3	62.4	59.2	61.5
Percentage of POE financed by domestic revenue	53.7	56.7	59.3	60.8	60.4	57.5	58.9
Percentage of POE financed by tax revenue	47.6	51.0	53.2	55.2	54.1	51.7	53.0
Percentage of POE financed by non tax revenue	6.1	6.3	7.1	6.8	6.3	5.8	6.5
Percentage of POE financed by grant revenue	3.7	3.6	3.1	2.5	2.0	1.6	2.6
Percentage of POE financed by EXB	5.4	4.8	4.3	3.8	3.5	3.5	4.0
Percentage of POE financed by internal borrowing	5.3	5.1	6.5	6.6	6.8	5.3	6.1
Government saving	73.2	100.7	131.2	181.9	247.6	310.9	
Budget deficit	-30.9	-39.4	-51	-61.4	-79.4	-93.1	
Deficit financing	30.9	39.4	51	61.4	79.4	93.1	
External borrowing	18.7	19.1	20.4	22.4	26.9	37	
Internal borrowing	18.5	20.3	30.6	39	52.5	56.1	
Share of Energy of spending from capital spending	11.0	11.5	11.9	12.2	12.6	12.7	12.2
Percentage of energy spending financed by tax revenue	4.0	4.5	4.8	5.3	5.6	5.7	5.2

Percentage of energy spending financed by external finance	0.8	0.7	0.7	0.6	0.6	0.6	0.6
Human capital spending as percent of capital expenditure	14.5	15.2	15.6	16.1	16.7	16.8	16.1
Percentage of human capital financed by tax revenue	5.3	6.0	6.4	7.0	7.4	7.5	6.9
Percentage of human capital financed by grant	0.4	0.4	0.4	0.3	0.3	0.2	0.3
Percentage of human capital financed by EXB	0.6	0.6	0.5	0.5	0.5	0.5	0.5
Percentage of human capital financed by external finance	1.0	1.0	0.9	0.8	0.8	0.8	0.8

Notice: RE- recurrent expenditure, CE- Capital expenditure and POE- poverty oriented expenditure

Source: Own computation from GTP II data

Appendix C: Number and investment capital approved projects by ownership since 1992/93

	Types of investment							
	Domestic investment		Foreign investment		Public investment		Total investment	
Year	**No of Projs.**	**Capital in million Birr**	**No of Projs.**	**Capital in million Birr**	**No of Projs.**	**Capital in million Birr**	**No of Projs.**	**Capital in million Birr**
1992/93	542	3750	3	233	0	0	545	3983
1993/94	521	2926	4	438	1	57	526	3421
1994/95	684	4794	7	505	2	39	693	5338
1995/96	897	6050	10	434	1	6	908	6490
1996/97	752	4447	42	2268	1	7	795	6722
1997/98	816	5819	81	4106	1	14	898	9939
1998/99	674	3765	30	1380	9	4915	713	10060
1999/00	561	6740	54	1627	9	5760	624	14127

2000/01	635	5675.7	45	2923	7	257	687	8855.7
2001/02	756	6117.3	35	1474	10	1598.8	801	9190.1
2002/03	1,127	9362.9	84	3369	6	706.11	1217	13438.01
2003/04	1,862	12177.7	347	7205	16	1837.04	2225	21219.74
2004/05	2,240	19571.7	622	15405	10	1486.48	2872	36463.18
2005/06	5,100	41841.1	753	19980	6	18215.08	5859	80036.18
2006/07	5,322	46630.1	1150	46949	0	0	6472	93579.1
2007/08	7,307	77868.2	1651	92249	3	261.56	8961	170378.8
2008/09	7,184	83630.2	1613	73111	10	82783.52	8807	239524.7
2009/10	5,080	40852.2	1413	55169	3	393.89	6496	96415.09
2010/11	5,360	42,093	952	53,357	10	154,019	6322	249469
2011/12	5,042	59,316	604	83,975	3	2,877	5649	146168
2012/13	6,273	34,823	722	49,485	16	27,763	7011	112072
2013/14	128	628	34	2,508	1	2,500	163	5636
2014/15	362	1,530	45	2,605	0	0	407	4135
2015/16	772	5,464	80	1,245	0	0	852	6708.6
Total	59,997	525,872	10,381	522,000	125	305,496	70,503	1,353,369
Average	2,500	21,911	433	21,750	5	12,729	2,938	56,390
Percentage of total	85.10	38.86	14.72	38.57	0.18	22.57		

Source: EIA NB. Projs- project

Appendix D: Set and Parameters

$dwts_c$ - weight of commodity c in the producer price index

ica_{ca} - quantity of c as intermediate input per unit of activity a

$icd_{cc'}$ - quantity of commodity c as trade input per unit c ' produced and sold domestically

$ice_{cc'}$ - quantity of commodity c as trade input per exported unit of c '

$icm_{cc'}$ - quantity of commodity c as trade input per imported unit of c '

inta_a - quantity of aggregate intermediate input per activity unit

iva_a - quantity of value-added per activity unit

$\overline{mps}$ - base saving rate for domestic institution i

$mps\ 01_c$ - 0-1 parameter with 1 for institutions with potentially flexed direct tax rates

pwe_c - export price (foreign currency)

pwm_c - import price (foreign price)

$qdst_c$ - quantity of stock change

$\overline{qg}_c$ - base – year quantity of government demand

$\overline{qinv}_c$ - base – year quantity of private investment demand

$shif_{if}$ - share for domestic institution i in income of factor f

$shii_{ii'}$ - share of net income of i ' to i ($i' \in INSDNG'; i \in INSDNG$)

$\overline{tinsi}_1$ - exogenous direct tax rate for domestic institution i

$Tins01_i$ - 0 - 1parameter with 1 for institutions with potentially flexed direct tax rates

tm_c - import tariff rate

tq_c - rate of sales tax

$trnsfr_{if}$ - transfer from factor f to institution i

Parameters (Greek Letters)

α_a^{va} - efficiency parameter in the CES value – added function

α_a^{ca}-shift parameter for domestic commodity aggregation function

α_a^q - Armington function shift parameter

β_{ach}^h- Marginal share of consumption spending on home commodity *c* from activity *a* for household *h*

β_{ch}^m- Marginal share of consumption spending on marketed commodity *c* for household *h*

δ_{ac}^{ac} - share parameter for domestic commodity aggregation function

δ_c^q - Armington function share parameter

δ_c^t - CET function share parameter

δ_{fa}^{va} - CES value –added function share parameter for factor f in activity a

γ_{ch}^m- Subsistence consumption of marketed commodity c for household h

γ_{ach}^h - Subsistence consumption of home commodity c from activity a for

House hold h

θ_{ac} - Yield of output c per unit of activity a

ρ_c^{va} - CES value – added function exponent

ρ_a^{ac} – domestic commodity aggregation function exponent

ρ_c^q- Armington function exponent

ρ_c^t- CET function exponent

Exogenous Variables

$\overline{CPI}$- Consumer price index

$\overline{DTINS}$- Change in domestic institution tax share (= 0 for base; exogenous variable)

$\overline{FSAV}$- Foreign savings (FCU)

$\overline{GADJ}$-Government consumption adjustment factor

$\overline{IADJ}$- Investment adjustment factor

$\overline{\boldsymbol{MPSADJ}}$-Savings rate scaling factor (= 0 for base)

$\overline{QFS_f}$ -Quantity supplied of factor

$\overline{\boldsymbol{TINSADJ}}$ -direct tax scaling factor (= 0 for base; exogenous variable)

$\overline{WFDIST_{fa}}$ -wage distortion factor for factor f in activity a

Endogenous Variables

DMPS - change in domestic institution saving rates (= 0 for base; exogenous Variable)

DPI - producer price index for domestically marketed output

EH_h - consumption spending for household

EXR - exchange rate (LCU per unit of FCU)

GOVSHR - government consumption share in nominal absorption

GSAV - government savings

INVSHR - investment share in nominal absorption

PA_a - activity price (unit gross revenue)

PDD_c - demand price for commodity produced and sold domestically

PDS_c - supply price for commodity produced and sold domestically

PE_c - export price (domestic currency)

$PINTA_c$ - aggregate intermediate input price for activity a

PM_c - import price (domestic price)

PQ_c - composite commodity price

PVA_a - value-added price (factor income per unit of activity)

PX_c - aggregate producer price for commodity

$PXAC_{ac}$ - producer price of commodity c for activity a

QA_{a} - quantity (level) of activity

QD_{c} - quantity sold domestically of domestic output

QE_{c} - quantity of exports

QF_{fa} - quantity demanded of factor f from activity a

QG_{c} - government consumption demand for commodity

QH_{ch} - quantity consumed of commodity c by household h

QHA_{ach} - quantity of household home consumption of commodity c from activity a for household h

$QINTA_{a}$ - quantity of aggregate intermediate input

$QINT_{ca}$ - quantity of commodity c as intermediate input to activity a

$QINV_{c}$ - quantity of investment demand for commodity

QM_{c} - quantity of import of commodity

QQ_{c} - quantity of goods supplied to domestic market (composite supply)

QT_{c} - quantity of commodity demanded as trade input

QVA_{a} - quantity of (aggregate) value-added

QX_{c} - aggregated marketed quantity of domestic output of commodity

$QXAC_{ac}$ - quantity of marketed output of commodity c from activity a

TABS - total nominal absorption

$TINS_{i}$ - direct tax rate for institution i ($i \in$ INSDNG)

$TINS_{ii'}$ - transfer from institution i' to i (both in the rest INSDNG)

WF_{f} - average price of factor f

Appendix E: Equation of the Model

Within period Equation (Static Part)

Price Block

1. Import price

$$PM_C = pwm_C.(1 + tm_C).EXR + \sum_{c' \epsilon CT} PQ_c.icm_{c'c} \qquad c \epsilon CM$$

2. Export price

$$PE_C = pwe_C.(1 - te_C).EXR - \sum_{c' \epsilon CT} PQ_{c'}.ice_{c'c} \qquad c \epsilon CE$$

3. Demand price of domestic non-traded goods

$$PDD_C = PDS_C + \sum_{c' \epsilon CT} PQ_{c'}.icd_{c'c} \qquad c \epsilon CD$$

4. Absorption

$$PQ_C(1 - tq_C).QQ_C = PDD_C.QD_C + PM_C.QM_C \qquad c \epsilon (CD \subset CM)$$

5. Marketed output value

$$PX_C.QX_C = PDS_C.QD_C + PE_C.QE_C \qquad c \epsilon CX$$

6. Activity price

$$PA_a = \sum_{c \epsilon C} PXAC_{ac}.\theta_{ac} \qquad \alpha \epsilon A$$

7. Aggregate intermediate input price

$$PINTA_a = \sum_{c \epsilon C} PQ_c.ica_{ca} \qquad \alpha \epsilon A$$

8. Activity revenue and costs

$$PA_a.QA_a = PVA_a.QVA_a + PINTA_a.QINTA_a \qquad \alpha \epsilon A$$

9. Consumer price index

$$\overline{CPI} = \sum_{c \epsilon C} PQ_c.cwts_c$$

10. Producer pric index for non-traded output

$$DPI = \sum_{c \epsilon C} PDS_c.dwts_c$$

Production and Trade block

11. Leontief Technology: Demand for Aggregate Value- Added

$$QVA_a = iva_a.QA_a \qquad a \epsilon AlEo (\subset A)$$

12. Leontief Technology: Demand for Aggregate Intermediate Input

$$QINTA_a = inta_a.QA_a \qquad a \epsilon AlEo (\subset A)$$

13. Value-added and factor demands

$$QVA_a = \alpha_a^{va}\left(\sum_{f\epsilon F}\delta_{fa}^{va}\,QF_{fa}^{-\rho_a^{va}}\right)^{\frac{-1}{\rho_a^{va}}} \qquad a\epsilon A$$

14. Factor Demand

$$WF_f\overline{WFDIST}_{fa} = PVA_aQVA_a\left(\sum_{f\epsilon F\prime}\delta_{fa}^{va}.QF_{fa}^{-\rho_a^{va}}\right)^{-1}\delta_{fa}^{va}QF_{fa}^{-\rho_{a^{-1}}^{va}} \qquad a\epsilon AF\epsilon F$$

15. Disaggregated intermediate input demand

$$QINT_{ca} = ica_{ca}QINTA_a \qquad a\epsilon A; c\epsilon C$$

16. Commodity production and allocation

$$QXAC_{ac} + \sum_{h\epsilon H} QHA_{ach} = \theta_{ac}QA_a \qquad a\epsilon A; a\epsilon CX$$

17. Output aggregation function

$$QX_{ca}=\alpha_a^{ac}.\left(\sum_{a\epsilon A}\delta_{ac}^{ac}.QXAC_{ac}^{-\rho_c^{ac}}\right)^{-\frac{1}{\rho_a^{ac}-1}} \qquad c\epsilon CX$$

18. First –order condition for output aggregation function

$$PXAC_{ac} = PX_cQX_c\left(\sum_{a\epsilon A\prime}\delta_{ac}^{ac}.QXAC_{ac}^{-\rho_c^{ac}}\right)^{-1}\delta_{ac}^{ac}.QXAC_{ac}^{-\delta_c^{ac-1}} \quad a\epsilon A; c\epsilon CX$$

19. Output transformation(CET) function

$$QX_c = \alpha_c^t.\left(\delta_c^t.QE_c^{\rho_c^t} + (1-\delta_c^t)QD_c^{\delta_c^t}\right)^{\frac{1}{\rho_c^t}} \qquad c\epsilon(CE\cap CD)$$

20. Export-domestic supply ratio

$$\frac{QE_C}{QD_c} = \left(\frac{PE_c}{PDS_c}.\frac{1-\delta_c^t}{\delta_c^t}\right)^{\frac{1}{\rho_c^{t-1}}} \qquad c\epsilon(CE\cap CD)$$

21. Output transformation for non-exported commodities

$$QX_c = QD_c+QE_c \qquad c\epsilon(CD\cap CEN)\cup(CE\cup CDN)$$

22. Composite supply (Armington) function

$$QQ_c = \alpha_c^q\left(\delta_c^qQM_c^{-\rho^q} + \left(1-\delta_c^q\right).QD_c^{\rho^q}\right)^{\frac{1}{\rho^q}} \qquad c\epsilon(CM\cap CD)$$

23. Import-domestic demand ratio

$$\frac{QM_C}{QD_c} = \left(\frac{PDD_c}{PM_c}.\frac{\delta_c^q}{1-\delta_c^q}\right)^{\frac{1}{1+\rho_c^q}} \qquad c\epsilon(CM\cap CD)$$

24. Composite supply for non-imported outputs and non-produced imports

$$QQ_c = QD_c + QM_c \qquad c\epsilon(CD\cap CMN)\cup(CM\cup CDN)$$

25. Demand for transaction service

$$QT_c = \sum_{c\prime\varepsilon C\prime}(icm_{cc\prime}.QM_{c\prime} + ice_{cc\prime}.QE_{c\prime} + icd_{cc\prime}.QD_{c\prime}) \qquad \text{c} \in \text{CT}$$

Institutional Block

26. Factor income

$$YF_f = \sum_{\alpha\epsilon A} WF_f.\overline{WFDIST}_{fa}.QF_{fa} \qquad f\epsilon F$$

27. Institutional factor income

$$YIF_{if} = shif_{if}\left[(1-tf_f).YF_f - trnsfr_{rowf}.EXR\right]$$

28. Income of domestic, on-government Institutions

$$YI_i = \sum_{f\epsilon F} YIF_{if} + \sum_{f\epsilon INSDNG\prime} TRII_{ii\prime} + trnsfr_{igov}.\overline{CPI} + trnsfr_{irow}.EXR \qquad i\epsilon INSDNG$$

29. Intra-institutional transfers

$$TRII_{ii'} = shii_{ii'}(1-MPS_{i'}).(1-TINS_{i'}).YI_{i\prime} \quad i\epsilon INSDNG\,;i'\epsilon INSDNG'$$

30. Household consumption expenditure

$$EH_h = (1-\sum_{i\epsilon INSDNG} shii_{ih}).(1-MPS_h)(1-TINS_h).YI_h \qquad h\epsilon H$$

31. Household consumption demand for marketed commodities

$$PQ_cQH_{ch} = PQ_c\gamma_{ch}^m + \beta_{ch}^m(EH_h\text{-}\sum_{c\prime\epsilon C} PQ_c\gamma_{c'h}^m - \sum_{a\epsilon A}\sum_{c\prime\epsilon C} PXAC_{ac}\gamma_{ac'h}^h) \;\; c\epsilon C;\;\; h\epsilon H$$

32. Household consumption demand for home commodities

$$PXAC_{ac}QHA_{ach} = PXAC_{ac}\gamma_{ach}^h + \beta_{ach}^h(EH_h\text{-}\sum_{c\prime\epsilon C} PQ_c\gamma_{c'h}^m - \sum_{a\epsilon A}\sum_{c\prime\epsilon C} PXAC_{ac}\gamma_{ac'h}^h) \;\; c\epsilon C;\;\; h\epsilon H$$

33. Investment demand

$$QINV_C = \overline{LADJ}.\overline{qinv}_c \qquad c\epsilon CINV$$

34. Government consumption demand

$$QG_C = \overline{GADJ}.\overline{qg}_c \qquad c\epsilon C$$

35. Government revenue

$$YG = \sum_{i\epsilon INSDNG} TINS_i.YI_i + \sum_{c\epsilon CM} tm_c.pwm_c.QM_c.EXR + \sum_{c\epsilon C} tq_c.PQ_C.QQ_c + \sum_{f\epsilon F} YIF_{govf} + trnsfr_{govrow}.\text{EXR}$$

36. Government expenditure

$$EG = \sum_{c\epsilon C} PQ_c.QG_c + \sum_{i\epsilon INSDNG} trnsfr_{i\,gov}\,\overline{CPI}$$

System Constraint Block

37. Factor market

$$\sum_{a \epsilon A} QF_{fa} = \overline{QFS}_f \qquad f \epsilon F$$

38. Composite commodity markets

$$QQ_c = \sum_{a \epsilon A} QINT_{ca} + \sum_{h \epsilon H} QH_{ch} + QG_c + QINV_c + qdst_c + QT_c \qquad c \epsilon C$$

39. Current account balance for the rest of the world (in foreign currency)

$$\sum_{c \epsilon CM} pwm_c \,.\, QM_c + \sum_{f \epsilon F} trnsfr_{rowf} = \sum_{c \epsilon CE} pwe_c \,.\, QE_c + \sum_{i \epsilon INSD} trnsfr_{irow} + \overline{FSAV}$$

40. Government balance

$$YG = EG + GSAV$$

41. Direct institutional tax rates

$$TINS_i = \overline{tins}_i(1 + \overline{TINSADJ}.tins01_i) + \overline{DTINS}.tins01_i \qquad i \epsilon INSDNG$$

42. Institutional saving rates

$$MPS_i = \overline{mps}_i(1 + \overline{MPSADJ}.mps01_i) + DMPS.mps01_i \qquad i \epsilon INSDNG$$

43. Saving-investment balance

$$\sum_{i \epsilon INSDNG} MPS_i(1 - TINS_i).YI_i + GSAV + EXR.\overline{FSAV} = \sum_{c \epsilon C} PQ_c \,.\, QINV_c + \sum_{c \epsilon C} PQ_c \, qdst_c$$

44. Total absorption

$$TABS = \sum_{h \epsilon H} \sum_{c \epsilon C} PQ_c \, QH_{ch} + \sum_{a \epsilon A} \sum_{c \epsilon C} \sum_{h \epsilon H} PXAC_{ac} \, QHA_{ach} + \sum_{c \epsilon C} PQ_c \, QG_c + \sum_{c \epsilon C} PQ_c \, QINV_c + \sum_{c \epsilon C} PQ_c \, qdst_c$$

45. Ratio of investment to absorption

$$INVSHR.TABS = \sum_{c \epsilon C} PQ_c.QINV_c + \sum_{c \epsilon C} PQ_c \,.\, qdst_c$$

46. Ratio of government consumption to absorption

$$GOVSHR.TABS = \sum_{c \epsilon C} PQ_c \, QG_c$$

Appendix F: Between Period Models

1. Average capital rental rate

$$AWF_{ft}^{a} = \sum_{a} \left[\left(\frac{QF_{fat}}{\sum_{a'} QF_{fa't}} \right) WF_{ft} . WFDIST_{fat} \right]$$

2. Share of New Capital

$$\eta_{fat}^{a} = \left(\frac{QF_{fat}}{\sum_{a'} QF_{fa't}} \right) \left(\beta^{a} \left(\frac{WF_{ft} . WFDIST_{fat}}{AWF_{ft}^{a}} - 1 \right) + 1 \right)$$

3. Quantity of new capital by sector

$$\Delta K_{fat}^{a} = \eta_{fat}^{a} . \left(\frac{\sum_{a} PQ_{ct} QINV_{ct}}{DV} \right)$$

4. Unit price of capital

$$PK_{ft} = \sum_{c} PQ_{ct} \frac{QINV_{ct}}{\sum_{c'} QINV_{c't}}$$

5. Average capital rental rate

$$QFS_{ft+1} = QFS_{ft} \left(1 + \frac{\sum_{a} \Delta K_{fat}^{a}}{QF_{fat}} - 1 \right)$$

Appendix G: Impact on macroeconomic variable growth rate in percent

	INITIAL	BASE	PAD_HC	PAD_ELE	TAX_HC	FSAV_HC	BOTH_HC	TAX_ELE	FSAV_ELE	BOTH_ELE	PAD_INC
ABSORP	0.6	8.3	8.4	9.6	9.3	9.2	9.4	10.5	10.2	10.5	4.6
PRVCON	0.4	8.3	8.6	9.6	9.3	9.4	9.3	10.2	10.2	10.2	4.6
FIXINV	0.1	9.6	9.4	11.3	10.9	10.2	10.9	12.8	12.0	12.8	5.4
GOVCON	0.04	1									1.21
EXPORTS	0.1	13.7	13.8	16.8	15.2	14.9	15.2	18.4	18.0	18.4	7.9
IMPORTS	-0.2	9.7	9.8	12.4	11.0	10.7	11.0	13.8	13.4	13.8	5.1
GDPFC	0.5	9.4	9.4	10.9	10.5	10.3	10.5	11.9	11.6	11.9	5.3

Source: Simulation result

Appendix H: Impact of simulations on sectoral growth rate

	BASE	PAD_HC	PAD_ELE	TAX_HC	FSAV_HC	BOTH_HC	TAX_ELE	FSAV_ELE	BOTH_ELE	PAD_INC
SGDP	10.8	10.8	13.3	12.1	11.8	12.1	14.6	14.3	14.6	6.1
SAGR	7.3	7.5	7.6	8.2	8.1	8.2	8.0	7.9	8.0	4.2
SIND	17.0	17.1	21.1	18.8	18.3	18.8	22.8	22.3	22.8	10.3
SSERV	8.2	8.1	9.8	9.2	8.9	9.2	10.8	10.6	10.9	4.6

Source: Simulation result

Appendix I: Impact of simulation on sectors (deviation from the base) in percent

	PAD_HC	PAD_ELE	TAX_HC	FSAV_HC	BOTH_HC	TAX_ELE	FSAV_ELE	BOTH_ELE	PAD_INC
SGDP	0.0	2.5	1.3	0.9	1.3	3.8	3.5	3.8	-4.7
SAGR	0.1	0.3	0.9	0.8	0.9	0.7	0.5	0.7	-3.2
SIND	0.0	4.0	1.7	1.2	1.8	5.8	5.3	5.8	-6.7
SSERV	-0.1	1.6	1.0	0.7	1.0	2.7	2.4	2.7	-3.6

Source: Own computation from simulation result

Appendix J: Impact of simulation on factoral income growth

	INITIAL	BASE	PAD_HC	PAD_ELE	TAX_HC	FSAV_HC	BOTH_HC	TAX_ELE	FSAV_ELE	BOTH_ELE	PAD_INC
Flab	0.2	10.5	10.7	12.0	11.7	11.6	11.7	12.8	12.7	12.8	6.2
Flnd	0.1	8.7	9.0	9.5	9.7	9.7	9.7	9.9	9.9	9.9	5.1
Fliv	0.0	8.8	9.0	10.3	9.8	9.8	9.8	11.1	11.0	11.1	5.0
Fcap	0.2	9.3	9.5	10.8	10.3	10.3	10.3	11.4	11.4	11.4	5.1

Source: Simulation result

Appendix K: impact of simulation on factoral income growth (deviation from the base) in percent

	PAD_HC	PAD_ELE	TAX_HC	FSAV_HC	BOTH_HC	TAX_ELE	FSAV_ELE	BOTH_ELE	PAD_INC
flab	0.2	1.5	1.1	1.1	1.2	2.3	2.2	2.3	-4.3
flnd	0.2	0.8	1.0	1.0	1.0	1.2	1.2	1.2	-3.7
fliv	0.2	1.5	1.0	1.0	1.0	2.3	2.2	2.3	-3.8
fcap	0.2	1.6	1.1	1.0	1.1	2.2	2.1	2.2	-4.1

Source: Own computation from simulation result

Appendix L: Impact of simulation on growth rate of income of domestic non government institution

	INITIAL	BASE	PAD_HC	PAD_ELE	TAX_HC	FSAV_HC	BOTH_HC	TAX_ELE	FSAV_ELE	BOTH_ELE	PAD_INC
ent	0.19	9.84	10.05	11.45	10.93	10.9	10.94	12.08	12.04	12.08	5.52
hhd-rurp	0.1	10.08	10.3	11.56	11.19	11.15	11.2	12.28	12.22	12.29	5.86
hhd-rurn	0.19	9.47	9.75	10.88	10.52	10.57	10.52	11.42	11.46	11.42	5.38
hhd-urbp	0.01	9.61	9.86	11.14	10.67	10.7	10.68	11.76	11.77	11.76	5.46
hhd-urbn	0.13	8.43	8.65	9.75	9.41	9.42	9.42	10.34	10.33	10.34	4.75

Source: Simulation result

Appendix M: Impact of simulation on growth rate of income of domestic non government institution (deviation from base)

	PAD_HC	PAD_ELE	TAX_HC	FSAV_HC	BOTH_HC	TAX_ELE	FSAV_ELE	BOTH_ELE	PAD_INC
ent	0.21	1.61	1.09	1.06	1.1	2.24	2.2	2.24	-4.32
hhd-rurp	0.22	1.48	1.11	1.07	1.12	2.2	2.14	2.21	-4.22
hhd-rurn	0.28	1.41	1.05	1.1	1.05	1.95	1.99	1.95	-4.09
hhd-urbp	0.25	1.53	1.06	1.09	1.07	2.15	2.16	2.15	-4.15
hhd-urbn	0.22	1.32	0.98	0.99	0.99	1.91	1.9	1.91	-3.68

Source: Own computation from simulation result

Appendix N: Rate of direct tax

	INITIAL	BASE	PAD_HC	PAD_ELE	TAX_HC	FSAV_HC	BOTH_HC	TAX_ELE	FSAV_ELE	BOTH_ELE	PAD_INC
ent	0.1142	0.1313	0.1142	0.1142	0.1358	0.1142	0.1358	0.1358	0.1142	0.1358	0.1358
hhd-rurp	0.0009	0.0011	0.0009	0.0009	0.0011	0.0009	0.0011	0.0011	0.0009	0.0011	0.0011
hhd-rurn	0.0012	0.0014	0.0012	0.0012	0.0014	0.0012	0.0014	0.0014	0.0012	0.0014	0.0014
hhd-urbp	0.2830	0.3253	0.2830	0.2830	0.3363	0.2830	0.3363	0.3363	0.2830	0.3363	0.3363
hhd-urbn	0.0188	0.0217	0.0188	0.0188	0.0224	0.0188	0.0224	0.0224	0.0188	0.0224	0.0224

Source: simulation result

Appendix O: Impact of simulation on domestic non government institution saving in billion ETB

	INITIAL	BASE	PAD_HC	PAD_ELE	TAX_HC	FSAV_HC	BOTH_HC	TAX_ELE	FSAV_ELE	BOTH_ELE	PAD_INC
ent	36.0	44.4	47.0	59.3	53.2	54.2	53.2	63.9	65.1	63.9	18.2
hhd-rurp	3.9	10.7	11.0	13.6	12.8	12.7	12.8	15.2	15.1	15.3	4.6
hhd-rurn	7.8	10.5	11.1	13.4	12.6	12.7	12.6	14.6	14.7	14.6	4.5
hhd-urbp	0.5	11.0	12.3	15.2	13.0	14.1	13.0	15.5	16.8	15.6	4.6
hhd-urbn	17.7	27.6	28.9	35.2	33.1	33.2	33.1	38.9	38.9	38.9	12.0

Source: Own computation from simulation result

Appendix P: impact of simulation on domestic non government institution saving (deviation from the base) in billion ETB.

	PAD_HC	PAD_ELE	TAX_HC	FSAV_HC	BOTH_HC	TAX_ELE	FSAV_ELE	BOTH_ELE	PAD_INC
Ent	2.6	14.9	8.7	9.7	8.8	19.5	20.7	19.5	-26.2
hhd-rurp	0.4	3.0	2.2	2.1	2.2	4.6	4.5	4.6	-6.1
hhd-rurn	0.5	2.9	2.1	2.2	2.1	4.1	4.2	4.1	-6.1
hhd-urbp	1.2	4.2	2.0	3.1	2.0	4.5	5.8	4.5	-6.4
hhd-urbn	1.3	7.6	5.5	5.6	5.5	11.3	11.3	11.3	-15.6

Source: Own computation from simulation result.

Appendix Q: Impact of simulation on private investment in billion ETH

INITIAL	BASE	PAD_HC	PAD_ELE	TAX_HC	FSAV_HC	BOTH_HC	TAX_ELE	FSAV_ELE	BOTH_ELE	PAD_INC
65.9	104.3	110.2	136.8	124.7	127.1	124.8	148.2	150.7	148.3	43.8

Source own computation from simulation result

Appendix R: Impact of simulation on private investment (deviation from the base) in billion ETB.

PAD_HC	PAD_ELE	TAX_HC	FSAV_HC	BOTH_HC	TAX_ELE	FSAV_ELE	BOTH_ELE	PAD_INC
5.98	32.52	20.44	22.80	20.52	43.94	46.47	44.02	-60.43

Source: own computation from simulation result