Public Debt, Productive Expenditures, and Economic Growth Nexus

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Dedication

This humble effort is dedicated to my beloved parents

Muhammad Shafi Chohan

&

Farhat Samina

For their love, endless support, and encouragement

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First of all and above all, to *Allah Almighty* for giving me life, unconditional love, strength, knowledge, wisdom, blessing guidance, and protection that enable me to deal with and finish my research work. I owe a deep sense of gratitude with utmost pleasure to my worthy and respectable

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Table of Contents

Abstract

Teles and Mussolini (2014) presents a theoretical model of endogenous growth (AK), which validates that an increase in the level of the public debt to GDP ratio negates the positive effect of fiscal policy on economic growth. They argued that as government indebtedness extract a portion of young people's saving to pay interest on the debts. In this study, we revisit the basic question: "whether increase in the level of the public debt to GDP negates the positive effect of fiscal policy on economic growth''. To answer this question, we modified the basic Teles and Mussolini (2014) model with the following changes.

First, the Cobb-Dougles utility function is replaced with CES utility function.

Second, Instead of just consumption tax, both consumption and capital income tax are considered.

Third, Instead of $\delta = 1$ taken$0 \leq \delta \leq 1$.

Our theoretical model indicates that productive expenditure results a higher productivity in the economy that in turn increases reward of factor of production. The increase in the reward of both Labor and Capital enhance the accumulation of capital (saving). These evidences substantiates the fact that if government rotate a reasonable amount of public debt to productive expenditure then an increase in public debt to GDP ratio cannot negate the positive effect of fiscal policy.

Chapter 1

Introduction

1.1 Background of the Study

A number of economists argue that adjustment of business cycle changes is the fundamental objective of fiscal policy. Fiscal policy is public policy through which government monitor the adjustment of public expenditures and taxes. The idea of fiscal policy presents by John Maynard Keynes and he believed that an economy can affect its economic performance by adjusting government spending and taxes. Hence, according to this framework government spending and taxes are considered as an essential factor that adjust economic fluctuations. However, it is particularly important to consider fiscal composition and taxes in the situation of downturns. Notably the spontaneous stabilizers and counter-cyclical flexible fiscal policies build larger deficits in budget and therefore increase sustainability problems of fiscal policy.

However fiscal imbalance is one of the significant reason of an unnecessary liability in the economy, as government spending are not productive at aggregate level. Barro (1979) argued that in order to smooth the level of distortionary taxation, government should use the debt over time and concludesthat level of debt determine by the change in government expenditure or in income. In addition, level of debt level remain on its initial level and would be fixed, in the

presence of aggregate certainty. Hence, the factor of permanent expenditure and the debt level determine the pattern of taxes,whereas, these taxes adopt random walk.

On the other hand Lucas and Stokey (1983) argued for the state-contingent debt and taxes, as they illustrated that, both taxes and debt not following the path of random walk. This study showed under a rule of balanced budget taxes would not be as much volatile.In this framework debt value fluctuates between stationary value, which is monotonic function of initial debt.

In addition, Marcet and Scott (2007) illustrate that fiscal policy model and debt level decreases in result of a positive innovation in the deficits.

One important question in this scenario is that either high level of public debt reduces economic growth? Based on empirical literature,some of the existing studies argued that, public debt positively contribute in economic growth in short run, whereas, reduces the pace of economic growth in the long run, (Diamond, 1965; Saint-Paul, 1992).

Different studies have defined different mechanisms through which public debt affect economic performance. For instance Teles&Musolini (2014) explain the negative effect in terms of public expenditure productivity. They argued that as public debt mostly rotates to public projects so it is relatively less productive. Similarly, Chocrane (2011) explains the negative effects of public debt in term of uncertainty and risk. Tanzi and Chalk (2000) and Laubach (2009) argued that public debt hits private investment, as it results in high interest rate. However, it is also possible that expansionary fiscal policy leads to debt accumulation but it ends up with prolonged recessions having an optimistic effect on economic growth in case of short run and long run (Delong and Summers, 2012).

Most of the empirical studies (Furceri and Zdzienicka, 2012; Reinhart and Rogo, 2010; Reinhart et al., 2012) concluded that, public debt ratio become higher will lead to negatively affect economic growth. Whereas, some studies (Kumar and Woo, 2010; and Cecchetti et al. 2011)found the reverse causation or feedback of growth on public debt. In similar lines, Reinhart et al., (2012) argued that, as the debt level of an economy increase in the upward direction will led to negatively contribute in the economic growth.

In addition, they argue about the negative effect of public debt in term of economic growth that is measured empirically can be improved by discretionary countercyclical fiscal policy or automatic stabilizer.

Several studies (Modigliani, 1961; Saint-Paul, 1992) empirically tested a strong robust impacts of fiscal policy on growth of an economy by using the standard growth model of neoclassical framework. Their empirical findings examined, the tradeoff impact of public debt with growth of an economy. They justify that, growth rate of an economy decreases due to increase in public debt.

In contrast, the existing studies of Barro (1991) and Devarajan et al., (1996) explored one to one correspondence relationship between government expenditure and growth by using the mechanism of endogenous growth theories. One of their justification is that, the nature and composition of government expenditure is different across the country, as the structure and mechanism of tax burden.

These studies argued that as some part of the spending is needed to achieve balanced budgets, hence, less part of revenue used to attain balanced budget, which shows imposition of lower taxes increases employment and growth. However, it is important to know that which component

of spending and revenue are most harmful for growth. Similarly, to know the channel of fiscal policy through which it affects growth can support us to understand about the division of public spending and revenues,and which components should be limited.

Capital and recurrent expenditure are type of public expenditures that can be a cause of enhancing growth as it contributes to maintain vital infrastructure including electricity, water sewerage system, telecommunication, education and health, water disposal. However, these components of government expenditure have a negative effect in terms of taxation and excessive debt.[1] In the literature two well-known (i.e. Wagner's and Keynes)approaches have been launched of public expenditures.

The first Wagner's approach estimates that, total share of public sector in an economy depends on the per capita income, as the ratio of per capita income increases will lead to increase the growth of the economy in the upward direction. In similar way, Musgrave and Richard (1988) proposed that, Wagner' approach taken the role of public expenditure to be endogenous for the development of an economy. He further justify that, due to these reasons a country may increase government expenditure. Firstly, to improve law and order and to provide best infrastructure. Second, to increase welfare activities with increasing economic growth and, third, to cope up with the technology revolution (Cooray, 2009), whereas according to Keynes (1936), public expenditures is exogenous to national economy.

Barro (1988) and Paul (1992) have analyzed three direct effects of public expenditures on economic growth. They argue that generally a rise in public expenditure positively affects the economic growth, however, it may have negative effect if it increases tax burden which is

[1]Grossman (1988) argue that, it is a controversial issue both theoretically as well as empirically to test a significant positive or negative relationship between these two variables (i.e. productive expenditure and growth).

necessary to finance the debt service, consequently decreases savings. Teles and Mussolini (2014) argued that an increase in public expenditures increases productivity but at the same time raises interest rate expenditures on public debt which in turn decrease savings.

Telesand Mussolini (2013) analyzed the saving effect of public debt in AK growth framework. He discussed that as government expenditure bave an optimistic effect on productivity, and consequently rewards to factors of production (Labor and Capital) increases.

Teles and Mussolini mentioned that a rise in wage rate has a positive consequences, as it increases savings, which leads to increase in investment resultantly pace of economic growth increases. Teles and Mussolini also explains the indirect effect of government expenditure on level of debt and hence on economic growth. According to their findings an increase in government expenditure increases the rate of interestand government pay the interest rate against debt, so indirectly cost of debt increases due to increase in government expenditure, resultantly government indebtedness increases.

Teles and Mussolini (2014) explain the case of productive expenditure in term of its effect on economic growth effect of productive expenditure on economic growth considering debt to GDP ratio. Several existing studies have being a limitation and ignored the effect of debt in the presence of productive expenditure and its effect on economic growth. As, to justify this analysis theoretically Teles and Mussolini introduced a model with overlapping generation and endogenous growth, in which the government can increase its productive expenditure with the help of debt. Whereas productive expenditure is expenditure for the purpose of making subsequent sales. It is the **expenditures** made by business firms in buying capital goods of all descriptions and in paying wages. Capital goods include machinery, materials, components,

supplies, lighting, heating, and advertising. On the other hand government expenditure includes all government consumption, investment and transfer payments.There are several growth models like, Barro (1991) and Glomm and Ravikumar (1997) of endogenous growth theory argued that,the relationship of productive expenditure and economic growth (EG) is positive in cross-sectional units of both advanced and developing economies.However, most of these work established an inverse association between public debt and EG. Teles and Mussolini also explained the association of public expenditure with economic growth within the framework of endogenous growth and validate that not only the rate of indebtedness and the size of tax burden are causes that limit the effect of productive expenditure, as its effect is estimated by these growth models, whereas the variables debt to GDP ratio also explain this effect.

To find the effect of public debt on EG through productive expenditure Teles and Mussolini (2014) developed a theoretical framework that provide a limited case. Teles and Mussolini used the logarithmic utility function, which indicates that saving s_{it}will becomes an insensitive to only changes in the real interest rate, thusc_{1t}, c_{2t+1} and s_{1t} are independent of r_{t+1}. In this study we modified the Teles and Mussolini (2014) model making the following changes.

First, instead of logarithmic utility function, we used the CES utility function of representative household[2].

Second, instead of $\delta = 1$we assume $\delta = [0,1]$. With these changes, now instead of independent, saving rate explain by interest rate.

Third, Teles and Mussolini (2014) consider public tax only on capital income, whereas this study consider the imposition of public tax on both generations income, that on the wage income of the young generation, and capital income of the old generation.

With these changes, we analyze the dynamic of the model and hence its effects on the steady

[2] CES stand for Constant Elasticity of Substitution

state. After performing comparative static analysis we show the effect of changes in different variables and parameters on the steady state

1.1 Objectives of the Study

The study aims to extend literature on the following;

1. To generalize the OLG model of Teles and Messoulini (2014) by;

(a) Considering CES utility function

(b) Including both consumption and capital income taxes

(c) Instead of $\delta = 1$ taken $\delta = [0,1]$

2. To analyse the dynamics of the model with these changes and their effect on the steady state compared to that of Teles and Messoulini (2014).

3. To perform stability analysis of these steady states.

4. Performing comparative static analysis to see the effect of changes in different variables and parameters on the steady state.

Chapter 2

Review of Literature

2.1 Introduction

In this chapter, we review the existing literature of public debt, productive expenditure, fiscal deficit and its relationship with economic growth.As both theoretical and empirical work has been carried out on the topic, hence we will divide the existing literature into these two categories.

Existing literature provides a strong indication about the role of fiscal policy in stabilizing economies. Most of thestudies including Romer (1986),Aghoin and Howitt (1992), and Lucas (1988, 1993) have analyzed the situation of an economy by using the effect of fiscal policy through the models of endogenous growth.

In addition, Barro (1988) found the significant impacts of fiscal policy on both growth rate at the steady-state level and on the level of output.

Similarly, Barro, (1989) hypothesizes that fiscal policy is indirectly effected growth by the flow of government services and presents a difference between productive and unproductive expenditures, as well as, distortionary and non-distortionary taxation.

He argues that, the imposition of taxes influence the individuals decision making regarding saving and investment, as well as the accumulation of physical and human capital which are known as (distortionary taxes), while these decisions do not affect by non-distortionary taxes. Barro concludes that the public expenditure has negative effect on growth and investment. Although government consumption does not have direct effect on private productivity but its distortionary effects reduce savings and economic growth.

Working on the same lines, (Barro, 1988) complements that fiscal expansion cannot change the overall output in the existence of Ricardian equivalence. On the other hand, where government debt extended at abnormal level then endless rise in government expenditure could even produce negative growth effect (Blanchard, 1990, Ale Sina et al. 2002, Ale Sina and Ardagna, 2009).

Whereas, Zagler (2003) estimated that,high public debt and persistent fiscal deficit in the absence of Ricardian equivalence could destruct growth rate because government needs to ingest extra resources from private sector to cover that deficit,which is furtherly accelerated the level of private capital. The destructive impacts of public debt and fiscal deficit on growth furtherly exacerbated, as the nonproductive expenditure will be financed through the government borrowings.

Dalic (2013) used in his panel European Union countries spanning from 1999-2010. According to their empirical findingsDalic, the effect of government expenditure depends upon the structure of total expenditure. His study suggests that effects of government expenditures are weak on education and health of new member states of European Unions. While this negative effect of government expenditures could be decreased when total expenditures is reduced.

On the other hand, he suggests that improvement in fiscal balance could be achieved and fiscal policy is effective in terms of growth in the new members of European Union countries when either government cuts unproductive expenditure or uses the combination of an increase in non-distortionary taxes or reduction in less productive expenditures.

2.2 Public Debt and Economic Growth

The existing studies have the inconclusive views regarding the significant impacts of public debt and proposed threshold level of public debt on growth at the aggregate level.

Diamond (1965) assume the role of public debt in the framework of neoclassical growth model that, growth path of an equilibrium level is dynamically efficient.He furtherly assert that, interest rate path is lower than the equilibrium path of economic growth, will lead to accumulate human capital. Because of this, as the economy increases the level of public debt will led to enhance the welfare of present as well as the future generation.

In contrast, Saint-Paul (1992) found that, an expansion in the volume of public debt not furtherly stimulate welfares of present nor of the future generation by using endogenous growth model.He justify that, an increase in the public debt negatively contribute growth, and this may decline the welfare of future generation.He finally concludes that, an economy must lead to enhance the investment opportunity or to provide interest subsidy, these are the two policy tools to become higher sustainable economic growth. In this connection, Collignon and Stefan (2012) examine that, as the ratio of public debt increases declined welfare of the future generation as well as negatively affect growth, when an economy is at the steady-state level.

Similarly, Schclarek (2004) explore the significant impact of external debt on growth rate in case of both developed and developing countries. As, the external debt negatively affect growth rate in case of developing economies, whereas, in the developed countries external debt not significantly affect economic growth.

In similar lines, Cunningham (1993) concluded that, an increase in the public debt negatively contribute growth in a panel of sixteen developing countries.

Lin &Sosin (2001) investigate the relationship of government debt and interest rate using the overlapping generation's model and consider two cases.

First, when real-interest rate (RIR) ratio is become higher from the growth of an economy, then higher public debt may not significantly change real interest rate (RIR).

Second, when ratio of RIR is become lower from the growth of an economy, then higher public debt negatively affect growth rate in the existing economy.

Whereas, several studies (Saint-Paul, 1992; Josten, 2000) used overlapping generation models in the framework of endogenous growth to examine the influential impact of public debt on growth of an economy. These studies use overlapping generation models with continuous-time frame. They assumed AK technology, whereas, Josten in his study consider growth model through the formation of human capital. These both studies rely on the steady-state of the government to adapt tax rate, hence to sustain the debt-output ratio.

Adam and Bevan (2006) find the threshold level of budget deficit that was 1.5% of GDP. Additionally, they argued that budget deficit adversely affected by high debt stock. In connection to the dynamic functioning of public debt, (Bi, Leeper, &Leith, 2010) analyze that, potency of

public debt payment and its services mainly rely on the macroeconomic fundamentals. By using a nonlinear model they finds that, when government debt crosses a certain threshold level, then government may consider a default of its total debt liability.

Furthermore, some studies (Malik et al., 2010) conduct a country specific study for Pakistan spanning from (1972-2005). They found a significant and negative relationship between external debt and with growth of Pakistan economy. They furtherly augmented that, debt servicing affects negatively the economic growth of Pakistan as debt servicing puts an additional burden on future generation.Similarly, Cesar (2013) examines the effect of public debt on growth through its significant impact on the steady state of output per capita, in addition to discover alternative channels to those proposed in the prevailing literature. His results shows the statistical and inverse effect of public debt ratio on GDP and economic growth; though, the relationship is non-monotonic. Whilst domestic policies, quality of institutions, and outward-oriented policies amend the inverse association of public debt and economic growth.

Furthermore, Markus (2015) explore the statistical and robust impact of foreign debt on EG in case of developing as well as in the developed countries in time span of (1960-2015).

His findings include that the debt magnitude of coefficient of long run debt differs in all group of countries and negative effect on growth of an economy in long run of the countries with higher debt-to-GDP ratio.

In addition, theoretical model of Elmendorf and Mankiw (1999) encourages a long run correlation between growth and public debt.

Modigliani (1961) and Diamond (1965) hold the claim that due to increase in public debt interest rate increases, resultantly cost of capital increases therefore economic growth decreases.

In this connection, some of the studies Barro (1990) and Saint-Paul (1992) concluded that, long run growth is negatively effect through an increase in the ratio of public debt by using the endogenous growth model. They furtherly argued that, future reduction in distortionary taxation or in public spending, debt has to be compensated with adverse effects on growth.

However, several studies (Bohn, 1998; Mendoza and Ostry, 2008; Lo and Rogoff, 2015) argued that, it is mandatory for the government to increase the volume of public debt, when running smaller deficit or increasing the primary surplus. Whereas, Teles and Mussolini (2014) show that, an increase in public debt make constraint and decline the effectiveness of public expenditure, which discourage long-run economic growth. This may furtherly generates improbability or financial repression in future time period (Cochrane, 2011). Similarly, Laubach (2009) explore that, financial repression lead to increase RIR, this will lead to lower private investment opportunities in the economy.

Second, the literature related to public debt and economic growth, determines whether the long run association is similar in every country or are there some substantial changes in context of debt-growth. The following studies shows the differential impact of public debt and growth in cross-sectional units; These include;

i The usage of technology input in the production process vary in across the countries. Because of this, the statistical association between debt and growth is mixed (Temple, 1999).

ii Some studies of Reinhart et al. (2003) Manasse and Roubini (2009) showed that, the capability to bear high intensities of debt influenced due to several country-specific characteristics, which has significantly a strong relationship with past disaster as with some of the macro and official structure.

Furthermore, Dell'Erba et al. (2013) explore that, an increase in the public debt will led to worsen the debt services, as the domestic and foreign currency, debt arrangement, domestic versus external, long-term versus short term public debt varies in most counties.

As, the debt limit is define by Ghosh et al. (2013)[3] that, when debt level is surpasses a certain threshold level, which creates fiscal insolvency in the existing economy.

Third, several studies explain a non-linear association between in debt-growth perspective, through different empirical strategies, supporting us to examine threshold level or country precise non-linearity.

Whereas, this relationship varies slightly from standard empirical approach to pooled models, which is followed by several existing studies to interpret non-linearity in debt-growth perspective.

When country "A" growth performance is not well and higher debt-to-GDP ratio as from the country "B", then in deducing the outcomes is indirectly supposed thatif the same level of indebtedness were to reach by the country "B" debt-growth results would be same as country "A",

Sutherland (1997) and Perotti (2005) discuss an authentic literature on inadequate effects of fiscal policy could fuel up public debt non parallel effect on output growth in most developed economies. If fiscal sustainability reached on its tipping point then non linearities in connection between debt and growth may increase also. Whereas (Krugman, 1988; Aguiar et al., 2009)

[3] Ghosh et al. (2013) define 'debt limit' as the level of debt beyond which fiscal solvency fails and show that this debt limit is a function of countries' structural characteristics and GDP growth. This argument resembles the idea of country-specific debt 'vulnerability regions,' which would be consistent with country-specific non-linearities''.

argued that Investment distorted by the debt when the debt is so high than investor will be discouraged to take initiate for new project, as new projects will be more taxed due to rise in debt. Similarly creditorswouldincrease the rate of interest to compensate the default risk at the time of increase in debt with respect to GDP, resultantly its restraining investment due to increase in financing cost (Greenlaw et al., 2013).

2.3 Government Expenditure and Economic Growth

It is difficult to explain the precise effect of government expenditure, however, it is clear that the size of government matters in the process of economic growth. The relative effectiveness of the public sector determines the optimistic effect of government actions on output. In this association, a comprehensive work by Barro (1979), In Barro's model both growth and saving rates affected by the deviations in the part of productive government expenditures in GDP. Kneller et al. (1999) discover robust empirical provision for Barro's endogenous growth model, in which steady-state growth rate can be affected by the public expenditure and taxation. Mueller and Stratmann (2003) show that in low-income countries there is a strong relationship between growth and government size, where the government size likely to be small, however, his study shows an adverses association across high-income countries, where government size has grown larger. Similarly, the effect of government spending on poverty can be direct or indirect. Through direct effects of spending poors receive benefits when expenditures are allocated to the programs of employment. On the other hand, indirect effect of government spending encourages the investment opportunities in rural areas, research techniques and health and education techniques that stimulate agricultural sector which introduces a number of opportunities for poor people and hence reduces poverty, Shenggen et al(2000).

There is a continued debate about the impact of government expenditure on economic growth among economists. Abdullah, 2000. The first function performed by the government is provision of public goods including transport, health facilities, and level of education, defense, and power. Some scholars argue that economic growth rises when government increases its expenditures on their economy and its infrastructure. For instance, labour productivity rises when government increase its expenditures on education and health and consequently increases national output in an economy. On the other hand, private investment rises due to increase in the profitability of the firm when production cost decreases due to increase in government expenditures on infrastructure e.g. communication, roads and power and as a result it stimulates growth of an economy. More than a few empirical studies have found evidence that distribution of public funds to health, education, and infrastructure expenses affects economic growth positively (Aschauer, 1989; Easterly and Rebelo, 1993). However, a number of studies have produced insignificant results so there are no consensus about this issue (Devaragan et al., 1996; Agell et al., 2006). Whereas protection function comprises on the execution of property rights and law enforcement which reduces the chances of criminality, protection of peoples life and their property and save the nation from external aggression. Studies [Abdullah, 2000 and Sharma, 2008, Cooray, 2009] conclude that increase in government expenditures affects growth positively.

Some studies have pointed that higher government expenditures reduce the overall performance of economy rather than to promote economic growth. For example, the government may raise taxes and to get loans for financing higher expenditures. Due to imposition of higher taxes, income and aggregate demand decreases. Likewise, the increase in taxes tends to increase production cost, decreases investment expenditure and also decreases profitability. In addition, if

government gets loan from banksto overcome its expenditure, in turn private sector would be affected as less money allocated for private investment. The politicians and government officials sometimes allocate funds in unproductive projects to get popularity and continue to remain in power whereas the private sector can produce it in a better way. Sometimes the government misallocates resources which slow down the national output growth. As studies by Laudau (1986), Barro (1991), Engen and Skinner (1992), and Folster and Henrekson (2001) suggested that government expenditures decreases economic growth of a country.

IMF and World Bank categorize governmentspending into three groups as: social, economic and other spending. Education, health, nutrition and social safety nets come under social spending whereas spending on agriculture, infrastructure, telecommunication, transport, energy, etc are called economic spending. Further social spending can be categories into social service spending, for example health and education, social assistance (certain social groups) social insurance (unemployment insurance and pensions), and programs that generate the possibilities of employment. Different type of social development objectives can be attaining through all given type of government spending. While defense and general administration considered as the other type of spending.[4]

Government spending can have both a short term and a long term effect on economic growth. Long term effects of government spending include improvement in infrastructure, education, and technology. This type of government spending can have a short term effect in the form of an increase in demand for labor and other factors of production.

Shenggen et al, (2008) used data set of 44 countries of different regions that Asia, Africa and Latin America. In order to check the effect of Government expenditure on whole economy, they mainly focus on some different sectors of an economy including 'agriculture, defense, education, health, social security, and transportation and communication'. Their study concludes that government expenditure affects the growth rate more rapidly in Asia as compare to those in Africa and Latin America.

Barro (1991) comments about the significance of health expenditures. According to Barro health expenditure is an engine of economic growth and capital productive asset. (World Health Organization, 2005) explains that fifty percent difference of economic growth between developed and developing economies is due to ill-health and low life expectancy. So developed countries invest a large portion of their budget allocated to health facilities. As they believe that major driver for economic growth depends on their country resident's health.

Barro (1991) and López-Villavicencio and Mignon (2011) find that the GDP growth has inversely related to a part of government consumption in GDP. Similarly, Levine and Renelt (1992) finds thenegative effects of government expenditures on economic growth; they also argued that there is a weak relationship between government expenditure and economic growth. Ram (1986) studies the previous evidence on economic growth and the size of government and he finds the chance of opposite causation, in which the size of government could determine by the extent of economic growth.

In past few decades government spending patterns are significantly changed in developing countries. It is important to keep track of all the trends in the levels and division of government expenditures to measure the actual reason behind change during different time period. It is

important to understand such trends and techniques of numerous expenditures in different sectors of economy in order to make effective policies to spend government financial resources.

Frequent change in government expenditures in developing countries requires that we should monitor the relative contribution of these expenditure and causes of these changes in various areas like production growth and poverty reduction, so that the future target could be more clear and accurate.

As, the nature and composition of government expenditure may vary across the countries in case of both developed and developing countries, however, composition of public expenditure in developing countries and their effects on growth depends upon the experiences of developed countries,(Azariadis et al., 1990)

In contrast, Barro (1991) examined the effects of size of government and level of savings on growth of an economyand concluded that non-productive government expenditure lowered the per capita growth, in developing countries.

To check the effect of public investment on economic growth, Haque and Kim (2003) used the dynamic techniques of panel data of 15 developing countries. Their finding suggests that effect of public investment on transportation has strong belongings to economic growth. Similarly, by using cross-country data set, Sutherland et al (2009) inspects the relationship between infrastructure of an economy and economic growth and the study shows that communication and power generation sector has strong impact on growth of an economy.

Semmler et al (2007) examined the effect of fiscal policy after taking data of 35 countries and used calibrations to determine whether it will be helpful to increase the welfare and growth in low and middle-income countries. According to this study composition of public investment

expenditure in term of public infrastructure "medical and education" are most important sectors of an economy. Adjustment of an economy through different models considered as rule of thumb which suggests that at least one third part of public investment must be allocated to the public infrastructure that helps to enhance market production. In addition the study illustrated that in order to reduce poverty, growth increases slowly when emphasis of government expenditure on health and education is higher as compare to the investment that helps to increase market.

Singh and Weber (1997) investigate the relationship between government expenditure and economic growth using data set of Switzerland spanning from 1950-1994 they finds that fiscal spending can have an effect on long run growth, particularly education and health have permanent effects on growth, where education has positive while health has negative effect on growth. Stengos and Aurangzeb (2008) examined the relationship between economic growth and health expenditures with the help of augmented Solow growth model for Pakistan for the period 1973-2003. He finds that health expenditure and GDP growth has positive relationship in case of short and long run. Haider and Sabihuddin (2007) support the existence of positive relationship between health expenditures and GDP in the long run in Pakistan.

Ghani and Din (2006) examined the effect of public investment on economic growth in case of Pakistan from 1973 to 2004. They used VAR modeling approach and data of time series while model based on four type of variables 'public and private investment, public consumption and GDP. This study suggests that private investment has greater effect on growth as compare to public investment, while public investment somehow cancels the effects of private investment.

Similarly Schaltegger and Torgler (2006) examined the association between public expenditure and economic growth at local level, as previous studies focused on aggregate public

expenditures. Their findings suggest that public expenditures have negative effect on growth at local as well as at aggregate level; a finding consistent with previous studies.

Whereas Abu-Badaer and Abu-Qarn (2003) examined the effect of government expenditure on growth of three countries in which Israel, Syria and Egypt are included. They find bi-directional causality between government spending and economic growth for these three countries. Their findings reveal negative relationship between government expenditures and economic growth at aggregate level.However, at sectoral level they find negative relationship between military burden and economic growth for the three selected countries and positive impact of civilian expenditures on growth in case of Israel and Egypt also.

Badawi (2003) found that private investment in Sudan has greater effect on real growth as compared to the public investment whereas; public investment crowds out private investment significantly. Likewise, Ghani and Din (2006) found similar evidence for Pakistan using a VAR model.Nurudeen and Usman (2010) find that government expenditures has negative effect on education but positive effect on health, transport and telecommunication. Whereas capital and recurrent government expenditures have insignificant effect on economic growth.Fajinghensi and Odusola (1999) also found that recurrent expenditure had insignificant effect on growth. Akpan (2013)also indicated that different form of government expenditure had real effects on growth. Usually this may happen in a country due to frequent corruption in an economy as Haque and Kneller (2008)illustrated in their study that public investment increased due to increase in corruption, resultantly return on public investment decreased, eventually making it unproductive in endorsing growth.

More or less a common conclusion has been apparent other than the empirical literature based on coverage, methodologies and countries development. The effect of government expenditure on transportation, telecommunication, infrastructure, and education had significant effect on growth both in developing and advanced countries.

By contrast the effect of recurrent and capital expenditure on growth has been in some way mixed and indecisive. Whilesome of studies including Schaltegger and Torgler (2006) and Abu Quarn (2003) explains that in rich countries most of the studies unveil that large governments have negative effect on economic growth. While Bergh and Henrekson (2011) find statistically negative correlation between government size and annual growth rate in most recent studies. A most recent survey of review of literature shows rise in government size by 10% is connected with a 0.5% to 1% lesser annually growth rate. As Bergh and Henrekson (2011) put it:

"In general, public expenditure provides stabilizers in times of economic downturn that inevitably weaken the government's balanced budget. Whereas, fewer people will be unemployed when growth rates are higher, and public expenditure shares will be lesser in boom years. So, in short run a negative relationship between public expenditure and economic growth is to be expected. Therefore finding a negative association is no evidence that high expenditure causes low growth."

Escobari (2013) examines the role of government purchases (anticipated and unanticipated) in economic growth. Mollick and Cabral (2011) and Cabral and Mollick (2012) focus on this channel from 1986 to 2004 for a sample of developed and emerging market economies. They find that unanticipated government expenditures have significant and negative effects on output growth. While anticipated government expenditures have adverse and

insignificant effects on output growth. Similarly, they find that the output effects of unanticipated government expenditures are much higher in developed economies than in emerging markets. These results are very strong to a recursive action of expectations.

2.4 Fiscal Deficit and Economic Growth

2.5 Theoretical Perspective

Studies that have investigated the impact of fiscal deficit on economic growth fall into three groups, namely Neoclassical, Keynesian and Ricardian.

2.5.1 The New Classical View:

The part of fiscal deficit known as revenue deficit is reason to reduce the government savings. In the case of neo-classical, if government savings tend to decrease and then this decrease is not fully offset by the increase in private savings then overall savings will be less. This will have a negative effect on growth. According to neo-classical view, markets always clear due to full employment of resources. In this connection by shifting taxes to the future generation, fiscal deficit increases lifetime consumption. For instance in closed economy with increase in consumption saving decreases if economy's resources are fully employed. Whereas, in an open economy as investment and interest rate may remain fixed, however external borrowing is mostly used to finance twin deficits that saving investment gap and exports imports gap and hence to avoid local currency depreciation. Both cases show the fall in net national savings and rise in consumption by some combination of exports and fall in investment. The Neo classical assumes that individual consumption depends upon the solution to an intertemporal optimization problem where market rate of interest determined borrowing and lending rate. Also,

it assumes finite life time span of every individual where life span of successive generations overlap and consumer belongs to a specific generation.

2.5.2 Keynesian View of Fiscal Deficits:

According to traditional Keynesian framework there is no difference between other usages of the fiscal deficit as between government spending and investment expenditure and no difference between substitute sources of financing the fiscal deficit with external or internal borrowing or through monetization.

Actually, in the evaluation there is no clear budget constraint. Keynesian elaboration imagines that multiple expansions of output increase the money demand and if supply of money is fixed and through bond financing deficit is covered, resultantly rate of interest raises and offsets the multiplier effect. Though, Keynesian also claim that profitability of private investment improves when aggregate demand increases that decreases the public investment at any given rate of interest.

Consequently, increase in interest rate may be more than neutralized by the increased profitability of investment. Keynesians discuss that even if interest rate increases deficits may stimulate savings and investment primarily because of the employment of hitherto unutilized resources. However, deficits would lead to crowding out even in the Keynesian paradigm at full employment level.

This is the perception of the strong Keynesian analysis that, when every member of the population make a good perception regarding the budget deficit is beneficial for us and make the peoples become worthier. Then, this will lead to increase output and create an employment

opportunity for everyone. Whereas, loanable funds theory assumethe Keynesian paradigm rules out any direct effect on interest rate of borrowing by the government.

2.5.3 Ricardian Equivalence Perspective:

In the Ricardian perspective fiscal deficit have neutral effect on economic growth. The financing of budget through deficit only adds up the deferment to the taxes.Current period of deficit is just equivalent to the present value of future taxation that is obligatory to pay against the debt servicing resulting from the deficit. It can be explained as present value of government spending needs to be equal to the present value of both tax and non-tax revenues and government is liable to pay its spending for either now or in future. Fiscal deficit is a useful device to meet the requirement of lumpy expenditure or smoothen the impact of revenue shock. However, aggregate demand is not affected by such fiscal deficit if present value of their incomes affects the household spending decisions

Consider the present value of their future tax liabilities. It can be explained as investment remains unchanged when current savings decreases due to fiscal deficit may be followed by an equalizing increase in private savings. Resultantly interest rate does not change. This assumption is needed by the Ricardian equivalence that all individual in the economy are foresighted, government discount rate on consumption are equal to their discount rate and they based on long period of time for assessing the present value of future taxes. In order to pay tax liabilities they save their income for infinite period of time to take care of future generations.

2.6 Empirical Studies

Adam & Bevan (2006) have analyzed the relationship between fiscal deficit and growth for a panel of 45 developing nations and discover a conceivable nonlinear relationship between

growth and fiscal deficit. Keho (2010) has checked the causal relationship between budget deficit and economic growth for seven West-African countries for the period 1960-2005. This empirical study has mixed results; he did not find any connection between budget deficit and economic growth in three out of seven countrieswhile deficit had detrimental effects on economic growth in remaining four countries.

Nelson & Singh (1997) examine the effect of budget deficit on GDP growth rate using crosssectional data of seventy developing countries, for the time periods of 1970-1979 and 1980-1989. The results of the study showed that, in 1970s and 1980s the economic growth of these countries slightly affected by the budget deficit.

Avila (2011) has checked the interaction among insecurity at macro level, fiscal deficit and economic growth for Argentina during the time period of 1915-2006. This study showed that in Argentina deficit loaded on per capita income growth as a consequence of instability in relative prices.Some of these studies such as Taylor et al, (2012) have examined the relationship between debt and economic growth for the period 1961-2000 of USA with primary fiscal deficit.

Dalyop (2010) inspects about the relationship between productiveness of fiscal deficit and growth rate of Gross Domestic product and he finds that the effect of fiscal deficit is Ricardian in Nigerian economy, therefore the level of economic progress bad been affected by fiscal deficit. By using quarterly data from 2000 to 2011 (Rahman, 2012) examines interaction between budget deficit and economic growth in Malaysia and finds that budget deficit and economic growth have no long run relationship in Malaysia, predictable with Ricardian equivalence hypothesis.Mulas-Granados, 2005) examine the effects of expenditure composition and fiscal consolidation on economic growth during the 1990s in a sample of 39 low income

countries. They find strong budgetary positions are generally correlated with higher economic growth in both the short-run and the long-run. (Tan, 2006) examines both the short and long run relationship among inflation, economic growth and fiscal deficit in Malaysian economy during 1966-2003. This study finds no relationship among these variables in long run and also found fiscal deficit have no relationship with income neither in the long-run nor in the short-run. Similarly, (Mohanty, 2013) has examined the long run and short run relationship between fiscal deficit and economic growth in Indian economy during 1970-2012 and found significant but negative relationship between fiscal deficit and economic growth in long run. While short run relationship has discarded by vector Error correlation model and Granger causality test. Brender and Drazen (2008) find in their study that high budget deficit gives negative signals to the citizens, so due to lack of confidence among investors, citizens and other neighboring countries, economic growth badly affected by high fiscal deficit. Long run growth that is affected by negative fiscal deficit has been empirically documented in numerous studies for example Fischer and stanley (1993), Easterly and Rebelo (1993),and Schmidt-Hebbel (1994), Bleaney, Gemmell, and Kneller (2011) among others.

There is no agreement among economists either on analytical grounds or on the basis of empirical results whether financing government expenditure by incurring a fiscal deficit is good, bad, or neutral in terms of its real effects, particularly on investment and growth. Generally speaking, there are three schools of thought concerning the economic effects of budget deficits: Neoclassical, Keynesian and Ricardian. Among the mainstream analytical perspectives, the neoclassical view considers fiscal deficits detrimental to investment and growth, while in the Keynesian paradigm, it constitutes a key policy prescription. Theorists persuaded by Ricardian equivalence assert that fiscal deficits do not really matter except for smoothening the adjustment

to expenditure or revenue shocks. While the neo-classical and Ricardian schools focus on the long run, the Keynesian view emphasizes the short run effects.

Chapter 3

Methodology

3.1 Introduction

This chapter is devoted to analyze the dynamic of the model and its effects on the steady state. After performing comparative static analysis we show the effect of changes in different variables and parameters on the steady state.

3.2 Model

Consider an overlapping generation's model with households who live for two periods only. In the first period of their lives they are young and hence are called first generation. But in

the second period they become old and are retired and a new young generation replaces them.Let Lt individual are born in period "t" population grow at rate "n" thus Lt = (1+n) Lt-1

Young generation can work and supply one unit of Labor when they are young. At the end of the first period the young divide the resulting labor income between first period consumption and saving in second period. However the old generation cannot work. At the beginning of the period they can rent out their savings when they have young to the firms as capital or use those to buy government bonds. Hence during the retirement/second period, old people earn interest on the bonds and sell these bonds. They consume all these proceeds such that nothing is left to bequeath and die at the end of this second period.

We consider the Constant Elasticity of Substitution (CES) utility function of the representative household. This utility function depends on the consumption of this household during the working period C_{1t} and the consumption in the retirement period denoted byC_{2t+1}. The utility function take the form; $u(c_{1t}, c_{2t+1}) = \frac{c_{1t}^{1-\sigma}-1}{1-\sigma} + \beta \frac{c_{2t+1}^{1-\sigma}-1}{1-\sigma}$

3.2.1 Household s Utility Maximisation Problem

$$\max_{\{c_{1t}, c_{2t+1}, s_t\}} U(c_{1t}, c_{2t+1}) = \frac{c_{1t}^{1-\sigma}-1}{1-\sigma} + \beta \frac{c_{2t+1}^{1-\sigma}-1}{1-\sigma} \quad (1)$$

$$(1 + \tau_c)c_{1t} + s_t = \pi_t + (1 - \tau_w)w_t \quad (2)$$

$$(1 + \tau_c)c_{2t+1} = (1 + (1 - \tau_r)r_{t+1})s_t \quad (3)$$

$$c_{1t}, c_{2t+1}, s_t \geq 0$$

In order to find the inter-temporal budget constraint, we substitute $s_t$from equation (3) into equation (2) and obtain

$$(1 + \tau_c)c_{1t} + \frac{(1+\tau_c)c_{2t+1}}{1+(1-\tau_r)r_{t+1}} = \pi_t + (1 - \tau_w)w_t \quad (4)$$

The constraint implies that the present value of consumption in period's t and t+1 is equal to the present value of wealth net of tax. Now from equations (2) and (3), we isolate c_{1t} and c_{2t+1} as,

$$c_{1t} = \frac{\pi_t + (1-\tau_w)w_t - s_t}{1+\tau_c} \quad (5)$$

$$c_{2t+1} = \left(\frac{1+(1-\tau_r)r_{t+1}}{1+\tau_c}\right) s_t \quad (6)$$

By substituting equations (5) and equations (6) in the utility function we can change the constraints optimization problem given above into the unconstraint maximization problem in terms of single choice variable $s_t$as

$$\max_{(s_t)} U(.) = \frac{1}{1-\sigma}\left[\left\{\frac{\pi_t + (1-\tau_w)w_t - s_t}{1+\tau_c}\right\}^{1-\sigma} + \beta\left(\left\{\frac{1+(1-\tau_r)r_{t+1}}{1+\tau_c}.s_t\right\}^{1-\sigma} - 1\right)\right]$$

To obtain the optimal value of utility, the first order condition for maximization requires $\left|\frac{dU(.)}{ds}\right|_{s=\bar{s}} = 0$, and hence we obtain

$$\frac{1-\sigma}{(1+\tau_c)^{1-\sigma}}[\pi_t + (1-\tau_w)w_t - \bar{s}_t]^{-\sigma} - \beta\frac{1-\sigma}{(1+\tau_c)^{1-\sigma}}[(1+(1-\tau_r)r_{t+1})\bar{s}_t]^{-\sigma}(1+(1-\tau_r)r_{t+1}) = 0 \quad (7)$$

And upon simplification, this condition reduces to

$$(\pi_t + (1-\tau_w)w_t - \bar{s}_t)^{-\sigma} = \beta[(1+(1-\tau_r)r_{t+1})\bar{s}_t]^{-\sigma}(1+(1-\tau_r)r_{t+1}) \quad (8)$$

Equation (8) together with equations (5) and (6) provides

$$\frac{\dot{u}(c_{2t+1})}{\dot{u}(c_{1t})} = \left(\frac{c_{2t+1}}{c_{1t}}\right)^{\sigma} = \beta(1+(1-\tau_r)r_{t+1}) \quad (9)$$

Equation (9) is the usual *Euler equation* for the dynamic optimization problem stated above and if we denote $\beta = \frac{1}{1+\theta}$ where is the discount rate, then

$$\left(\frac{c_{2t+1}}{c_{1t}}\right) = \left[\frac{(1+(1-\tau_r)r_{t+1})}{1+\theta}\right]^{\frac{1}{\sigma}} \quad (10)$$

Equation (10) has the following implications.

$$i.\ c_{1t} > c_{2t+1}\ if\ \theta > (1-\tau_r)r_{t+1}$$
$$ii.\ c_{1t} = c_{2t+1}\ if\ \theta = (1-\tau_r)r_{t+1}$$
$$iii.\ c_{1t} < c_{2t+1}\ if\ \theta < (1-\tau_r)r_{t+1}$$

For instance, the first inequality states that if the discount rate (that is also the marginal rate of time preferences) exceeds after-tax real rate of return, then the marginal utility of consumption in period 1 will be less than the marginal utility of consumption in period 2, i.e., $u(c_{1t}) < u(c_{2t+1})$and hence c_{1t}will be greater than c_{2t+1}. Now from equation (4):

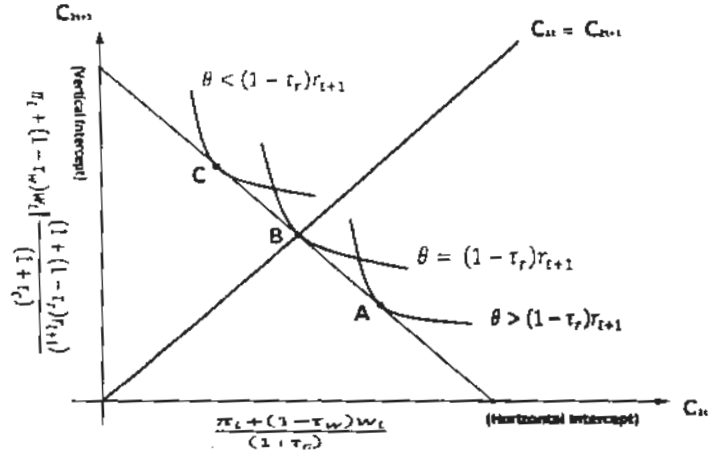


figure 1

$$\left(\frac{c_{2t+1}}{c_{1t}}\right) = [\pi_t + (1-\tau_w)w_t]\frac{(1+(1-\tau_r)r_{t+1})}{(1+\tau_c)c_{1t}} - 1 + (1-\tau_r)r_{t+1}),$$

$$= \left[\frac{\pi_t+(1-\tau_w)w_t}{(1+\tau_c)c_{1t}} - 1\right](1+(1-\tau_r)r_{t+1}) \qquad (11)$$

and substituting equation (11) in equation (10) and taking power $\frac{1}{\sigma}$ yields

$$\left(\frac{\pi_t + (1-\tau_w)w_t}{(1+\tau_c)c_{1t}} - 1\right)(1+(1-\tau_r)r_{t+1}) = \left[\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right]^{\frac{1}{\sigma}},$$

and after further simplification and re-arrangement of the terms involved, we acquire

$$\frac{\pi_t + (1-\tau_w)w_t}{(1+\tau_c)c_{1t}} = \left[\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right]^{\frac{1}{\sigma}} \frac{1}{1+(1-\tau_r)r_{t+1}} + 1.$$

By inverting both sides and simplifying it yields the optimal value of c_{1t}as

$$\bar{c}_{1t} = \frac{\pi_t+(1-\tau_w)w_t}{(1+\tau_c)}\left[\frac{1+(1-\tau_r)r_{t+1}}{1+(1-\tau_r)r_{t+1}+\left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}}}\right] \tag{12}$$

After plugging c_{1t}in equation (10) gives us the optimal value of c_{2t+1}as

$$\bar{c}_{2t+1} = \frac{(1+(1-\tau_r)r_{t+1})\left[\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right]^{\frac{1}{\sigma}}}{(1+(1-\tau_r)r_{t+1})+\left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}}}\frac{\pi_t+(1-\tau_r)r_{t+1}}{1+\tau_c} \tag{13}$$

Now we substitute c_{2t+1}in equation (4) or c_{1t}in equation (3) and simplify the resulting expression to acquire optimal savings level $s_t$as

$$\bar{s}_t = \frac{\left[\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right]^{\frac{1}{\sigma}}}{(1+(1-\tau_r)r_{t+1})+\left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}}}(\pi_t + (1-\tau_w)w_t) \tag{14}$$

Equations (12-14) provide us the representative young agent's optimal consumption and saving choices as functions of the variables w_t, π_t, r_{t+1}which the individual takes as given but are endogenous in this macroeconomic model and are based on the set of parameters $(\theta, \sigma, \tau_r, \tau_c, \tau_w)$. We observe that these optimal choices are proportional to the young persons after tax income $\pi_t + (1-\tau_w)w_t$In particular, we have

$$\frac{\partial \bar{c}_{1t}}{\partial \pi_t} = \frac{1+(1-\tau_r)r_{t+1}}{(1+(1-\tau_r)r_{t+1})+\left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}}}\cdot\frac{1}{1+\tau_c} > 0$$

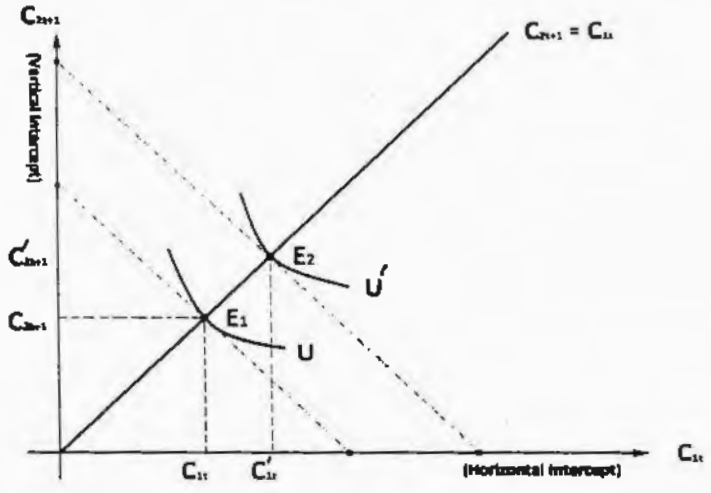
$$\frac{\partial \bar{c}_{1t}}{\partial w_t} = \frac{1-\tau_w}{1+\tau_c}\cdot\frac{1+(1-\tau_r)r_{t+1}}{(1+(1-\tau_r)r_{t+1})+\left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}}} > 0$$

$$\frac{\partial \bar{c}_{2t+1}}{\partial \pi_c} = \frac{(1+(1-\tau_r)r_{t+1})\left[\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right]^{\frac{1}{\sigma}}}{(1+(1-\tau_r)r_{t+1})+\left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)}\cdot\frac{1}{1+\tau_c} > 0$$

$$\frac{\partial \bar{c}_{2t+1}}{\partial w_t} = 0$$

$$\frac{\partial \bar{s}_t}{\partial \pi_t} = \frac{\left[\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right]^{\frac{1}{\sigma}}}{(1+(1-\tau_r)r_{t+1}) + \left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}}} > 0$$

$$\frac{\partial \bar{s}_t}{\partial w_t} = \frac{\left[\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right]^{\frac{1}{\sigma}}}{(1+(1-\tau_r)r_{t+1}) + \left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}}} . (1-\tau_w) > 0$$



These derivatives basically represent pure income effect.In order to analyze the impact of the change in the real rate of return r_{t+1}on savings we compute $\frac{\partial s_t}{\partial r_{t+1}}$ as follows.First we apply natural logarithm on both sides of equation (14) to obtain

$$ln\bar{s}_t = -\frac{1}{\sigma}\ln(1+\theta) + \frac{1}{\sigma} ln1 + (1-\tau_r)r_{t+1}) + \ln(\pi_t + (1-\tau_w)w_t) - ln\left[1 + (1-\tau_r)r_{t+1}) + \left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}}\right]$$

Partial derivative w.r.t r_{t+1}yields

$$\frac{\partial \bar{s}_t}{\partial r_{t+1}} = \frac{1}{\bar{s}_t}\frac{\partial \bar{s}_t}{\partial r_{t+1}} = \frac{(1-\tau_r)}{\sigma(1+(1-\tau_r)r_{t+1})} - \frac{(1-\tau_r)+\frac{1}{\sigma}\left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}-1}\left(\frac{1-\tau_r}{1-\theta}\right)}{1+(1-\tau_r)r_{t+1}+\left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}}}$$

$$\frac{\partial \bar{s}_t}{\partial r_{t+1}} = \bar{s}_t(1-\tau_r)\left[\frac{1}{\sigma(1+(1-\tau_r)r_{t+1})} - \frac{1+\frac{1}{\sigma(1+\theta)}\left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}-1}}{1+(1-\tau_r)r_{t+1}+\left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}}}\right]$$

$$= \bar{s}_t(1-\tau_r)\frac{(1+(1-\tau_r)r_{t+1})+\left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}} - \sigma(1+(1-\tau_r)r_{t+1}) - \left(\frac{1+(1-\tau_r)}{1+\theta}\right)}{\sigma(1+(1-\tau_r)r_{t+1})\left[1+(1-\tau_r)r_{t+1}+\left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}}\right]}$$

By substituting value of s_t from equation (14), we obtain

$$\frac{\partial \bar{s}_t}{\partial r_{t+1}} = (1-\tau_r)\frac{1-\sigma}{\sigma}\frac{\left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}}}{\left[1+(1-\tau_r)r_{t+1}+\left(\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right)^{\frac{1}{\sigma}}\right]^2}\cdot(\pi_t+(1-\tau_w))w_t$$

We observe that the overall effect of changes in r_{t+1} on s_t is

$$\frac{\partial s_t}{\partial r_{t+1}}\begin{Bmatrix}>0\\=0\\<0\end{Bmatrix} if\ \sigma\begin{Bmatrix}<\\=\\>\end{Bmatrix}$$

Note that the overall effect depends on the relative sizes of income and substitution effect, so we consider these three cases. Using equation (10) we get

$$c_{2t+1} = \left[\frac{1+(1-\tau_r)r_{t+1}}{1+\theta}\right]^{\frac{1}{\sigma}} c_{1t} \qquad (16)$$

indicating proportionality between c_{2t+1} and c_{1t}. Also, we use intertemporal budget constraint given in equation (4) as

$$c_{2t+1} = [\pi_t + (1-\tau_w)w_t]\frac{(1+(1-\tau_r)r_{t+1})}{(1+\tau_c)c_{1t}} - (1+(1-\tau_r)r_{t+1})c_{1t}$$

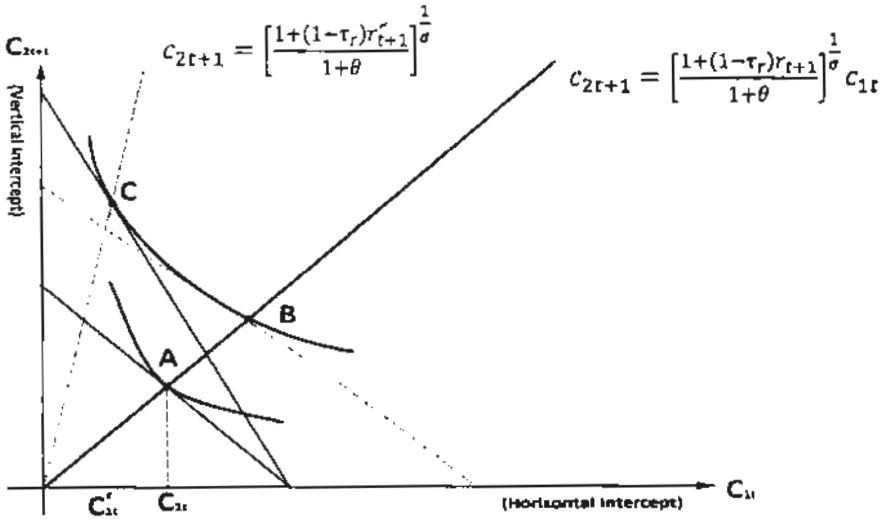


Fig 2: Effect of increase in r_{t+1}

The effect of increase in r_{t+1} should be explained in two different cases;

Case 1: $\sigma < 1$

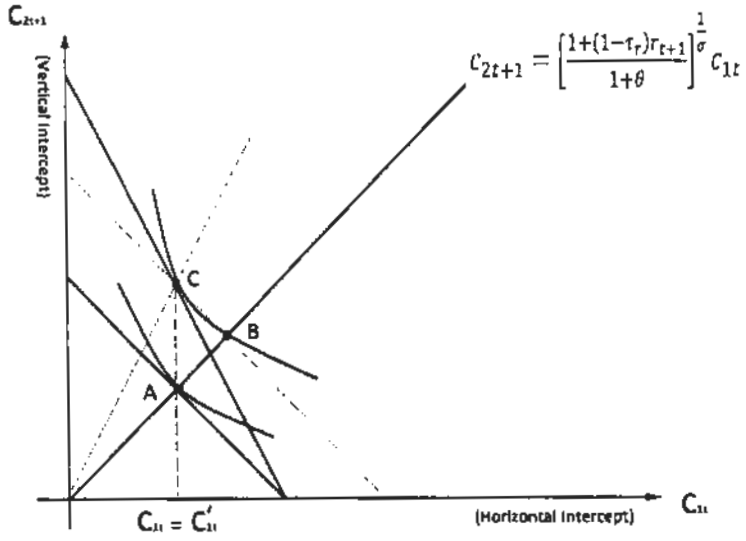
An increase in r_{t+1}has two effect on $c_{1t}$and hence on savings,s_t;From point A to B there is pure income effect that results in higher $c_{1t}$and hence $s_t$falls. But from point B to C is the substitution effect where we observe that c_{1t}falls and $s_t$increases. But the overall effect from A to C is dominated by substitution effect so that c_{1t} falls and $s_t$increases.

Case II:$\sigma = 1$

Where utility function reduces to $u(c) = \ln(c)$

1. This is the limiting case that is provided in Teles and Mussolini (2014).

2. One important implication of logarithm utility function is that savings $s_t$becomes insensitive to any changes in the real interest rate. Thus c_{1t}, c_{2t+1} and s_t all are independent of r_{t+1}:



Income effect is from A to B:

Substitution effect is from B to C: Overall effect from A to C: Also notice that when $\sigma = 1$

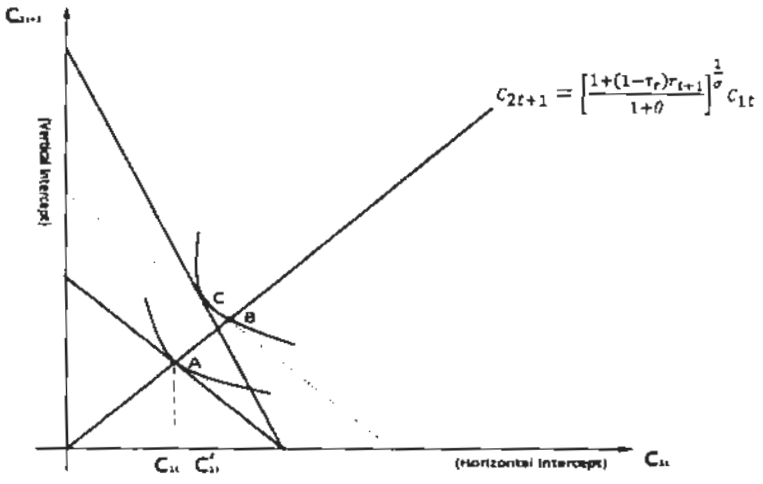
$$c_{1t} = \frac{1+\theta}{2+\theta}\left(\frac{\pi_t + (1-\tau_w)w_t}{1+\tau_c}\right)$$

$$\bar{c}_{2t} = \frac{1+(1-\tau_r)r_{t+1}}{2+\theta}\left(\frac{\pi_t + (1-\tau_w)w_t}{1+\tau_c}\right)$$

And optimal savings as:

$$\bar{s}_t = \frac{1}{2+\theta}(\pi_t + (1-\tau_w)w_t)$$

when $\sigma > 1$



Income effect is from A to B : c_{1t} ↑ and so s_t ↓

Substitution effect is from B to C : c_{1t} ↓ and so s_t ↑

Overall effect is from A to C : c_{1t} ↑ and so s_t ↓

That is, income effect dominates when $\sigma > 1$ and hence c_{1t} ↑ but s_t ↓

3.2.2 Firm's Profit Maximisation Problem

We assume that the economy has perfectly competitive markets and that the firms objective is to maximize profits subject to the output constraint. The problem is stated as;

$$\max_{(k_t,l_t)} \pi_t(l_t, k_t)\bar{s} = y_t - (w_t l_t + \tau_t k_t) \tag{18}$$

Subject to

$$y_t = AG_{P,t}^{1-\alpha} K_t^{\alpha} l_t^{1-\alpha} \tag{19}$$

Also we follow Teles and Mussolini (2014) by assuming that supply of labour is equal to the size of the population of youngs so that

$$l_t = 1 \tag{20}$$

Thus, government restricts the quantity of productive expenditures as a part of the aggregate product, that is

$$G_{p,t} = g_1 y_t, \quad g_1 \in (0,1) \tag{21}$$

Consequently, we have

$$y_t = A(g_1 y_t)^{1-\alpha} k_t^{\alpha}$$

And after collecting y_t:

$$y_t^{\alpha} = A g_1^{1-\alpha} k_t^{\alpha}$$

Or,

$$y_t = A^{\frac{1}{\alpha}} g_1^{\frac{1-\alpha}{\alpha}} k_t \tag{22}$$

And for this reason, we also acquire productive government expenditures as

$$G_{p,t} = A^{\frac{1}{\alpha}} g^{\frac{1}{\alpha}} k_t \tag{23}$$

Now for profit maximization problem provided in equation (18) above we have thefirst order conditions of optimisation as

$$\frac{\partial \pi}{\partial k_t} = 0 \rightarrow r_t = \frac{\partial y_t}{\partial k_t}$$

and thus

$$r_t = \alpha A G_{p,t}^{1-\alpha} K_t^{-(1-\alpha)} l_t^{1-\alpha}$$

using equation (20)

$$r_t = \alpha A \left(\frac{G_{p,t}}{k_t}\right)^{(1-\alpha)}$$

After substituting (23), we have

$$r_t = \alpha A \left[A^{\frac{1}{\alpha}} g_1^{\frac{1}{\alpha}}\right]^1$$

$$r_t = \alpha A^{\frac{1}{\alpha}} g_1^{\frac{1-\alpha}{\alpha}}$$

Similarly, we obtain another condition w.r.t $l_t$as

$$\frac{\partial \pi}{\partial l_t} = 0 \rightarrow \frac{\partial y_t}{\partial l_t} = w_t$$

Or

$$w_t = (1-\alpha)\alpha A G_{P,t}^{1-\alpha} K_t^{-\alpha} l_t^{-\alpha}$$

$$= (1-\alpha)\, A \left[A^{\frac{1}{\alpha}} g_1^{\frac{1}{\alpha}} k_t \right]^{1-\alpha} k_t^{\alpha} \qquad (24)$$

and after using equations (20) and (23), we obtain optimal wage rate in the economy as

$$w_t = (1-\alpha) A^{\frac{1}{\alpha}} g_1^{\frac{1-\alpha}{\alpha}} k_t \qquad (25)$$

Also note that capital accumulation following the law of motion for capital is;

$$k_{t+1} - k_t = i_t - \delta k_t$$

$$k_{t+1} = (1-\delta) k_t + i_t$$

Assuming the depreciation rate $\delta = 1$ above equation reduces to

$$k_{t+1} = i_t \qquad (26)$$

Notice that,

$$\frac{\partial r_t}{\partial g_t} > 0$$

$$\frac{\partial w_t}{\partial g_t} > 0$$

and

$$\frac{\partial s_t}{\partial g_t} = \frac{\partial s_t}{\partial w_t} \cdot \frac{\partial w_t}{\partial g_t}$$

This means that productive expenditures result in a higher productivity in the economy and therefore both real interest rate and the wages would also be higher in that economy. It is also indicated that output in our model is best designed by Ak form, so savings affects positively the long term growth. Indeed, any positive shock to productive $\left(\frac{\partial s_t}{\partial r_{t+1}}\right)$expenditures by government would raise permanently the overall productivity in the economy that would result in higher factor rewards. That is, with higher productivity there will be higher rental on capital and hence wages. These higher wages will result in higher savings in the economy. Higher savings mean

higher investments and capital accumulation that will result in economic growth. However, we can observe from equation (14) that

$$\frac{\partial s_t}{\partial \tau_w} < 0 \; and \; \frac{\partial s_t}{\partial \tau_r} < 0$$

This implies that if taxes are reduced by the government then this will result in higher savings and consequently net gains from productivity will also increase. These results are consistent with Barro(1990) and Glonm and Ravikumar (1997). The resulted model substantiate the fact that if government rotate a reasonable portion of public debt to productive expenditure, then it will prove benefical for economic growth. Because, increase in productive expenditure increases reward of both capital and labor that in turn increases accumulation of physical capital (saving). In Ak growth framework economic growth move parallel to accumulation of physical capital.

Chapter 4

Conclusion

A number of studies have investigated the role of public debt in growth effectiveness of fiscal policy. In this association, most recently Teles and Mussolini (2014) presents a theoretical model of endogenous growth (Ak framework), which validates the fact that an increase in the level of public debt to GDP ratio negates the positive effect of fiscal policy on economic growth. Teles and Mussolini (2014) argued that as government indebtedness extracts a portion of young people's saving to pay interest on the debt. Increase in tax on the income of young's people reduce saving and therefore accumulation of capital. Because in Ak growth framework productivity growth move parallel to the accumulation of capital. Because in Ak growth framework productivity growth move parallel to the accumulation of physical capital, hence in Ak framework increase in public debt to GDP ratio reduce productivity growth. In addition, they argued that an increase debt size, increases cost of debt in term of an increase in interest rate on debt, consequently minimize the positive effect of productive expenditure on economic growth. This effect can also understand with transfer in income between generations.

Young generation invest their saving in government securities, hence their saving extract from the economy to pay the interest burden on the public debt, which decreases the accumulation of capital. So this effect is related to that of the pay-as –you-go pension system in the overlapping generation model, in which income transferred between generations results reduction in the accumulation of capital.

In this study we reinvestigated the role of public debt in the growth effectiveness of fiscal policy. Hence, in this association, we modified the basic Teles and Mussolini (2014) model with some changes. First, the Cobb-Douglas utility function is replaced with CES utility function. Second, instead of just consumption tax, both consumption and capital tax are considered. Third, instead of $\delta = 1$ we have taken

$$0 \leq \delta \leq 1$$

Our theoretical model concludes that productive expenditure results a higher productivity in the economy that in turns increase reward of both Labor and capital. The increase in the reward of both capital and labor enhance the accumulation of capital and therefore productivity growth. These evidences substantiates the fact that if government rotate a reasonable amount of public debt to productive expenditure, then an increase in public debt to GDP ratio cannot negate the positive effect of fiscal policy.

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