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**THE IMPACT OF AGGREGATE GOVERNMENT EXPENDITURE ON
GROWTH IN OECD AND SSA COUNTRIES**

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**MPhil Economics, Kwame Nkrumah University of Science and Technology, 2015
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THE IMPACT OF AGGREGATE GOVERNMENT EXPENDITURE ON GROWTH IN
OECD AND SSA COUNTRIES

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Abstract

This study identified the extent to which aggregate government expenditure affect economic growth in OECD and SSA. The study used static and dynamic model which involved the use of fixed effect and pooled OLS with regards to the static model and SYS-GMM to achieve the set objective. The SYS-GMM showed that government expenditure had a negative significant impact on growth in OECD countries but a positive significant impact in SSA countries. The results for combining all the countries used for the study showed that, government expenditure had a negative impact on growth of real GDP per capita for all countries but was significant for the pooled OLS results. In a situation where government expenditure per worker is growth enhancing, it is recommended for government to implement expansionary fiscal policies through infrastructure development like roads, good educational system telecommunication networks etc to help enhance growth.

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Table of Contents

Abstract	iii
Acknowledgements	iv
Table of Contents	v
List of tables	vi
List of figures	vii
Chapter 1 Introduction	1
1.1 Statement of Problem	4
1.2 Main objective of the research proposal.....	7
1.3 Organization of the study	8
Chapter 2 Literature review	9
2.1 Theories of Economic Growth.....	9
2.1.1 Solow Growth Model	9
2.1.2 Musgrave Theory of Public Expenditure and Growth	14
2.1.3 The Wagner’s Law/Theory of Increasing State Activities	14
2.1.4 Endogenous Growth Models	16
2.2 Empirical Literature Review	18
Chapter 3 Research Methodology	25
3.1 Theoretical Framework	25
3.2 Data Sources and Types	36
3.3 Definition of Variables and a Priori Expectation.....	37
3.5 Methods of Analysis.....	42
3.6 Estimation Strategy	42
Chapter 4 Data Analysis and Presentation	44
4.0 Introduction.....	44
4.1 Test of Unit Root.....	44
4.2 Fixed effect and Pooled OLS estimation results	47
4.3 The Dynamic Panel-data estimation, SYS-GMM results for model (3.36)	53
Chapter 5 Summary of Findings, Conclusion and Policy Recommendations	62
5.1 Summary of findings.....	62
5.2 Conclusion	69
5.3 Policy recommendation	70
REFERENCES	71

List of tables

Table 3.4.1 Summary Statistics for OECD countries..... 40

Table 3.4.2 Summary Statistics for SSA countries..... 41

Table 4.1.1: Levin, Lin and Chu Panel Unit Root Test of Stationarity for OECD Countries..... 45

Table 4.1.2 Panel Unit Root for SSA Countries..... 46

Table 4.2.1 Fixed Effect and Pooled OLS results for both OECD and SSA (1980-2016)
.....48

Table 4.3.1. SYS-GMM results for both OECD and SSA (1980-2016) 55

Table 4.4.1 Fixed Effect, Pooled OLS and SYS-GMM results for OECD and SSA added together (1980-2016) 60

List of figures

Figure (3.1) Output per worker, actual and break-even investment..... 29
Figure (3.2) The effect of an increase in savings rate on investment.....30

Chapter 1 Introduction

Government in OECD and developing countries in the recent times are much concerned about achieving growth and development to improve upon the living standard of its people and hence the impact of government expenditure has been drawing the general interest of economists in recent times due to its effect on the level of growth. Though the government is not a key player at the market, government expenditure is expected to be a means of reducing the negative impacts of market failure on the economy (Richard W. Tresch, 2002). Notwithstanding, allotments of public expenditure with lack of thoughtfulness for the urgent needs of the country may call forth greater distortions in the economy which may be detrimental to growth. Only growth can create, if not the certainty, at least the option of a more comfortable life for the masses (Tanzi, 1994) and therefore government expenditure is mostly growth driven.

According to Keynes, government involvement in an economy is crucial in that, governments provide a solid base, institutions, resources and other useful measures to fuel the economy. However, endogenous growth model like Barro (1990) suggests that only productive government expenditures will positively affect the long run growth rate since government consumption crowds out private investment, dampens economic stimulus in short run and reduces capital accumulation in the long run. In a situation where government does not spend, then by reasonable assumption there will be very little economic growth in that protecting property, defence, providing public goods and other important economic infrastructures to ensure growth would be impossible. In other words, some government spending is essential for the successful functioning of the rule of law (Mitchell, 2005).

There had been a series of arguments about the impact of government expenditure on economic growth. Some argued that, government spending had a negative effect on economic growth and insignificant among such arguments are studies carried out by (Akpan, 2005) and (Romer, 1990) and studies conducted by (Gregorious and Ghosh, 2008) found a positive significant impact on economic growth. Whenever government spends on health and education it raises the productivity of labour and hence a rise in economic growth. Government expenditure in the form of national defence is crucial for protecting the country against outside attackers among others while in the form of agriculture helps prevent the ever-growing population from starvation and death but government revenue generation through tax serves as a disincentive to work, reduces corporate profit and hence crowds out private investment to ensure growth (Barro, 1990). In 2013, general government revenues represented on average 37.7% of GDP across OECD countries, a similar figure to pre-crisis levels (37.5% in 2007). However, between 2007 and 2009 average revenues decreased by 1.4 percentage points reaching 36.0% of GDP. This decline could be primarily attributed to sluggish or diminishing economic growth during the global financial and economic crisis. In 2013, taxes represented the largest share (on average 58.5%) of government revenues across OECD countries, around, one quarter were collected through net social contributions, while the remainder was for grants and other revenues (Pena Lopez & Ismael, "Government at a Glance", 2015).

Since government expenditure on health helps boost economic growth, currently, OECD countries have been increasing their expenditure on health. In somewhere 2001, an average of 8.4 % of their GDP was spent on health care which increased by 0.3 % from

2000. The increase was because of rapid advances in medical technologies, population aging, and rising public expectations (Manfred Huber and Eva Orosz, 2003).

Between 2009 and 2013, government investment declined by 0.8 % as a share of GDP and 1.4% as a share of total expenditures on average in OECD countries. In 2013, government investment represented 3.3% of GDP and 7.8% of total expenditure on average. In 2013, sub-central governments spent on average about 60% of total government investment. However, in countries such as Chile, Greece and the Slovak Republic more than 70% of government investment was carried out by central government (Government at a Glance, 2015).

Sub Saharan countries had been having problems concerning economic growth and development, GDP growth rate recorded 4.0 % in 1980 and a negative growth rate of 1.2% and 0.9 % in 1983 and 1990 respectively. It was then recorded a growth rate of 6.1% and 4.2% in 2006 and 2012 respectively with the average GDP growth rate between 1980 and 2012 being 3.1 percent (World Bank, 2013).

A study carried out by Nkurunziza et al. (2003) expressed that it is inconceivable for sub-saharan countries to catch up with the advanced countries since they have been experiencing low economic growth over the years. And a study conducted by Modebe et al. (2012) contended that, there has been an increase in government expenditure over the years without any significant increase in economic growth. In between 1980-2012, Sub-Saharan Africa's economic growth measured by GDP growth rate was 3.1% while government spending was 16.8% a percentage of GDP indicating that government spends but adds little to growth in sub-Saharan countries.

1.1 Statement of Problem

Government in both developed and developing countries are more concerned about the growth of the country and hence had been coming out with policies directed towards achieving growth and development. Since government cannot spend without any revenue, in 2013, general government revenues represented on average 37.7% of GDP across OECD countries which is almost as the figure to pre-crisis levels of 37.5% in 2007. Government tax revenue constituted the largest share of 58.5% on the average of government revenue throughout OECD countries, (Pena Lopez & Ismael, “Government at a Glance”, 2015).

Governments in OECD countries spent the largest share of total expenditures on social protection in 2013. On average close to one third of government spending is dedicated to social protection (32.4%). These are particularly high in Nordic countries, Luxembourg, France, Germany, Japan, Austria and Italy where they represent more than 40% of total government expenditures. Government expenditures represented on average 41.9% of GDP across OECD countries in 2013, (Pena Lopez & Ismael, “Government at a Glance”, 2015).

In 2013, OECD governments spent relatively less on defense (5.5%), public order and safety (4.4%), housing and community amenities (1.5%), recreation culture and religion (1.5%) and environmental protection (1.2%) although depending on countries this may vary quite significantly. Governments’ spending on health care, public services (which includes the debt servicing) and in education also represents important shares of government spending, each above 10% on average in 2013. Spending on economic affairs is also significant (9.5%) and varies from more than 25% in Greece to less than 7% in Denmark, Israel, Portugal and the United Kingdom. Generally, the largest expenditure

component of general government is social benefits followed by the compensation of employees. In 2013, on average, these two items accounted for 62.8% of the total government expenditures across OECD countries, (Pena Lopez & Ismael, “Government at a Glance”, 2015).

When it comes to policies to ensure growth, most Sub-Saharan countries had not been insensitive to that, for instance, there had been a remarkable progress in the educational development in SSA countries. The number of children in primary schooling has increased by 48% from 87 million to 129 million between 2000 and 2008. Enrolment in preprimary, secondary and tertiary education has also grown by more than 60% during the same period. Despite these significant improvements, many SSA countries are still a long way from achieving universal primary education (UPE) of adequate quality by 2015. The most recent data show that, in one-third of SSA countries, approximately 50% of all children do not complete primary education. Thirty-two million children of primary school age are still out of school in the region.

According to the UNDP Human Development Report for 2009, more than 70% of the SSA population is living on less than US\$1.25 per day in Burundi, Guinea, Malawi, Mozambique, Rwanda and the United Republic of Tanzania. Prevalence of disease and poor health conditions are other factors of low human development. HIV/AIDS, tuberculosis, malaria and various tropical diseases are commonly found in SSA.

During the four years preceding the financial crisis in 2008, the SSA region experienced stable economic growth of around 6% per annum, which was up from a 4% growth rate between 1995 and 2005. However, because of the global financial crisis since mid2008, the region’s growth rate decelerated to an estimated 1.2% in 2009 (World Bank,

2010). This, coupled with an estimated population growth rate of 2.4%, resulted in a negative GDP per capita growth of 1.3% for SSA.

Most government had put in place some measures to ensure growth and Ghana for instance came out with the Economic recovery Programme (ERP) in 1983 to ensure growth and Structural Adjustment Programme in (1986) to correct structural imbalances in the economy. Ghana's growth rate rose from a negative growth rate of 5 per cent in 1983 to a positive rate of 8 per cent in 1984 while government spending increased from 6 per cent to 7 per cent in 1983 and 1984 respectively (Aryeetey and Fosu, 2005). Ghana Vision 2020 programme was launched in 1995 to achieve growth and to catch up with the developed countries. Also, Kenya's government came out with a National Development Plan implemented between 1997 and 2001 intended to make the private sector as an engine of growth. This caused stable government expenditure at 16% from 1997 to 1999 in Kenya and GDP growth rate was recorded at less than 1% in 1997 and shot to 3% and 4% in 1998 and 2001 respectively (Darkoh S.O, 2014).

Whilst some studies had significantly shown a positive relationship between government spending and economic growth, others concluded a negative or no correlation between government spending and real output growth. Devarajan et al. (1996) conducted a study on disaggregated spending effect on economic growth for 43 developing countries and found that current expenditure had a positive significant impact on growth while capital expenditure had a negative impact on growth. Landua (1986), applying OLS on sample panel of 27 LDCs, found that government consumption expenditure had a negative on economic growth. Loizides and Vamvoukas (2005) conducted a trivariate causality testing on government expenditure and economic growth for Greece, UK and Ireland and

found out that, Government size granger caused economic growth in all countries of the sample in the short run and in the long run for Ireland and the UK. Alexander (1990) applied OLS method for sample of 13 Organization for Economic Cooperation and Development (OECD) countries panel (1959-84). The result showed that growth of government spending and inflation had a significant negative impact on growth.

To the best of our knowledge most of the studies conducted on government expenditure and economic growth are not related to both OECD and Sub-Saharan countries. In line with these suggestions, this research is a contribution to the literature of OECD and Sub-Saharan study cases on the decomposition and impact of government expenditure on economic growth. The review of the empirical literature showed that, much had been done on developing countries but not that much in developed countries. Therefore, the study would be helpful in both developed and developing countries.

The last motivation for this research is that, the availability of data spanning the period 1980-2016 for the case of OECD and Sub-Saharan countries, allowed for a meaningful panel data investigation and valid statistical inference. It is therefore necessary to undertake the current study and to fill this gap.

1.2 Main objective of the research proposal

To identify the impact of aggregate government expenditure on economic growth.

Specific objectives are:

- To find out the impact of domestic investment on economic growth.

- To find the impact of other macroeconomic variables like tax per worker, current account per worker, labor force growth rate, government military expenditure per worker etc on economic growth.
- To also find out whether government spending have a greater impact to growth in OECD countries than Sub-Saharan countries.

1.3 Organization of the study

There are five main chapters that formed the study and hence each chapter divided into sections and sub-sections. The general introduction to the study is what the first chapter addressed. Chapter two reviewed the theoretical and empirical literature, Chapter three focused on the methodology used to accomplish the objectives of the study. More so, chapter four analyzed the data gathered to accomplish the aim of this research. Lastly, a brief statement that presented the study and findings, policies recommended, and conclusion would be discussed in chapter five.

Chapter 2 Literature review

The section looked at the theories put forward by economists to explain economic growth and to look at empirical literatures reviewed on economic growth.

2.1 Theories of Economic Growth

Economic growth is an increase in the capacity of an economy to produce goods and services compared from one period to another. It can be measured in nominal or real terms, the latter of which is adjusted for inflation.

2.1.1 Solow Growth Model

Solow (1956) begins his analysis using a simple Cobb-Douglas production function that is characterized by constant returns to scale. The production function with government involvement is given by:

$$Y = f(K, L, G) \dots\dots\dots (2.1)$$

Where Y is output, K is the stock of physical capital, L is labour force and G is the level of government spending. Including G is not a standard feature of the Solow model, however we include it to investigate its effect if increases in G yield productive services, such as infrastructure spending. Solow (1956) in his assertion explains capital as output saved and invested but not consumed. Solow (1956) also assumed a single good economy with government intervention to affect long run economic growth. Government finances its purchases through lump-sum taxes on consumers, where T denotes total taxes and the government budget is balanced each period so that $G=T$. The national income equation with government intervention is given by:

$$Y=C+I+G\dots\dots\dots (2.2)$$

Given that consumers consume a constant fraction of disposable income given by:

$$C = (1-s) Y \dots\dots\dots (2.3)$$

Where “s” is the savings rate of the households.

Putting (2.3) into (2.2) gives:

$$Y = (1-s) Y + I + G \dots\dots\dots (2.4)$$

Expanding and rearranging yields:

$$sY = I + G \dots\dots\dots (2.5)$$

$$I = \dot{K} + \delta K \dots\dots\dots (2.6)$$

Defining the level of investment in equation (2.5) gives equation (2.6) above which is the level of investment comprising of the sum of capital stock changes over time and depreciation of capital.

Putting (2.6) into (2.5)

$$sY = \dot{K} + \delta K + G \dots\dots\dots (2.7)$$

Deriving the fundamental equation for the law of motion, we have:

$$\dot{K} = sY - \delta K - G \dots\dots\dots (2.8)$$

Define k as the capital-labour ratio K/L and take its natural log.

$$\ln k = \ln K - \ln L \dots\dots\dots (2.9)$$

Differentiating (2.9) with respect to time gives:

$$\frac{1}{k} \frac{\partial k}{\partial t} = \frac{1}{K} \frac{\partial K}{\partial t} - \frac{1}{L} \frac{\partial L}{\partial t} \dots\dots\dots (2.10)$$

$$\therefore \frac{\dot{k}}{k} = \frac{\dot{K}}{K} - \frac{\dot{L}}{L} = \frac{\dot{K}}{K} - n \dots\dots\dots (2.11)$$

Where “n” is growth rate of labour force in equation (2.11)

Now insert (2.8) into (2.11)

$$\frac{\dot{k}}{k} = \frac{sY-G-\delta K}{K} - n \dots\dots\dots (2.12)$$

Multiply both sides of equation (2.12) by k

$$\frac{\dot{k}}{k} k = k \left[\frac{sY-G-\delta K}{K} \right] - nk \dots\dots\dots (2.13)$$

Simplifying equation (2.13) gives:

$$\dot{k} = \frac{sY-G-\delta K}{L} - nk = sy - g - (n + \delta)k \dots\dots\dots (2.14)$$

Assuming a Cobb-Douglas production function of the form:

$$Y = K^\alpha L^\beta G^\gamma \dots\dots\dots (2.15)$$

Where constant returns to scale implies, $\alpha+\beta+\gamma = 1$ or $\beta = 1-(\alpha+\gamma)$

$$\text{Hence } Y = K^\alpha L^{1-(\alpha+\gamma)} G^\gamma \dots\dots\dots (2.16)$$

Writing the above in intensive form gives:

$$\frac{Y}{L} = \frac{K^\alpha L^{1-(\alpha+\gamma)} G^\gamma}{L} \dots\dots\dots (2.17)$$

$$y = \frac{K^\alpha G^\gamma}{L^{\alpha+\gamma}} \dots\dots\dots (2.18)$$

$$y = \frac{K^\alpha G^\gamma}{L^{\alpha+\gamma}} = \left(\frac{K}{L}\right)^\alpha \left(\frac{G}{L}\right)^\gamma = k^\alpha g^\gamma \dots\dots\dots (2.19)$$

Putting (2.19) into (2.14) gives:

$$\dot{k} = sk^\alpha g^\gamma - g - (n + \delta)k \dots\dots\dots (2.20)$$

At the steady state $\dot{k} = 0$

$$sk^\alpha g^\gamma = g + (n + \delta)k \dots \dots \dots (2.21)$$

Writing the above in implicit function form gives:

$$sk^\alpha g^\gamma - g - (n + \delta)k = 0 \dots \dots \dots (2.22)$$

Taking implicit derivative of k with respect to g gives:

$$\frac{\partial k^*}{\partial g} = - \frac{\partial F / \partial g}{\partial F / \partial k} = - \left[\frac{syk^\alpha g^{\gamma-1} - 1}{\alpha sk^{\alpha-1} g^\gamma - (n + \delta)} \right] \dots \dots \dots (2.23)$$

$$\frac{\partial k^*}{\partial g} = - \frac{s \left(\frac{\gamma k^\alpha g^\gamma}{g} \right)^{-1}}{\left(\frac{\alpha sk^\alpha g^\gamma}{k} \right)^{-1} - (n + \delta)} = - \frac{s(\gamma y / g)^{-1}}{(\alpha sy / k)^{-1} - (n + \delta)} = - \frac{s(\gamma y / g)^{-1}}{(\alpha sy / k)^{-1} - (n + \delta)} \dots \dots \dots (2.24)$$

The above uses the simple property that, $\frac{Y}{G} = \frac{yL}{gL} = \frac{y}{g}$ and $\frac{y}{g} = \frac{Y}{G}$ and $\frac{Y}{K} = \frac{yL}{kL} = \frac{y}{k} \therefore \frac{y}{k} = \frac{Y}{K}$

Given $syk^\alpha g^{\gamma-1} - 1 < 0$ since savings rate is less than 1, the numerator became positive when multiplied by the negative one. Assuming $(\alpha sy / k) > (n + \delta)$, the overall effect of government spending per worker would have a positive impact on the steady capital per worker. This therefore means that, the increase in government purchases increases the steady state output per worker to ensure growth. The growth rate of output increases above n temporarily as the new steady state is reached, and then returns to a growth rate equal to n. Of course, the actual effect of an increase in G on economic growth is an empirical issue.

The condition for a positive effect on y from g is that $\gamma > G / sY$, or $\gamma > t / s$ if one uses the balanced budget condition ($G = tY$). To avoid an unstable solution where an increase in G increases Y and T goes up more than G, we must have $\gamma < 1$, implying that the tax rate cannot exceed the savings rate. But if we assume $(\alpha sy / k) < (n + \delta)$, then the overall effect of government expenditure per worker would be negative. It can be seen from the

steady state capital per worker equation that, an increase in government per worker (g) lowers capital per worker and hence output per worker. Since government takes away from the private investable resources through taxes, the steady state capital and output per workers falls.

The above analysis assumes that the increase in government spending is permanent. In that case a new steady state value of k is reached with temporary deviations of the growth rate of output from the rate of population growth. In the case of a temporary increase in government spending (and taxes), the effect is ultimately reversed in the Solow model and the economy transitions back to its original steady state value of k . A period of above trend growth (if $\gamma > G/Y$) will be followed by a period of below trend growth until the growth rate returns to the rate of population growth.

Ultimately, Solow (1956) aspicated that, capital accumulation which is made up of both saving and investment cannot throw light on long-run economic growth. The intuition behind this is that, increase in saving rate causes a rise in per capita income which does not possess any growth effect in the long run. It is technology that accounts for permanent growth effects and other variables just have level effects.

Notwithstanding, Mankiw, Romer and Weil (1992) included human capital accumulation to Solow's predication which affects both the theoretical and empirical analysis of growth. The nature of growth can change theoretically when human capital is correctly evaluated.

It was well contended by Lucas (1988) that, when human capital is held constant, the returns to all consistent capital are constant even though the returns to physical capital accumulation are diminishing. It is noted that, cross-country differences analysis may take

issue when human capital is included. Whenever human capital is ignored, it will change its impact on physical-capital accumulation and population growth on income per capita.

2.1.2 Musgrave Theory of Public Expenditure and Growth

This theory was propounded by Musgrave (1959) as he found changes in the income elasticity of demand for public services in three ranges of per-capita income. He posits that at low levels of per-capita income, demand for public services tends to be very low, this is so because according to him such income is devoted to satisfying primary needs and that when per-capita income starts to rise above these levels of low income, the demand for services supplied by the public sector such as health, education and transport starts to rise, thereby forcing government to increase expenditure on them. He observes that at the high levels of per-capita income, typical of developed economies, the rate of public sector growth tends to fall as the more basic wants are being satisfied. The theory asserts that in the early stages of economic growth, public expenditure in the economy should be encouraged. The theory further states that during the early stages of growth there exist market failures and hence there should be robust government involvement to deal with these market failures. Ultimately the Musgrave model reverses the causation of the standard Solow growth model. Instead of government expenditures affecting growth, growth at least partially determines government expenditures. The theory is faulty because it ignores the contribution to development by the private sector by assuming that government expenditure is the only driver of economic growth.

2.1.3 The Wagner's Law/Theory of Increasing State Activities

Wagner's law is a principle named after the German economist Adolph Wagner (1835-1917). Wagner advanced his 'law of rising public expenditures' by analyzing trends

in the growth of public expenditure and in the size of public sector. Wagner's law postulates that: (i) The extension of the functions of the states leads to an increase in public expenditure on administration and regulation of the economy.

(ii) The development of modern industrial society would give rise to increasing political pressure for social progress and call for increased allowance for social consideration in the conduct of industry.

(iii) The rise in public expenditure will be more than proportional increase in the national income (income elastic wants) and will thus result in a relative expansion of the public sector. Musgrave and Musgrave (1988), in support of Wagner's law, opined that as progressive nations industrialize, the share of the public sector in the national economy grows continually.

According to Wagner (1883), causality runs from economic growth to public expenditure. The thrust of Wagner's Law is that as a country's output increases, public expenditure increases as well but at a much faster rate. Bagdigen & Cetintas (2004) reaffirmed wagners suggestions that had shown that there was a relationship between the growth of a country's output and public expenditure and this relationship was in one direction; from the growth of a country's output to public expenditure. According to Wagner (1883), public expenditure rises constantly for most countries demonstrating an upward sloping trend. In contrast, Keynes (1964) assumed that causality runs from public expenditure to economic growth in times of recession. The law is faulty because of its inherent assumption of viewing the state as separate entity capable of making its decisions ignoring the constituent's populace who in fact can decide against the dictates of the Wagner's Law.

Adolf Wagner raised a debate in (1893) that public spending is an endogenous factor influenced by the growth of national income. The model can be expressed as

$$G = f(Y) \dots\dots\dots (2.25)$$

Where G is public spending and Y stands for output of a country.

Rostow (1960) also argued that; society's pattern of economic growth and development is the reason for the increase of public expenditure. Peacock and Wiseman (1961) also contended that; a social crisis is the reason for increases in public sector expenditure.

2.1.4 Endogenous Growth Models

Empirical work carried out until three decades ago looking for any explanation of the differences in rates of economic growth in a cross-section of countries had concluded that many of these differences could not be explained by Solow model. These disappointing facts lead researchers to develop a model in which the steady state economic growth rate is determined within the model. Thus, some researchers such as Romer (1986,1990), Lucas (1988), Grossman and Helpman (1991), Aghion and Howitt (2005) and others developed what are known as "endogenous growth models". In these models the key determinants of growth are: economies of scale, endogenous investment in human capital, externalities, and public goods. Endogenous growth models emphasize the importance of the role played by any kind of human capital on the long-run economic growth process.

The simplest endogenous growth model corresponds to what is known as the 'AK' model, developed by Rebelo (1991). The AK model was adopted mainly to neutralize the diminishing marginal productivity of capital. This model assumes private investment

brings about certain externalities (spill-over like technical progress, education etc.) which benefit society. The AK model predicts a permanent increase in the growth rate from G , if there is any effect at all. The AK model is given as:

$$Y = AK \dots\dots\dots (2.26)$$

Where Y represents output, A is the level of technology and K is the capital stock. The output elasticity of capital is assumed to equal one ($\alpha = 1$) so that there is no diminishing marginal product of capital a unique assumption that greatly simplifies the model and puts the focus on changes in technology. The effect of capital on output can be directly through production and indirectly through technological improvements from learning by doing. Essentially, we have that $A = A(K)$. It is also assumed in the model that growth is accounted for by an increase in human capital, population and the savings rate. Jones (1995) objected to the AK model, noting that after the post war period, even though population, human-capital accumulation and savings rate rose progressively, growth showed no visible trend. A decreasing return to produced factors was found by Jones (1995) instead of the increasing or constant returns to produced factors proposed by the AK model.

In summary, it is difficult to make any firm predictions about the effects of government expenditures on economic growth because there is no consensus in the literature of just what the appropriate model of economic growth is. The Solow (1956) model remains the workhorse growth models offer little in the way of improvements other than suggesting that government expenditures could enhance human capital technology, but ultimately having little in the way of long-run effects. The public expenditures models best represented by Musgrave (1959) suggest that government expenditures are determined by the level of economic development and that the causation is reversed. At best these

models suggest important variables to hold constant in an empirical investigation of the role of government in economic growth, but little in the way of help determining the structure of the regression models or coefficient values.

2.2 Empirical Literature Review

The neoclassical model which presumes that growth in the long run is not affected by fiscal policy is disproved by empirical studies. Notwithstanding that, the results are far from conclusive. Taking into consideration the effects of public expenditure on growth which is the main concern of the research proposal, empirical studies analyze this by considering of the growth effects of either total government spending or its components. These include; Landau (1983), Kormendi and Menguirre (1985), Ram (1986), Aschauer (1989), Barro (1990, 1991), Levine and Renelt (1992), Easterly and Rebelo (1993), Cashin (1995), Devarajan et al. (1996), Mendoza et al. (1997), Nazmi and Ramirez (1997), Odedokun (1997,2001), Tanzi and Zee (1997), Kneller et al. (1999), Bleaney et al. (2001), Devarajan et al. (2001), Shioji (2001), Feehan and Matsumoto (2002), Gupta et al. (2002), Haque and Kim (2003), Milbourne et al. (2003), Ramirez and Nazmi (2003), among others. There have been conflicting results because of different assumptions made, methodologies used, panel datasets used, etc. On the one hand, public expenditure can displace private investment (the crowding-out effect), and on the other hand, public expenditure can encourage private investment (through investment incentives and technology complementarities) and so, economic growth.

Empirical studies carried out on the relationship between the composition of government expenditure and economic growth can be generally divided into categorical and non-categorical studies. Public expenditure components are grouped into productive

and unproductive by the categorical studies while the non-categorical studies permit the data and the results to determine which components to be regarded as productive and those that are unproductive. Public consumption that enhances the utility function of households are regarded as unproductive and are expected to reduce economic growth since it requires higher taxes to be implemented which will not only reduce investment returns but will also lower incentives to invest. On the other hand, public consumption that complements private sector productive activities such as infrastructure is assumed to be productive (Aschauer and Greenwood, 1985; Aschauer 1989; Barro, 1990, 1991; Grier and Tullock 1989; Easterly and Rebelo, 1993; Kormendi and Meguire, 1985; Summers and Heston, 1988).

Empirical studies by (Barro, 1981; Finn, 1998; and Linnemann and Schabert, 2004; among others) substantiate that; the utility functions of household rather than the private production function, is affected by the government consumption spending. The increases in government consumption slows down growth and development as it crowds out private investment in the form of taxation that reduces the resources of the private sectors to carry out investment. Studies carried out by Landau (1983), Barro (1991), and Barro and Sala-i-Martin (1995, 2004) conclude that countries with high shares of this spending in their GDP grow at a slower pace than others; while Kormendi and Menguirre (1985), Nazmi and Ramirez (1997), Mosley (2000), Kneller et al. (1999), Bleaney et al. (2001), and Bose et al. (2003), find that there is no effect of government consumption spending on the economic growth rate. Ram (1986) is one of the few studies that find that government consumption, particularly government services, affects growth in a positive way, through a positive externality effect. Ram (1989) responds to criticisms by Carr (1989) and Bhanoji (1989) by

offering some arguments in support of his main conclusion, namely government size positively affects economic growth.

Engen and Skinner (1992) found that government spending is productivity slowing which agrees with studies by Folster and Henrekson (1999, 2001) for 23 OECD countries over the 1970-1995 periods and for 27 high-income countries during the same period. Their results suggest a robustly negative relationship between public expenditure and growth.

Laudau (1983) studied the effect of government expenditure on economic growth for 96 countries with the result that real output is negatively affected by government expenditure. Similarly, Komain et al. (2007) found out that government expenditure and economic growth are not co-integrated in Thailand by using the Granger Causality test. The results also suggest a unidirectional relationship, as causality runs from government expenditures to growth. However, the results suggested a significant positive effect of government spending on economic growth.

Cappelen et al. (1984) study used the data are for 17 OECD countries for the period 1960-1980. A simple mathematical model based on economic theory is used to analyze for three relatively homogeneous subgroups of countries. Military spending was generally found to have a negative effect on investment. These two effects have an opposite impact on economic growth. The net effect is that military spending has an overall negative effect on economic growth for the whole sample of countries and for the subgroups, except for the Mediterranean countries.

Alexander (1990) paper models the effect of military spending on economic growth by specifying four sectoral production functions. The model is confronted with data from a group of developed countries. It is concluded that the gross effect of military spending on

growth is neither significantly positive nor negative, although the defence sector is substantially less productive than the “rest” of the economy. DeRouen Jr (1994) study differs from those by considering the relationship between “guns and growth” over time, and by looking at both the overall and externality effects of military spending. The findings demonstrate that defense spending has both positive and negative impacts on economic growth in Latin America, but that there is no net positive effect. Dunne (2002) paper has provided a contribution to the debate on the economic effects of military spending on economic growth, focusing upon a sample of small industrialising economies. The data is used to consider the individual economies and to provide some panel time-series results, which show some evidence of a negative impact of military spending on growth and investment.

Chang et al. (2011) applied GMM method to panel data of 90 countries spanning over 1992– 2006. Their results indicate military spending leads negatively economic growth for the panels of low income countries. Of four different regional panels, a negative but stronger causal relationship from military expenditure to economic growth is found for the Europe and Middle East–South Asia regions. Wijeweera and Webb (2011) study used a panel co-integration in the five South Asian countries of India, Pakistan, Nepal, Sri Lanka and Bangladesh over the period of 1988–2007. They found that a 1% increase in military spending increases real GDP by only 0.04%, military spending in these countries has a negligible impact upon economic growth.

Yang et al. (2011) paper the main objective is to decipher the military expenditure economic growth relationship, taking the level of economic development (income) into consideration. Their findings: (i) military expenditure has a significantly negative

relationship to economic growth for the 23 countries with initial incomes (threshold variable) less than or equal to \$475.93; (ii) when the threat level is heightened, economic growth (23 countries) is expected to decrease.

Dunne and Tian (2013) employed an exogenous growth model and dynamic panel data methods for 106 countries over the period 1988–2010. They found that military burden has a negative effect on growth in the short and long run.

Devarajan et al. (1996) investigated a study of disaggregated spending effects on economic growth for 43 developing countries for the period 1970 to 1990 using an Ordinary Least Squares (OLS) estimation procedure. The findings from the study suggest that capital expenditure has a negative impact on growth while current expenditure has a positive impact on growth.

Chinn and Prasad (2000) examined the medium -term determinants of current account in 18 industrialized and 71 developing countries and they used cross-section data and panel regression to examine the association between current account and its determinants across countries and over time. They also found that among developing countries, higher terms of trade volatility are also associated with larger current account surpluses. The degree of openness to international trade appears to be weakly associated with larger current account deficits among developing countries. However, their study found that a potentially important variable, average GDP growth does not bear any systematic relationship with current account balances.

Furthermore, Calderon and *et al* (2002) made a similar study which looked on the determinants as well as the impact of current accounts deficits in developing countries and the empirical linkage of current account deficits and a set of economic variables which

include economic growth. Some of the findings were that current account deficits are moderately persistent and a rise in domestic output growth generates a larger current account deficit and either higher growth rates in industrialized economies or larger international interest rates reduce the current account deficit in developing economies. In his study he also brought out the fact that economic growth can also have an impact on the current account balance, a temporary increase in the domestic output (GDP) growth rate has the effect of enlarging the current account deficit. A unit percentage rise in the GDP rate leads to an increase of about 0.21 percentage points in the current account deficit.

Al-Yousif (2002) carried out a study of defense expenditures on economic growth using a Granger-causality test for six Arab Gulf sub-region countries from 1975 to 1998. It was found that defense expenditures have a positive impact on economic growth for Bahrain, UAE, Iran and Saudi Arabia, while having a negative impact on Kuwait and no relationship in Oman.

Ghali (1999) estimated the effect of government size on economic growth by employing multivariate cointegration techniques for 10 OECD countries. In conclusion, government size was found to positively affect economic growth for all ten (10) countries. It is worthy of note that the study determined that the government spending effect on growth was made possible through international trade, exports, imports and investment.

Calderón and Servén (2008) estimated the effect of infrastructure expenditures on economic growth using infrastructure supply as a proxy for public spending in Sub-Saharan African countries. The study estimated growth and inequality equations as well as a standard set of control variables augmented by infrastructure quantity and quality indicators and controlled for the potential endogeneity of the latter. The empirical results

suggest that infrastructure development and a better quality of infrastructure services affected growth positively in the long-run but have a negative impact on income inequality. Folster and Henrekson (2001) added that the share of infrastructure to government expenditure is less than one-fifth for OECD countries and more than half for less developed countries.

Chapter 3 Research Methodology

The main objective intended to be achieved in this chapter was to identify the variables that explained the extent to which aggregate government expenditure affects the growth in output (or economic growth) in OECD and Sub-Saharan African countries. This chapter presented the methodology used in the study. The chapter is divided into two main sections. The first section focused on the theoretical framework for the study. Section two, discussed the estimation procedure for the study.

3.1 Theoretical Framework

This section developed a simple model that linked government spending to economic growth. Following the Solow model and using standard notations, the production function is given as:

$$Y_{(t)} = A_{(t)}K_{(t)}^{\alpha}L_{(t)}^{1-\alpha} \dots\dots\dots (3.1)$$

Where $0 < \alpha < 1$

Y is output, K is capital, A is the level of technology which grows at rate g, L is the labor force and is assumed to grow at rate n such that:

$$L_{(t)} = L(0)e^{nt} \dots\dots\dots (3.2)$$

$$A_{(t)} = A(0)e^{gt} \dots\dots\dots (3.3)$$

Rewriting (3.1) in intensive form gives:

$$y_t = Ak^{\alpha} \dots\dots\dots (3.4)$$

Defining $y = Y/L$ and $k = K/L$

The theoretical modeling continues by defining the national savings of the economy as:

$$S = S_{prt} + S_{govt} \dots\dots\dots (3.5)$$

Where S_{prt} represents private savings and S_{govt} represents government savings with a budget deficit where $S_{govt} < 0$. Inserting the components of private and government savings gave the equation below:

$$S = (Y + NFP + TR + INT - T - C) + (T - TR - INT - G) \dots\dots\dots (3.6)$$

Where Y = national income, NFP = net factor payments from abroad, TR = Transfer payments, INT = interest payments on debt, T = taxes, C = household consumption, G = government expenditures on final goods and services.

Simplifying equation (3.6) gives:

$$S = Y + NFP - C - G \dots\dots\dots (3.7)$$

Assuming the economy is an open economy with government involvement, the national income accounting identity (Y) was given by:

$$Y = C+I+G+NX \dots\dots\dots (3.8)$$

Inserting (3.8) into (3.7) gives:

$$S = (C+I+G+NX) + NFP - C - G \dots\dots\dots (3.9)$$

Defining $NX+NFP$ as the current account CA , and simplifying gave the condition:

$$S = I+NX+NFP = I+CA \dots\dots\dots (3.10)$$

The above equation stated that national savings was used to finance domestic investment and any current account deficit.

Private savings from equation (3.10) was given as:

$$S_{prt} = S - S_{govt} \dots \dots \dots (3.11)$$

$$S_{prt} = I + CA - S_{govt} \dots \dots \dots (3.12)$$

We now note that private savings, is equal to the marginal propensity to save multiplied by after-tax private income.

Therefore equation (3.12) can be rewritten as:

$$s\bar{Y} = I + CA - S_{govt} \dots \dots \dots (3.13)$$

Equation (3.13) defines what y-bar is, where $\bar{Y} = Y - T$

Domestic investment is given by:

$$I = \dot{K} + \delta K \dots \dots \dots (3.14)$$

Inserting (3.14) into (3.13) gives:

$$s\bar{Y} = \dot{K} + \delta K + CA - S_{govt} \dots \dots \dots (3.15)$$

Making \dot{K} as a subject give:

$$\dot{K} = s(Y - T) - \delta K - CA + S_g \dots \dots \dots (3.16)$$

The Solow model expresses all variables in intensive form (dividing by the stock of labor). To do so required; constant returns to scale production function of the form $Y = A f(K, L)$ that was expressed in terms of output per person as $y = A f(k)$, where $k = K/L$. Solow defined the steady state of the model where the capital-labor ratio is constant, or $\dot{k} = 0$. To investigate further, we explored how k evolved over time.

Taking the natural log of both sides of k gave:

$$\ln k = \ln K - \ln L \dots \dots \dots (3.17)$$

Differentiating (3.17) with respect to time gave:

$$\frac{1}{k} \frac{\partial k}{\partial t} = \frac{1}{K} \frac{\partial K}{\partial t} - \frac{1}{L} \frac{\partial L}{\partial t} \dots \dots \dots (3.18)$$

$$\therefore \frac{\dot{k}}{k} = \frac{\dot{K}}{K} - \frac{\dot{L}}{L} = \frac{\dot{K}}{K} - n \dots \dots \dots (3.19)$$

Multiply both sides of equation (3.19) by k

$$\dot{k} = \frac{\dot{K}}{L} - nk \dots \dots \dots (3.20)$$

Substituting (3.16) into (3.20) gives:

$$\dot{k} = [s(y - t) - \delta k - ca + s_g] - nk \dots \dots \dots (3.21)$$

$$\dot{k} = s(y - t) - ca + s_g - (n + \delta)k \dots \dots \dots (3.22)$$

Where y = output per worker, t = tax per worker, ca = current account per worker, s_g = government savings per worker, n = labor force growth rate, δ = rate of depreciation.

Substituting equation (3.4) into equation (3.22) gives:

$$\dot{k} = s(Ak^\alpha - t) - ca + s_g - (n + \delta)k \dots \dots \dots (3.23)$$

At the steady state, $\dot{k} = 0$ giving the equation below:

$$(n + \delta)k = s(Ak^\alpha - t) - ca + s_g \dots \dots \dots (3.24)$$

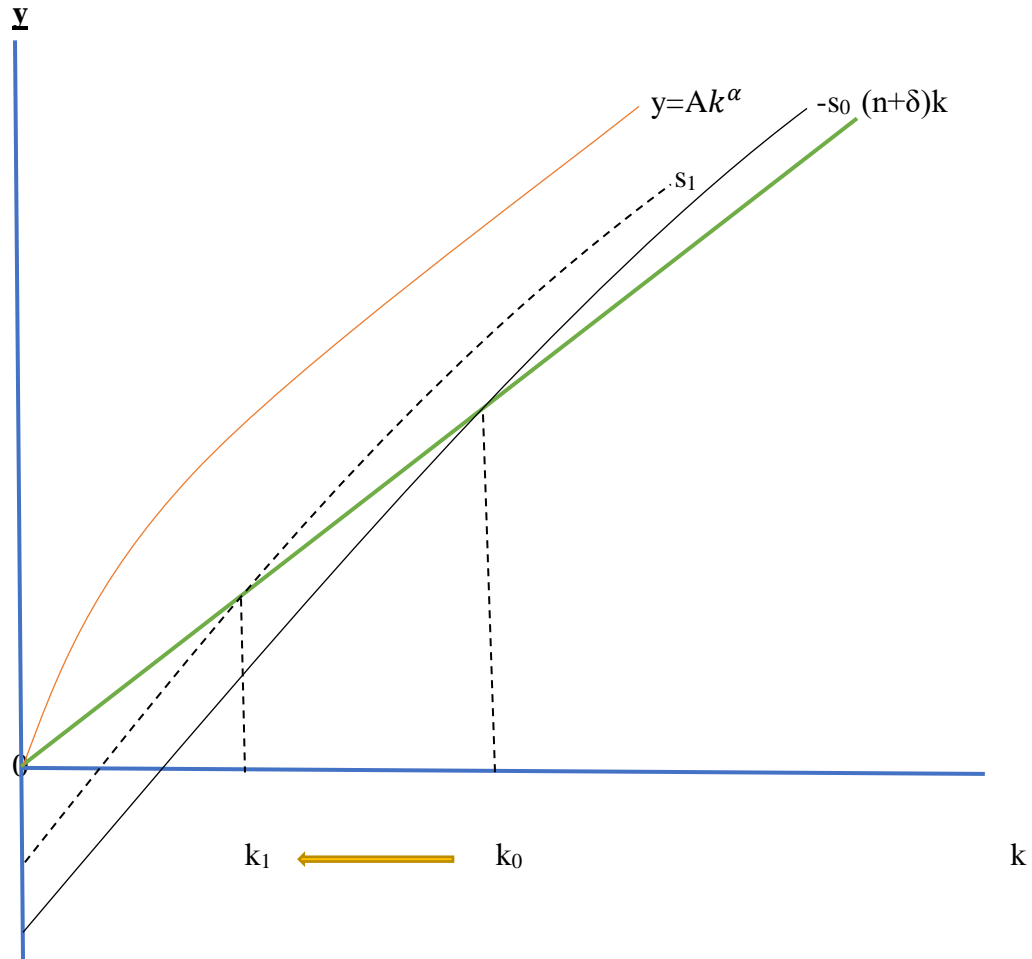


Figure 3.1: Output per worker, actual and break-even investment

An increase in taxes that is not accompanied by an increase in government spending will result in a budget surplus (or smaller budget deficit). Inspection of (3.24) revealed two effects on private savings. Higher taxes reduced the amount of income available for private savings, however the move to a budget surplus reduced the amount that government needs to borrow from private savings dollar for dollar. The net effect on private savings was found by the derivative of the RHS of (3.24) with respect to t .

$$\frac{\partial s}{\partial t} = -s + 1 = 1 - s > 0$$

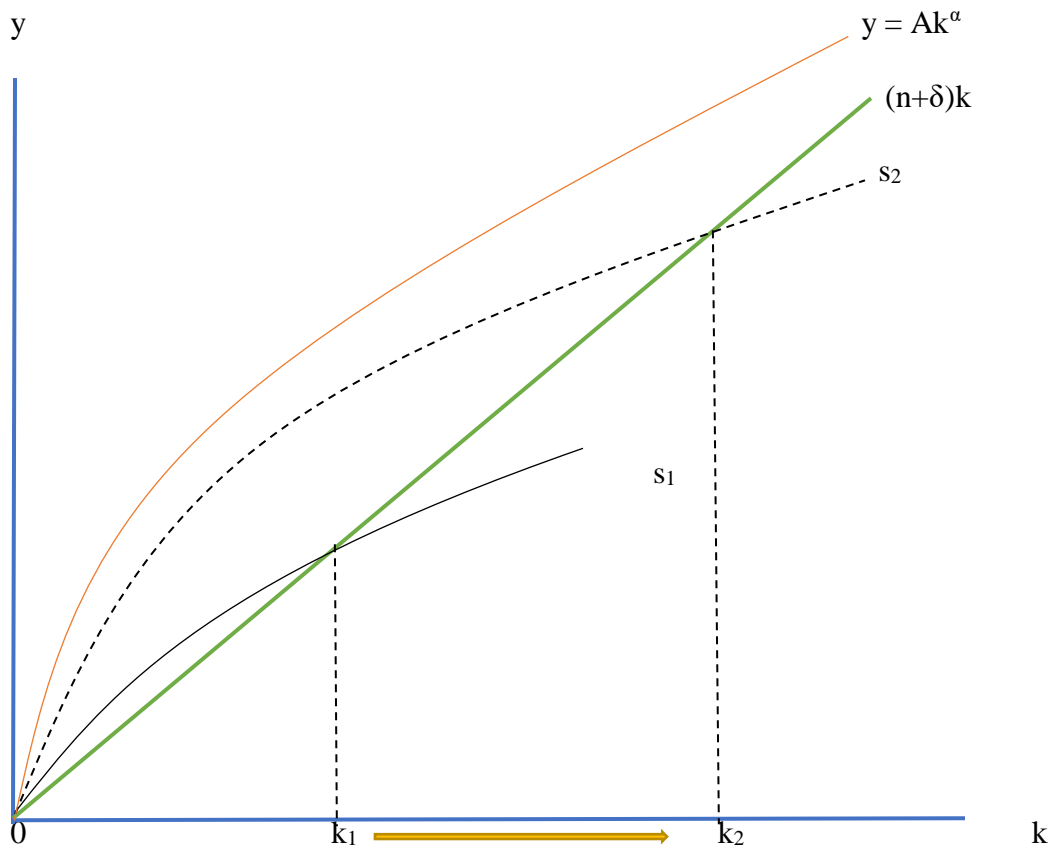


Figure 3.2: The effect of an increase in the savings rate on investment

If Figure (3.2) above, the savings curve shifts upward, and a higher capital-labor ratio is arrived at in the steady state. The growth rate of output increased above the steady state rate “n” until the new steady state is reached at k_2 . The model predicted a positive association between higher taxes and growth due to the overall positive effect on private savings.

From the theoretical modelling, the variables that affected economic growth were; taxes per worker, current account per worker, labor force growth rate, rate of depreciation and government savings per worker. We assumed that the rate of depreciation was homogeneous across countries and hence can be ignored. Since the focus of the study was on government expenditure, the government savings per worker was replaced with

government expenditure per worker since government savings is used to finance government expenditure.

The purpose of this study is to estimate the impact of government expenditure on growth. Following the classical growth literature, the model was developed from a production function which permitted a country's real GDP per capita represented by (y_{it}) to depend on theoretically informed economic variables namely; tax per worker (T), current account per worker (CA), labor force growth rate (LFGR) and government expenditure per worker (GE). Hence the production function was expressed in a functional form as below:

$$y_{it} = \beta(GE)^\alpha T^\tau CA^\rho LFGR^\theta Z_{it}^\lambda \dots\dots\dots (3.25)$$

Taking the natural logarithm of both sides of the production function and adding a disturbance term gave the econometric equation below:

$$\ln y_{it} = \pi + \alpha \ln GE + \tau \ln T + \rho \ln CA + \theta \ln LFGR + \lambda \ln Z_{it} + \varepsilon_{it} \dots\dots\dots (3.26)$$

Where $\pi = \ln \beta$ is the intercept, GE = Government expenditure per worker, T = tax per worker generated by the government to finance his expenditure, CA = current account per worker, LFGR = Labor force growth rate and Z_{it} is a vector of control variables of economic growth and ε_{it} is an error term. The vector of control variable "Zit" incorporates; inflation rate (INFL), Government military expenditure (GME) and domestic investment (INV).

Considering a linear panel data model:

$$\ln y_{it} = \sum_{j=1}^9 \beta_j x_{it} + v_{it} \dots\dots\dots (3.27)$$

Where $v_{it} = c_i + \mu_{it}$ is the composite error term

$$i= 1, \dots, N \quad t= 1 \dots T$$

From the above model, since β is constant, the model may seem to be protective.

Notwithstanding, the parameters can vary over time by suitably choosing x_{it} .

Pooled OLS estimation is consistent if $E(x_{it}^t v_{it}) = 0$, this practically means that we are assuming

$$E(x_{it}^t \mu_{it}) = 0 \dots \dots \dots (3.28)$$

$$E(x_{it}^t c_i) = 0 \dots \dots \dots (3.29)$$

Where $t = 1, 2, \dots, T$

Equation (3.29) is the restrictive assumption and since $E(x_{it}^t \mu_{it}) = 0$ holds if we have successfully modeled $E(y_{it} / x_{it}, c_i)$.

Using the standard notation of the panel literature and adding a disturbance term, we may write the fixed effect model as:

$$\ln y_{it} = \pi + \sum_{j=1}^9 \beta_j x_{it} + \mu_i + \varepsilon_{it} \dots \dots \dots (3.30)$$

The first fixed effect assumption is strict exogeneity of the explanatory variables conditional on μ_i .

Where y_{it} denoted real GDP per capita, μ_i is the country specific effect, x_{it} stands for the regressors and $\varepsilon_{i,t}$ is an error term.

Assumption 1:

$$E(\varepsilon_{it} \setminus x_i, \mu_i) = 0, \quad t= 1, 2, \dots, T$$

This assumption is like that of the random effect (RE), but the only difference is that, we do not assume the assumption 2 under the RE. That implies, under fixed effect E $(\mu_i \setminus x_i)$ can be any function of x_i .

The FE transformation is obtained by first averaging equation (3.30) over $t=1, \dots, T$ to get the cross-section equation below:

$$\bar{y}_i = \bar{x}_i \beta + \mu_i + \bar{\mu}_i \dots \dots \dots (3.31)$$

Subtracting equation (3.31) from (3.30) for each t gives the FE transformed equation:

$$y_{it} - \bar{y}_i = (x_{it} - \bar{x}_i) \beta + \mu_{it} - \bar{\mu}_i \dots \dots \dots (3.32)$$

Where $\bar{y}_i = T^{-1} \sum_{t=1}^T y_{it}$, $\bar{x}_i = T^{-1} \sum_{t=1}^T x_{it}$ and $\bar{\mu}_i = T^{-1} \sum_{t=1}^T \mu_{it}$

Since μ_i which the unobserved effect is out of the picture, we can therefore estimate equation (3.32) by pooled OLS.

The fixed effect model was used because it was assumed countries possess certain individual characteristics that are unique to them and are time invariant.

The study estimated the dynamic growth model following the static model by adding lag of real GDP per capita as a regressor. Hence the dynamic production function was expressed in a functional form as below:

$$y_{it} = (y_{it-1})^\varphi GE^\alpha T^\tau CA^\rho LFGR^\theta Z_{it}^\lambda \dots \dots \dots (3.33)$$

Taking the natural logarithm of both sides of the above and adding a disturbance term gives the econometric equation below:

$$\ln y_{it} = \varphi \ln y_{it} + \alpha \ln GE + \tau \ln T + \rho \ln CA + \theta \ln LFGR + \lambda \ln Z_{it} + \varepsilon_{it} \dots (3.34)$$

Using the standard notation of the panel literature and adding a disturbance term, we wrote the dynamic model as:

$$\ln y_{it} = \varphi \ln y_{it-1} + \sum_{j=2}^9 \beta_j x_{it} + \mu_i + \varepsilon_{it} \dots \dots \dots (3.35)$$

Where $|\varphi| < 1$ for stability.

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

Where $\ln y_{i,t}$ is the logarithm of real GDP per capita of country i in year t , $x_{i,t-1}$ is a vector of determinants of economic growth, μ_i is a country-specific effect and $\varepsilon_{i,t}$ is an error term. We put $y_{i,t-1}$ on the right-hand side of the growth equation to test the convergence hypothesis. A negative φ means that higher initial income reduces economic growth and vector $x_{i,t-1}$ includes our regressors of interest.

From equation (3.35), two problems arise when applying the fixed effects. First, the lagged dependent variable $y_{i,t-1}$ is correlated with the country-specific effect μ_i , which contributes to dynamic panel bias (Nickell 1981). Second, at least some of the variables in $X_{i,t-1}$ may be endogenous with growth such that a shock to the growth rate might also affect the variables resulting in the problem of reverse causality.

In studying economic growth, using the GMM estimator has relevant advantages over cross-section regressions and other estimation methods for dynamic panel data models. First, estimates will no longer be biased by any omitted variables that are constant over (unobserved country-specific or fixed effects) time. Also, the use of instrumental variables allows parameters to be consistently estimated. We then use all statistically

significant possible lagged values of each variable as instruments. The error terms should not be serially correlated.

The system GMM estimator is the most appropriate approach to estimating dynamic growth models. The system-generalized method of moments developed by Blundell and Bond will be applied since it addresses the weak instrument problem of DIFF-GMM.

Despite the strength of DIFF-GMM in solving the endogeneity problem and removing the fixed effect, Blundell and Bond (1998) demonstrate that if y is close to a random walk (persistence to shocks), the DIFF-GMM suffers the weak instrument problem.

The system-generalized methods of moments (SYS-GMM) developed by Blundell and Bond (1988) addresses the weak instrument problem of DIFF-GMM. The approach is comprised of two equations. The first is the usual DIFF-GMM that uses lagged levels as instruments for equations in first differences.

In line with the derivation of the standard growth model, equation (3.35) is expressed in semi-log linear functional form because inflation is expressed in levels, taking the natural log of inflation normally reduces its values significantly and results in problems of interpretation.

$$\ln y_{it} = \beta_0 + \phi \ln y_{it-1} + \beta_1 \ln(\text{ge})_{it} + \beta_2 \ln(t)_{it} + \beta_3 \ln(\text{ca})_{it} + \beta_4 \ln(\text{lfgr})_{it} + \beta_5 (\text{infl})_{it} + \beta_6 \ln(\text{gme})_{it} + \beta_7 \ln(\text{inv})_{it} + \mu_i + \varepsilon_{it} \dots \dots \dots (3.36)$$

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

Where y_{it} represents real GDP per capita, ϕ shows the speed of conditional convergence of real GDP to its long-run steady-state level. T is the number of time series observation and N denotes the number of groups.

3.2 Data Sources and Types

Data for all variables were taken from World Development Indicators covering the period of 1980 to 2016 for all twenty-eight (28) OECD and thirty-eight (38) Sub-Saharan African countries. Among the OECD countries used are; Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Greece, Hungary, Ireland, Israel, Korea, Japan, Italy, Luxembourg, Netherland, Norway, Poland, Portugal, Slovak Republic, Sweden, United State, United Kingdom, Chile, Germany, Mexico, Spain and Turkey. Among the SSA countries used are; Benin, Burkina Faso, Botswana, Burundi, Cameroon, Congo Republic, Cote d'Ivoire, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Mali, Malawi, Mauritania, Mauritius, Mozambique, Namibia, Nigeria, Niger, Sierra Leone, Togo, Uganda, Zambia, Zimbabwe, Chad, Central African Republic, Comoros, Congo Democratic Republic, Djibouti, Equatorial Guinea, Eritrea, Lesotho, Rwanda, Swaziland and Tanzania. Real GDP per capita measured by GDP per capita (constant 2010 US\$) [NY.GDP.PCAP.KD], Inflation measured by GDP deflator (Inflation, GDP deflator (annual %)) [NY.GDP.DEFL.KD.ZG], current account measured by the sum of Exports of goods and services (current US\$) [NE.EXP.GNFS.CD] + Imports of goods and services (current US\$) [NE.IMP.GNFS.CD] + Net current transfers from abroad (current US\$) [NY.TRF.NCTR.CD] + Net income from abroad (current US\$) [NY.GSR.NFCY.CD], labor force growth rate proxied by growth of Labor force, total [SL.TLF.TOTL.IN], tax per worker measured by Tax revenue (current LCU) [GC.TAX.TOTL.CN] divided by the working population, Government expenditure per worker measured by General Government final consumption expenditure proxied by General government final consumption expenditure (constant 2010 US\$) [NE.CON.GOV.T.KD] divided by the

working population, Government military expenditure per worker proxied by Military expenditure (current LCU) [MS.MIL.XPND.CN] divided by the working population, Private investment measured by gross fixed capital formation (constant 2010 US\$) [NE.GDI.FTOT.KD] divided by the working population. Stata 12 and Eviews 7 statistical packages were used for estimation of results.

3.3 Definition of Variables and a Priori Expectation

Government expenditure (GE) is proxied by general government final consumption expenditure (GGFCE) that includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security but excludes government military expenditures that are part of government capital formation. Government consumption expenditures consist of spending by government to produce and provide services to the public, such as public-school education. It includes services that are provided to the public free of charge or at below market prices; they may be consumed “collectively” (such as public safety) or “individually” (such as health care). It is also government spending that buys goods and services produced in the economy and that is not a transfer payment collected in taxation from one group in society and paid to another. Government consumption counts towards GDP, while transfer payments take money from some people and gives it to others. From the Solow model discussed, an increase in government expenditure per worker lowers capital per worker and hence output per worker which reduces growth of an economy. Since government takes away from the private investable resources through taxes, the steady state capital and output per workers falls. Also, the Solow model depicted that, an increase in government expenditure per worker in

infrastructural development increases the steady state capital and output per worker and hence a rise in the growth of an economy. Therefore, the relationship between government expenditure per worker and growth is expected to be either positive or negative. Therefore $\beta_2 > 0$ or < 0 .

The labor force growth rate (LABF) is defined as the percentage change in the number of people who are willing and able to work which is used to determine the unemployment rate. From the Solow model, the production of output is a function of labor force, labor force growth rate brings in more hands to work for production and therefore contributes to economic growth. Labor force growth also leads to an increase in the demand for goods and services which helps to increase aggregate output and hence ensuring economic growth. So, it is expected to have a positive relationship between labor force growth rate and economic growth. $B_3 > 0$.

Investment (INV) proxied by Gross fixed capital formation (GFCF) is defined as the acquisition (including purchases of new or second-hand assets) and creation of assets by producers for their own use, minus disposals of produced fixed assets. Hence, an increase in investment is likely to lead to an increase in employment, profitability through multiplier effects on aggregate demand. So, it is expected to have a positive relation between Gross Fixed capital formation and economic growth. That is $B_4 > 0$.

Government military expenditure (GME) is the military expenses incurred by the government to ensure peace and security and to maintain law and order in the country. The higher military expenditure, the safer the country becomes to attract investment to promote growth and development. It is therefore expected to have a positive impact on economic growth. That is $\beta_5 > 0$.

Tax per worker (T) is defined as the revenues collected from taxes on income and profits, social security contributions, taxes levied on goods and services, payroll taxes, taxes on the ownership and transfer of property, and other taxes. The relationship between tax per worker and growth is ambiguous in that, an increase in tax crowds out investment and serves as a disincentive to work which causes a fall in growth. But taxes when used to carry out infrastructural projects like roads, railways, internet crowds in investment to boost growth.

Inflation rate (INFL) is defined as the rate at which the general level of prices for goods and services is rising, and subsequently, purchasing power is falling. The rise in the general price level reduces the demand of firms output leading to a fall in economic growth. That is $\beta_7 < 0$.

Current account (CA) is the sum of trade in goods and services less imports, net income from abroad and net current transfers. The relationship between current account and growth is ambiguous, a positive current account balance indicates that the nation is a net lender to the rest of the world and hence increases the nation's net foreign assets by the amount of the surplus. Also, it shows how competitive the economy is, so consumers would prefer buying domestic goods than importing which ensures growth of the economy as the GDP increases. Therefore, it is expected to have a positive impact on growth. While a negative current account balance indicates that it is a net borrower from the rest of the world which increases the debt of a country. This discourages foreign direct investment as investors would be less inclined to invest in a country with higher debt. Therefore, current account if negative is expected to have a negative impact on growth.

3.4 Summary Statistics for OECD and SSA countries

The study would look at the summary statistics for the data used for both OECD and SSA countries to compare their mean, standard deviation, minimum and maximum values for the study

Table 3.4.1 Summary Statistics for OECD countries

Variable	Obs	Mean	Std. Dev.	Min	Max
rgdppclog	618	10.16737	.6578998	8.413482	11.02149
lfgrlog	459	16.30391	1.212634	14.45194	18.90704
capwlog	615	10.23271	.8536049	7.782969	11.91501
taxpwlog	588	9.489522	2.057426	.1669105	14.11425
gepwlog	618	25.08755	1.534755	21.51709	28.60863
invpwlog	618	9.226117	.6852178	7.274427	10.21698
mepwlog	620	7.927909	2.051895	-.3497828	12.77388
infl	617	9.821717	26.40889	-2.294247	384.7703

Source: Authors Estimate (2018) using STATA 12

The summary statistics from Table 3.4.1 showed that, the log of real GDP per capita had a mean of 10.17 with a maximum and a minimum value of 11.02 and 8.4 respectively. This suggest that, real GDP per capita had a minimal spread around the mean. Government expenditure per worker had the largest mean with a value of 25.09 and a maximum and minimum value of 28.61 and 21.52 respectively. This means that the role of government spending in OECD countries is said to be large. Labour force growth rate had a mean of 16.30 with a maximum and minimum value of 18.91 and 14.45 respectively. Current account per worker had a mean of 10.23 with a maximum and minimum value of 11.92 and 7.78 respectively. Tax per worker had a mean of 9.49 with a minimum spread around the mean of 0.17 and a maximum spread of 14.11. Investment per worker had a mean of 9.23 with a minimum spread of 7.27 and a maximum spread of 10.22. Government military

expenditure had the lowest mean value of 7.92 with a negative minimum spread around the mean of 0.35 and a positive maximum spread of 12.77.

Table 3.4.2 Summary Statistics for SSA countries

Variable	Obs	Mean	Std. Dev.	Min	Max
rgdppclog	769	6.716828	.8862429	4.880119	9.192381
infl	765	13.72875	22.8754	-27.04865	189.9751
lfgrlog	567	15.00162	1.151996	12.90091	17.86473
capwlog	558	6.91855	1.288626	2.551322	10.10723
gepwlog	761	20.10748	1.446917	15.09623	24.35689
invpwlog	553	5.619203	1.336706	.2138468	8.616286
mepwlog	518	7.817407	2.545074	-1.93058	12.82477
taxpwlog	563	9.400496	2.417628	-3.196442	14.22479

Source: Authors Estimate (2018) using STATA 12

The summary statistics from Table 3.4.2 showed that, the log of real GDP per capita had a mean of 6.72 which is less than that of OECD countries with a maximum and a minimum value of 9.19 and 4.88 respectively. Government expenditure per worker had the largest mean with a value of 20.11 and a maximum and minimum value of 24.35 and 15.10 respectively but these values were less than that of OECD countries. This means that the role of government spending in OECD is said to be larger than SSA countries. Labour force growth rate had a mean of 15 which was close to that of OECD countries with a maximum and minimum value of 17.86 and 12.90 respectively. Current account per worker had a mean of 6.92 with a maximum and minimum value of 10.11 and 2.55 respectively. Tax per worker had a mean of 9.40 with a minimum spread around the mean of -3.20 and a maximum spread of 14.22. Investment per worker had a mean of 5.6 with a minimum spread of 0.21 and a maximum spread of 8.62. Government military expenditure had the lowest mean value of 7.81 with a negative minimum spread around the mean of 1.93 and a positive maximum spread of 12.82.

3.5 Methods of Analysis

In order to accomplish the goal intended to be attained the target of the study, unit root test was carried out to attain the stationarity of the variables. The Levin, Lin & Chu panel test of stationarity test was applied.

3.6 Estimation Strategy

To secure the robustness of the estimation results regardless of the econometric technique, the research estimated the model using standard pooled OLS estimators, which ignores the country effects. Fixed effect panel estimation was also used to control for unobserved effects which are ignored by the pooled OLS estimation procedure. (GMM) panel data technique was used for the estimation of the dynamic model because the fixed and random effects methods do not also control for potential endogeneity and hence the system Generalized Methods of Moments developed by Arellano and Bond (1991) was employed to control for potential endogeneity.

In the estimation of the model, the stationarity of the variables EC_t , GE_t , T_t , CA_t , $LFGR_t$, $INFL_t$, GME_t and INV_t had to be determined so as to avoid inconsistency and false results of the parameter estimates. In addition, stationarity of the variables was essential to be undertaken so that when there is a sudden shock in the variables in the short run it would be restored in the long run path but if the variables are not stationary whenever there is a shock, that shock last permanently and cannot be restored back in the long run. The Levin-Lin-Chu test was used, and it suggested the following hypotheses:

H0: Each time series contains a unit root

H1: Each time series is stationary

Where the lag order p can change across individuals. The approach works as follows:

Firstly, the augmented Dickey-Fuller (ADF) is run for each cross-section on the equation below:

$$\Delta y_{it} = \rho_i y_{i,t-1} + \sum_{L=1}^{\rho_i} \theta_{iL} \Delta y_{it-L} + \alpha_i m_i^d + \varepsilon_{it} \dots \dots \dots (3.37)$$

The second step, two auxiliary regressions is run as below:

1. Δy_{it} on $\Delta y_{i,t-L}$ and d_{mt} to obtain the residuals $\hat{\varepsilon}_{it}$
2. $y_{i,t-1}$ on $\Delta y_{i,t-L}$ and d_{mt} to get residuals $\hat{v}_{i,t-1}$

The third step involves standardization of the residuals by performing

$$\bar{e}_{it} = \hat{\varepsilon}_{it} / \hat{\sigma}_{\varepsilon i} \dots \dots \dots (3.38)$$

$$\bar{v}_{i,t-1} = \hat{v}_{i,t-1} / \hat{\sigma}_{\varepsilon i} \dots \dots \dots (3.39)$$

Where $\hat{\sigma}_{\varepsilon i}$ denotes the standard error from each ADF.

Chapter 4 Data Analysis and Presentation

4.0 Introduction

This chapter reviewed the results obtained from the econometric analyses and discussed the results. The estimation results were presented in three parts; the first part demonstrated and discussed the unit root test of stationarity of the variables. Second, presented the static model results which involved both fixed effect and pooled OLS. The third part showed the GMM results for the impact of government expenditure and other variables that affect growth will be presented and discussed. Finally, the Arellano and Bond test for second order autocorrelation AR (2), the Sargan test for over-identifying restrictions, as well as the Hansen test for over-identifying restrictions were reported and analyzed.

4.1 Test of Unit Root

Unit root tests were carried out at this stage to examine the stationarity of the variables in the growth regression model. Stationarity of the variables is essential at this level to avoid inconsistent and false results of the parameter estimates. In addition, stationarity of the variables insures that when there is a sudden shock in the variables in the short run, they will be restored to the long run path to avoid any misleading results. To achieve this objective, the Levin, Lin and Chu panel test of stationarity was applied.

Table 4.1.1: Levin, Lin and Chu Panel Unit Root Test of Stationarity for OECD Countries

VARIABLES	LEVELS		FIRST DIFFERENCE	
	Constant	Constant and Trend	Constant	Constant and Trend
Ln _{yit}	-5.45332*** (0.0000)	2.82100 (0.4902)	-8.67440*** (0.0000)	-8.99042*** (0.0000)
LnGE	-4.90223*** (0.0000)	-3.27585*** (0.0001)		
LnT	-6.97505*** (0.0000)	-4.80022*** (0.0000)		
LnCA	-7.41327*** (0.0000)	3.90881 (0.0000)	-10.21332*** (0.0000)	-8.46629*** (0.0000)
LnLFR	-9.00280*** (0.0000)	-9.68044*** (0.0000)		
INFL	-2.04273** (0.0236)	-2.29170** (0.0670)		
LnGME	-3.311973* (0.0927)	-3.333245** (0.0400)		
LnINV	-4.028380** (0.0190)	-3.632860*** (0.0000)		

Source: Authors Estimate (2018) using EViews 7

*** The variable is stationary at the 1% significance level.

** The variable is stationary at the 5% significance level.

* The variable is stationary at the 10% significance level.

The values in Table 4.1.1 in any column are the estimated coefficients for the variables and their respective p-values in brackets.

Table 4.1.2 Panel Unit Root for SSA Countries

VARIABLES	LEVELS		FIRST DIFFERENCE	
	Constant	Constant and Trend	Constant	Constant and Trend
Ln _y _{it}	4.20933 (0.6531)	3.19416 (0.3421)	-6.99023*** (0.0000)	-7.11023*** (0.0000)
LnGE	2.66152 (0.3685)	6.49032 (0.1180)	-5.82733*** (0.0000)	-5.89902*** (0.0000)
LnT	-3.11975*** (0.0009)	-4.09844*** (0.0000)		
LnCA	-7.30882*** (0.0005)	-7.92881*** (0.0001)		
LnLFGR	-10.49044*** (0.0000)	-10.89421*** (0.0000)		
INFL	-3.66202** (0.0300)	-3.88210*** (0.0010)		
LnGME	-1.89064* (0.0949)	-2.6757** (0.0420)		
INV	6.72430 (0.4324)	-5.66430*** (0.0000)	-6.30332*** (0.0000)	-7.86642*** (0.0000)

Source: Authors Estimate (2018) using EViews 7

*** The variable is stationary at the 1% significance level.

** The variable is stationary at the 5% significance level.

* The variable is stationary at the 10% significance level.

The results in Table 4.1.1 and 4.1.2 suggested that; some of the variables were stationary in levels whereas others in first differences. This means when there is an unexpected shock of the variables, the effect of the shock will die out gradually (have no memory). The variables that were stationary in their levels will be restored back to their long run path following short run shocks faster than those stationary in first differences. The econometric method for cases when a subset of the variables is stationary in levels and

others in first differences is the Autoregressive distributed lag estimates (ARDL) method. However, the ARDL estimation technique was not used to achieve the set objectives because the method is difficult, and the results are challenging to interpret particularly when the model called for the use of instrumental variables. Available econometrics software packages do not include ready-made routines to estimate this model with instrumental variables. As a result, we moved on to the Fixed effect, Pooled OLS and SYS-GMM estimation method on the reliance that most of the regression variables were stationary in levels.

4.2 Fixed effect and Pooled OLS estimation results

The static estimation shows the results of OECD discussed in column two and three and SSA in column four and five. Column two and three shows the results for the fixed effect and pooled OLS in OECD countries. Whiles column four and five shows the results for the fixed effect and pooled OLS in SSA countries. The R-square for the fixed effect in OECD countries is 0.874 implying about 87% variation of growth is explained by the regressors. Also, the R-square of 0.901 for the pooled OLS in OECD countries implies that about 90% variation of growth is explained by the regressors. The fixed effect results in SSA had R-square of 0.678 implying about 68% variation in growth is explained by the explanatory variables. The pooled OLS had R-square of 0.864 which means that about 86% variation in growth of real GDP per capita in SSA countries. Government military expenditure per worker is found to have a positive insignificant impact on the growth in SSA countries for both fixed effect and OLS results but had a negative insignificant impact on the growth of OECD countries for the pooled OLS.

Table 4.2.1. Fixed Effect and Pooled OLS results for OECD and SSA (1980-2016).

DEPENDENT VARIABLE: Log Real GDP per capita

VARIABLES	FIXED EFFECT	POOLED	FIXED EFFECT	POOLED
	OECD	OLS OECD	SSA	OLS SSA
Infl	-0.000283 (0.000435)	-0.00169 (0.00142)	-0.002846 (0.0004054)	0.00115 (0.00115)
Lfgrlog	0.323*** (0.0518)	-0.567*** (0.0474)	-0.066** (0.029)	-0.0952** (0.0424)
Capwlog	0.139*** (0.0146)	-0.175*** (0.0300)	0.181*** (0.0294)	0.567*** (0.0490)
Taxpwlog	0.0425* (0.0218)	0.132* (0.0760)	0.058** (0.031)	-0.0574 (0.0518)
Gepwlog	0.125*** (0.0441)	0.414*** (0.116)	-0.057* (0.033)	-0.095** (0.042)
Invpwlog	0.0390* (0.023)	0.321*** (0.0543)	0.0324* (0.0178)	0.035* (0.019)
Mepwlog	0.0431 (0.0447)	-0.112 (0.159)	0.0453 (0.0288)	0.0208 (0.0797)
L.gepwlog	-0.0307 (0.0270)	0.145 (0.0969)	0.0675** (0.0305)	0.203** (0.0860)
L.mepwlog	-0.124*** (0.0437)	0.0318 (0.159)	-0.0383 (0.0275)	-0.0291 (0.0791)
L.taxpwlog	0.0539*** (0.0202)	-0.0743 (0.0747)	0.0297 (0.0182)	0.0241 (0.0516)
Constant	2.532*** (0.610)	4.253*** (0.279)	4.794*** (0.642)	2.374*** (0.336)
Observations	509	509	673	673
R-squared	0.874	0.901	0.678	0.864
Number of country	28		38	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The pooled OLS result is estimated to compare with the fixed effect model to find out how the regressors affect growth of real GDP using the two-estimation technique for the static model and to achieve the consistency of our results. Since μ_i which the unobserved effect is out of the picture, we therefore estimated model (3.27) by pooled OLS.

The results presented in Table (4.2.1) is based on Fixed effect and Pooled OLS. The reason of using these estimation approaches was to ascertain the consistency of our results. The results from Table (4.2.1) shows that government expenditure per worker had a positive significant impact on the growth of real GDP per capita in OECD countries for both fixed effect and Pooled OLS results at 1% significance level. A one percent increase caused growth of real GDP per capita to rise by 0.125% and 0.414% for both fixed effect and OLS respectively. %. The intuition behind this is that an increase in government expenditure per worker in infrastructural development increases the steady state capital and output per worker and hence a rise in the growth of an economy. The effect of government expenditure per worker was found to have a negative impact on growth of real GDP per capita in SSA countries for both fixed effect and Pooled OLS results. Government expenditure per worker was significant at 1% for the fixed effect results but 5% for the pooled OLS. A 1% increase in government expenditure per worker caused growth of real GDP per capita to fall by 0.057% for the fixed effect but caused growth to fall by 0.095% for the pooled OLS in SSA countries. From the Solow model discussed, an increase in government expenditure per worker lowers capital per worker and hence output per worker which reduces growth of an economy. Since government takes away from the private investable resources through taxes, the steady state capital and output per workers falls.

This explains why government expenditure was found to have a negative impact on growth in SSA countries.

The coefficient of labour force growth rate was found to have a positive impact on growth of real GDP per capita for the fixed effect results but a negative effect for the pooled OLS in OECD countries at 1% statistical significance. A 1% increase caused growth of real GDP per capita to rise by 0.333% for the fixed effect but fell by 0.567% for the pooled OLS in OECD countries. From the Solow model, the production of output is a function of labour force, labour force growth rate brings in more hands to work for production and therefore contributes to economic growth. Labour force growth also leads to an increase in the demand for goods and services which helps to increase aggregate output and hence ensuring economic growth. This met our prior expectation of a positive impact on growth of real GDP per capita. The intuition behind the negative impact of labor force growth rate on growth is that, an increase in labor force causes excess supply of labor and the price (wage) falls to do away of the surplus. The fall in wage serves as a disincentive to work since workers effort towards work is positively related to wage. This reduces output per man hour and hence a fall in growth.

It can be seen from Table 4.2.1 that, current account per worker had a positive significant impact on growth of real GDP per capita for the fixed effect but a negative effect for the OLS at 1% significance level in OECD countries. A 1% caused growth of real GDP per capita to increase by 0.139%. This means that with regards to the fixed effect results, OECD countries are net lender to the rest of the world and adds to its foreign asset. More so, it shows how competitive they are to the rest of the world which increases the demand of domestic output in OECD countries. Also, a 1% increase caused growth to fall by 0.175

in OECD countries for the OLS results. Current account was found to have a positive impact in SSA countries for both fixed effect and OLS results. A 1% caused growth to rise by 0.181% and 0.567% for both fixed effect and OLS results respectively. A positive current account balance indicates that the nation is a net lender to the rest of the world and hence increases the nation's net foreign assets by the amount of the surplus. Also, it shows how competitive the economy is, so consumers would prefer buying domestic goods than importing which ensures growth of the economy as the GDP increases.

The coefficient of tax per worker had a positive impact on growth in OECD countries at 10% significance level for both fixed effect and pooled OLS results. The fixed effect results cause growth in real GDP per capita to rise by 0.0425% for a 1% increase in tax per worker while a 1% increase caused growth to rise by 0.132% for the OLS results in OECD countries. The intuition behind is that, a rise in tax helps the government to raise revenue to finance its expenditure of carrying out infrastructural projects which helps to fuel the economy. The effect of tax per had a positive impact on growth with regards to the fixed effect results but a negative effect pertaining to the OLS results in SSA countries. The fixed effect results in SSA shows that, a 1% increase in tax per worker caused growth to rise by 0.058% at 5% level of significant. The OLS results showed tax per worker had an insignificant negative impact on growth of real GDP per capita.

The rate of inflation was found to have a negative insignificant impact on growth of real GDP per capita in both OECD and SSA countries but a positive insignificant effect for the OLS results in SSA countries. The estimated coefficient of investment per worker had a positive significant impact on growth of real GDP per capita in both OECD and SSA countries. A 1% increase caused growth of real GDP per capita to rise by 0.0390% at 10%

significance level for the fixed effect results in OECD countries. The results of the pooled OLS showed a 1% increase caused growth to go up by 0.321% at 1% level of significance in OECD countries. A 1% increase in investment per worker caused growth to rise by 0.034% and 0.035% for the fixed effect and OLS results respectively in SSA countries. The intuition behind the positive impact is that, an increase in investment is likely to lead to an increase in employment, profitability through multiplier effects on aggregate demand and hence a rise in growth of GDP per capita. The lag of government expenditure per worker had a negative insignificant impact on growth regarding to the fixed effect results but a positive insignificant impact referring to the OLS results in OECD countries.

The lag of government expenditure per worker had a positive significant impact on growth of real GDP per capita in SSA countries at 10% significance level. A 1% increase in the previous government expenditure per worker caused a current increase in growth of real GDP per capita to rise by 0.0675% and 0.203% for both fixed effect and OLS results respectively in SSA countries. The lag of government military expenditure per worker had a negative significant impact on growth of real GDP per capita in OECD countries for the fixed effect but insignificant impact for the OLS results. The lag of government military expenditure per worker had a negative insignificant impact on growth for both fixed effect and OLS results in SSA countries. The results of lag of tax per worker had a positive significant effect on growth of real GDP per capita in OECD countries with regards to the fixed effect results. A 1% increase in previous tax per worker caused growth of current real GDP per capita to rise by 0.0539% at 1% significance level. The impact of previous tax per worker had an insignificant impact on growth in SSA countries for both fixed effect and OLS results.

4.3 The Dynamic Panel-data estimation, SYS-GMM results for model (3.36)

The results from the SYS-GMM estimator technique are discussed in two subsections. The first presents the result of government expenditure and the other control variables that affect growth in OECD countries. The second discusses the impact of government expenditure and the other macroeconomic variables on growth in SSA countries.

For all the results, we report the Arellano and Bond test for second order autocorrelation (AR (2)), and the Sargan tests for over-identifying restriction. It must be noted that the presence of the lagged dependent variable means that all the estimated coefficients (except for the convergence parameter) measures the short-run effects of the explanatory variables.

The short run estimation results of the impact of government spending on growth are reported in Table 4.3.1 and Table 4.3.2 reports the long-run impact. From Table 4.3.1, the p-values of 0.252 and 0.382 reported for the Sargan test for OECD and SSA countries respectively, indicate a failure to reject the null hypothesis that the instruments as a group are exogenous. This confirms the validity of the chosen instruments and the results. It also suggests that the results are not weakened by too many instruments. The AR (2) test for autocorrelation has a null hypothesis of no second-order autocorrelation. The p-values of 0.526 and 0.506 reported for the AR (2) tests for the OECD and SSA countries respectively, suggest the absence of autocorrelation in the specification of the estimated model.

Referring to Table 4.3.1 below the coefficient of the lagged real GDP per capita is positive and statistically significant at the 1% significance level for both OECD and SSA countries.

A one percent increase in lagged real GDP per capita is associated with a stable increase in current growth of 0.926% for OECD countries but a 0.856% for SSA countries. This positive coefficient estimate agrees with the findings of some former empirical studies by Darku and Yeboah (2018), Sakyi and Egyir (2017), Darkoh (2014), Connolly and Cheng Li (2016), d'Agostino et al (2016). We start the empirical analysis with the economic interpretation of the coefficients government expenditure per worker (ge), government military expenditure (gme), and taxes per worker (t) followed by the other variables that affect economic growth for OECD countries. The results suggest that the lagged real GDP per capita, government expenditure per worker, government military expenditure per worker, private investment (inv), labor force growth rate (lfgr) and taxes (t) have a positive impact on economic growth and are statistically significant in OECD countries.

The inflation rate (infl) had a negative impact on growth and is statistically significant at 1% error level, a unit increase leads to 0.00091% fall in growth of real GDP per capita hence the welfare costs of inflation on growth for OECD countries are small. Most developed countries use monetary policies to target inflation hence its impact on growth is not that much. The current account balance (ca) had the predicted positive impact on growth that is statistically significant at 1% error level. A 1% increase in current account per worker causes growth of real GDP per capita to rise by 0.036%. The coefficient of the labor force growth rate (lfgr) is statistically significant at 5% error level. A 1% increase in the labor force growth rate is associated with the growth of real GDP per worker to increase by 0.089%, consistent with the Solow growth model.

Table 4.3.1.:SYS-GMM results for OECD and SSA (1980 2016).
DEPENDENT VARIABLE: Log of Real GDP per capita

Independent Variables	OECD	SSA
lny _{it-1}	0.926*** (0.021)	0.856*** (0.038)
Infl	-0.00091*** (0.000075)	-0.000318 (0.000287)
Capwlog	0.036*** (0.011)	0.046*** (0.013)
Lfgrlog	0.089** (0.042)	0.040*** (0.013)
Taxpwlog	0.068*** (0.011)	0.020* (0.011)
Gepwlog	-0.100** (0.044)	0.015** (0.007)
Gmepwlog	0.009 (0.016)	0.005 (0.018)
Invpwlog	0.026*** (0.009)	0.015** (0.007)
gepwlog _{t-1}	-0.053*** (0.015)	-0.036*** (0.012)
gmepwlog _{t-1}	-0.013 (0.017)	- 0.011 (0.016)
taxpwlog _{t-1}	-0.060*** (0.011)	-0.006 (0.005)
Sargan test	0.252	0.382
AR (2)	0.526	0.506

Note: ***, ** and * represents 1%, 5% and 10% significant level, respectively. Absolute values of the standard errors are reported in parentheses.

It can be seen from the above results that, the impact of government expenditure per worker in the short- run (long-run) is negative and significant at 5% error level. Since taxes per worker (t) are being held constant, these increases in spending are debt-financed. Nevertheless, a 1% increase in government expenditure per worker (ge) is associated with an increase economic growth of 0.100%. The result is contrary with similar evidence reported by Ram (1986) but agrees to the empirical works by Laudau (1983), Komain et al. (2007), Engen and Skinner (1992), Folster and Henrekson (1999, 2001). From Table 4.3.1, a 1% increase in government military expenditure per worker (gme) is associated with a 0.009% increase in economic growth. This is a much smaller elasticity than the value for ge , probably since military goods do not directly enter the economy-wide production function but offer benefits in terms of greater security and better institutions. This result agrees with the empirical study done by Al-Yousif (2002). The impact of previous government expenditure per worker had a negative significant impact on current growth of real GDP per capita. A 1% increase in previous government expenditure per worker caused current growth to fall by 0,053%. Previous government military expenditure per had a negative insignificant impact on growth but previous tax per worker had a negative significant impact on growth of real GDP per capita. A 1% increase of previous tax per worker caused growth to fall by 0.060%.

The results for SSA are reported in column 3 of Table 4.3.1 and are in stark contrast with the results for OECD countries. The lagged real GDP per capita coefficient is positive and significant at 1% error level with a one percent increase leading to 0.8456% rise in current growth of real GDP per capita. The coefficient of government expenditure per worker (ge) is positive and statistically significant at the 5% error level. A 1% increase is

associated with a 0.015% rise in the growth of real GDP per capita (holding taxes per worker constant). This result is not consistent with the prediction given by the Solow growth model in Chapter 3. This is not in line with empirical studies by (Barro, 1981; and Linnemann and Schabert, 2004; among others) that suggests an increase in government consumption slows down growth and development as it crowds out private investment spending. Studies carried out by Landau (1983), Barro (1991), and Barro and Sala-i-Martin (1995, 2004) conclude that countries with high shares of government consumption in their GDP grow at a slower pace than others and this result is in contrast with the finding by the named researchers. Empirical studies by Engen and Skinner (1992), Folster and Henrekson (1999, 2001) does not support the positive impact of government expenditure on the growth of real GDP per capita in SSA countries although their results are related to 23 OECD countries.

The estimated coefficient of the inflation rate suggests that a unit increase causes real GDP per capita growth to fall by 0.000318% but insignificant. This could be interpreted to mean that; inflation in SSA countries has insignificant welfare costs that are detrimental to economic growth. Most empirical studies suggest that a moderate level of inflation is favorable for income growth, but higher levels are detrimental to growth. Even though the; inflation rate fell during the post-trade liberalization period, inflation was still high for most of the regions well performing economies such as Ghana, Angola, Nigeria and Mozambique due to the depreciation of the domestic currency against U.S dollar and other major currencies, rising transportation costs, and increases in food prices. This could explain why inflation had a negative impact on economic growth.

The estimated coefficients of current account per worker had a positive significant

impact on the growth of real GDP per capita with a 1% increase associated with economic growth rising by a statistically significant of 0.046%. A 1% increase in investment is associated with a 0.015% increase in economic growth in SSA countries, while larger at 0.026% in OECD countries. The Solow model predicts that investment spending is an engine of economic growth if the marginal product of capital is high. It could be that this is less the case in SSA countries due to low productivity which in turn increases economic growth.

The estimated coefficient of tax per worker (t) had a positive impact on the growth of real GDP per capita and is statistically significant at 10% error level. This is not in line with the predictions of the Solow growth model. A 1% increase in tax is associated with a decrease in economic growth per capita of 0.020%. The coefficient estimates of government military expenditure (gme) is positively related to growth rate of real GDP per capita but is statistically insignificant. The lag of government expenditure per worker had a significant impact on growth of real GDP per capita. A 1% increase caused growth of current real GDP per capita to rise by 0.036%. The lag of government military expenditure per worker and tax per worker had a negative insignificant impact on current growth of real GDP per capita.

The study continued by adding the data for both OECD and SSA countries together to find how government expenditure affects growth. The results from the Table 4.4.1 below showed that the lag dependent variable had a positive significant impact on growth when OECD and SSA countries are pooled together. A 1% increase leads to 0.851% rise in growth of real GDP per capita. This means that previous growth leads to a positive significant impact on current growth for both countries. With regards to inflation, it had a

negative insignificant impact on growth when all the countries are added together. This means that, inflation retards growth in the countries used for the study. Current account per worker had a positive significant impact on growth from the three estimation results. This means that, both SSA and OECD countries are net lenders to the rest of the world and shows how competitive they are to the remaining world which increases demand of domestic output in OECD and SSA countries. A 1% increase in current account per worker leads to a rise in real GDP per capita by 0.427%, 0.172% and 0.033% for the pooled OLS, fixed effect and SYS-GMM estimation results respectively.

From Table 4.4.1, labour force growth rate had a positive impact on growth of real GDP per capita for all countries used for the study but insignificant for only the SYS-GMM results. A 1% increase leads to a rise of growth in all countries by 0.0765% and 0.0702% for both pooled OLS and fixed effect estimation results respectively. From the Solow model, the production of output is a function of labor force, labor force growth rate brings in more hands to work for production and therefore contributes to economic growth.

Government expenditure per worker had a negative impact on growth of real GDP per capita for all countries but was only significant at 1% level of significant for the pooled OLS results. The pooled OLS showed that, a 1% increase in government expenditure per worker caused growth to fall by 0.255%. This means the increase in government expenditure is not growth enhancing for all countries because, increase in government expenditure takes away resources from the private sector in the form of tax which crowds out private investment to ensure growth of real GDP per capita.

Table 4.4.1. Fixed Effect, Pooled OLS and SYS-GMM results for OECD and SSA added together (1980-2016). DEPENDENT VARIABLE: Log Real GDP per capita

VARIABLES	POOLED OLS	FIXED EFFECT	SYS-GMM
	OECD/SSA	OECD/SSA	OECD/SSA
lny _{it-1}			0.851*** (0.029)
Infl	-0.000733 (0.000970)	-0.000184 (0.00018)	-0.000350 (0.000239)
Lfgrlog	0.0765*** (0.0108)	0.0702* (0.0371)	0.031 (0.021)
Capwlog	0.427*** (0.0289)	0.172*** (0.0155)	0.033*** (0.009)
Taxpwlog	-0.104** (0.0469)	0.0133 (0.0140)	0.026** (0.011)
Gepwlog	-0.255*** (0.0739)	-0.0387 (0.0241)	-0.017 (0.012)
Invpwlog	0.332*** (0.0283)	0.0413*** (0.0124)	0.022*** (0.0007)
Mepwlog	-0.0595 (0.0737)	0.0323 (0.0219)	0.008 (0.017)
L.taxpwlog	0.0602 (0.0467)	0.0327** (0.0135)	-0.014** (0.006)
L.gepwlog	0.186** (0.0742)	0.0537** (0.0217)	-0.041*** (0.010)
L.mepwlog	0.0531 (0.0731)	-0.0454** (0.0210)	-0.012 (0.015)
Constant	2.684*** (0.261)	5.003*** (0.460)	
Observations	1182	1182	
R-squared	0.968	0.722	
Number of country		66	
Sargan test			0.421
AR(2)			0.322

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Tax per worker had a negative impact on growth for the pooled OLS results at 5% significance level but had a positive impact on growth of real GDP per capita for the fixed effect and SYS-GMM results. A 1% increase leads to a fall in real GDP per capita a fall in growth by 0.104 for the pooled OLS results. The intuition behind the negative impact on tax on growth for all countries is that, higher tax serves as a disincentive to work and reduces workers effort towards work.

Table 4.4.1 shows that, investment per worker had a positive significant impact on growth with regards to all the three estimation results for all countries at 1% error level. A 1% increase in investment per worker leads to a rise in growth by 0.332%, 0.0413% and 0.022% for the pooled OLS, fixed effect and SYS-GMM respectively. Government military expenditure per worker had insignificant impact on growth in all countries for the three estimation results. The lag of tax per worker and government expenditure per worker had a negative significant impact on growth for all countries with regards to the SYS-GMM estimation results from Table 4.4.1. A 1% increase in tax per worker and government expenditure per worker to fall by 0.014% and 0.041% respectively. This means previous government expenditure takes away resources in the form of tax which serves as a disincentive to work and adversely affect current growth of real GDP per capita. But previous tax per worker and government expenditure per worker had a positive impact on growth from the pooled OLS and fixed effect estimation results. The fixed effect and SYS-GMM results from Table 4.4.1 shows that government military expenditure had a negative impact on current growth of real GDP per capita but a positive impact from the pooled OLS results.

Chapter 5 Summary of Findings, Conclusion and Policy Recommendations

This chapter incorporates two discussion sections. These are: summary of findings, conclusion and policy recommendations. The objective of the study was meant to find out the impact of government expenditure on economic growth in SSA and OECD countries. Among the explanatory variables that were found to affect economic growth are; government expenditure per worker, tax per worker, government military expenditure, inflation, labor force growth rate, current account per worker and investment per worker. Panel data spanning 37 years were analyzed using static and dynamic model. The static model was estimated using fixed effect and pooled OLS while the dynamic model was estimated using SYS-GMM developed by Blundell and Bond.

5.1 Summary of findings

The Levin, Lin and Chu panel unit root confirmed a stationarity of the variables. It can be found that, some of the variables are stationary at the levels whereas others at the first difference. This means when there is an unexpected change of the variables or in the value of the error terms at a period (shocks), the effect of the shock will die out gradually. But the variables that are stationary at the levels would be restored back to its long run path following short run shocks faster than those at the first difference. In this study, we examined the impact of government spending on economic growth in OECD and SSA countries. From our theoretical and empirical modelling, it was found out that, economic growth in OECD and SSA countries were affected by; government expenditure per worker, tax per worker, government military expenditure, current account per worker, labor force growth rate, investment per worker and inflation. To achieve this, we estimated endogenous

growth model using fixed effect model, pooled OLS and the system GMM estimator that efficiently addresses the endogenous problems associated with the regressions.

From the static model results in Table 4.2.1, government military expenditure per worker was found to have a positive insignificant impact on the growth in SSA countries for both fixed effect and OLS results but had a negative insignificant impact on the growth of OECD countries for the pooled OLS. Also, government expenditure per worker had a positive significant impact on the growth of real GDP per capita in OECD countries for both fixed effect and Pooled OLS results at 1% significance level. A one percent increase caused growth of real GDP per capita to rise by 0.125% and 0.414% for both fixed effect and OLS respectively. The effect of government expenditure per worker was found to have a negative impact on growth of real GDP per capita in SSA countries for both fixed effect and Pooled OLS results. Government expenditure per worker was significant at 1% for the fixed effect results but 5% for the pooled OLS. A 1% increase in government expenditure per worker caused growth of real GDP per capita to fall by 0.057% for the fixed effect but caused growth to fall by 0.095% for the pooled in SSA countries. The coefficient of labour force growth rate was found to have a positive impact on growth of real GDP per capita for the fixed effect results but a negative effect for the pooled OLS in OECD countries at 1% statistical significance. A 1% increase caused growth of real GDP per capita to rise by 0.333% for the fixed effect but fell by 0.567% for the pooled OLS in OECD countries. It can be seen from Table 4.2.1 that, current account per worker had a positive significant impact on growth of real GDP per capita for the fixed effect but a negative effect for the OLS at 1% significance level in OECD countries. A 1% increase caused growth of real GDP per capita to rise by 0.139% for the fixed effect results. Also, a 1% increase caused

growth to fall by 0.175% in OECD countries for the OLS results. Current account was found to have a positive impact in SSA countries for both fixed effect and OLS results. A 1% increase caused growth to rise by 0.181% and 0.567% for both fixed effect and OLS results respectively. The coefficient of tax per worker had a positive impact on growth in OECD countries at 10% significance level for both fixed effect and pooled OLS results. The fixed effect results caused growth in real GDP per capita to rise by 0.0425% for a 1% increase in tax per worker while a 1% increase caused growth to rise by 0.132% for the OLS results in OECD countries. The effect of tax per had a positive impact on growth with regards to the fixed effect results but a negative effect pertaining to the OLS results in SSA countries. The fixed effect results in SSA showed that, a 1% increase in tax per worker caused growth to rise by 0.058% at 5% level of significance. The OLS results showed tax per worker had an insignificant negative impact on growth of real GDP per capita.

The rate of inflation was found to have a negative insignificant impact on growth of real GDP per capita in both OECD and SSA countries but a positive insignificant effect for the OLS results in SSA countries. The estimated coefficient of investment per worker had a positive significant impact on growth of real GDP per capita in both OECD and SSA countries. A 1% increase caused growth of real GDP per capita to rise by 0.0390% at 10% significance level for the fixed effect results in OECD countries. The results of the pooled OLS showed a 1% increase caused growth to go up by 0.321% at 1% level of significance in OECD countries. A 1% increase in investment per worker caused growth to rise by 0.034% and 0.035% for the fixed effect and OLS results respectively in SSA countries. The lag of government expenditure per worker had a negative insignificant impact on growth

regarding to the fixed effect results but a positive insignificant impact referring to the OLS results in OECD countries.

The lag of government expenditure per worker had a positive significant impact on growth of real GDP per capita in SSA countries at 10% significance level. A 1% increase in the previous government expenditure per worker caused a current increase in growth of real GDP per capita to rise by 0.0675% and 0.203% for both fixed effect and OLS results respectively in SSA countries. The lag of government military expenditure per worker had a negative significant impact on growth of real GDP per capita in OECD countries for the fixed effect but insignificant impact for the OLS results. The lag of government military expenditure per worker had a negative insignificant impact on growth for both fixed effect and OLS results in SSA countries. The results of lag of tax per worker had a positive significant effect on growth of real GDP per capita in OECD countries with regards to the fixed effect results. A 1% increase in previous tax per worker caused growth of current real GDP per capita to rise by 0.0539% at 1% significance level. The impact of previous tax per worker had an insignificant impact on growth in SSA countries for both fixed effect and OLS results.

From the SYS-GMM results in Table 4.3.1, the p-values of 0.252 and 0.382 reported for the Sargan test for OECD and SSA countries respectively, indicate a failure to reject the null hypothesis that the instruments as a group are exogenous. This confirms the validity of the chosen instruments and the results. It also suggests that the results are not weakened by too many instruments. The AR (2) test for autocorrelation had a null hypothesis of no second-order autocorrelation. The p-values of 0.526 and 0.506 reported for the AR (2) tests for the OECD and SSA countries respectively, suggest the absence of

autocorrelation in the specification of the estimated model.

Referring to Table 4.3.1 below the coefficient of the lagged real GDP per capita is positive and statistically significant at the 1% significance level for both OECD and SSA countries. A one percent increase in lagged real GDP per capita is associated with a stable increase in current growth of 0.926% for OECD countries but a 0.856% for SSA countries.

The inflation rate (infl) had a negative impact on growth and is statistically significant at 1% error level, a unit increase leads to 0.00091% fall in growth of real GDP per capita. The current account balance (ca) had the predicted positive impact on growth that is statistically significant at 1% error level. A 1% increase in current account per worker causes growth of real GDP per capita to rise by 0.036%. The coefficient of the labor force growth rate (lfgr) is statistically significant at 5% error level. A 1% increase in the labor force growth rate is associated with the growth of real GDP per worker to increase by 0.089%, consistent with the Solow growth model.

It can be seen from the results of Table 4.3.1 that, the impact of government expenditure per worker is negative and significant at 5% error level. Since taxes per worker (t) are being held constant, these increases in spending are debt-financed. Nevertheless, a 1% increase in government expenditure per worker (ge) is associated with an increase economic growth of 0.100%. From Table 4.3.1, a 1% increase in government military expenditure per worker (gme) is associated with a 0.009% increase in economic growth. The impact of previous government expenditure per worker had a negative significant impact on current growth of real GDP per capita. A 1% increase in previous government expenditure per worker caused current growth to fall by 0,053%. Previous government military expenditure per had a negative insignificant impact on growth but previous tax per

worker had a negative significant impact on growth of real GDP per capita. A 1% increase of previous tax per worker caused growth to fall by 0.060%.

The results for SSA reported in column 3 of Table 4.3.1 are in stark contrast with the results for OECD countries. The lagged real GDP per capita coefficient is positive and significant at 1% error level with a one percent increase leading to 0.8456% rise in current growth of real GDP per capita. The coefficient of government expenditure per worker (ge) was positive and statistically significant at the 5% error level. A 1% increase is associated with a 0.015% rise in the growth of real GDP per capita (holding taxes per worker constant).

The estimated coefficient of the inflation rate suggested that a unit increase caused real GDP per capita growth to fall by 0.000318% but insignificant. The estimated coefficients of current account per worker had a positive significant impact on the growth of real GDP per capita with a 1% increase associated with economic growth rising by a statistically significant of 0.046%. A 1% increase in investment is associated with a 0.015% increase in economic growth in SSA countries, while larger at 0.026% in OECD countries.

The estimated coefficient of tax per worker (t) had a positive impact on the growth of real GDP per capita and is statistically significant at 10% error level. This is not in line with the predictions of the Solow growth model. A 1% increase in tax is associated with a decrease in economic growth per capita of 0.020%. The coefficient estimates of government military expenditure (gme) is positively related to growth rate of real GDP per capita but is statistically insignificant. The lag of government expenditure per worker had a significant impact on growth of real GDP per capita. A 1% increase caused growth of current real GDP per capita to rise by 0.036%. The lag of government military expenditure per worker and tax per worker had a negative insignificant impact on current growth.

The results from the combined data for both OECD and SSA countries showed that, the lag dependent variable had a positive significant impact on growth when OECD and SSA countries are pooled together. A 1% increase leads to 0.851% rise in growth of real GDP per capita. With regards to inflation, it had a negative insignificant impact on growth when all the countries are added together. Current account per worker had a positive significant impact on growth from the three estimation results. A 1% increase in current account per worker leads to a rise in real GDP per capita by 0.427%, 0.172% and 0.033% for the pooled OLS, fixed effect and SYS-GMM estimation results respectively.

Government expenditure per worker from the combination of all countries had a negative impact on growth of real GDP per capita for all countries but was only significant at 1% level of significant for the pooled OLS results. The pooled OLS showed that, a 1% increase in government expenditure per worker caused growth to fall by 0.255%. Tax per worker had a negative impact on growth for the pooled OLS results at 5% significance level but had a positive impact on growth of real GDP per capita for the fixed effect and SYS-GMM results. A 1% increase leads to a fall in real GDP per capita a fall in growth by 0.104 for the pooled OLS results.

Table 4.4.1 shows that, investment per worker had a positive significant impact on growth with regards to all the three estimation results for all countries at 1% error level. A 1% increase in investment per worker leads to a rise in growth by 0.332%, 0.0413% and 0.022% for the pooled OLS, fixed effect and SYS-GMM respectively. Government military expenditure per worker had insignificant impact on growth in all countries for the three estimation results. The lag of tax per worker and government expenditure per worker had a negative significant impact on growth for all countries with regards to the SYS-GMM

estimation results from Table 4.4.1. A 1% increase in tax per worker and government expenditure per worker to fall by 0.014% and 0.041% respectively.

5.2 Conclusion

The study was meant to find the impact of aggregate government expenditure on growth in OECD and SSA countries. The unit root test confirmed the variables employed in the study were stationary. The study then presented results from our three-estimation procedure and government expenditure was found to have a positive significant impact on growth in OECD but a negative significant impact on growth of real GDP per capita in SSA countries for both fixed effect and pooled OLS results. The results from the SYS-GMM showed that government expenditure had a negative significant impact on growth in OECD but a positive significant impact on the growth in SSA countries. The impact of government expenditure per worker had a higher effect on growth in OECD than SSA countries for both the static and dynamic model results even though it differed in sign for OECD and SSA countries.

The SYS-GMM estimation results suggest that, there is a creation of expectation in the growth model. This is because, the lagged dependent variable had a positive significant impact on growth in both OECD and SSA countries. This means that a previous year growth in OECD and SSA countries will be able to lead to economic growth of the current year and hence if the government should carry out policies that lead to growth, growth will continue for the succeeding years.

The results for combining all the countries used for the study show that, government expenditure have a negative impact on growth of real GDP per capita for all countries but was significant for the pooled OLS results.

5.3 Policy recommendation

It is therefore recommended that, where government expenditure is growth enhancing, government should implement expansionary fiscal policies through infrastructure development like roads, telecommunication networks etc to help enhance growth.

Secondly, in a situation where government military expenditure per worker has a positive impact on growth of real GDP per capita, it is recommended for government to increase its military spending so that, the laws governing the country would be much respected to ensure a peaceful and democratic country. This would encourage domestic investment and attract foreign investment to ensure growth in the country.

It is recommended for the government to intensify export promotion as part of trade liberalization policies to do away with current account deficit and its negative impact on growth. More so, government should come out with policies to help add value to what is exported, this would help generate foreign exchange to solve the current account deficit in the country.

It is also recommended to implement policies that encourage macroeconomic stability. This can be done by coming out with monetary policies like contractionary policies aimed at reducing inflation in the country.

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