

THE IMPACT OF GOVERNMENT CAPITAL EXPENDITURE ON PRIVATE INVESTMENT IN SUB-SAHARAN AFRICA (1980-2015)

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Abstract

One of the major gaps in the private sector in the past years in sub-Saharan Africa has been the inefficiency of public investment. Based on this backdrop, this study broadly examined the impact of government capital expenditure on private investment in sub-Saharan Africa, using time series data spanning from 1980 to 2015. The study adopted flexible theory of investment which was the theoretical framework for the study and model specification for the study took its root from the theory. The study employed panel data analysis mainly static panel models of fixed effect and Random effect regression to examine the relationship between public capital expenditure and private investment among the selected countries of sub-Saharan Africa. The results of this study revealed that government capital expenditure has insignificant positive effect on private investment among the selected countries of Sub-Saharan Africa, though variables like debt stock and tax revenue have significant positive impact on private investment among the selected countries of SSA. The findings from this study also showed that official development Assistance, inflation and interest rate has insignificant negative effect on private investment. Based on the findings, it is recommended that government should maintain macroeconomic stability by improving expenditure control as well making sure that Central

Banks in these countries focus primarily on inflation control. Government of SSA countries should channel their capital expenditure on increasing productivity and competitiveness, searching for the areas where social returns are highest and spill-over effects are significant. Moreover, the countries of SSA should be encouraged and monitored to channel foreign financial resources into productive activities that can enhance private investment most especially in some countries like Angola, Nigeria and some others where a set of corrupt specific elite groups of people have seen foreign aids as a means of satisfying the selfish ends.

Keywords: Government Capital Expenditure, Private Investment, Flexible Theory of Investment, Sub-Saharan Africa, Panel Data Analysis

INTRODUCTION

In all organised societies, there is a role assigned for the government. The government performs functions that, if left to the private sector, would not be performed at all or would be performed in an unsatisfactory manner. In economic literature, budget is the most important expression of that role. Through the budget, the government implements or promotes its objectives. A successful budgetary policy is one that is both consistent with that role and also permits a clear evaluation of how well the desired objectives are being pursued or implemented. (Tanzi,1985)

Fiscal policy is undoubtedly one of the most important instruments used by government to achieve macro-economic objectives in the economies and this is the use of government spending and taxation to influence the economy. Governments typically use fiscal policy to promote strong and virile economic growth and reduce poverty. (Okoh, 2008) highlights public spending as one of the main policy tools employ to promote development and to tackle poverty not only in the developed nations but also in the developing economies. He also described government expenditure as the expenses that government incurs in carrying out its programmes and that it plays an important role in the functioning of the economy, whether developed, developing or less developed. Public spending therefore has often been used to fill gap between private savings and investment. The main aim of the tool should be a building of basic infrastructures necessary for creation of enabling environment and productive industrial sector which determine the international competitiveness of economies. Boosting investment ought to be place of pride if the continent of Africa is to achieve sustained growth and to be a pole of global growth in the twenty-first century. It is evident in recent time that the lion share of the SSA

region economies continues to experience solid growth, driven by infrastructure investment effort, buoyant service sector and strong agricultural production (REO, 2014)

Nevertheless, growth trends in most of sub-Saharan Africa remain fluctuating across all countries in the region. Since 1970s, Sub-Saharan Africa's economic growth performance has been very disappointing. In the 1970s, annual growth rate of real GDP per capita averaged 0.7 per cent (World Bank, 2012). This moderate growth rate was supported by a boom in commodity prices and foreign aid. However, during the next two decades, Sub-Saharan Africa suffered negative per capita growth. Real GDP per capita was falling, on average per year, by 0.9 per cent in the 1980s and 0.4 per cent in the 1990s respectively. As a result, in 1999, Sub-Saharan Africa real GDP per capita was at the level of about 5 per cent lower than in 1970. The deterioration of economic performance since 1980s was connected with weak macroeconomic policies, structural weaknesses of economies and external factors, particularly low and declining prices of primary commodities, unfavourable changes in terms of trade, soaring global interest rates, rising protectionism in the industrialized world (Iyoha, 1999). It is worth noting that growth performance among the Sub-Saharan African countries starts to experience boost since mid-1990s. From 2000 to 2010, real GDP per capita rose by more than 50 per cent in such countries as Cape Verde, Rwanda, Chad, Mozambique, Sierra Leone, Ethiopia, doubled in Angola and more than tripled in Equatorial Guinea. On the contrary, in the same period, there were some countries like Zimbabwe, Eritrea, and Liberia where their real per capita output contracted by 20-40 per cent (World bank, 2012).

Achieving higher economic growth in stimulating investment is one of the major challenges for sub-Saharan Africa. Its long term growth has been slow relative to other developing countries (Latin America, Asian countries, etc.), experiencing less than half of the average growth and about half of average investment efficiency levels obtained in other developing countries most especially Asian countries. Sub-Saharan Africa is the poorest region in the world. In 2010, its per capita based on purchasing power parity equaled \$2281, compared to \$3229 in South Asia, \$6672 in developing East Asia and Pacific, \$11192 in developing Latin America and Caribbean (World Bank 2010). In explaining Africa's slow long-term growth, one can make a distinction between endowment variables and policy variables. In view of the above, infrastructure has not received adequate attention in public policy and spending.

From the above discussion, it is obvious that the impact of government expenditure on growth rate of these sub-Saharan African countries should be better based on development expenditure. Therefore, government capital expenditure is deemed a vital tool to improve growth rate and to attract investment both in developed and developing countries. So far, as the effect of government spending on economic growth and increased investment is concerned, the

common wisdom suggests that expenditure on development of infrastructure like road, railway, power generation, irrigation telecommunication etc. which are lacking in some developing countries is likely to accelerate growth and to act as a springboard for private investment. In addition, public expenditure on health and education can provide the foundation for investment and perhaps enhance growth. By contrast, one of the challenges facing some of the sub-Saharan African countries is the chronic characteristics of underdevelopment and poor infrastructure development which is attributed to the fact that larger percentage of national output is spent on consumption expenditure (CBN 2005). More so, according to Regional Economic Outlook (REO) 2014, there is still large deficit of infrastructure found in the power sector, transportation and human capital development in sub-Saharan Africa. It is against this background that this study explores the impact of government capital expenditure on private investment in sub-Saharan Africa.

The paper is organized into five sections. Following these introductory remarks is a section on the review of the empirical literature. This is followed by the research methods, the results and discussion in section three and four respectively. The study ends in section five with concluding remarks.

EMPIRICAL LITERATURE

For easy analysis and thorough understanding of the past research works, tables 1 and 2 below depict the summary of some of the empirical literature.

Table 1. Summary of Empirical Literature on Cross-countries

S/N	Author	Study Area/Scope	Methods of Estimation	Findings
1	Emad (2009)	Crowding out and Crowding in effects of government bond market on private sector investment (Japan case study)	Error Correction Model	The finding of the study is that the finding by bond does not crowd out private investment
2	Daniel (2009)	Effect of government spending on income and employment as a central unresolved question in macroeconomics	Vector Error Correction Model	The study finds that state government spending has
3	Even burg and wohar (1995)	Linkage between private investment and government provision of public capital and government investment	Granger causality test	The study found that there in symbolic relationship between government investment and private investment ad that there is existence of feedback effect between public and private investment

4	Voss(2002)	Short-term and long-term interactions between government investment and private investment with reference to Canada and the USA	Vector Auto regressive Analysis(VAR)	The study demonstrate that there is no evidence of good –im and that innovation to government investment tended to crowd out private investment.
5	Afonso and Aubyn (2010)	Relationship between public investment and private investment	VAR Model	The empirical findings indicate that both government and private investments have a positive effect output
6	Ahmed and miller(1999)			
7	Furceri and souse(2011)	Effect of government spending in private investment using 145 developed and developing countries for the 1960-2007	Panel Data	The findings revealed that government spending creates an important crowding out effect by negatively affecting both private investment and private consumption
8	Mahmoud zadeh, sadeghi(2013)	Effectiveness of government expenditure crowding in or crowding out	Panel Data	
9	Wang (2005)	Relationship between government expenditure and private investment in Canada during the period 1961 to 2000	Co-integration and Error Correction Framework	The empirical results stated that government capital expenditure on infrastructure has negative effect whereas government expenditure on education and health has positive effects on private investment
10	Cavallo and Daude (2008)	Impact of public investment on private investment from 116 developing countries for period between 1980 and 2006	Dynamic panel data techniques	The study revealed that the effect is dampened in countries with better institution and that public infrastructure maybe
11	Atukerea (2004)	Relationship between public and private investment for sample of twenty five developing countries in Africa, Asia and Latin America over (1970-2000)	Probit model and grange causality	The study found out public investment crowd in private investment. The result by using probit model indicated that public investment may crowd out private investment.

12	Erden and Holcombe (2005)	Effect of public investment on private investment in the developing countries	Panel data	In developed countries, public investment crowd out private investment which is in contrast to developing countries
13	Ghassan and Al-Dehailan (2008)	Relationship between public investment and private investment in Saudi Arabia	Threshold co-integration test	The finding is that public investment boosts private investment in Saudi Arabia
14	Asante(2000)	Determinants of private investment in Ghana (1970-1992)	Panel data	The study found that the growth of real credit to the private sector, real exchange had a positive and statistical significant effect on private investment, with public investment confirming a possible complementary effect.
15	Frimongmarbuah(2010)	Determinants of private sector investment in Ghana (1970-2002)	ARDL Modelling approach	Public (government) investment ratio and credit to the private sector had a positive but insignificant impact on private with public investment confirming a possible crowding - in effect.
16	Samuel (2012)	Relationship between public and private investment financing in Kenya (1964-2006)	Co-integration and Error Correction Frame work	The study shows that investment in agriculture had a significant positive effect. Investment in infrastructure had insignificant positive effect while domestic debt had a significant negative impact.
17	Hussain, Mohammed, Akram and Lah (2009)	Association between government expenditure and private investment in Pakistan (1975-2008)	VECM method	The result showed that current expenditure such as defense and debt servicing crowded out private investment while development expenditure on education, infrastructure and health crowded in private investment.

18	Kollamparabil and Nicolaou (2011)	Relationship between public expenditure and private investment in South Africa		The study found that although public investment is not crowd in or crowd out Private investment, it exerts and indirectly impact private investment through the accelerator effect.
19	Njimanted and Mukete (2013)	Public expenditure and private investment in Cameron (1980-2012)	Vector Autoregressive technique	The study found that public expenditure insignificant crowd in private investment.

Table 2. Summary of Empirical Literature in Nigeria

S/N	Author	Study Area/ Scope	Method of Estimation	Findings
1	Mohammed, Aminu and Mubarak(2010)	Crowding in and Crowding out of government expenditure and private investment in Nigeria	Multiple regression analysis	The study showed positive relationship between public infrastructure and private investment
2	Nwoss, Adebisi and Adedeji (2013)	Relationship between components of public spending and private investment in Nigeria	Error correction model	The study revealed that components of public spending have different impact on private investment. The recurrent expenditure had positive(crowd in) effect on private investment while capital expenditure had negative(crowd off) effects on private investment
3	Ahmed (2002)	Private capital formation and public investment in Sudan (1970-1998)	Co-integrated vector auto repressive model	The study revealed that Public Sector investment crowd out private sector investment.

4	Saheed (2012)	Impact of government capital expenditure on exchange date	Co-integration and error correction model	The findings showed that government spending on social and community services has a significant impact on exchange date while capital expenditure on administration, economic services and transfer service is not statistically significant in respect of their impact on exchange date.
5	Ndoh (2011)	Relationship between public expenditure, private investment and agricultural output (1970-2008)	ARDL Modelling approach	The finding showed that foreign investment has insignificant impact in short term
6	Ahmad and Qayyum 2008	Effect of government spending and macro- economic uncertainty on private investment (1972-2005)	Multivariate co-integration analysis	The study revealed that government recurrent expenditure appears on substitutes to private investment
7	Busari and Amashionyeodiye (2007)	Relationship between the private investment and political instability in Nigeria (1990-2000)	Ordinary least square method	The study indicated that political instability does not have any significant direct impact on private investment
8	Ekpo (1995)	Relationship between public investment and private investment	Co-integration analysis and error correction model	The study revealed that physical infrastructure expenditure crowd out private investment while the government expenditure on social services crowd in private investment
9	Vincent and Clem (2013)	Crowding out effect of government expenditure on private sector investment. (1970-2006)	Co-integration and structural analysis	The study showed that there is negative relationship between fiscal deficit and private investment
10	Onakoye and Somoye (2013)	Impact if public capital expenditure on economic growth	Three stage least square (3SLS) technique	The study showed that pubic capital expenditure contribute positively to economic growth.

Source: Author's compilation (2016)

RESEARCH METHODS

Theoretical Framework

Flexible Theory of Investment

This section, in analysing the financial determinants of private investment, specifies appropriate models of private investment for SSA. Among the various approaches considered in modeling public capital formation as one of the major determinants of private investment, the flexible accelerator model appears to be the most popular and has often been applied in most empirical researches in developing countries (Blejer and Khan, 1984; Ouattara, 2004). This model is most appropriate to developing countries as a result of institutional and structural factors present in most developing countries, such as the absence of well- functioning financial markets, the extensive role of the government in the provision of investment, foreign exchange constraints, and other market imperfections (Blejer and Khan, 1984). Thus this section derives a theoretically consistent model of private investment within the flexible accelerator framework that will allow for such resource constraints and, at the same time, incorporate other variables accounting for private investment behaviour in developing countries.

In a representation of the accelerator model, the desired stock of capital at any time period is assumed to be proportional to expected output. Mathematically, this can be expressed as:

$$k_{t^*} = \alpha Y_t^e \text{-----(1)}$$

Where k_{t^*} is the desired capital stock the private sector wishes to have in place in future periods, Y_t^e is the expected level of output in period t , and α is a constant denoting the capital output ratio. It is necessary to accentuate the desired change in the capital stock and to highlight the component of the replacement of worn out capital known as depreciation, by decomposing the desired capital stock into two forms, presented as:

$$I_{t^*} = (K_{t^*} - K_{t-1}) + \partial K_{t-1} \text{-----(2)}$$

Equation (2) can be simplified as:

$$I_{t^*} = (K_{t^*} - (1 - \partial)K_{t-1}) \text{-----(3)}$$

On introducing a lag operator (L), equation (3) can conveniently be written as:

$$I_{t^*} = (1 - (1 - \partial)L)K_{t^*} \text{-----(4)}$$

From equation (1), if it is substituted into equation (4), the desired level of investment yields;

$$I_{t^*} = (1 - (1 - \partial)L)\alpha Y_t^e \text{-----(5)}$$

Where I_{t^*} = the desired level of investment in period t

∂ = depreciation rate of the capital stock,

L = the lag operator.

In order for the model to fit the flexible accelerator principle, the desired capital stock must be affected by changing economic conditions. Lags in the adjustment of actual investment that arise because of the time it takes to plan, build, and install new capital can be introduced through a partial adjustment mechanism for the capital stock based on Nerlove's Partial Adjustment Model (PAM), whereby the actual stock of capital is assumed to adjust to the difference between the desired stock in period t and the actual stock in the previous period. The adjustment process of such investment models can be represented as:

$$(I_t - I_{t-1}) = \gamma(I_t^* - I_{t-1}) \text{-----(6)}$$

Where $(I_t - I_{t-1})$ = the level of actual investment in period t and $t-1$ respectively

$I_t^* - I_{t-1}$ = the desired change in the capital stock

γ = the partial adjustment coefficient (speed of adjustment, $0 \leq \gamma \leq 1$)

Since the flexible accelerator model allows economic conditions to influence the adjustment coefficient, empirical works by Blejzer and Khan (1984), Chhibber and Van Wijnbergen (1988) and Eshun et. al (2014) identified such factors as expectation of profitability, credit availability, government expenditure policies, and real interest rate as having significant impact by way of influencing the ability and initiatives of private investors to implement their investment projects. These factors were thought of as affecting the speed of adjustment. Thus, attempts were made to model the speed of adjustment by incorporating the above factors in a mathematical formulation presented as:

$$\gamma = \gamma_0 + \frac{1}{(I_t^* - I_{t-1})} [\gamma_1 \pi_t + \gamma_2 R_t + \gamma_3 C_t + \gamma_4 G_t] \text{-----(7)}$$

Where π represents profits, R is the real interest rate, C is real credit availability, and G is government real capital expenditure. From equation (7), if the value of γ is substituted into equation (6) the resultant becomes:

$$I_t = \gamma_0 I_t^* + \gamma_1 \pi_t + \gamma_2 R_t + \gamma_3 C_t + \gamma_4 G_t + (1 - \gamma_0) I_{t-1} \text{-----(8)}$$

Further simplification yields:

Substituting equation (5) into equation (8) yields;

$$I_t = \gamma_0 (1 - (1 - \partial)L) \alpha Y_t^e + \gamma_1 \pi_t + \gamma_2 R_t + \gamma_3 C_t + \gamma_4 G_t + (1 - \gamma_0) I_{t-1} \text{-----(9)}$$

The model in equation (9) incorporates variables that best capture the behaviour of private investment decision-making. Thus guided by theory on the basis of the above derivations, the empirical model for private investment is explicitly specified below for estimation purposes;

$$I_t = \alpha_0 + \alpha_1 \pi_t + \alpha_2 R_t + \alpha_3 C_t + \alpha_4 G_t + u_t \text{-----(10)}$$

Where I_t = private investment, G_t = government capital expenditure, C_t = real credit availability, π_t = profit and R_t = Real interest rate.

Model Specification

Panel data is used to examine the relationship between government capital expenditure and private investment among selected countries of Sub-Saharan Africa and the model of this study would follow the work of Eshun et. al (2014) which took their roots from flexible Accelerator theory. The model for this study modifies the foregoing incorporated model with inclusion of variables like official development assistance (ODA), debt and tax revenue. Therefore, the model for this study is specified below

$$PI = f(CAPEX, ODA, DT, TAX, INF, RIR) \text{-----} 11$$

Explicitly, the model can be re- stated as follows:

$$PI_{it} = \alpha_0 + \alpha_1 CAPEX_{it} + \alpha_2 ODA_{it} + \alpha_3 DT_{it} + \alpha_4 TAX_{it} + \alpha_5 INF_{it} + \alpha_6 RIR_{it} + U_t \text{-----} 12$$

For the sake of reducing heteroscedacity and to convert the research data from rates and absolute terms into the same numerical structure, the above equation is log- linearized as below:

$$\ln PI_{it} = \alpha_0 + \alpha_1 \ln CAPEX_{it} + \alpha_2 \ln ODA_{it} + \alpha_3 \ln DT_{it} + \alpha_4 \ln TAX_{it} + \alpha_5 \ln INF_{it} + \alpha_6 \ln RIR_{it} + U_{it} + \eta_i + \varepsilon_t \text{-----} 13$$

Where

PI =Private investment (Gross fixed capital formation minus public capital spending).

CAPEX =Government Capital Expenditure (Public expenditure minus recurrent expenditure)

ODA/GDP = Official Development Assistance-Gross Domestic Product Ratio.

DT= Public Debt

TAX= Tax Revenue

INF = Inflation Rate

RIR = Real Interest Rate

\ln = Natural Logarithm

i = entity or country, t = time or year

η_i = denote unobserved country specific fixed effect

U_{it} = denote time specific effect

U_t, ε_t = Error terms or stochastic terms

$\alpha_0 - \alpha_6$ = coefficients or parameters

$\beta_0 - \beta_6$ = = coefficients or parameters

A priori Expectation

It is expected that there will be positive relationship between government capital expenditure and private investment. The reason for this expectation is that capital expenditure is

development expenditure which is highly productive to boost economic growth and private investment.

$$\frac{\partial PI}{\partial CAPEX} > 0$$

It is expected that there will be positive relationship between official development assistance and private investment. An increase in foreign aid will bring about increase in private investment.

$$\frac{\partial PI}{\partial ODA} > 0$$

It is expected that there will be negative relationship between inflation and private investment. A rapid increase in the rate of inflation will lead to high cost of production and therefore affects investment negatively.

$$\frac{\partial PI}{\partial INF} < 0$$

It is expected that there will be inverse relationship between debt financing and private investment. Heavy and continuous debt spends on unproductive sectors would not do a country good and may have adverse effect on the economy. Such situation may crowd out private investment.

$$\frac{\partial PI}{\partial DT} < 0$$

It is anticipated that there will be negative relationship between taxation and private investment. High taxes will discourage hard work and also reduce aggregate demand for goods and services, therefore, retard growth and reduce investment.

$$\frac{\partial PI}{\partial TAX} < 0$$

It is expected that there will be indirect relationship between interest rate and private investment. An increase in interest rate will encourage saving and therefore crowd out private investment.

$$\frac{\partial PI}{\partial RIR} < 0$$

Sources of Data

This study relies on secondary data. Data like government capital expenditure, private investment and official development assistance were sourced from World Bank Development Indicator, World Bank Data Base, World Bank Global Development Network Growth Data Base, National bureau of statistics and Central Bank of various sub-Saharan African countries statistical bulletins (2015). Data such as inflation, interest rate and debt were sourced from IMF's International Financial Statistics (IFS) and United Nation statistical bulletin (2015).

ANALYSIS AND FINDINGS

Panel Unit Root Test Results

This aspect assesses the panel dimension of our data in order to understand the individual nature of the variables and to verify their suitability for the estimation techniques adopted. The first step of the analysis is to perform the unit root test so as to avoid spurious result and to determine the order of integration for stationarity properties of the panel data by means of homogenous panel unit root test (Levin, Lin and Chu(LLC)) and heterogeneous panel unit root test(Augmented –Dickey Fuller Fisher test(ADF Fisher)). Both test' results are presented in table 3 below.

Table 3: Levin, Lin and Chu test and Augmented –Dickey Fuller Fisher test.

Variables	LL Chu unit root test			ADF- Fisher Chi- Square unit root test		
	<i>t</i> * Statistics	P value	Order of integration	<i>P</i> * Statistics	P value	Order of integration
PI	-9.2950	0.0000***	<i>I</i> (1)	-11.5234	0.0000***	<i>I</i> (1)
CAPEX	-9.9784	0.0000***	<i>I</i> (2)	-16.6971	0.0000***	<i>I</i> (2)
ODA	-2.0034	0.0226**	<i>I</i> (0)	-2.0152	0.0219**	<i>I</i> (0)
DT	-8.0928	0.0000***	<i>I</i> (1)	-9.4545	0.0000***	<i>I</i> (1)
TAX	-12.2545	0.0000***	<i>I</i> (1)	-14.3898	0.0000***	<i>I</i> (1)
INF	-3.7704	0.0000***	<i>I</i> (0)	-4.9430	0.0000***	<i>I</i> (0)
INT	-3.6139	0.0002**	<i>I</i> (0)	-3.2897	0.0005**	<i>I</i> (0)

*** and ** denote 1% and 5% levels of significance respectively.

In table 3, the result reveals that all the series are integrated of different orders. While official development assistance (ODA), inflation (INF) and interest (INT) are stationary at their levels, other variables are made stationary at first difference except government capital expenditure (CAPEX) which is stationary at second difference. Thus, panel data regression on the series cannot be spurious. The condition for panel co integration is not met, therefore, there is need to proceed to pooled ordinary least square regression, fixed effect and random effect.

Panel Data Analysis

To analyze the relationship between government expenditure and private investment among selected countries of sub-Saharan Africa, the study employed panel data analysis of a single equation model with private investment as the dependent variable and capital expenditure, official development assistance, debt, tax revenue, inflation and interest rate as independent variables. In an attempt to arrive at the most consistent and efficient estimates, the study conducted both restricted and unrestricted panel analyses including pooled ordinary least

square regression(restricted), fixed effect and random effect panel estimation(unrestricted), followed by post estimation test such as restricted f-test of heterogeneity, and Hausman test. Hence results for each of the estimations are presented in separate tables for unique analysis, before drawing conclusion on the most consistent and efficient estimator.

Pooled OLS Estimation

Pooled OLS estimator is the most restrictive panel data estimation technique, which assumes that the regression coefficients and constant estimates are the same for all cross sectional subject over time. Therefore the model does not take cognizance of the possible heterogeneity/uniqueness in cross sectional units and/or time periods.

Table 4. Pooled OLS Parameter Estimates
Series: PI CAPEX ODA DT TAX INF IR

Variable	Coefficient	Standard Error	T-Test Values	Probability
C	-5180750*	839230.8	-6.17	0.000
CAPEX	-.0011677	.0276556	-0.04	0.966
ODA	-829486.9	1674846	-0.50	0.621
DT	346.2598*	25.1575	13.76	0.000
TAX	526262.1*	37868.53	13.90	0.000
INF	-5955.685	11409.82	-0.52	0.602
IR	-146230.8*	52137.38	-2.80	0.005

R-square=0.4975

Adjusted R-square=0.4902

F-statistics= 68.16

Prob(F-stat)=0.0000

*denotes level of Significance at 1% & 5%

Table 4 reveals that capital expenditure exerts negative impact on the private investment of the twelve selected sub-Saharan African countries, when no consideration is given to possible heterogeneity effect that may exist among the countries, specifically the result shows that an increase in capital expenditure of the selected countries by a million US dollars will pull down private investment by about 0.0011677 US dollars measured in thousand. Table shows that official development assistance, inflation rate and interest rate of the sub-Saharan African countries negatively influence private investment with specific estimates of -829486.9, -5955.685, -146230.8 for ODA, INF and IR respectively. It implies that all sub-Saharan African countries believe to exhibit homogenous characteristics increase in the official development assistance by one percentage of gross domestic products, private investment will decline by

829486.9 thousand US dollar. Also an increase in the inflation rate in sub-Saharan African countries by one percent will decline private investment by 5955.685 thousand US dollars, and a percentage rise in the interest rate of the selected sub-Saharan African countries will cause private investment to fall by about 146230.8 thousand US dollars. On the contrary, variables including debt and tax revenue as reported in table 4 exert positive impact on the level of private investment in the selected sub-Saharan African countries. The result shows that when debt stock of these countries increased by a million US dollars, the private investment will increase by about 346.2598 thousand US dollars, and also a million US dollars increase in the value of tax revenue generated in these countries, has the tendency to hike private investment by about 526262.1 thousand US dollars. Notably the result shows that the influence of variables like debt, tax revenue and interest rate on private investment in the selected Sub-Sahara African countries appear to be significant, as against the insignificant impact of the likes of capital expenditure, official development assistance and inflation rate. The reported R-square statistics of 0.4975 reveals the joint influence of capital expenditure, official development assistance, debt, tax revenue, inflation and interest rate on the systematic variation of private investment in the selected sub-Sahara African countries when country specific effect over time are silenced.

However in reality it is not justified to assume that there is no country specific effect among the twelve selected sub-Saharan African countries given the differentiated economic policies, political terrain and government ideologies, macroeconomic goals per time, as well as unique market structure and business cycles of nations around the world. As such there is need to take cognizance of the heterogeneity effect that may exist across the selected countries over time, thus there calls for unrestricted panel analyses (fixed effect and random effect)

Fixed Effect Estimation

Fixed effect model takes cognizance of the heterogeneity/uniqueness that may exist across subject unit and/or time period, as such the model includes fixed effect for each of the cross sectional unit and/or specific period. The fixed effect estimation employed in this study covers both the one-way fixed effect model and the two-way fixed effect model. The one-way fixed effect model only allows the intercept term (The fixed effect) to differ across individual subject unit (i.e countries) while the two-way fixed effect model allows for both the cross sectional and time effect. The fixed effect estimation employed in this study made use of the least square dummy variables (LSDV) technique, which included only $n-1$ dummy variables for one-way fixed effect estimation and $[(n-1) + (T-1)]$ for the two-way fixed effect estimation in order to avoid falling into the dummy variable trap (a situation of perfect collinearity). The inclusion of the fixed effect is to identify the effect of some variables (not included in the model) such as political

structure, political ideology, policies and reforms, administrative styles, state bureaucracy, geographical location, availability of natural resources e.t.c on the relationship between capital expenditure and private investment in Sub-Sahara African countries, thus tracing the subject and period specific uniqueness of the 12 selected countries over the scope covered in the study.

Table 5. Fixed Effect Parameter Estimate (Cross Sectional Specific)

Series: PI CAPEX ODA DT TAX INF IR

Variable	Coefficient	Standard Error	T-Test Values	Probability
C	-3346530*	1207367	-2.77	0.006
CAPEX	0.0350843	.0226174	1.55	0.122
ODA	-526032.5	1601476	-0.33	0.743
DT	135.0548*	20.904	6.46	0.000
TAX	274253.9*	74123.09	3.70	0.000
INF	-6553.509	8263.073	-0.79	0.428
IR	-47281.62	39752.08	-1.19	0.235

R-square=0.7984

Adjusted R-square= 0.7899

F-statistics=93.66

Prob(F-stat)= 0.0000

From Table 5, it was discovered that capital expenditure exerts positive impact on the private investment in Sub-Sahara African countries when the heterogeneity effect that may exist among the selected countries had been incorporated into the model. Table 5 reveals that the impact of other explanatory variables on private investment remains almost the same with what was discovered in the pooled OLS model except CAPEX that was positive when heterogeneity effect has not been recognized. It implies that inclusion of cross sectional effect in the model has noticeable influence on the causal-effect relationship between capital expenditure and private investment of the selected Sub-Saharan African countries while impact of other variables such as official development assistance (ODA), debt (DEBT), tax revenue (TAX), inflation (INF) and interest rate (INT) on private investment tend to be identical with those of the pooled OLS estimation. Reported R-square value of 0.7984 shows that about 80 percent of the systematic variation in private investment can be explained jointly and significantly by capital expenditure, official development assistance, debt, tax revenue, inflation rate, interest rate, as well as dummy included in cross sectional effect representations.

Table 6. Fixed Effect Parameter Estimate (period Sectional Specific)

Series: PI CAPEX ODA DT TAX INF IR

Variable	Coefficient	Standard Error	T-Test Values	Probability
C	-4158828	1525711	-2.73	0.007
CAPEX	-.0430762	.0324273	-1.33	0.185
ODA	-1076953	1757648	-0.61	0.540
DT	367.3301	27.13606	13.54	0.000
TAX	522360.8	40299.48	12.96	0.000
INF	-8784.013	12335.84	-0.71	0.477
IR	-87369.94	63934.23	-1.37	0.173

R-square=0.5301

Adjusted R-square=0.4805

F-statistics=10.69

Prob(F-stat)=0.0000

Table 6 reveals the estimation of the period specific effect model. cursory overview of the result in table 6 reveals that close semblance with the result presented in table 4 (Pooled OLS estimation) for all variables. Specifically, the table shows that capital expenditure, Official development assistance, inflation rate and interest rate exert negative impact on private investment of the selected Sub-Saharan Africa countries, while debt and tax revenue exert positive impact on private investment. However the reported R-square reveals that about 53 percent of the systematic variation in private investment can be jointly explained by variation in the explanatory variables and the included intercept terms for the period specific effects.

Random Effect Estimation

Owing to problems inherent in the fixed effect model such as loss of degree of freedom as more dummy variables are added to the model, possibility of multi-collinearity, inability of the fixed effect model to track the impact of time-invariant variables e.t.c, random effect assume that the heterogeneity is random rather than fixed and that the random effect is incorporated into the error term thus forming a composite error term.

Table 7. Random Effect Estimation

Series: PI CAPEX ODA DT TAX INF IR

Variable	Coefficient	Standard Error	Z-Test Values	Probability
C	-2005226	1496169	-1.34	0.180
CAPEX	0.0301602	.0224719	1.34	0.180
ODA	-514100.6	1586358	-0.32	0.746
DT	141.2207	20.88376	6.76	0.000

TAX	314073.2	68829.72	4.56	0.000
INF	-6525.399	8291.452	-0.79	0.431
IR	-57632.54	39623.76	-1.45	0.146

Table 7...

R-square=0.4719

Wald chi2(5) = 82.32

Prob > chi2 = 0.0000

Result of random effect estimation presented in table 7 reveals that capital expenditure exerts positive influence on private investment of the selected Sub-Sahara African countries. The result also reveals that official development assistance, inflation rate, and interest rate negatively influence private investment, while the influence of debt and tax revenue remain positive as observed in other. Notably from the random effect model it was observed that only debt and tax revenue exert significant influence on private investment of the selected Sub-Saharan African countries. The reported R-square statistics reveals that about 47% of the systematic variation in private investment of the selected countries can be jointly and significantly explained by variation in variables such as capital expenditure, official development assistance, debt, tax income, inflation rate and interest rate.

Post Estimation Test

To verify which of the estimator is relatively consistent and efficient amidst the likes of Pooled regression estimator, fixed effect estimator, and random effect, post estimation tests were conducted including: Restricted F-test and Hausman test.

Restricted F-test of fixed Heterogeneity effect

This section presents the summary of the test statistics carried out to validate the presence of heterogeneity among cross-sectional units and across time. The test is carried out to know whether there is significant difference between the differential intercept across countries and time period, and to validate whether the restriction of the pooled OLS estimation is justified.

Table 8. Restricted F Test of Heterogeneity (Cross-Sectional and time Specific)

	F-statistics	Probability
Cross sectional	54.55	0.0000
Time specific	0.77	0.8176

Table 8 reveals the result of the heterogeneity test conducted with respects to the cross sectional and period specific effect. Reported in table, are f-statistics values of 54.55 and 0.77

with probability values of 0.0000, and 0.8176 respectively. Table reveals that there is enough evidence to reject the null hypothesis that all differential intercept corresponding to the cross sectional specific units are equal to zero, but otherwise for the period specific intercepts. Therefore it can be concluded that there is cross sectional heterogeneity/uniqueness effect among the selected sub - Saharan African countries in the discourse of capital expenditure and private investment, while over time there is no significant heterogeneity. Thus, pooled OLS estimator restriction is not valid as cross-sectional heterogeneity effect is too significant to be ignored.

Hausman Test

In an attempt to know the most reliable estimation between the fixed effect estimation and the random effect estimation, Hausman test is conducted to ascertain whether the difference between coefficient estimates of fixed and random effect estimators are systematic. The null hypothesis underlying the test is that fixed effect estimates do not differ substantially from the random effect estimates. Notably, the test statistics developed by Hausman has an asymptotic chi-square distribution.

Table 8. Hausman Test

Null hypothesis	Chi-square stat	Probability
Difference in coefficient not systematic	20.06	0.0004

Table 8 reveals a chi-square value of 20.06 alongside a probability value of 0.0004. The result shows that there is enough evidence to reject the null hypothesis that differences in coefficients of fixed effect estimation and random effect estimation is not significant. It indicates that the random effect estimator is not suitable as there is likelihood that there is correlation between the random effects incorporated into the composite error term and one or more of the regressors. Therefore given the result of the restricted f-test of heterogeneity and the Hausman test, it can be concluded that the most consistent and efficient estimator among the three estimators (pooled regression estimator, fixed effect estimator and random effect estimator), employed in an attempt to analyze the relationship between government capital Expenditure and Private Investment among Selected Countries of Sub-Saharan Africa is the one-way fixed effect estimations presented in table 5.

DISCUSSION OF FINDINGS

Various econometric tests were conducted in this study. To begin with, the stationary test was conducted first to avoid spurious regression in the model of the study using stationarity properties of the panel data by means of homogenous panel unit root test (Levin, Lin and Chu (LLC)) and heterogeneous panel unit root test (Augmented –Dickey Fuller Fisher test (ADF Fisher)). The result revealed that all the series are integrated of different orders. While ODA, INF, and INT are stationary at their levels, other variables are made stationary at first difference except CAPEX which is stationary at second difference. The condition for panel co-integration is met, therefore, the study proceeds to panel data regression.

Panel data analysis was then conducted to analyse the relationship between capital expenditure and private investment in the selected countries of sub-Saharan Africa (SSA). Restricted F-test of fixed heterogeneity and Hausman's test with probability value of 0.0000 and 0.0004 respectively concluded that one –way fixed effect estimation is the apt estimator to analyse the relationship between government capital expenditure and private investment among the selected countries of sub-Saharan Africa. The results of one-way fixed effect revealed that government capital expenditure has insignificant positive effect with private investment while variables like debt stock and tax revenue also have positive link with private investment and statistically significant. The surprising result is that official development Assistance, inflation and interest rate has insignificant negative effect on private investment. Official development Assistance is expected to have positive effect which is contrary to the result and this is owing to the stringent condition attached to these foreign aids. The result of this study is also in consonance with the findings of Haroon and Naser (2011), Bader and Malawi (2010) and Ucan & ozturk(2011) that interest rate has an adverse effect on private investment. In Nigeria, Bakare (2011) also concluded that high inflation negatively influenced private investment..

CONCLUSION AND POLICY RECOMMENDATIONS

In a bid to examine the relationship between capital expenditure and private investment in sub-Saharan Africa (SSA), the study revealed that there is insignificant positive effect on private investment in SSA while variables like debt stock and tax revenue have significant positive impact on private investment. We therefore conclude that increase in capital expenditure has not proportionally significant to private investment as other regions like Asia and Latin America. The results of the study also exhibited that official development assistance, inflation and interest rate have not spurred private investment in SSA. Judging from the findings of this study, the following recommendations are raised: Governments of SSA countries should continue to raise the share of government capital spending and also direct it to public infrastructure services such

as electricity, water, port and ICT, education and health and Agriculture for effective improvement in the delivery of services. Besides, Governments of SSA countries should channel their capital expenditure on increasing productivity and competitiveness, searching for the areas where social returns are the highest and spill-over effects is significant so as to improve the quality and efficiency of public investment. Moreover, the quality and efficiency of capital expenditure in SSA should be improved through excellent institutional framework, fiscal discipline and quality and integrity of legal system. The international financial bodies like IMF, World Bank, African Development Bank and other multilateral institutions should be well mobilized to make substantial contributions to the countries of SSA like low-income countries and some landlocked countries such as Mali, Uganda and others through financial programmes, its policy advice and its technical assistances. On the other hand, some countries of SSA like Angola, Nigeria and so on where foreign aids seems to be amount of resources made available to already corrupt specific elite groups of people should be monitored in order to channel such financial resources into productive activities that can enhance private investment.

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