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ABSTRACT

The government in the SSA area is one of the largest regions of the world spending much on socio – economic activities such as the provision of public utilities, addressing externalities and imperfect markets, coordinating private sector activities, and redistribution of resources. Still, despite this huge capital expenditure, the desired results have not been remarkable compared with East Asian countries. The study, therefore, looked into the sensitivity analysis of the relationship between government capital expenditure and private investment in sub-Saharan Africa. The data, which was used for this study, were sourced from the World Bank Indicator which spans from 1980 to 2016. The paper was basically on the regional analysis of sub-Saharan African countries. The study employed panel data analysis to explore the relationship between government capital expenditure and private investment on a regional basis in SSA.

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Government Capital Expenditure and Private Investment in Sub-Saharan Africa: A Sensitivity Analysis

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ABSTRACT

The government in the SSA area is one of the largest regions of the world spending much on socio – economic activities such as the provision of public utilities, addressing externalities and imperfect markets, coordinating private sector activities, and redistribution of resources. Still, despite this huge capital expenditure, the desired results have not been remarkable compared with East Asian countries. The study, therefore, looked into the sensitivity analysis of the relationship between government capital expenditure and private investment in sub-Saharan Africa. The data, which was used for this study, were sourced from the World Bank Indicator which spans from 1980 to 2016. The paper was basically on the regional analysis of sub-Saharan African countries. The study employed panel data analysis to explore the relationship between government capital expenditure and private investment on a regional basis in SSA. The result of the panel data revealed that there is a negative and significant relationship between capital spending and private investment in both West African and Southern African regions. At the same time, the findings also exhibited a direct relationship between capital spending and private investment in East Africa. In the case of Central Africa, the results indicated that capital expenditure has no significant impact on private investment. Given the preceding finding, it was therefore concluded that private investment in East Africa is highly sensitive to macroeconomic reforms such as mild inflation and productive debt stock. This may be attributed to a good institutional framework and high quality of public investment. In line with these findings,

governments of SSA countries should continue to raise the share of government capital spending and also channel it judiciously to public infrastructures such as electricity, water, port and ICT, education and health, and Agriculture for better improvement in the delivery of services.

Keywords: government capital expenditure, private investment, regional analysis, and panel data analysis.

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I. INTRODUCTION

Over the past few decades, total government expenditure in many developing countries experiences overall growth. During the 1980s, expenditure increased slightly from \$993 billion to \$1,595 billion in 1990s, with an annual growth rate of 4.8 Per cent. In the 1990s, the government increased its spending power by 5.6 percent per year. The public expenditure further reached \$3,347.6 billion in 2002. There was accelerated growth in government expenditure in developing countries. However, among developing countries, regional deviations from these averages were quite marked. Across all regions, Asia countries, most especially Asian Tigers such as China, Malaysia, Singapore, etc., experienced the most rapid growth. At the same time, sub-Saharan

Africa and Latin America increased at a much slower pace. Almost all countries in Asia doubled all their total expenditure for the period between 1980 and 2002, and these countries had the most rapid growth over the period between 1980 and 2002. For African countries, expenditure grew at 3.8 percent over 1980-2002. Growth was much slower in the 1980s at 2.92 percent per annum. There was contractionary government expenditure in Africa countries until 1986 when African countries implemented macroeconomic structural adjustments. However, in the mid of the 1990s, African countries gained momentum in expanding government expenditures, growing at 4.8 percent per annum. Botswana had the most rapid growth, mainly due to the outstanding performance of its national economy; more than 10 percent per annum between 1980 and 2002. Since the years 2000 and 2010, there has been a tremendous improvement in the revenue base of some of these African countries as a result of increased revenue from oil and other solid minerals as well as a hike in the price of the commodity. There are also good reasons to believe, in the recent time between 2009 and 2012, that there has been an increasing in government expenditure on socio-economic activities such as education and health and that many rich-resource countries and some that are not resource-rich countries in SSA have witnessed a tremendous growth per capita, but the quality and the efficiency of the social spending in SSA are relatively low compared with Asian countries REO [15]. The government in the SSA region is one of the largest regions of the world, spending much on socio-economic activities such as the provision of public utilities, addressing externalities and imperfect markets, coordinating private sector activities, and redistribution of resources, World Bank [22]. Still, despite this huge expenditure as stated above, the desired results have not been remarkable compared with East Asian countries. This unsatisfactory growth performance in terms of investment in SSA makes the governments of the region focus on factors that affect the level and efficiency of investment as clearly suggested by empirical studies that raising investment rates must be a key part of any strategy to increase growth and enhance

investment. Given this, various literatures on investment recognize the private investment as a vital catalyst for economic development. For both developed and developing countries, private investment in the overall economic development is immensely great. In the same vein, it is widely accepted in the literature that expansion of private investment should be the main impetus for economic growth, therefore, aligning public investment resources gradually to focus on the social area, including alleviation of poverty and the upgrading of social capital as well as services that could be facilitation of this process. Private investment in developing countries needs to be seen not only as a contributor to economic growth and employment generation, but also as a catalyst to attract foreign direct capital. Private investment is one of the major sources of growth, employment, and engineer of development in developing countries. Despite this, there is need to generate private investment for development which requires an enabling environment and policy setting in which private sector operators can thrive and realize a fair return on their investment. More so, the right policy framework for investment in the overall economy is a prerequisite for attracting private investment. With such a framework and in the context of broader development strategies, the government can improve the development outcomes of investment by establishing priority and focusing scarce resources on specific sectors of the economy. Thus, government expenditure stands to be an important policy instrument through which an enabling environment can be created for greater private sector participation in the economies. It is, therefore, important to explain the role government could play to enhance and sustain private investment in the economy OECD[14]. This study calls for a thorough analysis of the relationship between government expenditure and private investment in sub-Saharan Africa. One of the policy targets of many developing nations is to use fiscal policy to improve the infrastructure network. Public expenditure has continued to be the main instrument used by countries in sub-Saharan Africa (SSA) to boost their productive apparatus. Still, disparities between sub-regions and

countries in the SSA appear so important that it is crucial to investigate the origin of the observed differences in determining the impact of government expenditure mainly capital expenditure on private investment. This raised the question: can we attribute these disparities to the variation in resource endowment and geography? Sachs [17] emphasized that SSA is tropical and therefore suffers from diseases such as Malaria, that the quality of the soil is poor and that many of its countries are landlocked. These factors, they claim, are the major reasons for SSA's unsatisfactory growth performance. This story was refuted by the evidence that location in the tropics has not prevented Malaysia, Singapore, and the tropical Chinese region of Hong Kong from making an impressive growth performance. Collier[5] pointed out that the disadvantages of tropical climate could be overcome by the discovery of vaccines and new strains of the crop. Ernesto[7] opined that globalization and technology are factors weakening the importance of geography for economic performance most especially landlocked countries by lowering the transportation cost. Therefore the sensitivity of private investment to differences in socio-economic characteristics of SSA does not depend on general phenomena but on country-specific peculiarities. Based on this background, this study wishes to examine the sensitive link between public capital expenditure and private investment in sub-Saharan Africa which is the broad objective of this study. The study specifically set out to delve into the socio-economic difference of the analysis of government capital expenditure and private investment in sub-Saharan Africa based on regions.

The paper is organized into five sections. Following the introductory remarks is a section on the review of the literature. This is followed by the research methods and the empirical findings in section three and four respectively. The study ends in section five with conclusion and policy recommendations.

II. EMPIRICAL REVIEW

Atukeren [3] examined the relationship between public and private investment using granger causality methodology for a sample of twenty-five developing countries in Africa, Asia, and Latin America over the period 1970-2000. His results indicated that public investment crowds in private investment. With the use of the probit model, the study found out that the higher the share of government involvement in an economy, the lower the trade openness and the more stable the macro and monetary environment is, the higher the likelihood that public investment may crowd out private investment. Asante [4] analyzed the determinants of private investment in Ghana using time series analysis and complementing it with a cross-sectional one from 1970 to 1992. The study found that real credit to the private sector, real exchange rate public investment, and lagged private investment to GDP ratio had a positive and statistically significant effect on private investment, with public investment confirming a possible complementary effect. Macroeconomic instability, however, hurts private investment. The study, therefore, concluded that macroeconomic instability had been major hindrance to private investment in Ghana, and so policies that address only some components of macroeconomic uncertainty may not be enough to revive private investment. Frimpong and Marbuah [9] employed the autoregressive distributed lag modeling approach to examine the determinants of private sector investment in Ghana from 1970 to 2002 using a time series analysis. The results indicated that the coefficient of real GDP, real interest rate, external debt, and inflation was statistically significant and positively related to private investment. Public (government) investment ratio and credit to the private sector had a positive but insignificant coefficient with public investment confirming a possible crowding-in (complementarity) effect. Openness had a strong negative impact on private investment at the 5 percent significance level. Finally, constitutional regime (political instability) represented by a dummy variable came out with a positive sign albeit not significant at any of the conventional statistical levels. Overall, the results

confirmed a significant accelerator theory effect on private sector investment in Ghana at the aggregate level over the period under study.

Samuel[18] examined the relationship between public investment and private investment financing in Kenya from 1964 to 2006, using an error correction framework and annual data for 1964 -2006. The study showed that investment in agriculture had a considerable positive impact while domestic debt had a significant negative impact. Political risk, real exchange rate, external debt and tax insignificantly had adverse effect. Investment in infrastructure had insignificant positive impact. These findings revealed important policy implications that investment in agriculture crowds in private investment while domestic debt crowds it out significantly. Nuru et al.[11] explored the impact of government expenditure on private investment in Kenya. The study employed Vector Autoregressive Model (VAR) using time series data for the period 1963-2012. The research findings indicated that both recurrent and development expenditure enhanced private investment. The study also concluded that government has to focus funds towards projects that are valuable to the private sector and eschew those that contend with or crowd it out. The study recommended that the government should undertake fiscal reforms in the areas that promote private investment.

Kollamparabil and Nicolaou[10] used quarterly data from 1960 to 2005 to analyze the nature and relationship between public expenditure and private investment in South Africa. The study discovered that although public investment is not crowd in or crowd out private investment, it exerts and indirectly impacts private investment through the accelerator effect. As a result of this, the study recommended that a more proactive fiscal policy was suggested to increase the investment-GDP ratio stimulating higher growth rates.

Njimanted and Mukete[12] carried out research work on public expenditure and private investment in Cameroon. The study showed that the economy of Cameroon had witnessed a double-digit trend of economic growth before

1986, as public spending exerts significant expansion in the size of the public sector and a declined period after 1986 characterized by government deficit expenditure. With the declining economy, the government of Cameroon forcefully used desperate measures to reduce expenditure and revenue respectively. These affected relevant economic indicators in Cameroon, especially private investment. It is on this ground that a study of this nature was designed to investigate the relationship between public expenditure and private investment in Cameroon and the kind of the causality between them. Based on secondary data from the World Bank database between 1980-2012 complemented by other sources, using the vector Autoregressive technique of estimation, this research work found that public expenditure insignificantly crowd in private investment. Based on this finding, the study recommends the complementary development roles of the government and those of the private sectors, emphasizing that the government of Cameroon should focus on infrastructural development, maintenance, quality education and research, industrialization, good governance, and security at the expense of superfluous expenditure which is political driven with no economic valuation.

Nwosa, Adebisi and Adedeji [13] examined the relationship between public spending and private investment in Nigeria for the period between 1981 and 2010. The study employed Error Correction Model and the results revealed that components of public expenditure have a different impact on private investment both in the long run and short run. Specifically, recurrent and government final consumption expenditure had positive (crowd-in) effects on private investment, while capital expenditure had negative(crowd-out) effects on private investment. Thus, the study recommended that greater emphasis should be placed on capital expenditure.

Udoh[19] investigated the relationship between public expenditure, private investment , and agricultural output between 1970 and 2008. The bounds test and Autoregressive Distributed Lag (ARDL) modeling approach were used to analyze both short-run and long-run impacts of public

expenditure, private investment (both domestic investment and foreign direct investment) on agricultural output growth in Nigeria. The study observed that foreign investment has an insignificant impact in the short-run. The study recommended that the policy makers should continue both private and public investment in a complementary manner to ensure that both short-run and long-run productivity of the agricultural sector was not undermined.

Ahmad and Qayyum[1] examined the effect of government spending and macroeconomic uncertainty on private investment in service sector for the period 1972-2005. The private investment model for services is estimated using the three steps methodology. These steps include univariate statistical analysis of a time series, multivariate co-integration analysis and the estimation of the long-run private investment function by using the Johansen Maximum Likelihood Method. The study revealed that government recurrent expenditure mostly appears as substitutes to private investment and affect private investment in services negatively in the long-run. The study recommended the need for appropriate interest rate policy, taken into cognizance the investment climate and the targeted sector of the economy in order to encourage private investment. The study also recommended that expansion in the size of the market and the enhancement of purchasing power of people are also needed to *encourage private investment in the services sector*. Ekpo[6] examined the relationship between public investment and private investment. In particular, the study attempted to determine the

influence of different categories of public expenditure on private investment. The study isolated infrastructure expenditure (which is social services that does not compete with private investment). Social services crowd in private investment while expenditure in real activities like manufacturing and construction crowd out private investment. This study strongly suggested that private sector is better placed to invest in construction and manufacturing. The study also revealed that capital expenditure on agriculture positively influence investment, while capital expenditure on education and health exerts positive impact on private investment.

Vincent and Clem[20] examined the controversial relationship about the possible crowding out effect of government expenditure in general and particularly deficits on private sector investments using data of 1970-2006. A modeling technique that incorporates co-integration and structural analysis was adopted. Evidence shows that there is a positive long run relationship between private investment and real growth of the national economy. This confirms the relevance of the accelerator principle to Nigeria, with contemporaneous accelerator parameter of 1.84. On aggregate, a 1% improvement in national income engenders 1.84% increase in private investment in Nigeria. In addition, the result indicated that fiscal deficits have had a depressive effect on private investment in the country. The estimation results suggested that a 1% increase in fiscal deficit leads to 0.267% decline in private investment. The results also indicated that Nigeria's debt profile has had strong and negative impact on private investment in Nigeria.

III. RESEARCH METHODS

This section focuses on model specification, identification of variables, a prior expectation, estimating techniques and sources of data.

3.1 Model Specification

This study followed the model of (Eshun et. Al.[6] which took their roots from flexible Accelerator theory. Thus, the model is specified as:

$$PI = f(CAPEX, ODA, DT, TAX, INF, RIR) \text{-----} 3.1$$

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

$$PI_{it} = \alpha_0 + \alpha_1 CAPEX_{it} + \alpha_2 ODA_{it} + \alpha_3 DT_{it} + \alpha_4 TAX_{it} + \alpha_5 INF_{it} + \alpha_6 RIR_{it} + U_{it} \quad 3.2$$

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:

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

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

3.2 Estimating Techniques

The estimating technique employed in this study is based on Panel data. The choice of this estimating technique is informed by the need to determine the time series characteristics of the variables that are used in this study. Panel data is used to determine the sensitivity of private investment vis-à-vis capital expenditure to the differences of economic characteristics of Sub-Saharan Africa.

3.3 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 (2012). Data such as inflation, interest rate and debt were sourced from IMF's International Financial Statistics (IFS) and United Nation statistical bulletin (2012).

IV. RESULTS AND DISCUSSION

The section of the research work covers the presentation of the empirical results as well as the analysis and discussion of the results.

4.1 Panel Unit Root Test Results

Table 4.1: 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 4.1, 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 cointegration is not met, therefore, there is need to proceed to pooled ordinary least square regression, fixed effect and random effect.

Analysis of the sensitivity of private investment to differences in the economic characteristics of Sub-Saharan African countries

This section presents analyses of the impact of capital expenditure on private investment across four different blocs of Sub-Saharan African countries including the West Africa bloc (Benin Rep, Mali and Nigeria), East Africa bloc (Kenya, Uganda, Tanzania), Central Africa bloc (Cameroun Gabon, Equatorial Guinea), Southern Africa bloc (Botswana, South Africa, Mozambique) in the quest to examine the sensitivity of private investment to differences in the economic characteristics of Sub-Saharan African countries. Below are the estimators employed in order to

ensure that conclusion is drawn on the most consistent and efficient estimator among pooled OLS estimator, fixed effect estimator and random effect estimator.

The results presented in table 4.2 reveals the pooled OLS coefficient estimates corresponding to each of the explanatory variables incorporated in the estimated pooled restricted model for each of the blocs, while results presented in tables 4.3, 4.4, 4.5 and 4.6 reveal the fixed effect (cross sectional specific), fixed effect (period specific), fixed effect (cross sectional and period specific) and random effect estimations respectively. However the post estimation test result presented in tables 4.7 and 4.8 for restricted F-test of heterogeneity and Hausman test respectively reveal that the most consistent and efficient estimation upon which inferential analysis and conclusion can be based, include the estimations result presented in tables 4.3 and 4.5 respectively. More specifically, estimations appropriate for the investigation of the connection between capital expenditure and private investment for bloc A and Bloc B are the two-way fixed effect model presented in table 4.5, while one-way fixed effect cross sectional specific estimations presented in table 4.3 tends to be most appropriate for bloc C and D.

4.2 Pooled OLS Estimation

Table 4.2: Pooled OLS Parameter Estimates
Series: PI CAPEX ODA DT TAX INF IR

Variable	Bloc A	Bloc B	Bloc C	Bloc D
C	954711.1*	-943134.6*	350830.2	-1.50e+07
CAPEX	00.364917*	0.0821183*	0.1814139*	-.0397944
ODA	-1315822	-1109639*	-3038670	6682388
DT	-60.51759*	327.9886*	95.52184	372.4534*
TAX	-184225.7*	66443.46*	22781.95	1014641*
INF	-3235.039	3884.459	-16723.17	-55800.41
IR	191714.3*	-54544.15*	8563.542	-491529.8

R-square: Bloc A=0.5475, Bloc B=0.7777, Bloc C=0.3787, Bloc D=0.5187
Adjusted R-square: Bloc A=0.5198, Bloc B=0.7641, Bloc C=0.3407, Bloc D=0.4892
F-statistics: Bloc A=19.76, Bloc B=57.13, Bloc C=9.96, Bloc D=17.60
Prob(F-stat): Bloc A=0.0000, Bloc B=0.0000, Bloc C=0.0000, Bloc D=0.0000

4.3 Fixed Effect Estimation

Table 4.3: Fixed Effect Parameter Estimate (Cross Sectional Specific)
Series: PI CAPEX ODA DT TAX INF IR

Variable	Bloc A	Bloc B	Bloc C	Bloc D
C	-878685.8	3114125*	-312036.3	-1.12e+07*
CAPEX	0.2462691*	0.100725*	0.102361	-0.10064*
ODA	605436.3	-1106636*	2277402	-8065501
DT	-66.57496*	228.4482*	25.03319	155.207*
TAX	-66785.96	-157536.3*	118970.5	644524*
INF	-3727.298	2302.144	-11934.08	-103886.4
IR	203918.5*	-30874.96*	29032.28	-389343.7
Cross-sectional Specific effects				
2	17222.9	-1783920*	-474472*	1.81e+07*
3	1736698*	-1484296*	-1579116	9442490*

R-square: Bloc A=0.6248, Bloc B=0.8148, Bloc C=0.4035, Bloc D=0.7880
Adjusted R-square: Bloc A=0.5935, Bloc B=0.7994, Bloc C=0.3538, Bloc D=0.7703
F-statistics: Bloc A=19.98, Bloc B=52.80, Bloc C=8.12, Bloc D=44.59
Prob(F-stat): Bloc A=0.0000, Bloc B=0.0000, Bloc C=0.0000, Bloc D=0.0000

Table 4.4: Fixed Effect Parameter Estimate (period Sectional Specific)
Series: PI CAPEX ODA DT TAX INF IR

Variable	Bloc A	Bloc B	Bloc C	Bloc D
C	315439.4	921302.3*	-1000651	-1038595
CAPEX	-0.1530343*	0.0380794*	0.1861134*	-0.1864788
ODA	279448.7	-3267418*	-1852068	1.07e+07
DT	-45.99851*	439.4021*	154.1645	400.524*
TAX	-93163.18*	-44029.04	149438.1	620407
INF	1870.348	5343.051*	-183.6355	-139193
IR	8s6634.39*	-59212.01*	65946.77	-935188.7

Period Specific Effects				
1981	71313.39	-98485.33	-407988.8	-1012004
1982	126517.4	-248767.8	-168957	3029147
1983	118507.9	-239055.6	-373852.3	-2782967
1984	146995.7	-180507.7	-382633.4	-2651279
1985	147823.3	-258067.6	-468888.1	-3538483
1986	345459.1	-642830.9	-637647.7	-3762880
1987	447162.7*	-396303	-323357.1	-4801332
1988	592809.9*	-600115	-478293.1	-5054132
1989	463477.4*	-656421.3	-326451.2	-6694303
1990	425509.3	-481925.7	-420101.7	-6741236
1991	480107.6*	-908108.3*	-625505.9	-8237574
1992	563466.7*	-567132.3	-760444.9	-8521404
1993	442200.5	-683212.5	-1037757	-4048917
1994	340665.5	-431959.3	-854069.9	-3462396
1995	379870.7	6233.734	-1464604	-3576746
1996	457135.1	-855261.4*	-1579688	-1838855
1997	518061.6*	-740245.8*	-2066102	-2098264
1998	366130.5	-731562.2*	-1945829	-488670.4
1999	582901.6*	-751646*	-2240442	-816656.7
2000	606869.7*	-857932*	1834957	-3185265
2001	655562.1*	-617098.8	-2117632	-4493025
2002	679089.6*	-598359.2	-1892246	-8196521
2003	793156.5*	-776834.5*	-1976118	-6297590
2004	1125863*	-841260.6*	-1936948	-3042544
2005	1282314*	-717034.9	-1844822	-1178126
2006	982045.8*	-364711.1	-1667076	-374660.8
2007	1097012*	1066347*	-1255995	-354510.4
2008	1171640*	855784.8*	-1311824	-288393.5
2009	1700683*	998116.3 *	-1111199	-4267441
2010	1872176*	1220254*	-1397689	-5053569
2011	2152826*	943702.4*	-1649482	-3161669
2012	2285330*	607540	-1371054	8748823
2013	2719570*	1272786*	-1327634	1.00e+07
2014	2951150*	758273.2	-1341394	1.17e+07

R-square: Bloc A=0.9207, Bloc B=0.9328, Bloc C=0.6029, Bloc D=0.6254
Adjusted R-square: Bloc A=0.8711, Bloc B=0.8909, Bloc C=0.3548, Bloc D=0.3913
F-statistics: Bloc A=18.57, Bloc B= 22.22Bloc C=2.43Bloc D=2.67
Prob(F-stat): BlocA=0.0000,Bloc B=0.0000Bloc C=0.0007Bloc D=0.0002

Table 4.5: Fixed Effect Parameter Estimate (two-way effect)
Series: PI CAPEX ODA DT TAX INF IR

Variable	Bloc A	Bloc B	Bloc C	Bloc D
C	1893593*	2404821*	—	—
CAPEX	-0.3484615*	0.0521504*	—	—
ODA	-2255898*	-3134734*	—	—
DT	-24.65797*	485.9385*	—	—
TAX	-139700.5*	-146665*	—	—

INF	3402.869	3661.43*	—	—
IR	13337.37	-45525.84*	—	—
Cross-sectional Specific effects			—	—
2	275292.9*	-519236.1	—	—
3	-1764727*	-811596.5*	—	—
Period Specific Effects			—	—
1981	24339.1	-108420.5	—	—
1982	49336.85	-200176.8	—	—
1983	168683.8	-197479.5	—	—
1984	322377.5*	-158913	—	—
1985	357448*	-191778.4	—	—
1986	347779.2*	-535789.1	—	—
1987	376959.4*	-357779.4	—	—
1988	496441.5*	-567883.5	—	—
1989	497028*	-605319.	—	—
1990	504404.6*	-566944.1	—	—
1991	518003.7*	-939002.3*	—	—
1992	580884.1*	-646308	—	—
1993	502195.8*	-786819.1	—	—
1994	396300.1*	-674066.3	—	—
1995	433357.9*	-202667.5	—	—
1996	523445.2*	-1062993*	—	—
1997	612484.3*	-955123.4*	—	—
1998	555984.7*	-999420.6*	—	—
1999	708011*	-889859.8*	—	—
2000	741538.4*	-1069094*	—	—
2001	838055.7*	-777082.9	—	—
2002	871568.5*	-1327634*	—	—
2003	1032297*	-983527.8*	—	—
2004	1360830*	-1040199*	—	—
2005	1541049*	-1017618*	—	—
2006	1477755*	-604301.4	—	—
2007	1726703*	977548.8*	—	—
2008	1831612*	706773.5	—	—
2009	2345611*	718732.7	—	—
2010	2547177*	872917.2*	—	—
2011	3125277*	637928.6	—	—
2012	3255647*	134140.1	—	—
2013	3746422*	767145.2	—	—
2014	4072880*	260125.1	—	—

R-square: Bloc A=0.9659, Bloc B=0.9420

Adjusted R-square: Bloc A=0.9428, Bloc B=0.9027

F-statistics: Bloc A=41.79, Bloc B=23.99

Prob(F-stat): BlocA=0.0000Bloc B=0.0000

4.6 Random Effect Estimation

Table 4.6: Random Effect Estimation
Series: PI CAPEX ODA DT TAX INF IR

Variable	Bloc A	Bloc B	Bloc C	Bloc D
C	954711.1*	-943134.6*	350830.2	-1.50e+07
CAPEX	0.364917*	0.0821183*	0.1814139 *	-.0397944
ODA	-1315822	-1109639*	-3038670	6682388
DT	-60.51759*	327.9886*	95.52184	372.4534*
TAX	-184225.7*	66443.46*	22781.95	1014641*
INF	-3235.039	3884.459	-16723.17	-55800.41
IR	191714.3*	-54544.15*	8563.542	-491529.8

R-square: Block A=0.5475, Block B=0.7777,Block C=0.3787, Block D=0.5187

Wald chi2(5): Block A=118.58, Block B=342.80,Block C=59.74,Block D=105.60

Prob > chi2: Block A= 0.0000,Block B=0.0000,Block C=0.0000,Block D=0.000

4.7 Post Estimation Test

Table 4.7: Restricted F Test of Heterogeneity (Cross-Sectional and time Specific)

Block A		
	F-statistics	Probability
Cross sectional	9.89	0.0001
Time specific	8.86	0.0000
Block B		
	F-statistics	Probability
Cross sectional	9.62	0.0002
Time specific	4.35	0.0000
Block C		
	F-statistics	Probability
Cross sectional	4.99	0.0000
Time specific	1.06	0.4076
Block D		
	F-statistics	Probability
Cross sectional	60.95	0.0000
Time specific	0.54	0.9749

Author's Computation, (2016)

Table 4.8: Hausman Test

Block A		
Null hypothesis	Chi-square stat	Probability
Difference in coefficient not systematic	20.89	0.0003
Block B		
Null hypothesis	Chi-square stat	Probability
Difference in coefficient not systematic	19.75	0.0014
Block C		
Null hypothesis	Chi-square stat	Probability
Difference in coefficient not systematic	40.01	0.0005
Block D		
Null hypothesis	Chi-square stat	Probability
Difference in coefficient not systematic	50.11	0.0001

Author's Computation, (2016)

Thus, overview of the most consistent and efficient model estimations in table 4.5 for each of the blocs reveals that for West African countries, an increase in capital expenditure has significant negative impact on private investment over the years, with other variables such as official development assistance, debt, and tax income which equally and significantly indicate indirect effect of capital expenditure on the private investment. However table 4.5 also reveals that private investment in West African countries has increased over time in the face of rising inflation rate and interest rate. This may be ascribed to increase in the revenue base of these countries involved. For East African bloc it was discovered from the table 4.5 that capital expenditure has over time spurred private investment given the reported positive coefficient of 0.0521504. Notably it was reported in table 4.5 that the positive impact of capital expenditure on private investment in East African bloc is significant. However the reported influence of other variables on private investment reveals that debt and

inflation rate in East African bloc act as significant catalyst to private investment expansion while rising official development assistance, tax income, and interest rate has over the years dampened the prospect of private investment in this bloc. cursory overview of the cross sectional specific effects and period specific effects reveal that there is significant heterogeneity effect for African countries like Mali and Nigeria in the West, while such effect is only significant for Tanzania in the East. Notably also it was discovered that there is significant period specific effect from 1994 till 2014 for West African bloc, but for East African bloc period specific effect is only significant for year between 1996 to 2000, 2002 to 2005, 2007 and 2010 respectively. The reported R-square statistics for blocs A and B reveals that 97% and 94% of the systematic variation in the private investment of West African bloc and East African bloc respectively can jointly explain variation in all the included variables in the two blocs

Table 4.8: Hausman Test

Block A		
Null hypothesis	Chi-square stat	Probability
Difference in coefficient not systematic	20.89	0.0003
Block B		
Null hypothesis	Chi-square stat	Probability
Difference in coefficient not systematic	19.75	0.0014
Block C		
Null hypothesis	Chi-square stat	Probability
Difference in coefficient not systematic	40.01	0.0005
Block D		
Null hypothesis	Chi-square stat	Probability
Difference in coefficient not systematic	50.11	0.0001

Author's Computation, (2016)

Thus, overview of the most consistent and efficient model estimations in table 4.5 for each of the blocs reveals that for West African countries, an increase in capital expenditure has significant negative impact on private investment over the years, with other variables such as official development assistance, debt, and tax income which equally and significantly indicate indirect effect of capital expenditure on the private investment. However table 4.5 also reveals that private investment in West African countries has increased over time in the face of rising inflation rate and interest rate. This may be ascribed to increase in the revenue base of these countries involved. For East African bloc it was discovered from the table 4.5 that capital expenditure has over time spurred private investment given the reported positive coefficient of 0.0521504. Notably it was reported in table 4.5 that the positive impact of capital expenditure on private investment in East African bloc is significant. However the reported influence of other variables on private investment reveals that debt and

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Estimation results for blocs C and D presented in table 4.10 reveal that capital expenditure exerts positive influence on the private investment of central African bloc with specification for countries including Cameroun, Gabon, and Equatorial Guinea, while the impact of capital expenditure on private investment in Southern African bloc (particularly for countries like Botswana, South Africa and Mozambique) is negative. The result reveals that other variables exert positive impact on private investment in Central Africa except inflation rate. For Southern African bloc however variables including official development assistance, inflation rate and interest rate exert negative influence on private investment while the impact of debt and tax income tend to be positive. From the result it was observed that there is significant cross-sectional specific effect for Gabon in the central African bloc and for south Africa and Mozambique shows significant cross sectional effect in the Southern African bloc. The reported R-square values for bloc C and D stood at 0.4035 and 0.7880 which implies that about 40% and 78% of the systematic variation in private investment in Central African bloc (represented by Cameroun, Gabon and Equatorial Guinea), and Southern African bloc (represented by Botswana, South Africa and Mozambique) can be jointly explained by all the included explanatory variables such as capital expenditure, official development assistance, debt, tax income, inflation rate and interest rate.

V. CONCLUSION AND POLICY RECOMMENDATIONS

Sequel to the findings of sensitivity of private investment to differences in economic characteristics of SSA which gives room for sample analysis in the four sub-regions of SSA, the results revealed that there is negative and significant relationship between capital spending and private investment in both West Africa and Southern Africa while the findings also showed significant direct relationship between capital spending and private investment in East Africa. In case of Central Africa, the results indicate that capital expenditure has no significant impact on private investment. It is therefore concluded that

private investment in East Africa is highly sensitivity to economic reforms like macroeconomic variables such as mild inflation and productive debt stock. This may be attributed to good institutional framework and high quality of public investment. In line with these finding, 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. 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 mobilized to make their substantial contributions to the countries of SSA most especially non-resources rich countries, landlocked countries and fragile countries like central African countries through financial programmes, its policy advice and its technical assistances.

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