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Keywords: *foreign aid, public investment, poverty level, sub-saharan africa countries, PMG estimator.*

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I. Introduction

Poverty is a major concern for academics, policy makers, governments at all levels and international organizations given its debilitating effects people and their wellbeing. This is because poverty, according to the United Nations (1998) is a fundamental denial of choices and opportunities, a violation of human dignity resulting in lack of basic capacity to participate effectively in the society. Specifically, extreme poverty has become a problematic issue in Sub-Saharan Africa, particularly since the 1980s and has risen to become one of the most challenging issues confronting many countries on the sub-continent. To this end, Sub-Saharan Africa is the world's leading beneficiary of external aid (Ogundipe and Ojeaga, 2014). Since 1960, the international community has devoted over US$568 billion to the development of Sub-Saharan Africa (SSA), representing roughly 15% of the continent's GDP or proportionally four times the Marshall plan that restarted the European economies after the Second World War (United Nations Economic Commission for Africa, 2010). However, after half a century of channeling resources to the Third World, unfortunately, poverty is still at an alarming rate in SSA region. A number of reasons have been cited to be responsible for this phenomenon, ranging from poor policies (see for example Burnside and Dollar, 2000; Collier and Dollar, 2001, 2002) and as well, the diversion of aid from investment to unproductive consumption uses (see Boone, 1996).

Foreign aid has emerged as a dominant strategy for alleviating poverty especially in developing countries deficient in investment capital (Kargbo, 2012). In these economies, the desired capital to improve economic growth and welfare is largely insufficient internally, which subsequently warrants the need for external capital. Given that most low-income countries lack the crucial incentive to attract significant foreign direct investment, the only external capital readily available to support development and welfare undertakings has to come from foreign aid (Kargbo, 2012). Foreign aid, and in general, external capital, has been postulated by noticeable scholars of development economics, to be a vital input to supplement low savings, support development and get rid of poverty in low-income countries.

Empirica evidences obtained from various research works within and outside Sub-Saharan Africa both at country-specific and cross-country level indicate that controversies abound on the relationship between foreign aid and poverty. For instance, Gomanee, Mosley, Morrissey and Verschoor (2003, 2005); Masud and Yontcheva (2005); Bahmani-Oskooee and Oyolola (2009); Alvi and Senbeta (2011); Herzer and Nunnenkam (2012); and Woldekidan (2015) showed that foreign aid reduces poverty and improves the welfare indicators in aid-recipient countries. The strand of the literature claims that foreign aid increases unproductive public consumption, worsen inequality and poverty in aid-recipient developing countries. Examples of such studies are: Boone (1996); Asra, Kim and Quibria (2005); Easterly (2006); Chong, Gradstein, and Calderon (2009) and Olofin (2013).

Given these polarized views therefore, this research contributes to the existing literature by incorporating public investment into foreign aid-poverty

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nexus. This is because public investment induced a reduction in poverty by creating direct welfare benefits in form of increased quantity and quality of final goods and services, higher employment by crowding in private investment (Anderson, Renzio and Levy, 2006). Also, the main objective of the donors in providing aid is to supplement domestic savings and increase public investment in LDCs which largely transformed to economic growth and reduces poverty. Hence, the need to examine the link among foreign aid, public investment, and poverty level. Although, the erstwhile studies have extensively focused on the linkage between foreign aid-poverty and public investment-poverty nexus.

This study adds to existing literature by exploring the nexusamong foreign aid, public investment, and poverty level based on their income level (Low, Lower-middle and upper income countries) using annual data of 26 sub-Saharan African countries covering the period of 1990 to2015. The classification of the SSA countries into sub-panels based on income level (Low, Lower-middle and upper income countries) is crucial in terms of homogenizing countries into similar characteristics which allows results to be compared and contrasted by income levels. The study focuses on only sub-Saharan African countries because the region is a major recipient of foreign aid and also, one of the poorest regions in the world. The choice of 1990 is based on the donor's objective of reducing the percentage of people living in extreme poverty between 1990 and 2015 by half and the countries are selected based on data availability.

In addition, in order to examine the link among foreign aid, public investment and poverty level in Sub-Saharan Africa based on their income level, this study employs the dynamic panel autoregressive distributed lag (PARDL) model introduced by Pesaran, Shin, and Smith (1999). This method is employed because it has the ability to: (i) distinguish between the short and long-run effect; (ii) overcome the delicate problems of the order of integration of variables that can work upon variables that are I(0) and/or I(1) and; (iii) allow for heterogeneity in the parameters. This represents the uniqueness of the present study on the aid-poverty relationship in the literature. Also, findings from this study will offer new insights to policy makers on ways to make aid more effective in reducing poverty through public investment in SSA region. The remainder of this paper is organized as follows. Section 2 presents are view of relevant empirical literature. Section 3 entails the methodology. Section 4 discusses the empirical results while Section 5 concludes the paper by recapping both the essence and findings of the study.

II. Review of Empirical Literature

The empirical relationship between foreign aid and its role in poverty reduction has been extensively examined in the past years. However, such empirical evidences appear to be inconclusive. For example, Gomanee, Mosley, Morrissey and Verschoor (2003) found that aid potentially benefits the poor when they employed random effect estimation technique to test the hypothesis that the wellbeing of the poor can be improved through public expenditure allocation induced by foreign aid, using two indicators of the welfare of the poor, namely; infant mortality and the Human Development Index (HDI) in 39 aid-recipient developing countries over the period 1980 to 1998. Using a different estimation technique, Gomanee, *et al.* (2005) re-examined the effect of aid on aggregate welfare for 104 aid recipient countries over the period of 1980-2000. The result of the fixed effect estimator revealed that aid has a direct effect on welfare or indirectly through growth with no evidence showing that aid operates through public spending.

Contrary to Gomanee*et al* (2003, 2005) Asra, Estrada, Kim and Quibria (2005) found that aid is ineffective when it is larger than the recipient country's absorptive capacity when they examined the impact of aid effectiveness in reducing poverty from 1960 to 1998 using panel data for 49 developing countries. They concluded that aid has not been effective in sub-Saharan African countries compared with other regions because there are other factors beyond macroeconomic policy and governance that are responsible for aid ineffectiveness in SSA region. However, Masud and Yontcheva (2005) evaluated the impact of two different kinds of aid (bilateral and Non-Governmental Organization (NGO) aid) on infant mortality and illiteracy rates for 58 developing countries between 1990 and 2001 using the random effects model and Two-Stage Least Square (2SLS) estimation technique. They found that NGO aid significantly reduces infant mortality and does so more effectively than official bilateral aid. The impact of bilateral aid on illiteracy was not significant.

Also, Nakamura and McPherson (2005) employed the Generalized Method of Moment (GMM) estimation technique to investigate the relationship between foreign aid and poverty reduction using a panel of 49 countries over the period of 1970 until 2001. They found that aid has no significant impact on several poverty indexes regardless of the decomposition of aid while real per capita income has the robust and highly significant impact on poverty reduction. Williamson (2008) found that foreign aid is ineffective at increasing overall health and is an unsuccessful human development tool using fixed effect estimation technique to test whether increases in human welfare (infant mortality, life expectancy, death rate, and immunizations (DPT and measles) can be achieved through the health sector of specific foreign aid in 216 aid-recipient countries over the period of 1973 and 2004.

Disparately, Asiama and Quartey (2009) found that aggregate bilateral aid flows to Sub-Saharan Africa

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do not have a significant direct effect on human development indicators (welfare and poverty) using GMM estimation technique to investigate the impact of foreign aid on the human development indicators (poverty and welfare) for 39 SSA countries over the period of 1975 to 2003. The study indicated that disaggregated aid, in the form of sector/project assistance and also programme assistance have significant effects on the human development indicators. Chong, Gradstein, and Calderon (2009) examined the impact of aid on both poverty and income inequality for 111 aid-recipient developing countries over the period of 1971-2002 and found that foreign aid is conducive to the improvement of the distribution of income when quality of institutions (Voice and accountability, corruption) are taken into account and that foreign aid itself does not have significant effect on inequality and poverty.

In investigating the relationship between health aid and infant mortality, Mishraa and Newhouse (2009) also applied the Generalized Method of Moment (GMM) estimation technique to examine the relationship between health aid and infant mortality, using data from 118 countries between 1973 and 2004. They found that health aid has a beneficial and statistically significant effect on infant mortality and that doubling per capita health aid is associated with a 2 percent reduction in the infant mortality rate. Bahmani-Oskooee and Oyolola (2009) found that foreign aid reduces poverty in aid-recipient countries and concluded that inequality was harmful in reducing poverty in investigating the impact of foreign aid on poverty, which was proxied by headcount ratio for 49 aid-recipient countries for the period 1981 to 2002 using the random effect models and the Two-Stage Least Square (2SLS) estimation techniques.

Furthermore, Alvi and Senbeta (2012) applied the same estimation technique as Bahmani-Oskooee and Oyolola (2009) to investigate the impact of foreign aid on poverty by aid source and type for 79 developing countries over the 1981-2004 period. The study established that a one percentage point increase in aggregate aid will reduce the proportion of people living below the poverty line by 1.8%, 2.8% for poverty gap and 2.6% for squared poverty gap. Similar to Chong *et al* (2009), Herzer and Nunnenkam (2012) assessed the long-run effect of foreign aid on income inequality for 21 aid recipient countries using panel co-integration technique over the period of 1970-2005, the authors discovered that aid exert an increasing effect on income distribution.

Focusing on ECOWAS countries, Olofin (2013) uncovered that total foreign aid and food aid impact positively on poverty, while technical aid reduces poverty when he examined the effects of different types of foreign aid on poverty levels in eight West African countries between 1975 and 2010 by employing both the Augmented Mean Group estimator (AMGe) and Common Correlated Effects Mean Group estimator (CCEMGe). In contrast to other studies above, Azam, Haseeb, and Samsudin (2016) investigated the effect of foreign remittances along with some other variables (foreign aid, debt, human capital, inflation and income) on poverty in 39 countries including the lower middle, upper middle and high income countries covering the period of 1990-2014 using the Panel Fully Modified OLS (FMOLS). The result of the study also revealed that aid and debt impact positively on poverty. Kaya, Kaya and Gunter (2013) examined the relationship between aid given to the agricultural sector and poverty reduction proxied by poverty headcount ratio at US$ 1 a day for a panel of 46 developing aid recipient countries over the period of 1980–2003. Using fixed effects and Three Stage Least Square (3SLS) estimation techniques, he established that aid directed to the agricultural sector of a developing country improves the welfare of the poor, by reducing the headcount poverty ratio both directly and indirectly.

Using the Iteratively Reweighted Least Squares (IRLS) and Generalized Method of Moment (GMM) estimation techniques, Pickbourn and Ndikumana (2016) assessed whether the volume of aid, its sectoral allocation has impact on human development outcomes (education, health, nutrition and access to clean drinking water and improved Sanitation) and gender equity in SSA countries over the period of 1973 to 2010. The result of the study revealed that increased allocation of foreign aid to the health and education sector not only ameliorates overall health outcomes, but it also improves gender-specific health outcomes and contribute to improving overall educational outcomes.

Edreese*t al* (2015) examined the impact of government spending, economic growth, trade, foreign aid and foreign direct investment on poverty reduction in Africa over the period of 1974 and 2013. The result of the GMM estimation technique revealed that foreign direct investment, economic growth, trade and government spending on education and health are positively related to poverty reduction while foreign aid negatively contributed to the poverty reduction in Africa. However, in a specific country study, Woldekidan (2015) examined the role of foreign aid in reducing poverty proxied by infant mortality rate, gross primary enrollment ratio and real household final consumption expenditure over the period of 1975-2010 in Ethiopia using Johansen maximum likelihood estimation technique. The study found that foreign aid has a significant impact on poverty by reducing infant mortality rate and increasing household consumption expenditure. The result further revealed that foreign aid has a negative impact on poverty when poverty is measured by gross primary enrollment ratio, but positive when augmented with macroeconomics policy index, while economic growth has a significant contribution to poverty reduction and poor quality of governance exacerbate poverty.

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In assessing the effectiveness of aid on public investment, Maria and Augustin (2012) applied Generalized Method of Moment (GMM) estimation technique to examine the impact of external debt and foreign aid on public expenditure allocation in 40 SSA countries after the launch of the Heavily Indebted Poor Countries initiative (HIPC) for the period of 1995-2009. The study found that debt servicing impact negatively on government expenditure and foreign aid while multilateral aid exhibits a positive effect on public investment.

In line with Maria and Augustin (2012), Chatterjee, Giuliano and Kaya (2012) also applied Generalized Method of Moment (GMM) estimation technique to examine the link between foreign aid and the composition of government spending in 67 developing countries for the period of 1972-2000. The results revealed that at the aggregate level, about 70 percent of total aid is fungible while aid targeted for public investment crowds-out 80 percent of domestic government spending. The results also revealed that aid does not affect private investment, but has a strong positive impact on household consumption. Gyimah-Brempong and Racine (2010) used panel data and the Local Linear Kernel Estimator (LLKE) to investigate the effects of foreign aid on physical capital investment in 32 SSA countries for the period of 1980-2007. The results revealed that foreign aid has a positive and significant impact on physical capital investment. This effect is robust to the measurement of aid as well as the policy environment.

Unlike Chatterjee, Giuliano and Kaya (2012) which regressed foreign aid on the composition of government spending, Douzounet and Urbain (2013) examined the effects of foreign aid on capital investment (human capital, physical capital) in 37 sub-Sahara African countries over the period 2000-2010. The results of their study showed that foreign aid positively and significantly affected the physical capital accumulation. However, Uneze (2012) investigated the impact of aggregate aid and disaggregated aid (multilateral and bilateral) on private investment in fourteen West Africa countries over the period of 1975-2008 using fixed effects estimation technique. The results revealed that multilateral aid affects private investment positively, but not bilateral aid. Aid uncertainty has a negative impact on domestic private investment and therefore reduces the value-effect of bilateral aid on domestic private investment. The study concluded that high volatility in bilateral aid is the source of the uncertainty in total aid. Ogun (2010) investigated the relative effects of physical and social infrastructure on poverty indicators over the period of 1970 to 2005 using Structural Vector Autoregressive (SVAR) estimation technique. The study found that infrastructure in general reduces poverty, social infrastructure explains a higher proportion of the forecast error in poverty indicators relative to physical infrastructure. In Pakistan, Ali (2010) examined the effect of different categories of government expenditures (government consumption, government investment, defense and educational expenditures) on poverty over the period 1972-2008 using Error Correction Mechanism (ECM). The result of the study revealed that productive government expenditures increase employment generation, improve the standard of living and thereby reduces poverty.

Lastly, Malimu, Toerien and Gossel (2013) investigated the effect of aid inflows and the volatility of public investment on economic growth in 26 Sub-Saharan African countries over the period of 1992 to 2011. Three volatility variables comprising aid, government revenue, and public investment were incorporated into an aid-growth model to test for their effect on economic growth using the Generalized Method of Moments (GMM) technique. The results revealed that foreign aid has a positive impact on growth while aid volatility has a negative impact on economic growth.

In summary, the subsidizing effects of foreign aid on poverty has been established in the literature. Studies have also explored the role of public investment in the poverty reduction debacle. However, the role of public investment in the foreign aid-poverty nexus has not been extensively dealt with. Further, studies that consider the trio of foreign aid, public investment and poverty level are scarce, especially for sub-Sahara Africa which is the focus of the present study. The foregoing gap in the literature therefore serves as the motivation for this study.

III. Model

Following the empirical literatures, this study adapts the model employed by Ferroni and Kanbur (1990) and Olofin (2013) to evaluate the relationship between foreign aid, public investment and poverty level. In the model, it is assumed that since aid directly finances government expenditure, focusing on public investment that is channeled towards projects that benefit the poor will provide a clearer transmission mechanism of aid effectiveness.

$$POV_{i,t} = \alpha + \beta FA_{i,t} + \delta PI_{i,t} + \theta Y_{i,t} + \varphi Z_{i,t} + \varepsilon_{i,t} \quad (3.1)$$

Where POV denotes poverty, α denotes country – specific intercept, FA is foreign aid, PI represent all forms of government investment that can improve citizen welfare such as government expenditure on education, health, infrastructure, Agriculture and Social sector, Y is the GDP per capita and Z_{it} corresponds alternatively to the level of financial depth, inflation rate and control of corruption COP while i denotes the country, t is the time period and ε_{it} is a time varying error term.

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a) Methodology

i. *Panel Unit Root Tests*

Panel ARDL or Pool Mean Group (PMG) can be applied whether the variables are purely I (0) or I (1), or the mixed of both (Pesaran and Smith, 1995; Pesaran *et al*., 1999). According to Asteriou and Monastiriotis (2004), the estimate of PMG could be spurious if the order of integration of any of the variables of interest happens to be I(2). It is therefore imperative to ascertain the order of integration of the study variables. For this tenacity, this study employs Im, Pesaran and Shin (IPS) (2003) panel unit root test technique. However, for comparison purpose, Levin, Lin, and Chu (LLC, 2002) panel unit root testis also applied.

ii. *Dynamic Panel ARDL (PMG) specifications*

This study employs the pooled mean group (PMG) estimator for dynamic heterogeneous panels. Pesaran, Shin, and Smith (1999) proposed important new technique to estimate non stationary dynamic panels in which the parameters are heterogeneous across groups known as pooled mean group. PMG estimator combines both pooling and averaging. This intermediate estimator allows the intercept, short-run coefficients, and error variances to differ across the groups but constrains the long-run coefficients to be equal across groups. This estimator is better over others because it provides consistent and efficient estimates of the parameters in a long-run relationship between both integrated and stationary variables in a panel data structure. The empirical specification of the PMG model can be written as follows:

$$\Delta InPOVI_{i,t} = \sum_{j=1}^{p-1} \lambda_j \Delta InPOVI_{i,t-j} + \sum_{j=0}^{q-1} \delta_j \Delta InFA_{i,t-j} + \sum_{j=0}^{q-1} \delta_j \Delta InPI_{i,t-j} + \sum_{j=0}^{q-1} \delta_j \Delta InY_{i,t-j} + \sum_{j=0}^{q-1} \delta_j \Delta FD_{i,t-j} + \sum_{j=0}^{q-1} \delta_j \Delta INF_{i,t-j} + \sum_{j=0}^{q-1} \delta_j \Delta COP_{i,t-j} +$$

$$\phi_i' \left[InPOVI_{i,t-1} - \left\{ \beta_0 + \beta_1 InFA_{i,t-1} + \beta_2 InPI_{i,t-1} + \beta_3 InY_{i,t-1} + \beta_4 FD_{i,t-1} + \beta_5 INF_{i,t-1} + \beta_6 COP_{i,t-1} \right\} \right] + \varepsilon_{it} \quad (3.2)$$

Where $\boldsymbol{POVI}_{i,t}$ is poverty index (FA) represents Foreign aid, (PI) represents Public investment. We also include a set of control variables that are commonly used in poverty equations: overall income per capita (GDP per capita) to control for economic development (Y), a variable of financial deepening (Private credit/GDP) (FD); growth of the consumer price index (Inflation) to control for the macroeconomic instability (INF); and an indicator of institutional quality (control of corruption) drawn from the International Country Risk Guide (ICRG) database which measures misuse or the abuse of public office for private gain. λ_j and δ_j represent the short-run coefficients of lagged dependent and independent variables respectively, β_i are the long-run coefficients, and ϕ is the coefficient of speed of adjustment to the long-run equilibrium. The subscripts *i* and *t* represent country and time indexes, respectively.

b) DATA

This study is based on panel data covering 14 low, 7 Lower-middle and 5 upper income countries as classified using 2012 GNI per capita over the period 1990–2015, to examine the relationship among foreign aid, public investment and poverty level. Data on foreign aid measured by Total Official Development Assistance received (constant 2010 US$), public investment (proxy by gross public investment; constant 2010 US$), poverty, GDP per capita (constant 2010 US$), financial deepening (Domestic credit to private sector as a ratio of GDP) and inflation rate (Annual percentage change in consumer prices) are sourced from the World Bank's World Development Indicators, 2016 edition while institutional quality measured by control of corruption is obtained from World Governance Indicators, 2016 edition. Countries are selected based on the availability of all the data required for this analysis. The list of sample countries considered is presented in Appendix (Table A1).

This study employs principal component analysis (PCA) to construct a composite index for the poverty from four indicators namely household consumption per capita, life expectancy at birth, infant mortality rate and gross primary school enrollment ratio. This index is hereafter denoted by poverty index. The justification for doing this is in two-fold. First, modeling various indicators of poverty in the same equation may lead to serious problem of multicollinearity. In addition, utilizing the aggregate effect of these indicators is likely a better approach than modeling each indicator separately. Second, there is no general consensus as to which measure of poverty is most appropriate. Therefore, having a summary measure of poverty that includes all the relevant poverty proxies (data permitting) to capture several aspects of poverty at the same time, such as household consumption per capita, life expectancy at birth, infant mortality rate and gross primary school enrollment ratio will provide better information on poverty level. It is believed that this new index of poverty is able to capture most of the information from the original data and is a better indicator than the individual variables.

IV. Results and Discussions

In this section, the estimated results for this study are presented and discussed. We first present the

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integration order of each variable include in our model in the context of unit root tests. The results of stationary tests in Table 1 show that indicate that financial deepening *(FD)*, inflation rate *(INF)* and Control of Corruption *(COP)*are stationary at level i.el(0) while poverty index *(POVI),* foreign aid *(FA)*, public investment *(PUI)* and GDP per capita *(Y)* are stationary at first difference i.e. I(1). Due to the existence of mixed levels of integration among series, PMG estimator is now suitable to estimate the impact of foreign aid, public investment among other variables on poverty level in SSA.

Table 1: Panel unit root test Result

	LLC-Test		IPS-Test	
	Level	First Diff	Level	First Diff
A: Upper Income Countries				
POVI	0.8196	-2.3175**	0.1624	9.938*
FA	-1.0814	-8.383*	-1.417	-8.6839*
PI	-0.8329	-7.9805*	-0.928	-8.0504*
Y	-0.4119	-7.9126*	-0.4449	-6.8518*
FD	-3.2741**		-2.4685**	
INF	-3.8038*		-4.2634*	
COP	-3.1664**		-3.4548**	
B: Lower-middle Income Countries				
POVI	2.3802	-6.2316*	1.2785	4.8311**
FA	-1.1734	-10.4189*	-1.3186	-11.7978*
PI	1.2314	-6.6195*	1.4834	5.9941*
Y	1.7144	-4.2944**	1.2122	5.0008*
FD	-5.1106**		-4.1326**	
INF	-4.7845**		-4.9563**	
COP	-8.9426**		-7.0033**	
C: Low Income Countries				
POVI	-0.8751	-4.4526**	0.6063	-4.3876**
FA	-1.3715	-14.0786*	-0.5011	-13.1808*
PI	1.2189	-17.0746*	-1.0721	-14.974*
Y	-0.0248	-8.8982*	0.3132	-11.3327*
FD	-4.4086**		-4.2591**	
INF	-6.3820**		-6.2917**	
COP	-11.2152*		-10.1861*	

Note 1: POV, LFA, LPI, LY, FD, INF and COP represent poverty index, natural log of foreign aid, natural log of public investment, natural log of GDP per capita, financial deepening, inflation rate and control of corruption respectively.
*Note 2: * and ** indicate significance at 1% and 5% levels, respectively, which Signifies rejection of the unit root hypothesis*.

In order to assess the short run and long run effects of foreign aid, public investment among other variables on poverty level, we estimate Pooled Mean Group (PMG) method. The result of the PMG-based error correction model is reported in Table 2. The log transformation of all the variables allows us to interpret the coefficients as elasticities. The result reveals that reduces poverty in aid-recipient countries. Conversely, foreign aid exerts a significant positive effect on poverty level in lower and low income countries both short and long run, that is foreign aid is associated with higher levels of poverty (corresponding to a rise in the number of poor people). This result conforms with the findings of Chong *et al* (2009), Olofin (2013), and Azam*et al* (2016). These studies found that aid is fungible because foreign aid has a significant negative impact on poverty level in upper income countries in the long run but insignificant positive impact on poverty level in the short run. This shows that foreign aid reduces poverty level in upper income countries. This result is in line with Gomanee*et al* (2003), Bahmani-Oskooee and Oyolola (2009), Alvi and Senbeta (2012): they suggest it increases the size of government unproductive consumption and not investment and that aid benefit the elitist group and not the poor. Additionally, the result indicate that public investment has a positive impact on poverty level in both short and long in lower and low income countries, that is public investment increases poverty level in both lower and low income countries. This outcome repudiates the finding of Ogun (2010) who

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found that massive investment in social infrastructure drastically reduce poverty in the urban areas. However, the result indicate that public investment has a negative impact on poverty in upper income countries. This finding replicate the common assumption that public investment plays an essential role in poverty reduction. This outcome is in line with the finding of Ali (2010) who found that government investment reduces poverty in Pakistan.

In order to investigate the composition effect of aid inflows, we add interaction terms of the aid inflows with public investment. This interaction term is to examine whether aid inflows and public investment are jointly influencing poverty level in SSA. The coefficient of the interaction term of aid inflows with public investment (FA*PI) is negative and significant in the long run in the three income groups though insignificant in the short run. These results suggest that a rise in aid inflows to SSA countries is associated with lower levels of poverty when the aid inflows is channeled to public investment rather than consumption in aid recipient countries. In other words, increase in public investment may allow the poor to benefit more from foreign aid. Furthermore, the result of the upper income countries reveals that GDP per capita, financial depth (measured by the private sector credit-to-GDP ratio) inflation rate exerts a negative impact on poverty in the long run but positive impact in the short run whereas control of corruption exerts a positive impact on poverty in the both short and long run in upper income countries. In addition, GDP per capita has a negative effect on poverty in low income countries in the long run but positive impact on poverty in the short run. On the contrary, GDP per capita and control of corruption have positive effect on poverty in both short and long run in lower middle income countries while financial depth and inflation have negative impact on poverty level in the long run. Lastly, the estimated coefficients of error correction terms are also significantly negative and smaller than unity in all the three income groups, thereby suggesting convergence to long run equilibrium. More specifically, the coefficients indicated that the system instantaneously reverts to its long run equilibrium following a shock that diverts its path away from steady state.

Table 2: Estimation results for PMG

	Upper Income		Lower Middle		Low Income	
Variable	Coeff	Prob	Coeff	Prob	Coeff	Prob
Long-run						
LFA	-5.0575	0.0421**	4.5860	0.0010*	3.9114	0.0001*
LPI	-5.7062	0.0121**	4.1469	0.0068*	2.5328	0.0088*
LFA*LPI	-0.2368	0.0429**	-0.1636	0.0193**	-0.1851	0.0001*
LY	-1.2846	0.0012*	5.4962	0.0006*	-0.0772	0.9034
FD	-0.0907	0.5807	-0.0139	0.0106**	0.0262	0.0074*
INF	-0.0116	0.1976	-0.0025	0.5916	0.0020	0.8312
COP	-0.6063	0.0005*	0.4841	0.0032*	0.7850	0.0109**
Short-run						
ECT(-1)	-0.7071	0.0000*	-0.5070	0.0022*	-0.2840	0.0480**
Δ LFA	-0.1035	0.8172	1.4418	0.6820	1.4983	0.6064
Δ LPI	-0.1481	0.6793	4.7978	0.1893	1.5600	0.5700
Δ LFA*LPI	-0.0009	0.9648	-0.2539	0.1851	-0.0698	0.5998
Δ LY	-0.0814	0.8232	1.5066	0.1442	1.8625	0.0001*
Δ FD	0.0202	0.8704	-0.0017	0.6768	-0.0028	0.5785
Δ INF	0.0029	0.5791	0.0013	0.8006	-0.0002	0.9030
Δ COP	0.0976	0.1134	-0.1254	0.4248	-0.1116	0.1370
C	-17.2184	0.0004*	8.6645	0.3963	7.0577	0.0451**
No of Contry	5		7		14	

Note 1: Note 1: POV, LFA, LPI, LY, FD, INF and COP represent poverty index, natural log of foreign aid, natural log of public investment, natural log of GDP per capita, financial deepening, inflation rate and control of corruption respectively.
*Note 2: The dependent variable is poverty index. Notes 3: *, **, and *** indicate significance at 1%, 5%, and 10% level, respectively.*

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V. Conclusion and Policy Recommendation

The study applied PMG estimation to analyze the effects of foreign aid and public investment on poverty level covering 14 low, 7 Lower-middle and 5 upper income SSA countries as classified using 2012 GNI per capita over the period 1990–2015.The estimated results show that foreign aid and public investment have negative impact on poverty level in upper income countries whereas in low and lower-middle income countries, foreign aid and public investment have a positive impact on poverty level. In addition, the interaction of foreign aid with public investment yields negative impact on poverty level in the three income groups. The policy implications of empirical results are: foreign aid donors should give high priority to sectors that benefit the poor such as agriculture and infrastructure development in the developing countries to facilitate poverty reduction. By doing so, such countries have a better chance of achieving sustainable transition out of poverty while promoting growth in both short and long run. Also, governments of low income, lower-middle income and upper income Sub-Saharan African countries should increase proportion of their budgetary allocation to the investment in social infrastructure which comprises investment in power, education and health, since investment in these areas can help to improve the welfare of people and reduce poverty level in both short and long run.

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Appendix

A1: List of Countries

Low income Countries	Lower-Middle income countries	Upper income countries
($1,035 or less)	($1,036-$4,085)	($4,086- $12,615)
Benin	Cameroon	Botswana
Burkina Faso	Nigeria	Gabon
Congo Democratic Republic	Mauritania	Namibia
Ethiopia	Senegal	Mauritius
Gambia	Sudan	South Africa
Guinea	Swaziland	
Kenya	Zambia	
Madagascar		
Mali		
Mozambique		
Togo		
Rwanda		
Tanzania		
Uganda		

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