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EFFECT OF FOREIGN AID ON HUMAN DEVELOPMENT IN SUB-SAHARAN AFRICA: A SYSTEM GMM APPROACH

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Abstract
Using data for 47 SSA countries from 2000 to 2016, the study examined the effect of foreign aid on human development in SSA by employing the System-GMM approach, which is specifically applicable to the present case. Results revealed that aid did not affect human development in SSA, whereas, corruption was found to reduce HDI, while trade openness improved it. Validity of results was confirmed by the Arellano-Bond test for autocorrelation in the disturbance term and the Hansen and Sargan tests for the validity of instrumental variables. The study recommended effective framework for utilization of foreign aid and reduction of corruption.

JEL Classification: O11, O15, O55
Keywords: Human Development, Foreign Aid, Sub-Saharan Africa (SSA)

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1. Introduction

Human development has to do with expanding people's choices, enhancing people's capabilities and improving the opportunities available to them. It is both a means and an end. Human development is more than considering economic growth as the latter and increases in income are avenues towards achieving human development but not an end in themselves. This is more so as it is the wealth of the people, rather than that of the economies, that is, after all, valuable to people (Human Development Report, 2016). According to UNDP (1997), human development is "the process of enlarging people's choices"; the choices being referred to in this paper allow people to be better educated, to be healthy and have longevity of life, to be able to enjoy a relatively decent standard of living, as well as political freedom, various components of self-respect and other guaranteed human rights.

Sen (1999) posited that "the usefulness of wealth lies in the things that it allows people to do - the substantive freedoms it helps people to achieve". Therefore, the appropriate view of development must indeed go beyond wealth accumulation and continuous increase in GNP. Thus, human development that includes living standard is a far better measure of the quality of life of the people than growth in per capita income, which only measures the wealth of nation that may not be evenly distributed due to inherent inequalities within a country. While some developing economies have made progress in human development since the beginning of the third millennium, a good number are still far behind in most basic development indicators, including education, health, access to clean and safe drinking water, good food and modern sanitation. Sub-Saharan Africa (SSA) is included in the latter category as a developing region, which, according to Human Development Report (2016), since the inception of the Human Development Index (HDI) had been a low human development region (from 1990-2010), but managed to move up the ladder and be categorized as a medium human development region (2011- 2015). In fact, the HDR (2005) reports pointed out that, among the eighteen countries in which human development reversals occurred between 1990 and 2003, twelve were in SSA and the rest were part of the former Soviet Union. The report linked this obvious lack of or slow HDI progress with lack of improvement in education, to economic stagnation and the continuous spread of HIV/AIDS. Other possible causes may also be badly or poorly implemented developmental policies, conflicts, inter-ethnic and civil wars common in Africa, especially in the 1990s.

In Africa, international aid remains one of the powerful weapons available to achieve development goals, particularly in SSA countries over time. For instance, from 2002 to 2009, Africa received the largest part of Official Development Assistance (ODA) from donor countries. Out of approximately $483 billion received worldwide, about 35 percent was given to African countries (OECD, 2010). Similarly, net disbursements of official development assistance to sub-Saharan Africa rose significantly

between 2000 and 2016 (OECD Statistics). Despite the increase in ODA inflows, the average growth of HDI was 1.67 from 2000 to 2010 and 1.04 from 2010 to 2015 (HDR, 2016).

Mcgillivray and Noorbakhsh (2004) established that aid contributes to aggregate well-being through wage increase as a result of demand for more labour and increases in public and private expenditure on education and health. Aid might be directly used in financing health and education, since most developmental assistance, in the first instance, comes into government accounts in developing countries. This way, aid affects human development indicators in manners that promote human development. The effectiveness of aid can be linked with human development because of its role in supplementing the domestic resource gap, thereby financing public investment in social services, which is directly linked with the welfare of the people. Human capital accumulation is facilitated by channelling foreign aid to education and health facilities, as such, will enhance standards of living if the masses have access to these basic services. However, the pertinent question is the following: 'if aid has the potential to improve human development and growth in the economy, why is the sub-Saharan African region receiving the largest proportion of aid still characterized by low human development, as revealed by the HDI figures?'

The government or its agencies, being the caretakers and users of aid funds, is/are to be directly responsible for using aid efficiently and effectively in order to achieve the human development that is inclusive in nature for the people in SSA countries. However, records and events have shown that, despite the increase in foreign aid to this region, the region is challenged with high ineffectiveness of government and high corruption rates among its government officials. Figures from OECD reports show that foreign aid in the sub-Saharan African region has been increasing over time since the beginning of the century as the growth on average in 2013 reached 6.1 percent in real terms. Meanwhile, a 2002 study by the African Union estimated the cost of corruption in the continent to be around $150 billion a year; this is quite higher than foreign aid to Sub-Sahara African (SSA) economy, which was around $134.8 billion dollars from 2000 to 2013. Corruption affects the disbursement of aid to ensure development as many of these countries have highly corrupt government officials whose actions lessen the effectiveness of aid. According to Transparency International (2017), on a scale of 0 to 100, over 21 sub-Saharan countries scored below 30, which shows that the rate of corruption is high in these countries.

Considering the fact that foreign aid inflow into sub-Saharan African countries has been increasing over the years and few or conflicting views are available on the effect of such ODAs on human development in the region; the present study aims at bridging the obvious knowledge gap. Specifically, the study assessed the effect of foreign aid alongside other control variables, such as government effectiveness and corruption, among others, on human development in SSA. The second section of

this paper reviews past literature, while the third section describes the study methodology. The fourth section presents and discusses the results, while the fifth section summarizes and concludes, accordingly.

2. Literature Review

Studies abound on the nature of the effects of foreign aid on development or on some indicators of development in countries and regions around the world, especially in developing and some emerging economies. Such studies have employed several methods to analyse and examine relationships between these two variables to each other or to other macroeconomic variables with varying objectives and types of data. In these studies, some techniques have remained prominent as they have been considerably used in existing literature. These include Ordinary Least Squares (OLS), Two Stage Least Squares (2SLS), Three Stage Least Square (3SLS), Generalized Method of Moment (GMM), Quartile Regression Approach, Vector Autoregression (VAR), Three Stage Least Squares (3SLS), Instrumental Variable (IV) method etc. While some of the studies have found a positive relationship between foreign aid and human development or some of its indicators, others reported a negative relationship. Some studies reported conditional effect, while others found no effect. This section firstly reviews past empirical works on aid effectiveness and, thereafter, reviews several methodologies that have been used in the literature concerning aid effectiveness.

2.1 Empirical Review

Studies concerned with aid effectiveness in the past have mostly concentrated on how foreign aid could affect economic growth. Only few have actually studied the effect of foreign aid on human development, while some have focused on components of human development.

Boone (1996) examined how effective foreign aid programmes were considering political regimes in recipient countries from a panel of ninety-six countries from 1970 to 1990. The study found that aid effectiveness was independent of the government of the countries - whether they were liberal or repressive. It was further reported that poor people did not benefit much from aid, since it failed to impart human development indicators and did not significantly impact growth and investment.

Burnside and Dollar (2000) assessed the relationship between foreign aid, policies that have to do with economy and per capita GDP growth using a panel of fifty-six different countries from 1970 to 1993. Study results showed that there was a positive relationship between aid and economic growth in developing countries that adopted sound fiscal, monetary and trade policies, but had little or no effect where poor policies were adopted. Kosack (2003) assessed the condition necessary for aid effectiveness in improving people's quality of life and found that aid affected the indicators of life quality positively and it is very significant in democratic countries and negative in

autocracies. Gomanee *et al*, (2003) examined the assertion that "aid can reduce the level of poverty by financing public expenditure", which is likely to be of great benefit to the poor in a sample of 38 countries studied from 1980-1998. The study also built a pro-poor expenditure index using regression to derive the weighted value of each element in the pro-poor expenditure indicator. It was reported that aid inflows and pro-poor expenditure are associated with higher welfare at all quintiles, i.e. they have greater direct impact on the human development index but an inversely proportional relationship with infant mortality.

Mcgillivray and Noorbakhsh (2004) conducted a study on ninety-four developing countries from 1980 to 2000 to examine the way aid and conflict impact human development. The study reported a significant negative effect of conflict and aid on HDI. Furthermore, it was surprisingly reported that aid effectiveness was not influenced by conflict circumstances. Kumler (2007) used a panel data consisting of 87 countries from 1980 to 2000 to examine the effectiveness of foreign aid in improving the level of human development and aggregate welfare and found that foreign aid has a negative relationship with human development. Asiama and Quartey (2009) examined how development aid affected welfare variables in thirty-nine Sub-Saharan African nations from 1975 to 2003 and reported that aggregate bilateral aid may have a positive effect, but did not show any significant effect on human development; on the other hand, financial sector development aid had a negative and significant effect on the human development indicator (specifically, on infant mortality rate).

Akinkugbe and Yinusa (2009) assessed the effectiveness of technical cooperation in improving state capacity for development for attaining the growth and development desired using a panel of forty-eight Sub-Saharan African countries from 1990 to 2007. Mixed effect was discovered on the link between technical assistance and human development in SSA. Gillanders (2011) examined the likely effect of foreign aid in SSA in a balanced panel of thirty-one SSA countries from 1973 to 2005 and reported that growth of the economy responded more to aid shocks in groups characterized by high level of aid dependency, poor or weak institution and better economic policies. It was further reported that human development responded positively to aid shocks in democracies and in good institutional environments. The finding corroborates that by Burnside and Dollar (2000) on the conditional effectiveness of foreign aid.

Okon (2012), using data from 1960 to 2010, carried out an empirical study on the effectiveness of ODA in determining the level of human development in Nigeria and reported a negative relationship between development aid and human development in this country. David (2017) examined the impact of ODA on poverty reduction within ECOWAS for a panel data from 1980 to 2014 and reported a negative but significant relationship between infant mortality rates (the proxy used for poverty level in the study) and ODA. It was concluded that foreign aid was indeed pro-poor but did not enhance growth in West African countries. Williamson (2018) examined the

likely effect of foreign aid (specifically to the health sector) for countries that received health aid from 1973 to 2004 and reported, after controlling for quality of institution and GDP, that foreign aid specific to the health sector did not significantly improve the overall health outcome among recipient countries. The study also reported that aid came out with the expected sign but was not statistically significant on health development indicators.

2.2 Methodological Review

Studies such as those by Boone (1996), Kosack (2003), Akinkugbe and Yinusa (2009) used the OLS technique involving fixed and random effects estimation. These studies reported different results. While Boone (1996) found aid not to be of benefit to the poor, Kosack (2003) found aid to be beneficial depending on the type of government practiced in such an aid-recipient country: it was more beneficial for democratic governments, without, however, improving the quality of life under authoritarian governments. Mcgillivray and Noorbakhsh (2004), Kumler (2007), and Okon (2012) examined the effect of foreign aid on human development. These studies used the 2SLS approach and found foreign aid to be negatively affecting human development indicators. A similar approach, namely the three stage least square (3SLS) used by David (2017), found that ODA negatively impacted infant mortality. However, Burnside and Dollar (2000), using the 2SLS approach found aid to be more effective in countries with better economic policies and less effective in countries with unsound economic policies. The result of Burnside and Dollar (2000) was re-examined by Dalgaard and Hansen (2012) using the same procedures but including some variables necessary for the correct specification of the model; the latter found that aid positively affected growth in any policy environment. Asiama and Quartey (2009) used the Generalized Method of Moments (GMM) and found a negative relationship between aid and welfare variables (life expectancy and infant mortality rate in this case). In a similar study, Gillanders (2011) used the Vector autoregressive framework and found that growth of the economy responded more to aid shocks in groups characterized by high level of aid dependency, poor or weak institution and better economic policies. The study carried out robustness check with the GMM technique. It may be concluded that research findings on the effectiveness of aid on human development differ depending on variables, data, the estimation methods adopted, scope (time covered) and countries. However, debates and discussions on the effectiveness of aid are still on-going. The present study employs up-to-date data with the appropriate estimation method and robustness checks and hopes to report more dependable findings regarding the nature of the relationship existing between foreign aid and human development in SSA.

3. Methodology

3.1 Theoretical Background and Model Specification

The focus of several studies on aid effectiveness over the years has been between aid and other macroeconomic variables, such as savings and economic growth. Not until recently have empirical works started studying the nature of the relationship between aid and human development. The first strand of relevant literature on the effectiveness of aid derived their theoretical background from the Harrod-Domar growth model (Rosentein-Rodan, 1961). Thus, the Harrod-Domar model, which became a reference model in the early 1960s, posits that economic growth is directly related to the level of savings and inversely related to the capital-output ratio, which measures the absorptive capacity of capital. In such a model, savings are perceived as an exogenous factor. Since the shortage of savings is the reason for giving foreign aid to underdeveloped countries, it means savings are directly related to foreign aid, i.e., aid bridges the gap where there is obvious shortage of savings. This, in turn, stimulates investment, which leads to economic growth. While some empirical studies found a positive and significant relationship between aid, savings and economic growth (Papanek, 1972; Newlyn, 1973), others reported a negative and insignificant relationship (Rahman, 1968 and Khan *et al*, 1993).

However, the neo-classical model of growth became the reference point for recent empirical findings (Boone, 1996; Burnside and Dollar, 2000; Kosack, 2003; Fasanya and Onakoya, 2012). The leading neoclassical framework that can serve as a reference model for an aid-effectiveness study is the Solow growth model. This model explains the long run growth by focusing on labour or population growth, capital accumulation and growth in productivity, otherwise known as technological progress. According to Burnside and Dollar (2000), a modified neoclassical model can provide an analytical framework for investigation concerning foreign aid and growth. The interpretation can be that foreign aid serves as income transfer to poor countries, which raises the level of savings that can now be invested and ultimately lead to growth. In the same vein, the modified neoclassical model can provide the necessary framework for empirical investigation concerning foreign aid and economic development (human development). This is so because, economic development is the ultimate goal to be reached when an economy continues to enjoy increase in output production (economic growth). In the world today, policy makers are concerned with economic growth that leads to better standards of living for the populace and, thus, economic development, which promotes human development as a priority. Therefore, this study brings its own novelty by using the Solow growth model as a theoretical explanation for the link between foreign aid and human development.

The Solow model exhibits a Harrod neutral production function, i.e., it is labour augmenting, and the basic assumption of the Solow growth model regards the production function that there are constant returns to scale (CRS) and diminishing returns of input factors. The model is given as:

$$Y = f(K, AL) \tag{1}$$

Where; Y = output, K = capital, AL = effective labour. Because of its constant returns to scale assumption, we can rewrite the model in its intensive form, as follows:

$$Y.\frac{1}{AL} = \frac{1}{AL}\, f(K, AL) \tag{2}$$

$$\frac{Y}{AL} = f\left(\frac{K}{AL}, 1\right) \tag{3}$$

Here, $\frac{Y}{AL} = y$ is the actual output per effective labour and $\frac{K}{AL} = k$ is the capital per effective labour.

Thus, $y = f(k)$ (4)

According to the model, k is a function of savings as a proportion of output "sY".

Thus, $k = sf(Y)$ (5)

Capital accumulation in the economy depends on savings and the depreciation rate of capital. Hence the capital accumulation equation becomes:

$$\acute{K} = sY - \delta K \tag{6}$$

Where $\acute{K}$ is net capital accumulation or the growth of capital overtime, δ is the depreciation of capital and δK represents the investment necessary to replace worn-out capital, sY is Savings per worker needed to make capital investment.

Given that the growth rate of knowledge overtime $\acute{A}/A = g$ and the growth rate of labour over time $\frac{\acute{L}}{L} = n$, the differentiation of capital per effective labour gives its growth rate overtime:

$$k = K/AL \tag{7}$$

The differentiation of the above leads to:

$$\acute{k} = \acute{K}/AL - K\acute{A}L/AALL - K\acute{L}A/AALL \tag{8}$$

Given that the growth rate of knowledge overtime $\acute{A}/A = g$ and the growth rate of labour over time $\frac{\acute{L}}{L} = n$ equation (8) can be written as follows:

$$\acute{k} = \acute{K}/AL - K/AL\, g - K/AL\, n \tag{9}$$

Furthermore, because $\acute{K} = sY - \delta K$ and k= K/AL, the equation (9) can be written as:

$$\acute{k} = (sY - \delta K)/AL - kg - kn \quad (10)$$

$$\acute{k} = (sY)/AL - (\delta K)/AL - kg - kn \quad (11)$$

Since $Y/AL = y = f(k)$ and $k = K/AL$, then equation (11) can be written as follows:

$$\acute{k} = sf(k) - k\delta - kg - kn \quad (12)$$

Collecting the like terms, we would have:

$$\acute{k} = sf(k) - k(\delta + g + n) \quad (13)$$

The equation above is known as the Solow equation. It gives the growth capital per labour ratio, k (also known as capital deepening), and shows that the growth of k depends on savings sf(k) and the cost of capital (δ + g + n).

3.2 Model Specification

The shortage of savings in underdeveloped/developing economies has, however, led to the need for/reliance on foreign aid. Thus, saving as a proportion of income, in equation 5, is related to aid as a proportion of output or income (AID/GDP = AIDN).
Therefore, $k = f(AIDN)$ (14)

Equation (3) can be rewritten by replacing k with AIDN, $y = f(AIDN)$ (15)

Moving forward to proxy output with human development in the model above, equation (15) can be written as: $HDI = f(AIDN)$ (16)

Considering the perceived influence of corruption and government effectiveness in the ability of aid to improve human development, equation (16) is rewritten to include such variables as control; therefore, the corruption perception index, government effectiveness and trade openness were included as such and the model for the study has become:
$HDI = f(AIDN, AIDG, AIDC, CORRUP, GOVEFF, OPEN)$ (17)

However, the equation estimated for the purpose of the study is explicitly stated in econometric as follows:

$$HDI_{it} = a_0 + a_1 HDI_{it-1} + a_2 AIDN_{it} + a_3 AIDG_{it} + a_4 AIDC_{it} + a_5 CORRUP_{it} + a_6 GOVEFF_{it} + a_7 OPEN_{it} + \eta_i + \mu_t + \varepsilon_{it} \quad (18)$$

Where, HDI represents the human development index, AIDN represents aid as a share of the GDP, AIDG is the interaction between aid and government effectiveness, AIDC

represents aid interaction with the corruption index, CORRUP and GOVEFF stand for corruption and government effectiveness, respectively, while OPEN represents trade openness; η represents the country specific effects, μ represents the time effects and ε represents the error term.

The estimation technique preferred in this study is the system-Generalized Method of Moment (System-GMM) regression technique. In relevant literature, it has been established that aid and human development have a bi-causal relationship, which has led to the problem of endogeneity. A well-suited technique to deal with such an endogeneity issue is the GMM methodology, which actually combines the relevant regressors expressed in both their first differences and levels in a system. The GMM technique is divided into two, namely, Differenced GMM and System GMM. The latter is the method preferred in this study, because it has been shown in practice to be capable of correcting for unobserved country heterogeneity, errors due to measurement, omitted variable bias and likely endogeneity problems, which often affect growth estimation (Hoeffler and Tample, 2001; Blundell and Bond, 1998 and Arellano and Bover, 1995).

There are a number of compelling reasons why the GMM estimation approach is preferred and these are carefully enumerated. The modeling strategy, which is dynamic, enables the control of persistence in human development levels since it has behavioral effects that persist. Persistence can be checked through correlation of the HDI and its corresponding first lag. The number of years is lower than the number of countries, i.e., the value of the time period is lower than that of cross-sections. The method leaves room to account for any likely endogeneity problem by controlling for unobserved heterogeneity with time invariant omitted variables. Variations across countries are controlled in the regressions, and, furthermore, Blundell and Bond (1998) postulate that the system GMM estimator corrects for biases associated with the difference estimator. The GMM approach, in particular, fits well for panel data estimations, when the number of periods T is relatively lower, while the value of cross section units N is relatively higher, there are regressors that are not strictly exogenous (endogenous regressors), and fixed effects exist. It is also useful when heteroskedasticity and autocorrelation exist within each country's data but not across countries.

In the present study, the equation is transformed by orthogonal deviations, which is an alternative to differencing and was proposed by Arellano and Bover (1995). The orthogonal deviation subtracts the average of all future available observations of a variable from the existing data of the variable. "No matter how many gaps, it is computable for all observations except the last for each individual, so it minimizes data loss" (Roodman, 2009). Furthermore, included in all estimations are time dummies that capture time specific effects. Time dummies reflect the assumption of no autocorrelation across countries and help reduce the level of autocorrelation among different countries and the idiosyncratic error term, which will certainly lead to a very robust estimation.

However, to avoid proliferation or over-identification of instruments, which causes bias of the GMM estimator, over-fitting of endogenous variables, and weakening of the Sargan/Hansen test, the rule of thumb is that the number of instruments to be included in the model should not be higher than the number of periods in the cross sections (Asongu and Nwachukwu, 2017). The two-step system GMM estimates, which are robust to heteroscedasticity, and the panel-specific autocorrelation with Windmeijer correction for finite samples, which helps eliminate standard error, are specifically adopted. Arellano and Bover (1995) and Blundell & Bond (1998) emphasize the need to conduct serial correlation tests for the random error term in the GMM estimation. The serial correlation tests are called AR(1) and AR(2) tests. AR(1) test has a null hypothesis that there is no autocorrelation, specifically concerning the first order in the error term series, while the null hypothesis of AR(2) is that there is no serial correlation specifically concerning the second order type in the error term series. For better results, it is important that the null hypothesis of AR(1) test should be rejected, while the null hypothesis of AR(2) test should be accepted. In testing for overall validity of the instrumental variables used, the Sargan and Hansen test, which is a test of over-identifying restrictions, is used. It is good to know that the consistency of the GMM estimator depends on the validity of instruments. The null hypothesis under both Sargan and Hansen tests is that all instrumental variables, as a group, are exogenous. Therefore, a higher p-value (insignificant) is desirable so that the stated null hypothesis may be accepted. According to Bond (2002), the good estimate of the lagged dependent regressor should fall between its OLS and Within-Group (Fixed Effect) estimates. Thus, these estimates provide a useful robustness check on results. To this end, this study carried out the post-estimation exercise in order to establish the validity and correctness of estimates.

3.3 Data Sources and Measurement

This study assessed the effect of foreign aid on human development in sub-Saharan Africa. Given the importance of human development and the role of government in addressing the problem of low human development in the region, data from a total of 47 SSA countries were utilized in the course of the study. Human development, which is the dependent variable, was measured as an index, as given by the human development index of the UNDP database. Foreign aid is measured in Dollars as a ratio of GDP of the countries in the study in constant 2010 US Dollar price. Aid was originally in current US dollar price in the World Development Indicator (WDI) database but was converted to constant 2010 US Dollar price as appropriate. Trade openness measures the degree of openness of the economy to trade, as captured by the addition of import and export as a ratio of the GDP and was sourced from WDI. The interaction of foreign aid and government effectiveness was captured by multiplying both variables. The same was done to capture the interaction of foreign

aid and the corruption index. Government effectiveness and control of corruption estimates, which give a country score ranging from approximately -2.5 to 2.5, were sourced from the World Governance Indicator (WGI).

4. Results and Discussion

4.1 Pre-estimation: Analyses carried out here included descriptive statistics and correlation analyses of study variables.

Descriptive Statistics of Variables

The descriptive statistics presented in Table 1 gives a glimpse of the basic statistics of study variables. It includes measures of central tendencies, dispersion, minimum and maximum values, degree of peakedness (measured by the kurtosis values), asymmetry (measured by the skewness statistics), and the normality test (measured by the Jarque-Bera statistics) of all the series considered in the study. From Table 1, HDI, AIDN, AIDG, AIDC, GOVEFF, CORRUP and OPEN have mean values of 0.471138, 0.083079, -0.06897, -0.05105, -0.72936, -0.61893 and 78.39425, respectively. All variables except AIDG and AIDC were positively skewed, while all variables were leptokurtic, except for GOVEFF and CORRUP, which were both mesokurtic, since their values were close to three. The Jarque-Bera statistics is significant for all variables suggesting that they were all not normally distributed.

Table 1. Descriptive Statistics of Study Variables

	HDI	AIDN	AIDG	AIDC	GOVEFF	CORRUP	OPEN
Mean	0.4711	0.0830	-0.0689	-0.0511	-0.7293	-0.6189	78.3942
Median	0.4540	0.0637	-0.0354	-0.0329	-0.7723	-0.7155	68.6868
Maximum	0.7820	1.0941	0.0377	0.1682	1.0494	1.2167	351.1057
Minimum	0.2550	-0.0020	-1.3973	-0.7970	-2.1632	-1.7727	19.1008
Std. Dev.	0.1065	0.0958	0.1235	0.0845	0.6154	0.6127	42.2426
Skewness	0.68223	4.4740	-5.3305	-2.9502	0.5136	0.7302	2.2811
Kurtosis	3.2372	38.9769	45.9323	18.5009	2.7595	2.9821	11.6891
Jarque-Bera	57.5679	42377.63	60336.17	8482.01	32.2819	61.8655	2825.238
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sum	339.2190	61.4783	-51.0351	-37.7731	-507.64	-430.78	55189.55
Sum Sq. Dev.	8.1585	6.7920	11.2676	5.2842	263.26	260.94	1254459
Observations	720	740	740	740	696	696	704

Source: Authors' computation 2018

Correlation Analysis

Correlation refers to the degree of linear joint movement or relationship between two or more variables and this was computed in the present study as part of the pre-estimation analysis in order to avoid multicollinearity in the model to be estimated. From the Table 2, it can be deduced that the variables in the model did not exhibit high correlation up to 0.95, which, according to Iyoha (2004), can cause serious multicollinearity among variables if they exist together in an econometric model.

Table 2. Correlation Matrix

	HDI	AIDN	AIDG	AIDC	GOVEFF	CORRUP	OPEN
HDI	1						
AIDN	-0.38666	1					
AIDG	0.376004	-0.90855	1				
AIDC	0.484377	-0.79493	0.909374	1			
GOVEFF	0.574897	-0.21225	0.427758	0.471797	1		
CORRUP	0.543456	-0.06056	0.257149	0.440921	0.845457	1	
OPEN	0.440047	-0.01465	-0.02758	0.087155	0.090832	0.173906	1

Source: Author's computation 2018

4.2 Model Results

The estimated results of the two-step system GMM are presented in Table 3. Here, the instrument collapsed and was also set to a lag limit of 2 and limit of (2-1) for level equation, while corruption was removed from the instrument list in order to avoid instrument proliferation. The estimated results revealed that one period lagged HDI has significant and positive effect on present year HDI at 1 percent level of significance. This may reflect a specific trend in human development indicators in the sub-region. It is worthy of note that foreign aid does not significantly affect human development, since the coefficient of the aid variable, albeit positive, was not significant. This corroborates the work of Boone (1996), who also reported that foreign aid does not affect development. Neither the interaction of foreign aid with government effectiveness nor its interaction with the corruption index was significant at any acceptable risk level. However, corruption was revealed to be significant and negative. The coefficient value of -0.0126 implies that a one percent increase in the corruption perception level in the sub-region resulted in a 0.0126 percent decrease in the human development index. The major implication of this is that corruption significantly reduced human development in Sub-Sahara Africa. The reason for this is not farfetched because, if money and other resources needed for developmental projects (such as road, hospital and school constructions, provision of stable power supply and the provision of an enabling environment for businesses to survive) is embezzled because of high level

of corruption, indices of basic human development will decline. Trade openness was also found in this study to be positive and significantly affecting human development in line with *a priori* expectations. Proper management of trade relations with other countries is ordinarily expected to positively impact the livelihood of the people.

The F-statistic indicated statistical significance indicating the overall significance of the model. In addition, the number of instruments in the model was 25, which is below the number of groups, thereby reducing the chance of having the problem of instrument proliferation that weakens the Sargan and Hansen tests.

Table 3. Two-step system-GMM Estimation Results
Dependent Variable: HDI

Two-step estimates with robust standard errors			
Independent variables	Co-efficient	t-statistics	Probability value
LAGGED HDI	0 .8962***	3.92	0.000
AIDN	0.1185	0.34	0.732
AIDG	0.0591	0.15	0.884
AIDC	0.0337	0.12	0.901
GOVEFF	0.0153	0.29	0.771
CORRUP	-0.0126**	-2.37	0.011
OPEN	0.0231**	2.12	0.046

F-stat: 1.24e+07 **Prob-value (F-stat):** 0.000
Number of instruments = 25, **Number of groups** = 47, **Number of observations** = 598
Source: Author's Computation 2018

4.3 Post-estimation Analyses

Serial Correlation Test

The GMM methodology tests for serial correlation using the Arellano-Bond test of autocorrelation are AR(1) and AR(2) tests. The null hypothesis is that there is no autocorrelation. The AR(1) and AR(2) came out with a probability value of 0.031 and 0.237, respectively. The AR(1) test, which tests for serial correlation at first difference, rejects the null hypothesis at 5% level of significance implying the presence of autocorrelation. According to Arellano and Bond (1991), the AR(1) test should be rejected so that the GMM result may be valid. The AR(2) test accepts the null hypothesis, which should be theoretically so. Both the AR(1) and AR(2) tests validate the estimates of the system-GMM result (Table 4).

Table 4. Arellano-Bond test of autocorrelation

	Z-statistics	Probability value
AR(1)	-2.15	0.031
AR(2)	1.18	0.237

Source: Authors' Computation 2018

Sargan and Hansen Tests

The consistency of the GMM estimates depends on the validity of instruments. The Sargan and Hansen tests are both tests of over-identifying restrictions, which test for the overall validity of the instrumental variables used in the estimation process. The null hypothesis was that all instruments as a group were exogenous or, more specifically, that all instruments are valid. The Sargan and Hansen tests statistics in the present study have probability values of 0.224 and 0.317, respectively, both indicating the acceptance of the null hypothesis, i.e., that the instruments were valid.

Table 5. Presentation of Sargan and Hansen tests

	chi-square statistics	Probability value
Sargan test	1.48	0.224
Hansen test	1.00	0.317

Source: Author's computation 2018

OLS and Within-group (Fixed Effect) estimates

Results of the OLS regression in Table 6 reveal that the lagged HDI was significant at 5% level with a coefficient value of 0.9890. All other variables except trade openness (which is significant at 10 percent level) were insignificant at an acceptable level.

Table 6. Summary of Ordinary Least Squares estimates (OLS)
Dependent Variable: HDI

Independent Variables	Regression Coefficients	t- Statistics	Probability Value
LAGGED HDI	0.9890	236.93***	0.000
AIDN	0.0050	0.64	0.521
AIDG	0.0121	1.38	0.167
AIDC	-0.0133	-1.53	0.126
GOVEFF	0.0013	1.37	0.170
CORRUP	0.0004	0.51	0.609
OPEN	0.00001	1.72*	0.087
CONSTANT	0.0089	3.83**	0.000

R^2 = 0.9973 Adjusted R^2= 0.9972 F-Stat = 10060.29 Prob (F-stat) = 0.0000
**Significant at 10%, **Sig at 5% and ***sig at 1 %*
Source: Author's Computation 2018

Fixed Effect Estimation Results

Table 7 shows the results of the Within Group (Fixed Effect) estimation and it shows that the lagged HDI coefficient was 0.8186, significant at a 5% probability value. The interaction variable between aid and corruption (AIDC) came up with a negative and significant coefficient. This may reveal how corruption slows down or reverses the initial objective foreign aid is meant to achieve. Furthermore, trade openness (OPEN) impacted positively on HDI implying that, if the region opens its economies to beneficial trade, it will certainly translate to positive changes in human development.

Robustness Check of the System GMM Results

According to Bond (2002), the validity of the System GMM results, among other criteria, depends on the ability of the lagged dependent variable to fall in the range of its pooled OLS estimate and its Within-group (Fixed effect) estimates. The lagged HDI of two step system GMM fell in between its values in both pooled OLS (Table 6) and Within-group estimates (Table 7), i.e., 0.8186 < 0 .8962 < 0.9890 in the present study. Hence, the validity of the model is confirmed.

Table 7. Summary of Within-Group (Fixed Effect) Estimation
Dependent Variable: HDI

Independent Variables	Regression Coefficients	t- Statistics	Probability Value
LAGGED HDI	0.8186***	43.52	0.000
AIDN	0.0134	0.97	0.333
AIDG	0.0230	1.79	0.074
AIDC	-0.0251**	-2.15	0.032
GOVEFF	0.0020	1.01	0.313
CORRUP	0.0018	0.95	0.344
OPEN	0.00003***	3.66	0.000
CONSTANT	0.0950***	9.46	0.000

R^2 = 0.9756 F-Stat = 1012.89 Prob (F-stat) = 0.0000
****Significant at 10%, **Sig at 5% and ***sig at 1 %***
Source: Authors' Computation, 2018

5. Conclusion

There has been influx of Official Development Assistance (ODA), otherwise known as foreign aid, into Sub-Sahara African countries. There is abundant literature on the assessment of the impact of foreign aid on human development, as a whole, or some indices (indicators) of human development (such as education, health, standard of living, etc.) and results have been very diverse. While some authors have reported a positive relationship, others have reported a negative one, while some have found no relationship between the two variables. The system GMM was adopted, because, among other reasons, the number of countries was higher than the number of years considered. Results of the panel analysis show that foreign aid did not significantly affect human development in SSA, and it should be noted that this, actually, corroborates some literature findings, such as those by Boone (1996). The non-significance of foreign aid should be regarded as a serious issue because it implies that the objective of the donors of foreign aid, for which funds were released, were not being achieved. However, some control variables were found to significantly affect HDI in SSA. For instance, it was found that corruption significantly reduced the HDI, while trade openness improved it. This was further corroborated by the result of the OLS and Fixed effect/Within-group estimation, through which it was shown that foreign aid interacted with the corruption index, reduced the HDI, while trade openness improved it. The phenomenon of corruption is a serious 'drag' on development in SSA, as shown in this study, and there is a dire need, now more than

ever, to curb the menace of corruption if the region aspires to develop and level up with other regions around the world. Moreover, no matter what the volume of funds released to SSA in the form of foreign aid may be, the pervasive corruption, especially in the government, will inhibit its effectiveness. The implication is that measures to reduce corruption should be adopted, while an appropriate framework for effective utilization of foreign aid is put in place, so that Sub-Saharan African countries may benefit maximally from aid programmes. Furthermore, SSA countries should be encouraged to open-up their economies to beneficial trade relationships with the outside world, which would ensure human/economic development.

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