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The Relationship Between Foreign Aid and Growth: A Comparative Analysis of Low Income, Lower-Middle Income and Upper-Middle-Income African Countries

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Abstract
Our paper studies 53 African economies by segregating them into 27 Africa low-income economies (ALICs), 18 Africa lower-middle-income economies (ALMICs) and 8 Africa upper-middle-income (AUMICs) economies according to United Nations (UN) income threshold categorization. The paper uses panel data of aid and GDP (economic growth) with control variables from 1990 to 2015 to investigate the direction and causal linkage between aid and economic growth in a quest to fill the void created by previous empirical literature in generating inconclusive results on the effects of foreign aid on economic growth through aggregate countries studies. Our study addresses this gap by employing Pedroni (1999) panel cointegration method to test the cointegration relationship between the series and the granger causality is investigated by the pooled mean group estimator (PMGE). Then, we investigate whether or not a strong relationship between aid and economic growth holds by using Pedroni (2001) method of Panel FMOLS and DOLS estimates. The results established the existence of cointegration relationship between aid and growth in all the three income sub-groups. There is also evidence of bidirectional granger causality between aid and economic growth in low- income and lower-middle income sub-groups. The results however record unidirectional causality in the case of African upper-income sub-group. There are mixed panel FMOLS and DOLS findings for the groups. The panel results indicate a strong relationship between aid and growth for the lower and upper-middle-income economies and no strong relationship for the low-income countries. The issues of strong aid-growth relationship in the individual country case analysis present a new perspective to policy makers to understand by taking into consideration the specific degree of GDP growth in each country in order to formulate effective aid-based policies to propel growth.
Keywords: foreign aid, economic growth, Africa, disaggregated aid, Causality Analysis

1. Introduction

Since the beginning of the century, Africa's economies have experienced robust economic growth averaging 5-6 percent annually. The progress is reflected in a number of countries rising to become Middle-Income countries (MICs) whiles others still remained as Least Developed Countries (LDCs) which are considered as the poorest of the world. Currently, there are 109 middle-income countries (MICs) and 31 low-income countries. Out of the 109 income countries, 53 are lower income countries and 54 are upper lower income countries according to the new thresholds report that is determined at the start of the World Bank's fiscal year in July (See World 2017). The categorization is dependent on the per capita threshold of the countries. Table 1 shows the new thresholds for classification by income

Table 1: new thresholds for classification by income

Income Threshold	GNI/Capita (current US$)	Countries
Low-income (Least developed Countries)	< 1,005	Guinea, Rwanda, Benin, Guinea-Bissau, Senegal, Burkina Faso, Sierra Leone, Burundi, Somalia, Central African Republic. Liberia, South Sudan, Chad, Madagascar, Tanzania, Malawi, Togo, Congo, Dem. Rep., Mali, Uganda, Eritrea, Mozambique, Zimbabwe, Ethiopia, Gambia, Niger, Comoro
Lower-middle income	1,006 - 3,955	Angola, Nigeria, Côte d'Ivoire, Cameroon, Congo rep, Cape Verde, Djibouti, Egypt, Ghana, Lesotho, Morocco, Mauritania, Sudan, São Tomé and Principe, Swaziland, Zambia, Kenya, Tunisia
Upper-middle income	3,956 - 12,235	Botswana, Algeria, Gabon, Libya, Mauritius, Namibia, South Africa, Equatorial Guinea
High-income	> 12,235	Seychelles

African countries which have moved to middle income status have also increased over time and now stands at 27 countries (World Bank 2017). Notwithstanding the middle-income status achieved by many of these

countries, there is still high level of poverty and unfavourable human development indicators reminiscent of a major challenge. Least developed countries (LDCs) per definition are low-income countries facing austere structural impairments to sustainable development. These countries are extremely susceptible to both external and internal economic shocks with low levels of human assets. The least developed countries received formal (United Nations) UN endorsement in 1971. Currently there are 47 LDCs and more than two thirds of these countries are located in Sub-Saharan Africa (34) (OECD 2016). Whiles LDCs experience rising incomes, extreme poverty is still high. OECD 2016 reports that over half of the population in LDCs lives in extreme poverty as against 12% in other developing countries. The international community continuous to provide foreign aid to MICs and LDCs and the practice has been in existence for long. Dating back to the UN formal endorsement of the LDC category in 1971, the LDCs have benefited from distinctive and preferential treatment in view of enhancing economic growth and evading the poverty trap. The UN 'programme of Action'' (POAs) adopted in 1980 at the united nations conference for least developed countries' in Paris provided a framework through which development assistance are provided to LDCs while subsequent bilateral and multilateral aid to LDCs were done on successive UN POAs. Writing on Africa, (Moyo, 2009) asserts Africa aid in the last 50 years is estimated to be over one trillion US dollars. Available data from the 1990s to 2010 indicate that the increase in aid to LDCs surpassed the overall increase in global aid and begin to take a downward spiral. Aid figures in 2014 points to total waning in aid allocation to LDCs in real terms. The figure 46 billion in 2010 is recorded and dropped to 41 billion in 2014 but again experience an upward adjustment to 131.6 billion in 2015. In the midst of this monumental aid and shift in income status, many LDCs and MICs category of African countries are still bedevilled with underdevelopment, poverty, and little economic transformation triggering the debate of effectiveness of aid. The debate on effectiveness was topical and gained momentum at the Paris declaration endorsed by organization for Economic Co-operation and Development (OECD) Development Assistance Committee (DAC) members in 2005. Several empirical Studies on the effectiveness of foreign aid in growth promotion has been robustly disputed and produced mixed results. Some of these studies found foreign aid to be correlated with growth (Stoneman, 1975, Fayissa & El-Kaissy, 1999, Lensink & White, 2000; Hansen & Tarp, 2000, 2001; Clemens, Radelet, Bhavnani, & Bazzi, 2012; Bru¨ckner, 2013) whiles other studies produced negative results as in the cases of aid (Doucouliagos & Paldam, 2009; Easterly, 2003a; Easterly, 2003b; Easterly, Levine, & Roodman, 2004; Kosack, 2003; Rajan & Subramanian, 2008; Roodman, 2007) as reported by Zohid Askarov And Hristos Doucouliagos, (2014)

Some also reasoned that the international community role in middle-income countries should be minimal because of the increased domestic resources and international private capital at their disposal. Others think that most MICs are still confronted with considerable structural deficits and susceptibilities affecting their development process.

Our paper contributes to this debate on aid effectiveness literature by focusing on a specific group of countries investigating the effects of foreign aid on growth in LDCs and MICs economies in Africa. Although, there are many research works done with regards to foreign aid and its impact on economic growth in country-specific level and regional level, to the best of our knowledge, there is no focus on comparative analysis on the subject in the same region to comparatively measure the impact of aid on growth in LDCs and MICs. This will be a significant contribution to academic knowledge and a concise suggestive policy document to donors in aid policy formulation.

2. Literature Review

Countless academic literature written on foreign aid and growth and foreign aid effectiveness over the past 30 years have engaged the attention of scholars with varying outcome of the studies. One class of writings lead evidence to the support foreign aid promotion of growth theory whiles others led credence to the theory that foreign aid has no effects on growth if not having detrimental effects on growth.

The school of thoughts that support evidence that foreign aid does not lead to growth school can be put into two viewpoints, namely.

a) Foreign aid does not lead to economic growth

This assertion is that aid does not have any effect on growth. (Easterly, 2003a; Easterly, 2003b; Easterly et al., 2004; Rajan & Subramanian, 2008; Roodman, 2007) all have led evidence to prove that aid does not lead to growth. Interestingly, Boone (1994) vehemently assert that aid has no significant and positive correlation with growth simply because all foreign aid almost goes into consumption and Rajan & Subramanian, (2008) support the same assertion by pointing to the property of fungibility of aid indicating such a property makes aid ineffective. (Mosley, 1980; Mosley et al., 1987) are all proponents of the thought that aid does not impact growth. Moyo (2009) strongly proposed the following as reasons why aid does not impact growth in Africa: 1) misplaced sectoral allocation of aid: he argued that less than 6.5% of development assistance and resources are allocated to sectors that drive nations development and growth such as education, healthcare, infrastructure, energy, agriculture, technology, and the environment; 2) Unbridle corruption and diversion of aid: The

development resources and debts that are meant for the financing of the sectors of development are siphoned, diverted corruptly government and development administrators which benefit themselves, families, and associates and not direct and invested in the needed sectors of the country's economy for enhanced growth; 3) in the cold war period, donor countries policies on aid is preferred to African countries that alien to them thereby making Official Development Aid (ODA) inflow unpredictable and non-dependable in long-term development planning. There are also donors conditionalities attached to the aid that makes the distribution of aid pre-emptive and effective use difficult for development 4) finally, aid from developed countries to African countries was for trade which is unsuitable for African development and mostly this trade is inappropriate and not suitable to African conditions.

b) Foreign aid leads to negative influence on growth.

The second contention is that aid has significant negative effects on the economic growth of recipient countries. Several researchers present evidence to that effect. Mallik (2008) using six poorest and highly-dependent countries in Africa, he studied the impact of aid in stimulating growth. He used cointegration analysis covering the period between 1965 and 2005, he found out that in five out of the six countries aid is negatively related to growth in the long run except for Niger. In the short run analysis, there is apparently no significant impact of aid on economic growth. There are other interesting findings by Knack (2001) who argued dependence on aid has the propensity to undermine institutional fight of corruption, incite conflict of aid funds control, and divert public sector rare talent to the aid industry. This assertion is in part synonymous to the findings of Svensson (2000) who study confirmed that foreign aid in ethnically heterogeneous countries causes increased corruption with greater impact. (Brautigam, 2000:3) alludes to the fact that Aid can lead to fiscal indiscipline by aid recipient governments who will ignore prudent fiscal principles and engage in a riskier fiscal behaviour because of the knowledge of donors' availability. This is seemly in tandem with the work of Collier and Dollar (2004) who posits that foreign aid directly augments public resources and lessens the need for a recipient government in financing its expenditures via taxation which augments government resources. Finally, Ear (2007) contends that FDI can be reduced on dependence on Aid.

In the context of developing countries, foreign aid is examined to be imperative to economic growth, principally in Africa, where foreign aid is the key source of foreign capital inflows. Understandably, foreign aid potentially has a unique role to play in boosting economic growth, raised incomes and reduce poverty in developing countries (Pallageet al, 2001). Loxley and Sackey (2008) examined 40 countries within the period between 1973 and 2004 and established that aid provokes economic growth through investment. Addison et al. (2005) also affirm aid and growth positive connexion in SSA via poverty reduction. Gomanee et al. (2005) studied the transmission mechanisms that aid used to impact growth in 25 Sub-Saharan African countries stretching from the period 1970 to 1997 and established a positive relationship when Investment was the key transmission mechanism, as well as, via import financing and government consumption.

3. Methodology

3.1: Scope of Study

New thresholds for classification of income by the World Bank 2017, put countries of the world into low-income, lower-middle income, and upper-middle income categorisations. Even though these categorised countries are from different regions of the world, they seem to be challenged with similar economic and other developmental upheavals hence, have been benefiting from the official development assistance programs over the years. These nations are not however homogenous but with heterogeneous characteristics because of their location in different regions. These nations have heterogeneity in their ownership of natural resources, population dynamics, and governance. The considerable geographical disparities that exist between these different countries, as well as regional and national economic, social and political factors, have bearing on the impact of aid these nations receive. Consequently, our consideration and inclusion of countries in this study is exclusively African low-income countries (ALIMs) and Africa middle-income countries (AMICs) and not a full set of the various global income threshold categorisations so as to have a more homogenous regional sample to deal with the issue of regional disparities. We will do a comparison of these three-income threshold categorised economies and draw the distinction and similarities bearing in mind that cross-country analysis also contains heterogeneity.

3.2 Model Specification

In responding to the question of economic growth–aid causality, a multiplicity of approaches has been developed. These approaches are central to assessing the effects of aid. In this section, we discuss the specifications of the model to address the direction of causality of aid and economic growth in aid recipient economies. Our model is founded on preceding growth models used in past growth literature and empirics to address basically two objectives: firstly, to estimate and compare the long-term impact of aid on growth in low income countries, lower-middle income and upper-income Africa countries over the period 1990 to 2015, and secondly, to comparatively estimate the impact of disaggregated aid on growth in the same income categories. Consequently,

following conventional procedural practice in causality analysis, we first test the properties of the panel data to determine whether the variables are stationary or non-stationary. If the determination that shows that the variables are stationary-their distribution does not follow any trend or change over time, a granger causality could be computed. Stationarity avoids the problem of spurious regression. In the case of non-stationarity, a vector error procedure can be used. We use the panel unit root tests, including Levin and Lin (1993) and Im, Pesaran, and Shin (2003) (IPS hereinafter called) versions and ADF Fisher type test statistic (termed Phillips-Perron tests), that runs with unbalanced panel data. The null hypothesis holds that all panels contain a unit root thereby making them non-stationary. We reject the null hypothesis when the test statistic is lower than the critical value. In the event that the series confirms that series are integrated at 1(1), the conditionality of panel cointegration and panel granger causality tests is fulfilled, in which case we test the connection between the variables. A version of the panel augmented Dickey-Fuller unit - test is as follows:

$$\begin{bmatrix} \Delta x_{1t} \\ \Delta_{2t} \\ . \\ . \\ . \\ \Delta x_{Nt} \end{bmatrix} = \begin{bmatrix} y_1 x_{1t-1} \\ y_2 x_{2t-1} \\ . \\ . \\ . \\ y_N x_{Nt-1} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ . \\ . \\ . \\ e_{Nt} \end{bmatrix}$$

By definition; N describes cross-sections number. The assumption of the error terms is said to be white noise processes. The null hypothesis of one panel unit root is defined by $y_1 = y_2 = ...y_n = 0$

The regression of Levin and Lin (1993) (LL) panel unit root test is given by: $\Delta x_{it} = y_i x_{it-1} + e_{it,}$, for i =1, N and t=1, …, T.

The definition of the panel estimator is given by:

$$\sqrt{NT(\hat{y}-1)} = \frac{\frac{1}{\sqrt{N}}\sum_{i=1}^{N}\frac{1}{T}\sum_{t-1}^{T} x_{it}e_{it}}{\frac{1}{\sqrt{N}}\sum_{i=1}^{N}\frac{1}{T^2}\sum_{t-1}^{T} x^2{}_{it-1}}$$

The t-statistics for the null hypothesis test of the panel unit root is:

$$t_y = \frac{(\hat{y}-1)\sqrt{\sum_{i=1}^{N}\sum_{t=1}^{T} x_{it-1}}}{\sqrt{\frac{1}{NT}\sum_{i=1}^{N}\sum_{t-1}^{T} e_{1t}^2}}$$

The Monte Carlo experiments led by Levin, Lin and Chu (2002) specify that the panel-based unit root test power is much comparably higher than the individual unit root tests.

The IPS test allows for a varied coefficient of unit root and it also allows for an average of the individual Dickey-Fuller tests. It is defined below:

$\bar{t} = \frac{1}{N}\sum_{i=1}^{N} t_i$ Where t_i is the individual t-statistic for testing $H_0 : \gamma = 0 \forall i, i = 1,....,N.$ The IPS null hypothesis test is given by $\gamma_i < 0$ for $i = N_1 + 1, N_1 + 2,...., N$ such that $\lim_{N\to\infty} = \frac{N_1}{N} = c, 0 < c \leq 1$ Therefore, the test permits heterogeneity in the panel. Monte Carlo experiments done by Karlsson and Löthgren (2000) also validates the IPS test to have improved power properties.

Next, we proceed to test the cointegration of the variables. Our empirical model for guesstimating the aid-growth causality is given as:

$$GDP_{it} = \alpha_0 + \sum_{j=1}^{J} \rho_j GDP_{it-j} + \sum_{k=2}^{K} \gamma_k Aid_{it-k} + \varepsilon_{it} \quad (1)$$

$$Aid_{it} = \alpha_0' + \sum_{j=1}^{J} \alpha_j Aid_{it-j} + \sum_{k=1}^{K} \gamma_k' GDP_{it-k} + \varepsilon_t' \quad (2)$$

By definition: GDP proxy economic growth in real per capita GDP and Aid for the measure of foreign aid which is net official development assistance (ODA) as a share of GDP, and ε is the error terms. J and K are the maximum lags used for the tests, i proxies the receipt countries and t for time.

Where the subscripts i and t characterise countries and time respectively. GDP_{it}, is per capita GDP growth of the ith country for t period and proxy economic growth. Aid_{it}, denotes 'Aid' or foreign aid, which is net official development assistance (ODA) from country i at time t. J and K are the maximum lags used for the tests. ε_{it}, is the error term. We also restrict the number of lags to 1 so that the largest dataset can be conserved for the low-income countries, lower-middle -income and upper-middle-income countries.

To measure the distinctive component of aid on growth, we also disaggregated aid into its distinctive component and measure the impact on growth. That equation is given by

$$GDP_{it} = \alpha_0 + \sum_{j=1}^{J} \rho_j GDP_{it-j} + \sum_{k=2}^{K} \gamma_k DAid_{it-k} + \varepsilon_{it} \quad (3)$$

$$DAid_{it} = \alpha_0 + \sum_{j=1}^{J} \alpha_j DAid_{it-j} + \sum_{k=1}^{K} \gamma_k GDP_{it-k} + \varepsilon_t \quad (4)$$

Where $DAid_{it-k}$ is the disaggregated aid components (which are multilateral or Bilateral aid).

After testing for the causality, we then continue in line with the work of (Ozturk, Aslan and Kalyoncu 2010) to conduct Panel FMOLS (Fully modified Ordinary Least Squares) and DOLS (Dynamic Ordinary Least Squares) estimates developed by Pedroni (2001). Pedroni (2001) recommended more authoritative test which is proficient than single equation procedures with the potency to investigate directly the cointegrating vector condition required for strong relation to be established. With these methods, we are able to advance the null hypothesis in a more natural form in order to test for the existence on otherwise of a strong connexion between aid and economic growth exits for all countries of the panel consistently. Our models as suggested by Pedroni (2001) and used by (Ozturk, Aslan and Kalyoncu 2010) is as follows:

$$y_{it} = \alpha_i + \beta_i Aid_{it} + \mu_{it}$$

Where $i = 1, 2, 3, \ldots\ldots N : t = 1, 2, 3, \ldots\ldots T$

By definition, y_{it} is the GDP per capita, Aid_{it} defines aid. y_{it} and Aid_{it} are in cointegration with the regression equation slope β_i which maybe homogenous across i or maybe not.

$$y_{it} = \alpha_i + \beta_i Aid_{it} + \sum_{k=ki}^{ki} y_{ik} Aid_{it} + \mu_{it}, \quad i = 1, 2, 3, \ldots\ldots, N, \quad t = 1, 2, 3, \ldots\ldots T$$

From equation (1), let $\varpi_{it} = (\hat{\mu}_{it}, Aid_{it})$ = stationary vector comprising the assessed residuals and differences in P.

Again let, $\Omega_{it}^{1} = \lim_{T \to \infty} E\left[T^{-1} (\sum_{t-1}^{T} \varpi_{\pi})(\sum_{t-i}^{T} \varpi_{iT})' \right]$ =the long-run covariance for this vector process decomposed as $\Omega_i = \Omega_i^0 + \Pi_i + \Pi_i'$ where Ω_i^0 is the concurrenting covariance; Π_i is the weighted sum of autocovariances.

The group mean (FMOLS) estimators are stated as

$$\hat{\beta}_{GMF}^{*} = N^{-1} \sum_{1}^{N} \left[\sum_{t=1}^{T} (Aid_{it} - \overline{Aid}_i)^2 \right]^{-1} \left[\sum_{t=1}^{T} (Aid_{it} - \overline{Aid}_i) y_{it}^{*} - T\hat{\gamma}_i \right]$$

By definition $y_{it}* = (y_{it} - \bar{y})_i - \frac{\hat{\Omega}_{21i}}{\hat{\Omega}_{22i}} Aid_{it}$ and, $\hat{\gamma}_i = +\Gamma_{21i}^{*} + \Omega_{21i}^{*} - \frac{\hat{\Omega}_{21i}}{\hat{\Omega}_{22i}} (\Pi_{22i} + \Omega_{22i}^{0})$. Between

dimensions estimator is $\hat{\beta}^*_{GMF} = N^{-1}\sum_{i=1}^{N}\beta_{CFM.i}$ where $\sum_{i=1}^{N}\beta_{CFM.i}$ = the conventional estimator is applied to the ith country of panel. T-statistics are calculated as $t_{\hat{B}^*_{GMF}} = N^{-0.5}\sum_{i=1}^{N} t_{\beta^*_{CFM.i}}$ where $t_{\hat{\beta}^*_{CFM.i}} = (\beta^*_{CFM.i} - \beta_0)\left[\Omega^{-1}_{11i}\sum_{t-1}^{T}(Aid_{it} - \overline{Aid_{it}})^2\right]$

From equation 2, the group-mean panel dynamic ordinary least square (ODLS) estimator is $\hat{\beta}^*_{GMD} = N^{-1}\sum_{1}^{N}\left[\sum_{t=1}^{T} z_{it}z'_{it}\right]^{-1}\left[\sum_{t=1}^{T} z_{it}\tilde{y}_{it}\right]$ where z_{it} is a 2(k+1)1 vector of regressions dimension. DOLS estimator is written as $z_{it} = Aid_{it} - \overline{Aid}_{it}, \Delta Aid_{it-k,\ldots,}\Delta Aid_{it+k}$ and $\tilde{y}_{it} = y_{it} - \overline{y}_{it}$. Between dimension estimators can also calculated as $\hat{\beta}^*_{GMD} = N^{-1}\sum_{i=1}^{N}\beta^*_{CD.i}$ where $\beta^*_{CD.i}$ is traditional DOLS estimator applied to the ith country. t-statistic are $t_{\beta^*_{GMD}} = N^{-0.5}\sum_{i=1}^{N} t_{\beta_{CD.i}}$ where $\beta^*_{GMD} = (\beta^*_{CD.i} - \beta_0)\left[\tilde{\sigma}_i^{-2}\sum_{t-1}^{T}(Aid_{it} - \overline{Aid_{it}})^2\right]^{0.5}$ and the long-run covariance of the residuals from DOLS regression.

3.3 Description of Data and Variables

The data employed covers 27 Africa low-income countries, and 18 Africa lower-middle-income economies, 8 Africa Upper middle-income economies totally 53 economies within Africa over the full sample period of 1990-2015. Conventionally, the measure of aid inflow is the net official development Assistance (Net ODA) from the Organisation for Economic Cooperation and Development (OECD). (Chang, Fernandez-Arias, & Serve´n, 2002) intimates that from the donor's perspective, the ODA measures the net resource transfer but with consideration of an "all-or-nothing approach" to specific flows inclusion. Multilateral aid is given by a multilateral organization whose membership is made up of member governments, who collectively govern the organization and are its primary source of funds. Bilateral aid represents aid given by a government directly to the government of another country.

4. Results and Discussion

4.1 Descriptive Statistics

Table 2 presents the descriptive statistics of our main variables of interest under study

Summary Statistics Income Countries					
variables	**Observation**	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**
Upper-Middle Income Countries					
GDP	186	3.556843	13.73291	-62.22509	140.5011
AID	I86	1.99E+08	2.64E+08	-14520000	1.42E+09
Bilateral Aid	186	1.81E+08	2.41E+08	-17210000	1.35E+09
Multilateral Aid	186	55.83672	71.47220	2.840000	510.3000
Lower-Middle Income Countries					
GDP	456	1.910065	4.307351	-27.14594	30.35658
Aid	456	6.92E+08	9.64E+08	13130000	1.14E+10
Bilateral Aid	456	4.97E+08	7.71E+08	8660000.	1.10E+10
Multilateral Aid	456	194.4989	195.5121	6.760000	1354.720
Low-Income Countries					
GDP	649	0.818811	7.950622	-50.23014	91.64805
Aid	649	6.34E+08	7.11E+08	19310000	5.53E+09
Bilateral Aid	649	4.34E+08	5.03E+08	12800000	5.09E+09
Multilateral Aid	649	246.8607	243.7525	-101.6400	2226.860

Note: Aid, Bilateral aid and multilateral aid are types of ODA in Current US dollars

4.2 Panel Root Tests

Conventionally, it is the practice to see long-run cointegrating parameters as reflecting relationships of cointegration among $I(1)$ set of variables. In research standard methodology, the order of cointegration among the variables is first established and having established that the variables are in the same order of cointegration, then we proceed to conduct test to see whether there is at least one linear relationship among the variables.

In this unit root test, the variables of interest ought to be stationary at $I(1)$ or $I(0)$ and no variable should be integrated at $I(2)$.The use of non-stationary data is avoided in order to avoid spuriousness or misinterpretation of regression results (Granger, 1969). Our findings overwhelmingly reject the null hypothesis of unit root at first difference and also at some isolated instance at levels. This means that our series are uniquely integrated at first difference $I(1)$ and in some isolated cases at $I(0)$. It is interesting to note that these findings are consistent with the Neoclassical Theory of economic growth. Consequently, we examine a cointegration analysis in the next phase for the determination among the different variables in the panel the existence of one or more long run relationships.

Table 3: Unit root tests for GDP and Aid

	LL		IPS		PP	
Methods	No Trend	Trend	No Trend	Trend	No Trend	Trend
Variables	**Low Income Countries**					
GDP	-3.507*	0.588	-2.305*	0.120	386.088*	107.245*
Aid	1.731	0.500	2.460	0.839	77.146	79.753*
Bilateral aid	0.096	0.157	1.494	0.651	54.299	56.899
Multilateral aid	-0.875	-0.553	-0.150	-1.172	95.834*	121.949*
1st Difference						
GDP	-11.803*	-12.274*	-7.484*	-3.048*	325.482*	243.916*
Aid	-9.647*	-7.098*	-12.187*	-9.606*	529.636*	525.694*
Bilateral aid	-8.874*	-6.209*	-11.356*	-8.429*	446.308*	627.171*
Multilateral aid	-13.068*	-10.402*	-15.1984*	-12.1641*	629.124*	1360.69*
Levels	**Lower Middle-Income Countries**					
GDP	-8.812*	-5.463*	-6.948*	-2.477*	55.358*	121.775*
Aid	-2.388*	-3.631*	-3.085*	-3.625*	66.2643*	54.4300*
Bilateral aid	-1.599	-2.775*	-2.413*	-3.429*	2.806*	59.758*
Multilateral aid	-4.855*	-6.947*	-4.597*	-6.368*	96.148*	104.879*
1st Difference						
GDP	-17.673*	-22.389*	-15.006*	-9.519*	318.816*	285.060*
Aid	-19.116*	-16.190*	-19.104*	-16.677*	367.319*	482.189*
Bilateral aid	16.538	-13.700*	-17.436*	-14.350*	338.605*	535.949
Multilateral aid	-25.157*	-17.203*	-25.198*	-19.420*	467.057*	1188.08*
Levels	**Upper- Middle Income Countries**					
GDP	-8.156*	-7.984	-1.066	0.645	54.1598*	43.663*
Aid	-0.076	0.859	0.170	-0.438	20.496	31.428*
Bilateral aid	-0.241	0.391	-0.392	-2.441*	20.243	29.523
Multilateral aid	-1.583	-1.813	-1.517	-2.012	23.805	28.550
1st Difference						
GDP	-14.744*	-10.861*	-4.767*	-2.612*	116.901*	368.437*
Aid	-2.951	-0.604	-6.921*	-5.183*	179.399*	119.190*
Bilateral aid	-10.749*	-7.568*	-12.145*	-10.131*	140.747*	146.635*
Multilateral aid	-16.219*	-14.585*	-14.377*	-13.087*	160.532*	135.555

NB: LL, IPS and PP are Levin, Lin and Chu; Im, Pesaran, and Shin and Phillips-Perron Panel root test respectively. The null hypothesis is that all panels contain Unit roots.

4.3 Panel Cointegration Test and Estimations

In the second estimation, a cointegration relationship between economic growth and aid is conducted by employing Pedroni (1999) cointegration framework. The Pedroni cointegration framework caters for both heterogeneous and homogenous panels' cointegration tests. Pedroni recommends different cointegration tests that permit for cross-sectional heterogeneous intercepts and trend coefficients across. Seven repressors contingent on seven residual-based statistics are available. The null hypothesis of no cointegration is rejected when the one-sided v-statistic has positive and large values and negative and large values reject the null hypothesis of no cointegration of the other test statistics.

Table 4: Results of Panel Cointegration

	Intercept	trend & Intercept	No Intercept/ trend
Within dimension test Statistics		**LOW INCOME COUNTRIES**	
Panel v – Statistic	-2.811	-5.507	-1.471
Panel p-statistic	-6.415*	-4.470*	-6.276*
Panel PP-statistic	-15.828*	-18.215*	-12.437*
Panel ADF statistic	-15.916*	-18.029*	-12.549 *
Between dimension Test statistics			
Panel p-statistic	-4.737*	-2.633*	-6.070*
Group PP-statistic	-18.617*	-19.516*	-17.52
Group ADF statistic	-17.010*	-17.114*	-16.973*
		Kao Residual Cointegration Test	
Kao (1999) AD t-statistic			-17.512*
	Intercept	trend & Intercept	No Intercept/trend
Within dimension test Statistics		**LOWER MIDDLE-INCOME COUNTRIES**	
Panel v – Statistic	-1.629	-3.755	-0.659
Panel p-statistic	-4.425*	-3.098*	-4.530*
Panel PP-statistic	-10.003*	-12.367*	-8.563*
Panel ADF statistic	-9.7581*	-11.882*	-7.585*
Between dimension Test statistics			
Panel p-statistic	-2.589*	-1.095	-3.977*
Group PP-statistic	-12.282*	-14.705*	-12.876*
Group ADF statistic	-12.159*	-11.542*	-10.610*
		Kao Residual Cointegration Test	
Kao (1999) ADF t-statistic			-6.003*
	Intercept	trend & Intercept	No Intercept/trend
Within dimension test Statistics		**UPPER MIDDLE-INCOME COUNTRIES**	
Panel v – Statistic	0.602	-3.381	-0.65
Panel p-statistic	-3.531*	-1.933*	-4.530*
Panel PP-statistic	-7.120*	-9.736*	-8.563*
Panel ADF statistic	-7.130*	-8.821*	-7.585*
Between dimension Test statistics			
Panel p-statistic	-1.718**	-0.746	-3.977*
Group PP-statistic	-7.048*	-8.942*	-12.8
Group ADF statistic	-6.989*	-8.041*	-10.610*
		Kao Residual Cointegration Test	
Kao (1999) ADF t-statistic			-4.643510*

Note: ***, ** and * denote significance at the 1, 5 and 10% level respectively. The null hypothesis is Null No cointegration. The Trend assumption is no deterministic trend and the Automatic lag length selection based on SIC with a max lag of 1

Table 4 presents the results of both the within the dimension and between dimension cointegration test statistics. The test estimates reject the null hypothesis at 1% significance in the low-income countries at all the tests with the exception of panel v-statistic in the within dimension test. The lower-middle and upper-middle countries also pass all the test at 1 percent significance at all the dimension test statistics except at the panel v-statistic at the within dimension statistic and one insignificant value at the between dimension test. The Kao (1999) statistic also provides the same positive results at 1% significance level for all the incomes sub-groups. The implication is that both Pedroni (1999) and Kao (1999) panel cointegration tests reject the proposition of the null hypothesis providing evidence in support of the belief that aid and GDP are co-integrated for the whole panel in the long-run. Since there is evidence of a long run relationship between foreign aid and GDP growth, we, therefore, proceed to test for causality and the result is presented in Table 5.

4.4 Direct Growth Estimates

The test for panel granger causality is predicated on the fact that the Pedroni (1999) cointegration test established a long run cointegration as is seen in Table 4. We therefore examine the direction of causality between GDP and Aid within the panel framework based on the two main regression equations (1) and (2). The estimation of equation (1) and (2) are achieved by the use of the pooled mean group estimator (PMGE) proposed by Pesaran et al. (1999). We use optimal lagged levels of our series dated t–1 following the example of (Menard, Audrey, Laurent, and Weill 2016). Choosing the number of lags j and k is conventionally a critical issue. Dumitrescu and Hurlin (2012) used the formula $T > 5 + 2X$, where X is the number of lags and T standing for the number of time periods in determining the minimum extent of time we need for each number of lags. So, we restrict the number

of lags to one so that the largest dataset can be conserved for the least developed Countries, Lower middle - income and Upper middle-income countries.

4.4.1 Main Aid Granger Causality tests

Table 5 shows the regression measuring the impact of aid on growth.

Table 5: Results for Main Aid Granger Causality tests

	Low income countries	**Lower middle - income**	**Upper middle -income**
GDP Regression			
Dependent Variable	**H_0: AID DOES NOT GRANGER CAUSE GDP (AID → GDP)**		
	Aid	**Aid**	**Aid**
GDP	**1.53***	**1.270***	**3.270***
	(2.21)	(2.450)	(1.710)
ECM_{t-1}	**-0.864***	**-0.590***	**- 0.524***
	(0.061)	(0.069)	(0.093)
AID REGRESSION			
	H0: GDP DOES NOT GRANGER CAUSE AID (GDP → AID)		
	GDP	**GDP**	**GDP**
Aid	**7.66****	**451.0***	**279.0**
	(3.94)	(611.o)	(602.0)
ECM_{t-1}	**-0.008***	**-0.147 ****	**-0.170****
	(0.002)	0.042)	(0.066)
Conclusions			
	Bidirectional Causality	Bidirectional Causality	Unidirectional Causality

Note: *** indicates statistical significance at the 10% level and ** represents 5% and * is 1% significance level. Standard errors are in parenthesis and all the trend specification is constant level. Dependent lags estimates are fixed as well as the Dynamic repressors estimates.

Our findings show that aid granger hugely causes GDP in low-income countries, lower-upper income, and upper-middle income countries. This finding of a link between GDP and Aid is akin to many other empirical findings (see Yakama Manty Jones, 2013; Ferreira, Simões, 2013; Gomanee et al. 2005). These conclusions are also somewhat in accordance with the studies by (Alemu and Lee, 2015) who found aid positively significant for Africa middle-income countries and low-income countries. Ekanayake and Chatrna's (2010) also obtained positive relationship for aid and growth Sub-Saharan Africa and Duc (2006) somewhat obtained a negative relationship between aid and growth for Sub-Saharan Africa. This finding is a reasonable finding given that aid is a major source of foreign capital injection into these economies. This capital provides supplementary finances to governments in undertaking capital-intensive projects. Some government budgets are even financed by donors' aid. Some donors' donations assist in the private capital formation and technical assistance which is a particular kind of aid that helps in technology transfer, knowledge diffusion and capital injection wherefore economic growth is stimulated. We allowed for feedback analysis, strangely enough, the feedback hypothesis led evidence to the effect that growth in all the income subgroups also cause Aid inflow except in the upper-middle income sub-group. Even though the level of income regulates the donation of aid where poorer countries are the largest recipients as well as countries with lower growth, Rajan, and Submaranian, (2005) summits that countries achieving higher levels of growth with the proven record of effective aid usage also receives aid. The former demystifies our findings.

4.4.2 Disaggregated Aid Components Granger Causality tests

Previous empirical findings suggest that granger causal relationship is predicated on the aid type received by the receipt economies from donors or/and with the type countries involved in the analysis (Okada and Samreth, 2012). In the spirit of this literature exposure, we extend our estimations to include aid types such as (Bilateral aid and multilateral aid). We run regression to establish the link between economic growth and these dimensions of aid. Our aim is to understand the fundamental relationship between growth and aid by subjecting these components of aid to separate empirical scrutiny. We understand that the disaggregated total aid components-bilateral and multilateral aid can both exert unique influence on economic growth or in the reverse, be influenced in different ways by GDP.

Consequently, similar analysis is done with the disaggregated aid components as it is done in the case of the main aid analysis above to see their impact on growth. From the table, bilateral aid and multilateral granger cause growth in lower-middle-income countries and bilateral aid also cause growth in upper-middle-income countries. Both components remain insignificant in the low-income countries. In the feedback hypothesis, growth granger causes bilateral aid in low-income countries and lower-middle income countries but absence in upper-income countries. Growth however granger cause multilateral aid in all the income subgroups in the

negative.

Before the additional estimates, it is imperative to state that our empirical results are occasioned by data availability, duration, specification involved in the estimation methodologies as well as the methodology itself. These are primarily the determinants of the outcome of the results which found aid significant in influencing growth in the direct growth estimations where aid granger causes growth.

Table 6: Disaggregated Aid granger causality estimates

	Low income countries		**Lower middle – income**		**Upper middle –income**	
GDP Regression (Aid components →GDP)						
Independent Variable	Bilateral aid	Multilateral aid	Bilateral aid	Multilateral aid	Bilateral aid	Multilateral aid
GDP	**-0.019**	**0.511**	**0.233***	**1.1762***	**0.173***	**0.055**
	(0.344)	(0.316)	(0.075)	(0.261)	(0.016)	(0.258)
ECM_{t-1}	**0.915***	**-0.938***	**-0.826***	**-0.786***	**-0.616**	**-0.763***
	(0.061)	(0.073)	(0.102)	(0.080)	(0.138)	(5.155)
Bilateral Aid Regression (GDP → Bilateral Aid)						
	GDP		**GDP**		**GDP**	
Bilateral Aid	**0.151***		**2.023***		**0.010**	
	(0.027)		(0.446)		(0.0163)	
ECM_{t-1}	**-0.103***		**-0.0305***		**-0.315***	
	(0.027)		(0.053)		(0.051)	
Multilateral Aid Regression (GDP →Multilateral Aid)						
	GDP		**GDP**		**GDP**	
Multilateral Aid	**-0.001***		**-0.061***		**-0.020***	
	(5.100)		(0.013)		(0.004)	
ECM_{t-1}	**-0.328***		**0.499***		**-0.382***	
	(0.030)		(0.078)		(0.127)	
Conclusions						
	Unidirectional causality in both aid components dimensions		Bidirectional causality in both aid components dimensions		Unidirectional causality in both aid components dimensions	

Note: *** indicates statistical significance at the 10% level and ** represents 5% and * is 1% significance level

4.5 Additional estimations

4.5.1 Panel FMOLS and DOLS estimates

Pedroni (2001) proposed a reliable test to investigate the condition directly on the cointegrating vector which is necessary for a strong relation as compare to single equation methods. With these methods, we can test for the presence of a strong relationship between the given variables. In our case, we test whether or not strong relationship exists between aid and GDP by posing the null hypothesis in a more natural way to ascertain whether the strong relationship between the variables holds consistently for all countries of the panel.

The tables 7, 8 and 9 below report the results of all the FMOLS and DOLS test results which reveal whether aid FMOLS and DOLS kindle growth or not in the investigated economies. The bottom of the table contains the individual FMOLS and DOLS estimates as well as the panel estimates.

Table 7: Panel FMOLS and DOLS test results Least Developed Economies

Country	FMOLS	t-statistics	MOLS	t-statistics
Burkina Faso	-5.662	-3.085***	-7.788	-9.151***
Burundi	-1.445	-1.393	-0.612	-0.820
Benin	-8.974	-4.350***	-12.451	-3522***
Central African Republic	1.889	0.747	0.872	0.311
Chad	-14.372	-2.905***	-11.842	-6.536***
Congo Democratic Republic	-6.675	-1.766*	-4.959	-0.674
Comoros	-4.783	- 4.145***	-0.656	-0.131
Eritrea	-17.109	-4.620***	-17.350	-3.183**
Ethiopia	-6.676	-0.838	-11.468	-0.936
Guinea	-1.005	-0.718	-3.035	-1.219
Guinea-Bissau	-10.432	-10.799***	-10.766	-13.993***
Gambia	-1.922	-0.718	-13.536	-3.153***
Liberia	-4.649	-5.126***	-5.100	-6.163***
Madagascar	-14.718	-5.645***	-19.423	-5.811***
Malawi	-1.272	0.312	25.596	1.546
Mali	-3.532	-1.600	-7.876	-1.956*
Mozambique	-6.845	0.853***	-8.140	-4.066***
Niger	-1.298	-0.587	-6.088	-2.693***
Rwanda	-4.711	-3.683***	-5.053	-2.114*
Sierra Leone	-9.269	-3.809***	-10190	-10.343***
Somalia	1.772	4.042	0.000	0.000
South Sudan	-0.609	-0.103	0.000	0.000
Senegal	-1.489	-1.086	-3.158	-1.368
Tanzania	-19.048	-7.764***	-24.921	-3.624***
Togo	-4.228	2.597	-11.217	-2.988***
Uganda	-15.718	-6.002***	-12.272	-2.390**
Zimbabwe	-4.178	-0.796	-22.641	-4.164***
Panel Results	0.908	2.348***	1.009	1.720*

NB: *, **and ***1%, 5% and 10% are significant rejection levels respectively. $H_0 : B_i = 1$ is for the t-statistic

Inferencing to the table 7, there is a prodigious rejection of the null hypothesis of a strong relationship running from aid to GDP. With the individual country estimates, data from all countries rejected the null hypothesis at the 1% level of significance for the FMOLS except for the Central African Republic which is rejected at 10% level. Similarly, except for Eritrea and Mail and Rwanda which produce rejection at 5%, 10% and 10% respectively, all the rest of the countries produce rejection at 1%. In addition, there is a strong relationship between aid and GDP for Burundi, Central African Republic, Ethiopia, Guinea, Gambia, Malawi, Mali, Somalia, South Sudan, Senegal, Togo, and Zimbabwe in the case of the FMOLS test. The implication is that as aid, increases, GDP will correspondingly increase for these countries. With the DOLS estimates, Burundi, Central African Republic Congo Democratic Republic, Comoros, Ethiopia, Guinea, and Malawi rejected the null hypothesis and affirm strong aid - GDP relation. Looking at the panel result estimates of FMOLS AND DOLS show weak results for the least developed countries.

Table 8: Panel FMOLS and DOLS test results for Lower middle-income economies

Country	FMOLS	t-statistics	MOLS	t-statistics
Angola	-345.410	-6.851***	-391.357	-8.891**
Cameroon	-22.263	-1.877***	17.074	0.559***
Cape Verde	-13.947	-4.451***	-4.490	-0.645
Côte d'Ivoire	-13.947	-2.833***	2.895	0.709
Congo Republic	-39.648	-4.353***	-35.789	-2.113**
Djibouti	-9.982	-13.794***	-9.660	-7.387***
Egypt	-39.292	-0.881	204.177	0.761
Ghana	-31.607	-2.939***	-29.884	-1.670
Lesotho	-32.477	-6.416***	-36.336	-4.540***
Mauritania	-9.433	-2.930***	-4.536	-1.231
Morocco	-91.878	-2.883***	-176.690	-1.880*
Nigeria	-284.828	-2.272**	-391.761	-2.983***
São Tomé and Principe	-15.701	-18.960***	-20.244	-5.463**
Sudan	--60.939	-1.328	5.117	0.0737
Swaziland	-75.220	-5.064***	-73.754	-3.765***
Kenya	-18.352	-4.891***	-14.743	-4.884***
Tunisia	-160.542	-3.050***	-170.466	-1.348
Zambia	-25.739	-5.069***	-31.269	-3.262***
Panel Results	-1.480	1.342	1.722	1.4545

NB: *, **and ***1%, 5% and 10% are significant rejection levels respectively. $H_0 : B_i = 1$ is for the t-statistic

The individual panel FMOLS and DOLS estimates for lower-middle-income economies are tabulated in Table 8. Among the individual estimates, 15 economies result demonstrated a rejection at 1% level for the FMOLS. Similarly, the strong relationship is rejected at 5% level for Nigeria. However, Egypt and Sudan individual estimates confirm the presence of a strong relationship between aid and Growth. More so, the strong relation case cannot be rejected for Cameroon, Cape Verde, Egypt, Ghana, Côte d'Ivoire, Lesotho, Mauritania, Sudan and Tunisia in the DOLS analysis. Except for São Tomé and Principe and Congo Republic which is rejected at 5% level and Morocco at 10% all the other countries demonstrate rejection at 1% level in the DOLS analysis. The panel FMOLS and DOLS tests report a case of a strong relationship that runs from aid to GDP. This is suggestive of aid significantly impacting GDP of lower-middle income economies at the panel level whiles the results are weak for the individual lower-middle-income economies.

Table 9: Panel FMOLS and DOLS test results for Upper middle-income economies

Country	FMOLS	t-statistics	MOLS	t-statistics
Algeria	-1677.944	-4.440***	-1830.573	2.1728**
Botswana	-176.000	-3.979***	-261.4611	-4.355***
Equatorial Guinea	-581.305	-2.818***	-1231.754	-8.126***
Gabon	-98.435	-3.208***	-134.586	-3.226***
Libya	5171.046	0.453	1747.532	19.793***
Mauritius	-411.407	-4.768***	-485.881	-2.978***
Namibia	-48.758	-3.213***	3.554	0.317
South Africa	489.245	-0.537	-557.245	-0.1947
Panel Results	9.815	-0.861	-2.809	-0.1575

NB: *, **and ***1%, 5% and 10% are significant rejection levels respectively. $H_0 : B_i = 1$ is for the t-statistic

Table 9 reports the test results of panel FMOLS and DOLS for upper middle- income economies. Per the FMOLS analysis, all but except for Libya and South Africa where a strong relationship cannot be rejected, all the other 6 countries vehemently rejected the null hypothesis of a strong relationship. On the other hand, Namibia and South Africa show a robust relationship between aid and GDP whereas Algeria rejected same at 5% and the other 8 countries rejected same at 1% level in the DOLS analysis. For the panel data test, the results confirm a strong relationship between aid and growth at both FMOLS and DOLS tests.

The overall results of our study provide evidence to the effect that in some cases there is a strong relationship between aid and GDP on specific countries bases in all the income grouping categories as well as a large degree of no strong relationship in most countries. On the panel basis, the strong relationship preposition running from aid to GDP was overwhelmingly rejected in the least developed economies, whereas the hypothesis of a strong relation between aid and growth was underscored in the context of lower-middle-income economies and upper-middle-income economies. Instructively, the evidence of strong relationship between aid and growth

in the lower middle-income economies and upper-middle-income economies indicating that aid leads economic growth. gives the cause for the rigid pursuance of aid inflow policies whereas, in the case of the least developed economies where the results are suggestive of no strong relationship, there is the need for reconsideration of a strong aid application policies.

5. Conclusion

There is an emergent literature that examines the relationship between AID and GDP growth which measure economic growth. A large chunk of this literature focuses on developing, developed and emerging countries. It is imperative for policymakers to understand the relationship between Aid and economic growth in order to design effective donors and recipients' policy reflecting the essence of aid donation and reception. A general conclusion from these studies is always varied which has tremendous research setback.

In this study, we use the panel data of aid and GDP for the 53 Africa economies countries using annual data from 1990 to 2015. The countries studied are divided into three groups: Africa low-income group (least developed countries), Africa lower middle-income group and Africa upper middle-income group. The aim of this study is to investigate if there is a relationship between Aid and growth, examine the granger causality between these variables and then show the significance of this relationship. A relationship between aid and economic growth is investigated by employing Pedroni (1999) panel cointegration method and granger causality is investigated by the pooled mean group estimator (PMGE). Then, we investigate whether or not a strong relationship between aid and economic growth holds by using Pedroni (2001) method of Panel FMOLS and DOLS estimates.

The results established the existence of cointegration relationship between aid and growth in all the three income sub-groups. There is also evidence of bidirectional granger causality between aid and economic growth in low-income and lower-middle income sub-groups. The results however record unidirectional causality in the case of African upper-income sub-group.

In the disaggregated aid components analysis. The result show unidirectional causality in both aid components dimensions, bidirectional causality in both aid components in the lower-middle sub-group and unidirectional causality in both aid components in the upper-middle

Finally, there are mixed panel FMOLS and DOLS findings for the groups. The panel results indicate a strong relationship between aid and growth for the lower and upper-middle-income economies and no strong relationship for the low-income countries. The issues of strong aid -growth relationship in the individual case analysis is important for policy makers to understand and also take into consideration the specific degree of GDP growth in each country in order to formulate effective aid-based policies to propel growth. The evidence of strong relationship between aid and growth in the lower-middle-income economies and upper-middle-income economies affirming that aid leads to economic growth gives calls for the rigid pursuance of aid inflow policies whereas, in the case of the least developed economies where the results are suggestive of no strong relationship, there is the need for reconsideration of a strong aid application policy. In addition, due consideration of the degree of economic growth in each aid recipient economy must be given by policymakers in the formulation of aid policy. A strategic collaboration by aid donors and recipients are needed to ensure the right amount of aid is applied to the right interventions originally intended for as guaranteed by the issuance of the aid.

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