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FOREIGN AID AND ECONOMIC GROWTH IN SUB-SAHARAN AFRICAN COUNTRIES

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Abstract

This study investigates the effect of Official Development Assistance (ODA) on economic growth in Sub-Saharan African (SSA) countries using a panel of 24 countries over 38 years, extracted from the World Development Indicators, African Development Bank and the Penn World Tables 9.0. (2006). We employ the moment moment quantile regression approach to establish whether the effect of ODA varies along the conditional economic growth distribution. Quantile estimates show that ODA is positively related to economic growth in the Sub-Saharan Africa (SSA) region. Moreover, our study finds that the positive impact of aid is bigger in the countries with high levels of economic growth-- the results show a positive statistically significant effect at 75^{th} and 95% quantiles for 5% and 10%, respectively. Controlling for social infrastructures and institutions quality, the results also show a positive and statistically significant relationship between this control variable and economic growth in 50^{th} quantile, 75^{th} quantile and 95^{th} quantile, suggesting that improvement in institutions quality brings much benefit to the countries within those quantiles compared to those in the lower quantiles. Incorporating institutions quality institutions variable and interaction terms into the model influences the effect of aid on economic growth. With those variables ODA is only effective in countries located within the 25^{th} and 50^{th} quantiles, implying that aid has significant effect on economic growth net of institutions quality and other control variables. The implication of our findings is that aid can be strategically employed as a central instrument for stimulating economic growth in SSA countries, particularly low-income countries.

Keywords: Official Development Assistance, MM-QR, GDP

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1. Introduction

Over the past four decades, Sub-Saharan African countries (SSA) have been receiving huge amounts of foreign aid, in the form of total Official Development Assistance (ODA). According to Arndt and Jones (2015) in 1960 the ODA was disbursed between USD 38,192.36 million to USD 14,6676.1 million in 2015. The UN (2015) points out that from 2000 to 2015, developing regions received a great deal of support through the Millennium Development Goals (MDGs), which primarily focused on addressing development challenges in the world's poorest countries. This commitment to eradicate poverty and suffering has persisted and carried out into the new era of 2030 Agenda for Sustainable Development. This is the new framework of development cooperation that unifies the world in its efforts to achieving a sustainable future.

According to the UN (2015), a key feature of the 2030 Agenda in the Sustainable Development Goals (SDGs) comprised of 17 goals and 169 targets[1] is to reduce poverty and inequality and promoting economic growth and economic development afterwards. As pointed out by Murshed and Khanaum (2013), these goals were accepted by the major donor countries as guiding principles for their assistance. However, despite these efforts, both poverty and inequality remain very high in SSA, with the data showing that per capita gross domestic product (GDP) has fallen to 0.59% in those countries. Moreover, it is evident that the impact of ODA on growth is still ambiguous. In other words, there is no consensus among economists on whether that form of foreign aid has helped or harmed economic growth in those specific countries. Furthermore, some studies such as that by Moyo (2009) point out that instead of helping economic growth in SSA countries, several of these countries appear to have become more dependent on ODA.

As already mentioned above, after several decades of research in the field of international trade, the direction of the impact of ODA on economic growth remains uncertain. Moreover, there is some contradiction at the empirical level. For example, some studies such as those undertaken by Papanek (1973), Levy (1988), Burnside and Dollar (2000), Dalgaard et al. (2004), Karras (2006), Rajan and Subramania (2008), Ndambendia and Njoupougnigni (2010), Zoundi (2015), Gillanders (2016), and Adedokun (2017) found evidence that ODA stimulates economic growth, while others (Gong and Zou, 2001; Mallik, 2008; Mitra and Hossain, 2013, and Mitra et al., 2015) point out that ODA is detrimental to economic activities.

As depicted from the Appendix A, over the decades ODA grew quite significantly. However, GDP did not grow at the same levels as ODA did. This implies that ODA might not be yielding the expected results in the recipient countries. In addition, the existing studies, except that by Zoundi (2015), fail to analyse this impact considering the extent to which these countries depend on ODA. For instance, Moyo (2009) stresses that there is a room that ODA turns SSA countries into foreign aid dependence, but she did not assess how those countries absorb ODA and how this yields the expected results in the less dependent countries.

Unlike Moyo, Zoundi segregates his data into two subsamples (dependent and non-dependent countries on foreign aid). However, although Zoundi's study looks similar to this study, it is worth to stress that (i) the former does not really look at the effectiveness of foreign aid. But, instead, it looks at its absorptive capacity; and (ii) Zoundi uses a limited sample from 15

[1] See the 2030 Agenda in the SDGs report for more detailed discussion of these goals and targets.

countries[2], which leads to scepticism when generalizing the results to the entire continent. These factors suggest that there is a gap in the existing literature that needs to be filled up.

In this context, the general objective of this study is to investigate the impact of ODA on economic growth by employing moment quantile regression model to explicitly pinpoint the effect of aid at various points of the economic growth distribution, taking the SSA countries as a case study.

The results suggest that ODA is positively related to economic growth in the SAA region. Moreover, our study finds that the positive impact of aid is bigger in the countries with high levels of economic growth. In other words, the higher is the quantile, the higher is the impact yielded by ODA on growth. In addition, we found that controlling for institutions quality plays a significant role at different quantile distributions, suggesting that improvement in institutions quality brings much benefit to the countries within the 50^{th}, 75^{th} and 95^{th} quantile compared to those in the lower quantiles. These results change when we control for social infrastructures, institutions quality and ODA, their inclusion in the model suggest that ODA yield expected results in countries within the 25^{th} and 50^{th} quantiles. This imply that countries lagging behind might need more of the ODA relative to countries that are relatively ahead and therefore, more focus should be given to those needy countries.

The remainder of this paper is organized as follows. Section two gives the relevant literature review (i.e., directly related to the topic of this study). Section three presents the methodology used to achieve the objectives of this study. Section four describes the data of analysis. Section five analyses the econometric results. The last section concludes this paper and gives recommendations.

2. Literature Review

Many authors over the years have tried to define the concept of ODA. Among the existing definitions, those developed by Ijaiya and Ijaiya (2004), Murshed and Khanaum (2013), and Eroglu and Yavuz (nd) stand out. In this context, Ijaiya and Ijaiya (2004) define ODA as a source where development is internationally financed. According to them, there are two types of ODA, namely bilateral and multilateral. In turn, Murshed and Khanaum (2013) define ODA as a donation of services, money, and goods from one country to another. Contrarily, Murshed and Khanaum (2013) stress that such donations can be addressed for different purposes since they can be humanitarian and altruist. Finally, Eroglu and Yavuz (nd) define the concept of ODA as a tool that is widely and accepted as a flow of financial resources from rich to poor countries. This study uses the definition of the concept of ODA developed by Murshed and Khanaum (2013).

With the nature of ODA as previously discussed, its impact on economic growth in SSA should be notable. However, it has been long that the impact of ODA on growth is debated. Therefore, after Boene (1996), many recent studies (discussed ahead) have been carried out to address the impact of foreign aid on economic growth. A body of empirical studies has already been conducted to investigate the relationship between ODA and economic growth, and the findings are not conclusive. Earlier studies on this topic found contradictory results when it comes to the direction of the relationship between those two variables of primary interest of this study.

[2] ECOWAS member countries.

For example, among the studies whose results show positive relationship between ODA and economic growth, those undertaken by Levy (1988), Dalgaard et al. (2004), Karras (2006), and Ndambendia and Njoupougnigni (2010) stand out. In this context, Levy (1988) used a panel data and cointegration analyse to investigate the extent to which ODA impacted economic growth in SSA, and his results showed that there was a positive relationship between the two variables. In turn, Dalgaard et al. (2004) employed different estimation procedures such as ordinary least squares (OLS), two-stage least squares (2SLS) and generalized model of moments (GMM) in a sample of about 65 countries over the period of three years (1999 to 2001), and came into the same conclusion as Levy. However, Dalgaard et al. highlighted that good trade, monetary policy, and fiscal policy have more and positive impact on growth in the Third World countries. This highlight suggests that perhaps developing countries should improve their policies to improve the results yielded by ODA. Using a sample of 71 developing countries over the period 1960-1997 and a dynamic fixed effects (DFE) model, Karras (2006) concluded that foreign aid is positively correlated with economic growth. Finally, Ndambendia and Njoupougnigni (2010) used econometric techniques such as mean group, pooled mean group estimator, and DFE model, and found a positive relationship between ODA and growth.

On the other hand, among the studies whose results show negative relationship between ODA and economic growth, those undertaken by Rajan and Subramania (2008), Mitra and Hossain (2013), Mitra et al. (2015), and Adedokun (2017) stand out. In this context, Rajan and Subramania (2008) used panel data and an instrumental variables econometric technique and found little robust evidence of either negative or positive impact of ODA on growth. Using the cointegration econometric technique, Mitra and Hossain (2013) investigated the existing relationship between ODA and growth in Philippines over the period of 40 years and obtained results showing that an increase in foreign aid by 1% led to a decrease in economic growth by 0.51%, *ceteris paribus*. However, the two authors found a different impact of trade openness, a result that perhaps indicates that African countries ought to think first in improving their trade policies, and by so doing, ODA would have much better results compared to those yielded within poor trade policies (Mitra et al., 2015). Finally, Adedokun (2017) used GMM, and an extensive panel data set to investigate the impact of ODA on economic growth in SSA countries. He obtained results showing that ODA has an insignificant negative impact on economic growth in aggregate SSA. Adedokun points out that these results are mostly due to bad governance and weak institutions, which are key factors to proportionate good environment for ODA effectiveness, as also indicated by Ijaiya and Ijaiya (2004). While numerous studies have been carried out on the effect that aid might have on economic growth, no consensus has been achieved regarding the matter in developing countries. Moreover, we are not aware of any studies that have examined the distributional nature of the impact of aid on growth in the sample of countries under study. More specifically, the key contribution of our study is that we employ quantile regression model to explicitly pinpoint the effect of aid at various stages of the economic growth distribution. This method beats the traditional estimation procedures such as OLS, due to its robustness to outliers in the dependent variable. Evidently, there is a gap in the existing literature and our study attempts to bridge it.

3. Methodology

In subsections that follow, we specify the econometric model, and present the estimation procedures.

3.1 Econometric Model Specification

The theoretical growth nexus is built on the neoclassical Solow growth model (Solow, 1956). This model assumes that the long-run economic growth rate is determined by the exogenous technological progress and the stable steady state is reached by endogenous change in capital accumulation. Furthermore, the Cobb-Douglas technology points out that the total output is determined by an increase in inputs and the exogenous improvement in technology (Singh, 2014). Therefore, the model specification is derived from the augmented human capital Cobb-Douglas production function. This function assumes that output is a function of capital and labour inputs, and its original form can be re-written as follows:

$$Y = AK^{\alpha}L^{\beta}e^{u}, \tag{1}$$

where Y is output, K denotes domestic capital input, L refers to labour input, A is a positive parameter that measures the inputs' productivity, α and β are the elasticities of production with respect to K and L, respectively, and e^{u} is the multiplicative disturbance term.
In equation (1), output is measured by real GDP (2010 = 100) (in US$), human capital is measured by the number of years of schooling, and labour is measured by the number of people engaged (in millions). This study is conducted under the assumption that the above production function exhibits constant returns to scale, therefore, the sum of the mentioned above production elasticities is equal to one (i.e., $\alpha + \beta = 1$).

Considering that the model given by equation (1) is linear in logarithmic functional form, we transform it by applying natural logarithms in both sides of it. The resulting log-log model below describes the relationship between the mentioned above inputs and economic growth in the country i at time t.

$$log(Y_{it}) = \beta_0 + \sum_{j=1}^{2} \beta_j log(X_{it}) + \alpha_i + u_{it}, \tag{2}$$

where *log* is the natural logarithm, $log(Y_{it})$ is the GDP per capita percentage change over time across countries i (i.e., economic growth), $\beta_0 = \log(A)$ is the model intercept, the subscript $i\ (=1,...,N)$ is the cross-section dimension that represents the SSA countries, the subscript $t\ (=1,...,T)$ is the time-series dimension that represents years, X is the set of the mentioned above input variables, the $\beta_j\ (j=1,2)$ are partial regression coefficients, α is the non-observed effect (a time-invariant scalar that captures the effect of the SSA countries' individual characteristics on growth), and u is the random error term. Moreover, in the attempt to achieve the objective of this study and believing that aid plays a role in the process of national welfare generation, we add foreign aid to right-hand side of the model, and equation (2) becomes as shown below.

$$log(Y_{it}) = \beta_0 + \sum_{j=1}^{2} \beta_j log(X)_{it} + \lambda log(F_{it}) + \alpha_i + u_{it},, \tag{3}$$

where F_{it} denotes foreign aid measured by ODA in US$ as a percentage of GDP, and λ is the respective coefficient.

To be comprehensive, we include the following control variables on the right-hand side of equation (3): inflation, human capital, trade openness, money supply, institutions quality, social infrastructures and population. Notice that these variables are identified in the growth literature as other factors that also affect economic growth. In this context, equation (3) can be re-written as specified below.

$$log(Y_{it}) = \beta_0 + \sum_{(j=1)}^{2} \beta_j log(X_{it}) + \lambda log(F_{it}) + \sum_{(k=1)}^{6} \delta_k Z_{it} + \alpha_i + u_{it}, \quad (4)$$

where Z is the set of the mentioned above control variables, δ_k $(k = 1,...,6)$ is the set of the control variables' coefficients, and all other variables, parameters and subscripts are as defined before.

Given the functional form applied to equation (4), all the additional regressors referred to in the previous paragraph are entered in logarithmic form, with the exception of the social infrastructures' variable, due to the fact that it takes the minimum value of zero, as shown in summary statistics presented in Table 2.

In augmented growth model given by equation (4), inflation is measured by the percentage change in the consumer price index (CPI), human capital is measured by the number of years of schooling, trade openness is measured by the total trade-GDP ratio, money supply is measured by the M_2 monetary aggregate (in US$), institutions quality is measured by the world governance indicator of political, the social infrastructures variable is measured by the mobile phones subscribers per 100 people and population is measure in millions.

The subscript it indicates that equation (4) is a panel data model, so the number of observations is given by NT, were N is the number of the SSA countries, and T is the number of years covered by this study (i.e., time span).

This study is conducted under the assumption that the economic growth identity does not follow the Keynesian view that only consumption, investment, and government spending determine growth, because, as argued by Alfaro (2008), Acemoglu and Robinson (2012), Sachs et al. (2004), Rodrik et al. (2004), and Romer and Frankel (1999), different factors in different countries can determine economic growth. Therefore, the right-hand side variables in the augmented model given by equation (4) seem to be the factors that determine economic growth in the SSA countries.

Notice that in equation (4), foreign aid is the test variable, while the other regressors are the control variables, therefore λ is the parameter of the most interest in this study.

Assuming that the model can be sensitive to different types of specification, the study undertakes a robustness check by adding interactive terms to the right hand side of equation (4), and therefore, the Z set also includes the following interaction variables: $ODA \times Social\ Infrastructures$ and $ODA \times Instituions\ quality$

3.2. Estimation Procedures

Different trade studies that have investigated the impact of ODA on growth have ignored different impacts that may be yielded by ODA at different distribution. However, assuming

that ODA impact may differ according to the countries level of development, we consider that aid effectiveness tends to be different at different levels of economic growth. Contrary to the previous studies, we estimate equation (4) by the moment moment quantile regression with fixed effects (MM-QR), an estimation procedure proposed by Machado and Silva (2019). The MM-QR approach considers the conditional scale function and conditional mean to estimate regression quantile Machado and Silva (2019). It is appealing because it also allows us to include a set of different countries with a range of heterogeneous characteristics in a way that the conditional distribution does not have standard shape such as fat-tailed, truncated distribution, or asymmetric.

Equation (4) specified in the previous section is a fixed effect model, so it can become a random effects model by adding a composed error term that also includes the country-specific characteristics ($v_{it} = \alpha_i + u_{it}$). However, as explained in the last paragraph of Section (2), we employ the moment moment quantile regression approach, which can be formally expressed as follows:

$$qy_i(\varphi \mid X = x) = x'\beta, \tag{5}$$

where y denotes the dependent variable in equation (4), x is the vector of all regressors in the same equation, φ represents the quantile and β is the set of elasticities to be estimated. Nevertheless, the standard conditional quantile regression does not account for heterogenous and country specific effect in the panel structure of the data. Therefore, estimating equation 4 using a standard quantile regression displayed in equation 5 would yield biased results. To address this problem, we account for individual intercepts α by estimating the quantile regression as shown in the equation 6 below:

The quantile regression model aims at minimizing the weighted average through the following equation: $Qlog\ Y_{it}(_{\varphi}|X_{it}) = \alpha_i + X'_{it}\beta q(_{\varphi}), i = 1, \dots, n,$ (6)

Where $q(_{\varphi}) = F_U^{-1}(_{\varphi})$. The inclusion of many individual specific intercepts in the quantile regression can cause the large proportional increase of other regressors in the amount of of fixed effects (Koenker, 2004). To address this and other inconsistences that maybe triggered by the conditional variance of the dependent variables we employ the MM-QR that accounts for unobserved conditional mean and the conditional variance of the dependent variable's differences using a location-scale model proposed by Machado and Silva (2019). Assuming that the location and scale functions are known, the model can be specified as presented below:

$$log\ Y_{it}(_{\varphi}|X_{it}) = \alpha_i + X'_{it}\beta + \sigma(\delta_i + X_{it}\,\Upsilon)\varepsilon_{it}, \tag{7}$$

Where σ represents the scale function which is assumed to be linear in covariates. Further, the explanatory variables may only affect the distribution of the dependent variable through known scale and location. Furthermore, equation 7 can be re-written as depicted in equation 8 below.

$$\hat{Q}logY_{it}(_{\varphi}|X_{it}) = \left(\widehat{\alpha_i} + \widehat{\delta_i}\hat{q}(_{\varphi})\right) + X'_{it}\left(\hat{\beta} + \hat{\Upsilon}\hat{q}(_{\varphi})\right), \tag{8}$$

From this equation we can derive the point estimate of the coefficient β of the variable of interest at the $_{\varphi}th$ quantile, see the equation below.

$$\widehat{\beta}(_{\varphi}, X_{it}) = \widehat{\beta} + \hat{q}(_{\varphi})\hat{\Upsilon}, \tag{9}$$

The MM-QR uses OLS of time-demeaned independent and dependent variables to estimate the coefficients $\widehat{\beta}$. This regress $(Y_{it} - \sum_t \frac{Y_{it}}{T})$ on $X_{it} - \sum_t \frac{X_{it}}{T}$). The location shift which represents the standard fixed effect from a within regression, $\widehat{\alpha_i}$, is predicted from the above estimation of $\widehat{\beta}, \widehat{\alpha_i} = \frac{1}{T}\sum_t Y_{it} - X'_{it}\widehat{\beta}$). Moreover, to estimate the scale parameter $\hat{\Upsilon}$ it is necessary that the actual residual from the location estimation is predicted. Therefore, the residuals are $\widehat{R_{it}} = Y_{it} - \widehat{\alpha_i} - X'_{it}\widehat{\beta}$. Now we can estimate the scale parameter $\hat{\Upsilon}$ by regressing the time-demeaned

absolute value of residuals ($|\widehat{R_{it}}| - \sum_t |\widehat{R_{it/T}}|$) on X_{it}. We then estimate the part of conditional variance that is time-constant and unobserved by $\widehat{\delta_i} = \frac{1}{T}\sum_t(|\widehat{R_{it}}| - X'_{it}\widehat{Y})$. We finally estimate the $q(_\varphi)$ by

$\frac{min}{q}\sum_i\sum_t \sigma_\varphi\left(\widehat{R_{it}} - (\widehat{\delta_i} + X'_{it}\widehat{Y})q\right)$,

From this we obtain quantile $\hat{q}(_\varphi)$ estimates in the data, where σ is the check function (Machado and Silva 2019).

The table below presents the expected signs of the partial regression coefficients of that final model.

TABLE 1: *EXPECTED SIGNS OF* β_j $(j = 1,...,6)$ *AND* δ_k $(k = 1,...,4)$

Variable	Expected coefficient sign
Capital	+
Labour	+
ODA	+/-
Inflation	-
Human capital	+
Trade openness	+
Money supply	+
Institutions quality	+
Social infrastructures	+
Population	-

Notes: ODA = Official Development Assistance; and FDI = Foreign Direct Investment.

The above table shows the expected positive signs of the coefficients for both capital and labour inputs, and the expected negative signs of the coefficients for inflation. In paragraphs that follow, we justify each of these expected signs.

Production theory predicts positive marginal products of factors of production. In line with this economic theory, we expect positive signs of the marginal products of both inputs' variables (Solow, 1956).

Based on the international trade literature and Kaldo's export-led growth model (Thirlwall, and Kaldor, 1970), we also conduct this study under the assumption that high levels of foreign aid and more openness or outward orientation stimulates growth. Given this assumption, we expected positive estimates of the coefficients for foreign aid[3] and trade openness.

According to Andersen and Gruen (1995) and Fischer (1993), inflation is thought to be as a harmful factor for economic growth. This is due to an increase in business uncertainty caused

[3] However, due to the inconclusive results in the empirical literature on foreign trade and growth, we also consider the hypothesis that the sign might differ from the expected one.

by high levels of inflation and, hence, a decrease in investment rates. In line with the two authors' reasoning, we expect a negative sign of the estimated coefficient for inflation.

Based on the neoclassical economic growth theory, which predicts that highly skilled workers always contribute to successful economic growth through innovation capacity, and that human capital input in current time can yield high levels of productivity in the long run (Barro, 1991; Clervin and Wijnbergen, 2010; and Gitaru, 2015), we expect a positive sign of the estimated coefficient for human capital.

Based on the Keynesian theoretical framework, an increase in money supply yields positive results by reducing the levels of interest rate and therefore increase investment Calvo (1983). In so doing, it increases the national income, therefore, it is expected a positive sign of the estimated coefficient for money supply.

Also, it has been so long acknowledged that institutions quality (world governance indicator of political instability) has been taken as a fundamental variable in the economic growth determination (Acemoglu and Robison, 2012). According to these two authors, everything spins around the quality of institutions where if they are not good, the nation is more likely to fail. In this context, we expected a positive sign of the estimated coefficient for corruption. Jone (1995) states that good infrastructures, on the other hand, can be a way through which the countries can have access to large markets and increase their exports and, consequently, increase their balance of payments constrain. This link between social infrastructures and economic growth gives importance to the variable in question. Under these assumptions, it is expected a positive sign of the estimated coefficient for the social infrastructure's variable.

Finally, apart from the exogenous savings in the neoclassical production function, Solow (1956) argues that production is also a function of population growth rates. According to him, holding everything else constant countries with higher population growth rates will tend to reduce the stead state per capita income. Therefore, it can be argued that it is expected a negative sign between population and growth.

4. Data

The estimation of the final model given by equation (4) used panel data on each of the model variables. The data were collected annually from the Word Development Indicators (i.g: real GDP, trade openness, inflation, money supply, institutions quality, social infrastructures, FDI, and population), African Development Bank (i.g: ODA), and Penn World Tables (i.g: capital, labour, and human capital), for the period covered by this study (1980-2019). Furthermore, given the lack of studies in that period, it would be good to extend our time span to 2020. However, the availability of the data determined the above study period.

Given both the number of variables and the sample size (number of the countries) used in this study, it was normal that some of the variables exhibit missing data. Therefore, to address this problem, we applied the imputation technique suggested by Bak and Hansen (2016). According to these two authors, imputation technique for missing data is an econometric tool that supplement missing values by the value calculated with the use of average and certain algorithms. Following those authors' reasoning, the missing data were filled up through an arithmetic mean using forward and backward trends from the available data values of the

observed variables. Notice that the technique in question was also used by other scholars such as Farahane and Heshmati (2020).

Table 2 exhibits the data features of the selected 12 non-transformed variables that are included in the final model specified in the previous section. In the study we used the following features, mean, which is used to determine the central point of relative distribution frequency. The standard deviation depicts the spread of several observation and finally we use minimum and maximum values.

TABLE 2: SUMMARY STATISTICS

Variable	Number of Observations	Mean	Standard deviation	Minimum	Maximum
Real GDP per capita	960	2225.835	2611.883	164.465	12724.86
Capital	960	254188.1	621317.6	4351.79	3115441
Labor	960	6.053	8.939	.135	73.021
ODA	960	6.048	6.981	1.261	1.190
M2	960	6.411	277.272	1	960
Human capital	960	1.678	.445	1.014	2.939
Inflation	960	129.042	149.674	.092	1313.064
Trade openness	960	2.471	2.951	2.390	2.491
Population	960	1.691	2.671	.588	200.964
Social infrastructures	960	26.491	41.334	0	165.600
Institutions quality	960	-.425	.757	-2.514	1.183

Notes: Real GDP per capita (in 2010 constant US dollars)

With 960 observations for each variable, the table shows that GDP per capita has a mean of 2225.835 US dollars with least developed countries exhibiting minimum of 164.465 US dollars per person and the relatively ahead countries showing a value of about 12724.86 US dollars per person. Regarding the variable of interest, ODA, it is found that it has a mean value of 6.048 US dollars that SAA ever received with a minimum and maximum of 1.261 and 1.190 US dollars, respectively. The described statistics suggest no observable outliers among the selected variables, and therefore, they are suitable for further analysis.

5. Analysis of Econometric Results

The estimation of the growth model given by the quintile regressions produced the results summarized in table 3 below.

TABLE 3: RESULTS OF THE ESTIMATION OF THE QUANTILE REGRESSION

	(0.25)	(0.5)	(0.75)	(0.95)
VARIABLES	logpcGDP	logpcGDP	logpcGDP	logpcGDP
logCapital	0.504***	0.499***	0.494***	0.489***
	(0.155)	(0.085)	(0.027)	(0.085)
logLabour	0.266	0.366	0.482***	0.591*
	(0.627)	(0.343)	(0.108)	(0.346)
logODA	0.043	0.052	0.062***	0.071*
	(0.076)	(0.041)	(0.013)	(0.042)
logM2	-0.012	-0.004	0.005	0.014
	(0.046)	(0.025)	(0.008)	(0.025)
logHC	0.131	0.049	-0.044	-0.133
	(0.692)	(0.377)	(0.118)	(0.381)
loginflation	0.030	0.028	0.025**	0.023
	(0.065)	(0.035)	(0.011)	(0.036)
logopenness	-0.120	-0.110**	-0.099***	-0.088*
	(0.089)	(0.049)	(0.015)	(0.049)
logPopulation	-0.870	-0.936***	-1.013***	-1.085***
	(0.587)	(0.320)	(0.100)	(0.323)
Observations	960	960	960	960

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figures in table 3 above show that capital has a positive significant effect on economic growth at 1% level across all the quantiles. An increase in capital by 1% leads to a positive impact on economic growth across all the quantiles. However, the impact varies across the quantiles. Among the quantiles, the 25^{th} is having the highest coefficient and the 95^{th} recording the least coefficient. This implies that the impact of capital on economic growth is higher at the lower quantiles relative to the upper quantiles of the distribution.

Capital accumulation spurs economic growth of the countries in the lower quantile through improvement in quality of human resource. This result is similar to that reported by Ogundari and Awokuse (2018), who found a positive relationship between capital and economic growth.

With regards to labour, it is observed a positive effect on economic growth. The impact of labour on economic growth, varies across the quantiles showing statistical impact on the two late quantiles and with 95^{th} quantiles having the highest coefficient. This shows that the impact of labour on economic growth is much higher at the upper quantiles. This can be attributed to the efficiency of the level of labour in developed economies with appropriate labour laws, which impacts on their productivity, hence a higher positive impact of labour on economic growth in the countries in upper quantile. This finding can also be attributed to the quality of labour force in the countries in upper quantile. Our result partly corroborates with the study by Saba and Abbas (2016), which indicates that the countries with skilled labor experience much growth than those having less skilled labor.

With regards to ODA, figures in the table 3 show a positive statistically significant effect at 75^{th} and 95^{th} quantiles for 5% and 10%, respectively. The impact is, therefore, greater at the upper quantile. This result is different from those reported by Su and Nguyen (2020), according to which ODA has negative and positive relationships on economic growth in the countries within the lower and upper quantiles, respectively. Development assistance helps countries to

put appropriate infrastructure in place to propel economic growth. This finding can be attributed to the use of ODA in the provision of essential services such as health care and others in the countries within the upper quantile, hence its positive impact on economic growth. This result corroborates with the studies by Levy (1988), Dalgaard et al. (2004), Karras (2006), and Ndambendia and Njoupougnigni (2010), whose results show a positive relationship between ODA and economic growth. However, our finding differs from results that show a negative relationship between ODA and economic growth, undertaken by Rajan and Subramania (2008), Mitra and Hossain (2013), Mitra *et al.* (2015), and Adedokun (2017).

The results show an insignificant relationship between money supply, human capital and economic growth. This implies that any change on these factors does not play a significant role on economic growth. With regards to the relationship between inflation and economic growth, figures in the same table show a positive statistically significant relationship only in 75^{th} quantile. The result, which is significant at 1% level, shows that an increase in CPI by 1% leads to about 0.025% increase in economic growth for countries within the 75^{th} quantile at 1% level, consistent with Sepehri and Moshiri (2004).

The study reveals a negative statistically significant relationship between trade openness and economic growth at the 50^{th}, 75^{th} quantile and 95^{th} quantile. The results shows that trade openness leads to about 0.11% and 0.01% and 0.09% reduction in economic growth in 50^{th}, 75^{th} and 95^{th} quantiles, respectively. This means that the countries within the upper quantiles are those that are affected negatively by trade openness. This result corroborates the study by Nazar (2021), which found a negative relationship between trade openness and economic growth. However, it refutes the finding by Fetahi-Vehapi et al. (2015), which shows a positive relationship between trade openness and economic growth. The possible causes of the differences in the results can be explained by the different estimation techniques used in two studies.

Furthermore, the study also reveals a negative statistically significant relationship between population and economic growth. Specifically, an increase in population by 1% leads to about 0.94%, 1.01% and 1.09% reduction in economic growth in the quantiles 50^{th}, 75^{th} and 95^{th}, respectively. This confirms that population and economic growth nexus which exhibits a negative correlation between population and economic growth (Solow, 1956).

The estimation of the quantile regression with the inclusion of institution quality variable in the model, given by equation (4), is displayed in Table below.

TABLE 4: QUANTILE REGRESSION (WITH INFRASTRUCTURE AND INSTITUTIONS QUALITY)

	(0.25)	(0.5)	(0.75)	(0.95)
VARIABLES	logpcGDP	logpcGDP	logpcGDP	logpcGDP
LogCapital	0.486***	0.461***	0.436***	0.411***
	(0.059)	(0.034)	(0.031)	(0.054)
LogLabour	0.227	0.281**	0.335***	0.390**
	(0.215)	(0.126)	(0.115)	(0.197)
LogODA	0.041	0.044***	0.046***	0.049**
	(0.026)	(0.015)	(0.014)	(0.023)
logM2	-0.013	-0.005	0.002	0.010

	(0.016)	(0.009)	(0.008)	(0.014)
LogHC	0.054	-0.095	-0.245*	-0.395
	(0.268)	(0.157)	(0.143)	(0.246)
Loginflation	0.032	0.033***	0.035***	0.036*
	(0.022)	(0.013)	(0.012)	(0.020)
Logopeness	-0.125***	-0.117***	-0.108***	-0.100***
	(0.031)	(0.018)	(0.016)	(0.028)
logPopulation	-0.851***	-0.872***	-0.894***	-0.916***
	(0.208)	(0.121)	(0.111)	(0.190)
Social infrastructures	0.001	0.001***	0.001***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Institutions quality	0.038	0.009	-0.019	-0.048
	(0.037)	(0.022)	(0.020)	(0.034)
Observations	960	960	960	960

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The relationship between social infrastructures and economic growth is found to be positive and statistically significant. Moreover, the results show that an improvement in social infrastructures leads to about 0,01% increase in economic growth at 5% level across all the quantiles. Although regarded as an important player, institutions quality in this case is found to be statically insignificant across all the quantiles. This implies that not accounting for the impact across different distributions might be misleading.

Capital variable and labour variable maintained their respective positive statistically significant in all the quantiles just as it is presented in Table 3 at 1% level and except that labour is also statistically significant at quantile 50^{th}. The impact of labour on economic growth with the inclusion of social infrastructure and institutions quality still shows that the impact is greater on the countries that are located in the upper quantile of economic growth (50^{th}, 75^{th} and 95^{th} quantiles), and with a slight change of magnitude as in the original model without institutions quality variable. Compared to the results presented in Table 3, the inclusion of social infrastructure and institutions quality variable, however, caused a decrease in the magnitude of the change. The impact increases as a country moves towards the upper quantile in economic growth.

Contrary to the findings presented in Table 3, the inclusion of the social infrastructure and institutions quality variable in Table 4 seem to alter the ODA coefficient—level of significance on economic growth from the 50^{th} quantile at 10% level. This result shows that 1% increase in ODA leads to 0.044%, 0.046% and 0.049%, increase in economic growth in the countries located in the quantiles 50^{th}, 75^{th} and 95^{th}, respectively. Likewise, although variable such as inflation and trade openness have remained with the same signs, they also increase their relevance shown by how their impact on economic growth is statically significant. Apart from these observed changes, all other variables' signs and the level of significance remained unchanged.

5.1 Robustness check

We conducted the robustness check of the model by interacting ODA with social infrastructures and ODA with institutions quality. Table 5 presents the produced results.

TABLE 5: QUANTILE REGRESSION INTERACTION TERMS

	(0.25)	(0.5)	(0.75)	(0.95)
VARIABLES	logpcGDP	logpcGDP	logpcGDP	logpcGDP
logCapital	0.477***	0.452***	0.425***	0.395***
	(0.046)	(0.050)	(0.085)	(0.131)
logLabour	0.224	0.275	0.331	0.392
	(0.158)	(0.174)	(0.292)	(0.451)
logODA	0.036**	0.040*	0.044	0.048
	(0.018)	(0.020)	(0.034)	(0.053)
logM2	-0.011	-0.005	0.002	0.009
	(0.011)	(0.012)	(0.021)	(0.032)
logHC	0.030	-0.139	-0.323	-0.524
	(0.201)	(0.221)	(0.371)	(0.575)
loginflation	0.028*	0.030*	0.032	0.035
	(0.016)	(0.018)	(0.030)	(0.047)
logopeness	-0.130***	-0.122***	-0.112***	-0.102
	(0.023)	(0.025)	(0.042)	(0.065)
logPopulation	-0.864***	-0.876***	-0.888***	-0.902**
	(0.154)	(0.170)	(0.286)	(0.441)
Social infrastructures	0.001**	0.002***	0.002**	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
Institutions quality	0.380	0.407	0.436	0.467
	(0.336)	(0.370)	(0.621)	(0.960)
ODAInfrastructure	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
ODAInstitutions	-0.017	-0.020	-0.023	-0.027
	(0.017)	(0.019)	(0.031)	(0.049)
Observations	960	960	960	960

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Figures in the above table show that the interaction between ODA with social infrastructure and institution quality, both indicate a negative statistically insignificant relationship with economic growth over the observed quantiles. something notable is that although the interaction terms seem not to be playing a significant role, its inclusion in the model appear to alter somehow the impact of ODA on economic growth. For example, contrary to the results on Tables 3 and 4, ODA is found to be yielding positive and statistically significant impact in countries located in the lower quantiles, 25^{th} and 50^{th}. This would imply that it is of paramount importance the inclusion of these interaction terms. If that hypothesis holds, then this would indicate that countries located on the upper quantiles would be unnecessarily received ODA that would be channelled to poor countries and thereafter assist them converging towards countries that are relatively ahead.

6. Conclusions

The aim of this study was to examine the relationship between aid and economic growth in the SSA countries. To achieve this objective, it employed moment moment quantile regression model, whose estimation used data for 24 countries over 38 years, extracted from different sources, such as the World Development Indicators, African Development Bank and the Penn World Tables 9.0. We first estimated the effect of aid on economic growth, controlling for typical variables in existing studies. The second specification incorporated social infrastructure and institutions quality to estimate the impact of aid on economic growth. The third specification investigated the interacted effect of institutions and aid on economic growth.

Our findings appear to lend support to studies that find that aid is positively related to economic growth in the developing world. Moreover, our study finds that the positive impact of aid is bigger in the countries with high levels of economic growth-- this result shows a positive statistically significant effect at 50^{th} and 75% quantiles for 5% and 10%, respectively. Our findings are inconsistent with those reported by Su and Nguyen, (2020), which show that ODA has a negative relationship with economic growth. Controlling for social infrastructures and institutions quality, the results show while a positive and statistically significant relationship between institutions quality and economic growth in 50^{th} quantile, 75^{th} quantile and 95^{th} quantile, institutions seem to be statistically insignificant across the quantiles. This result shows that an improvement in social infrastructures brings about many benefits to the countries within the 50^{th}, 75^{th} and 95^{th} quantile compared to those in the lower quantiles. However, incorporating interaction terms into the model seems to necessarily influence the effect of aid on economic growth, implying that aid has a significant effect on economic growth net of institutions quality and other control variables.

The implication of our major finding is that aid can be strategically employed as a central instrument for stimulating economic growth in SSA countries, particularly low-income countries.

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