




## THE IMPACT OF AID AND MACROECONOMIC POLICY ON GROWTH IN NIGERIA: A BOUNDS TESTING APPROACH



 Nuruddeen  
USMAN<sup>1\*</sup>

 Martins.O.  
APINRAN<sup>2</sup>

<sup>1,2</sup>Monetary Policy Department, Central Bank of Nigeria.

\*Email: [usmanstrategic@yahoo.com](mailto:usmanstrategic@yahoo.com) Tel: +2349072778379

\*Email: [Gbengamartins699@yahoo.com](mailto:Gbengamartins699@yahoo.com) Tel: +2349066376055



(+ Corresponding author)

### ABSTRACT

#### Article History

Received: 21 February 2019

Revised: 27 March 2019

Accepted: 1 May 2019

Published: 17 May 2019

#### Keywords

Aid  
Macroeconomic policy  
Growth  
ARDL  
Nigeria.

#### JEL Classification:

C01; C51; E13; F35.

This paper explores the impact of aid and macroeconomic policy on growth with Nigeria as a case study. Given its limited use in the aid efficiency literature on Nigeria, the autoregressive distributed lag (ARDL) model was applied in this study for time series data covering 44 years (1970-2014) in an attempt to expand the use of this approach and to check if a similar (negative) relationship is found between aid and growth. The results showed a positive correlation i.e. aid supports growth in Nigeria in the long-term. The other variables identified above and trends such as labour force and technological change were also found to be positive towards economic growth in the long-term, though governance showed an insignificant relationship. In the short-term, investment and policy were found to have a negative correlation on growth. More data on governance (before 1996) could be applied to expand the findings of this study and other measures of macroeconomic policy could be used to test if a similar result is obtained as principal component analysis was applied in this case. Given our findings, this paper recommends that the government of Nigeria should prioritize aid since it has been empirically found to support growth.

**Contribution/ Originality:** This paper uses the endogenous growth theory taking into account the role of macroeconomic policy and governance to test the effectiveness of aid on growth in Nigeria which no other research has done.

## 1. INTRODUCTION

The study seeks to evaluate the relationship between ODA (overseas developmental aid) and growth, in the Federal Republic of Nigeria. The relationship between aid and growth has received a lot of interest in literature. This interest has been due to the hotly contested debate ongoing on the impact of aid on growth. On one side of the debate, Hansen and Tarp (2001) and Lensink and Morrissey (2000), Lu and Ram (2001) and Guillaumont and Chauvet (2001) have argued that aid works irrespective of the macroeconomic policy that a recipient country implements. On the other hand, the World Bank found that the effectiveness of aid is dependent on the macroeconomic policies implemented by the country, i.e. aid is effective in promoting growth where the policy environment is strong, but has a minimal impact on economies which enact poor macroeconomic policies. This is supported by the findings of Burnside and Dollar (2000), Burnside and Dollar (2004) and Collier and Dehn (2001). The findings of the World Bank are embraced by most aid donor countries.

The findings described above have resulted from mostly cross-section data analysis. A few panel analyses also exist, such as that of Hansen and Tarp (2001). The use of time-series data is not widespread, surprisingly, in the literature. This is due to most papers focusing on continents and regions, rather being country specific time-series estimations.

Whilst looking at the impact of aid on growth in Fiji and Solomon Islands, Gounder (2001) used a time-series estimation to find that aid is a significant factor in the two countries. In sub-Saharan Africa, Osei *et al.* (2005) studied the effectiveness of aid in Ghana whilst looking at exports. The findings reported that the enactment of good macroeconomic policies enhanced the effectiveness of aid on growth. Feeny (2005) looked at the impact of aid on growth in Papua New Guinea and found that aid has not supported growth in the country. Nidup (2015) used a similar methodology as Feeny (2005) to discuss the “Non-Indian aid and growth nexus in Bhutan” and the findings concluded that aid is detrimental to growth. Concerning Nigeria, Fasanya and Onakoya (2012) found that aid is significant in promoting growth in Nigeria. Studies, which contributed earlier to the literature, such as Islam (1992) for Bangladesh and Mbaku (1993) for Cameroon, found that aid is ineffective at generating growth. However, the findings are misleading, as the two studies failed to account for the time-series nature of the data and cointegration relationships among variables.

Nigeria as a former colony of the United Kingdom became independent in 1960. At the time of independence, Nigeria received \$33 million in aid and as of 2014 it has received \$3.5 billion worth of aid (World Bank). Nigeria is the largest country and economy in Sub-Saharan Africa (SSA) with a population of 180 million and a GDP of \$492.86 billion as of 2014 (World Bank, 2016) making it the twenty first<sup>1</sup> largest economy in the world. The World Bank officially classifies Nigeria as a low middle-income country, in spite of its natural and human resources. The World Bank also classifies Nigeria with the largest amount of poor people in SSA. Nigeria accounts for almost a quarter of the poor in Africa, with 68% of its population living in poverty according to the World Bank (2016). The reason for Nigeria’s poor macroeconomic performance is due to the persistence of corruption, poor governance and poor macroeconomic management of the country’s finances, as it has been a major OPEC member since the 1960s (Oyedepo, 2012). The main reason countries receive aid (loans, grants and concessions) is to achieve poverty reduction, as noted by Todaro and Smith (2011). Aid is given with the intention that transfers could be made to spur economic growth and reduce the levels of poverty and income inequality. Figure 1 shows the sectorial distribution of aid received by Nigeria between 2002 to 2011. The majority of the aid received has been utilized for debt relief purposes, which totals \$18 billion. Donors have also given aid to Nigeria for it to fund its social infrastructure, improve health, education etc.

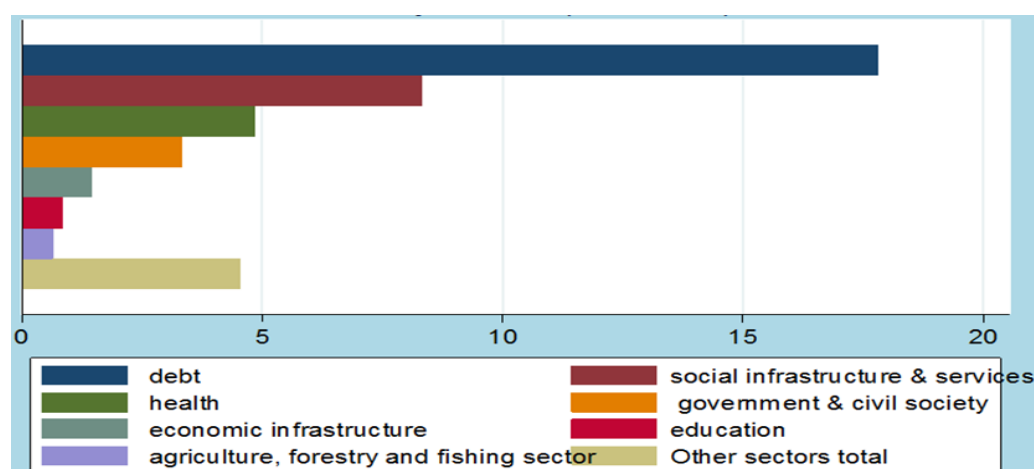


Figure-1. ODA BY sector 2002-2011 (\$ Billions). Nigeria.

<sup>1</sup> International Monetary fund (IMF) estimates 2016

Aid can also be divided into bilateral and multilateral aid. Bilateral aid relates to aid between countries while multilateral aid is from international organizations such as the World Bank and the United Nations. Between 1990 and 2012, Nigeria has received more bilateral aid than multilateral aid by a ratio of 13 to 4. Figure 2 shows the distribution for each year.

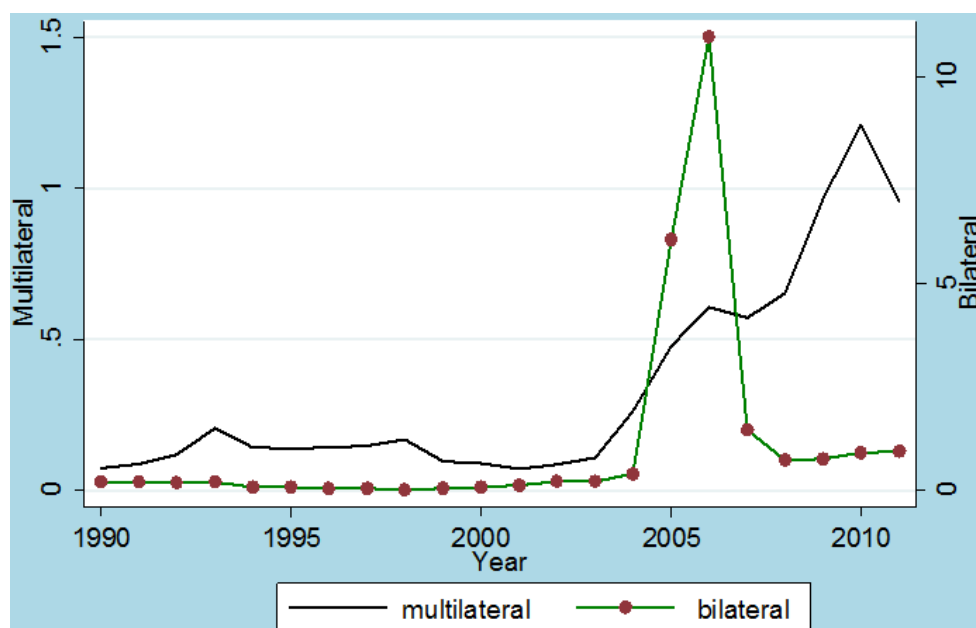


Figure-2. Bilateral and Multilateral Aid (\$ Billions).

### 1.1. The motives for Aid Donation

Why do countries provide aid to Nigeria and what is their motivation for doing so? Table- shows the amount of aid that has been given by the OECD (Organization for Economic Cooperation and Development) countries. The United Kingdom has given the highest share of aid since Nigeria's independence with eight billion dollars. The OECD countries in total have given Nigeria aid of twenty-nine billion dollars since its independence.

Table-1. Overview of Foreign aid to Nigeria from OECD Countries (1960-2014).

Donor Country	Amount (million USD)	Share of OECD total (%)
United Kingdom	8,442	29.0
United States of America	4,957	17.0
France	3,814	13.1
Italy	1,378	4.7
Germany	3,590	12.3
OECD Total	29,087	

"We doubled aid spending to Nigeria under the Coalition, blowing vast sums on daft schemes in a nation with traditionally dysfunctional government, corrupt politicians and its own space project" said Ian Birrell (former adviser and speechwriter to David Cameron, UK Prime Minister) in an article in The Telegraph on 22 July 2015.

Richer countries have given aid since the 19th century for both economic and strategic reasons. For example, the United Kingdom gives aid to its former colonies since 1920s to maintain a strategic interest in the infrastructure of the countries. There is also the case of using aid for influence such as when, during the 1980s, at the height of the cold war, the United States of America (USA) and the Soviet Union (USSR) spent money to compete for the alliances of third world countries. Such is the case that, in those times, debt-ridden countries were given aid to help them pay bills. Nevertheless, aid could be given for mutual-self-interest; this is what the People's Republic of China is doing in many African countries where China gives aid to African countries for economic and

social development and in return, China gets better access to the natural resources of the African countries it deals with.

However, currently, the appetite for giving aid in OECD and rich countries is low, due to low growth rates and structural issues affecting their economies from the 2008 recession. Some countries are beginning to question why Nigeria, an oil producing country should be receiving aid as per Birrell's statement (2015).

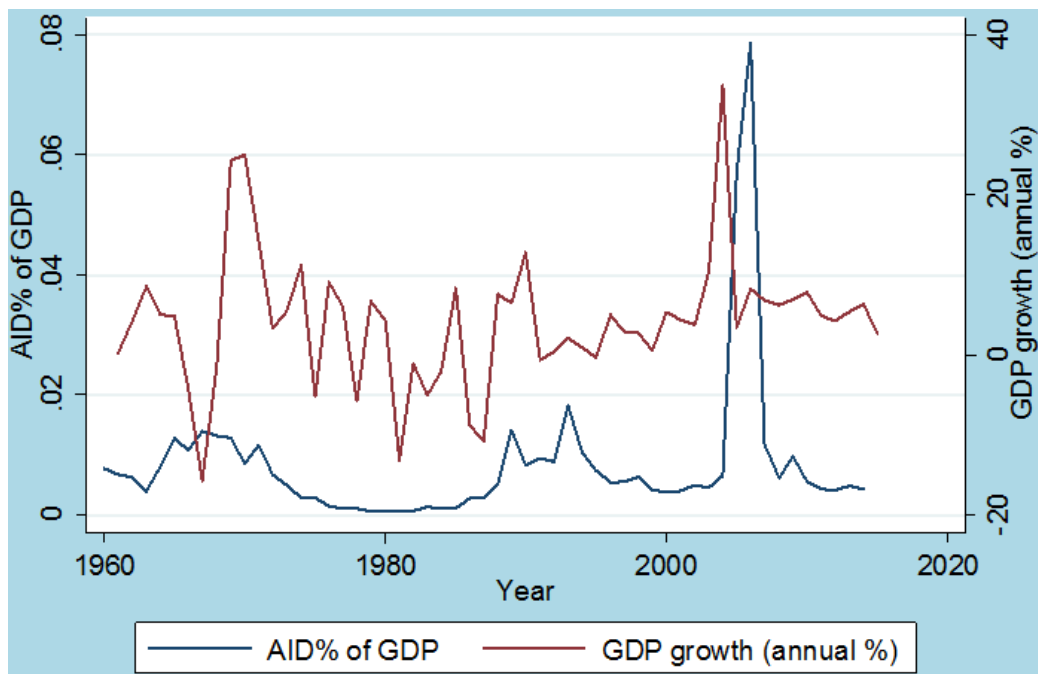


Figure-3. Aid and growth rates (%), Nigeria, 1960-2014.

### 1.2. Aid and Growth over Time

Figure 3 summarizes the growth rates and the aid to Gross Domestic Product ratio (GDP) for Nigeria. The chart indicates that the highest amount of aid received by Nigeria was in 2005 where it received \$12 billion. The proportion of aid to GDP has been fluctuating between an average 3-5% of Nigeria's GDP. The largest year of aid relative to GDP was 2006 when it was 8%.

This paper used data from 1970-2014, to investigate if the impact of aid on growth in Nigeria is dependent on strong macroeconomic policies and good governance. The estimation used Pesaran and Shin (1998) auto-regressive distributed lag model (ARDL) approach to cointegration to test the hypothesis. This approach is useful, as it avoids the problem of testing for stationarity and provides estimates that are concrete<sup>2</sup> no matter whether endogenous regressors exist or not?

Testing the effect of sound macroeconomic policies required creating a measure of policy. Recent literature followed the work of Burnside and Dollar (2000) who created a policy variable that contains the level of inflation, the relative budget surplus/ deficit and the degree of openness in the economy. This was done with the intuition that countries, which exhibit good macroeconomic policies, have low inflation rates, have a high degree of trade openness and large amounts of budget surplus, relative to GDP. Other studies such as Collier and Dollar (2002) have used a World Bank Country Policy and Institutional Assessment Index (CPIA) as a measure of a

<sup>2</sup>Statistically significant approach to determine cointegration amongst small samples. With ARDL, it is possible for different variables to have different lags. Johansen, S., 1988. Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, 12(2-3): 231-254. Available at: [https://doi.org/10.1016/0165-1889\(88\)90041-3](https://doi.org/10.1016/0165-1889(88)90041-3). does not allow this.

macroeconomic index. This study used the principal component technique analysis (PCA) used by Burnside and Dollar (2000).

This paper is organised in five sections. Section one, the introduction, covers the background to the study, the research question and the objective of the study. Section two is an overview of the literature of aid and growth. Section three, describes the sources of the data and the methodology being used in the estimation in Section four. Section four presents the results and their analyses. Finally, Section five provides the conclusion and policy recommendations.

## 2. REVIEW OF RELEVANT LITERATURE

This section focuses on the review of past literature related to the relationship between aid and growth in the Federal Republic of Nigeria. This section presents research examining aid effectiveness using cross-country, panel and country-specific/time-series studies.

The argument for giving aid from rich to poor countries was made earlier on by Chenery (1966) in his two-gap model<sup>3</sup>. The model showed that aid serves to fill in resource gaps in the countries that needed it. Most low-income countries face a shortage of domestic savings to match the needed amount of investment opportunities or to finance foreign exchange needed for exports.

### 2.1. Cross-Country Studies

Examining cross-country evidence in developing countries, Burnside and Dollar (2000) & Burnside and Dollar (2004) looked at the relationship between aid and growth, conditional on the policy environment in place. The study found that aid has a positive impact on growth only if good macroeconomic policies are in place. Dalgaard *et al.* (2004) focused on aid conditional on geography and came to similar findings as Burnside and Dollar (2000).

Supporting the findings of Burnside and Dollar (2000) but criticized it for being sensitive to sample choice and negative external shocks, they Collier and Dehn (2001) incorporated an export price shock into the analysis of aid effectiveness on growth Collier and Dehn (2001). Using the Burnside and Dollar (2000) regression, they found aid and growth are highly significant and when shocks are included in the model, the Burnside and Dollar (2000) findings became robust to sample choice. Collier and Dehn (2001) concluded that targeting aid to countries experiencing negative shocks appears to be more important than sending aid to countries with good macroeconomic policies. Ovaska (2003) & Doucouliagos and Paldam (2006) failed to support the findings of Burnside and Dollar (2000) finding aid to be harmful to growth, irrespective of the policy environment in place.

However, Burnside and Dollar (2000)'s findings and methodology have come under some criticism. Adding more countries to the specification used by Burnside and Dollar (2000) and increasing data length, Easterly *et al.* (2004) failed to find similar findings. Ram (2004) also added to criticisms of the findings of Burnside and Dollar (2000). The study argued against constraining the regression coefficients of both bilateral and multilateral types of aid to be equal. The paper found that by separating bilateral and multilateral aid, the estimated coefficients changed in the model significantly. The paper concluded by finding that the effect of bilateral aid on growth is positive whilst the impact on multilateral aid is negative.

Hansen and Tarp (2001) addressed the non-linearity of the aid variable in contradiction to Burnside and Dollar (2000) whereby the study generated the square of the aid variable and concluded that regardless of good macroeconomic policy, aid was significant in promoting growth. This supported the results of Durberry and Norman (1998) who used an augmented Fischer-Easterly model to estimate both the cross-sectional and panel

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<sup>3</sup>Where,  $E-Y=I-S=M-X=F$ . (E) is expenditure, (Y) is national income, (I) is investment, (X) is exports, (M) is Imports and (F) is foreign aid. If  $(E)>(Y)$  then economy requires (F) to supplements shortfall in income.

estimates. Similarly, Feeny and McGillivray (2010) scrutinized the effectiveness of aid on growth in small island developing states (SIDS). The study concluded that aid was effective on growth, but that it had diminishing returns.

Lensink and Morrissey (2000) examined the relationship between aid and investment, whilst accounting for uncertainty and found that aid has had a positive and significant impact on growth, due to its effects on the level of investment. The uncertainty of aid receipts reduces the effectiveness of aid in sub-Saharan Africa.

“If the recipients are unsure whether they will achieve the policy targets required to trigger the release of a tranche of aid...uncertainty may be increased...uncertainties with respect to [aid] inflows may render aid less effective as investors, confronted with uncertainty, may decide to postpone or even cancel investment decisions. Uncertainty may have similar effects on the investment decisions and broader fiscal behaviour of government” (Lensink and Morrissey, 2000).

In consensus with Lensink and Morrissey (2000), Bulř and Hamann (2003) established that aid is more volatile than other macroeconomic variables. Chauvet and Guillaumont (2009) & Pallage and Robe (2001) came to similar findings.

Hudson and Mosley (2001) examined the connection amongst aid policies and growth. They considered the hypothesis that aid effectiveness can be linked to good macroeconomic policies being in place for it to have maximum impact, should it be sent to recipient countries. Hudson and Mosley (2001) found little evidence of policy being important, when they restricted good policies to mean “free market” policies. Good policies appeared to matter in stimulating growth but, they did not appear to impact aid effectiveness. The study used pooled annual data of developing countries.

Guillaumont and Chauvet (2001) compared two versions of aid effectiveness and aid allocation in the paper “Aid and Performance: A reassessment”. Guillaumont and Chauvet (2001) used a pooled sample of countries for 12 years to conclude that, policy is not an important factor in determining the effectiveness of aid and that the effectiveness of aid depended on the “climate environment”. The worse the climate environment, the more effective the aid is.

Svensson (1999) examined the nexus between aid, growth and democracy, using a pooled cross-country analysis of aid receiving countries. Svensson (1999) discovered that, in the long-term, the growth impact of aid is conditional on the degree of political and civil liberties in the country that is the recipient of aid. Svensson (1999) similarly argued that aid has a positive impact on growth in countries with better institutional checks (i.e. Democracy). Focusing on political regimes, Boone (1996) analysed the efficiency of aid to 97 recipient countries. Boone (1996) attained that in autocratic governments, aid does not have an impact on growth or poverty reduction. This is in covenant with Isham *et al.* (1995) which examined the returns to World Bank funded projects in different countries. They found that returns are higher in countries with better institutions and civil liberties.

Supporting the findings of Hansen and Tarp (2001), Feeny and McGillivray (2008) argue that the ability of foreign aid or ODA to improve economic growth in a country depended on the level of absorption capacity of the recipient country. The absorption capacity factors are, the level of infrastructure in the country, the institutional quality of the governments in place and the level of skills available. Hence, foreign aid at an excess level raises the problem of absorption capacity and is thus counterproductive towards generating growth in the recipient economy according to Minoiu and Reddy (2010) & Dalgaard and Hansen (2001). In addition, Djankov *et al.* (2008) found that the aid curse is greater than the oil curse significantly in countries or regions that have governments who are heavily dependent on aid as a source of revenue.

The cross-country evidence is not one-sided; Bräutigam and Knack (2004) conducted a cross-country study of sub-Saharan African countries and found aid has a negative relationship on growth, despite controlling for external factors, such as conflict and democracy. Likewise, Mallik (2008) took into account 35 years of overseas developmental assistance to six poorest African countries (Central African Republic, Malawi, Niger, Sierra Leone, Mali and Togo) using a cointegration analysis and found the long-term effect of aid on real GDP was negative, for



the majority of countries used in the study. Equally, assessing growth and debt burden in least developing countries, Bjerg *et al.* (2011) found that aid has no relationship with growth, but aid is effective in repayment of debt. Barro (1991) and Duc (2006) used a model of growth theory to model overseas developmental assistance for 39 different recipient countries during several time-periods. The studies concluded that in least developing countries (LDC) the relationship between aid and growth is negative. Likewise, Rajan and Subramanian (2005), Van Wijnbergen (1984) & Voivodas (1973) cited the Dutch-disease phenomenon as a reason for the negative impact of aid on growth.

## 2.2. Panel Studies

Using panel data analysis, in southern Asia, Kaosar and Idrees (2010), Asteriou (2009) and Bhavan *et al.* (2011) looked at the nexus between aid and growth. They all found that the impact of aid on growth is positive. On the contrary, Feeny (2007) investigated the effectiveness of aid on growth in rural Melanesian countries and found no impact.

Rajan and Subramanian (2008) examined the effects of aid on growth, both in cross-sectional and panel data analysis, by taking into account that a bias might exist when aid is sent to low growth countries to find the evidence of a positive relationship between aid and growth. This is remarkable as it also challenges the findings of Burnside and Dollar (2004), Burnside and Dollar (2000), Dalgaard *et al.* (2004) and Cassen (1994) to find that aid effectiveness does not depend on policy, geography and type of aid.

Lu and Ram (2001) estimated a panel data analysis for 56 aid-receiving countries, using the period of 1970-1993. The analysis was done with particular focus on the macroeconomic policies of the recipient countries and its effect on growth. Lu and Ram (2001) found the policy measure to be highly fragile and if augmentation is done in the model by including country-specific policy variables, policy is observed to have no significant effect on aid and growth. However, the findings reported a positive relationship between aid and growth and the parameters estimated for several variables become more precise when country dummy variables are included. This is in agreement with the findings of Moreira (2005) who evaluated the impact of aid on growth using a large panel set to find that aid has a positive relationship with growth irrespective of the policy environment in place. Moreira (2005) also, found that aid is less effective on growth in the short-term than in the long-term.

Concentrating on the West-African region, Manty (2013) used a Chenery (1966) two-gap model to test the hypothesis of foreign aid led growth in West Africa. The study used panel cointegration techniques and country-by-country cointegration techniques to find that a positive long-term relationship between aid and growth, where, aid is found to have causation to economic growth in Senegal, Guinea and Mali. In the case of Guinea, a negative causality between aid and growth was obtained.

Dayton-Johnson and Hoddinott (2003) inspected the inter-relationship between aid, policy, growth and poverty reduction. Dayton-Johnson and Hoddinott (2003) used a panel of developing countries to argue that with the introduction of country fixed effects the Burnside and Dollar (2000) argument of aid working only in a good policy environment fails, especially in sub-Saharan Africa. Dayton-Johnson and Hoddinott (2003) also found that in countries outside Sub-Saharan Africa, aid raises growth, independent of the macroeconomic policy environment and that change to the specification in the way aid is measured, including an interaction in the regression & using different measures of policy does not disregard the findings of Burnside and Dollar (2000).

## 2.3. Country-Specific Studies

The country specific studies also produced varied findings. Kargbo (2012) examined the effect of foreign aid in Sierra Leone since its independence and found that aid is significant in promoting growth, with aid being more effective after the country's civil war. Al-Khaldi (2008) scrutinised the association between aid and economic development in Jordan between 1990-2005. The paper found that aid has had a direct impact on growth;

macroeconomic policies were key determinants in the aid growth relationship. [Dhakal et al. \(2009\)](#) studied the consequence of aid to two aid heavily dependent countries, Bhutan and Nepal. [Dhakal et al. \(2009\)](#) found that aid and labour force participation rates increased economic growth by modelling growth as function of capital & labour and aid & labour into two different equations.

[Mavrotas \(2005\)](#) examined the importance of aid heterogeneity and its fiscal response to a major recipient of aid in sub-Saharan Africa, Uganda. The paper used time series data on different categories of aid (technical assistance, food aid and programme aid). The findings stressed the importance of disaggregating aid in effectiveness research, as different categories of aid have different impacts. The study explicitly found that, food and programme aid specifically reduced the amount of public investment, whilst technical assistance aid was positive with the level of investment.

[Osei et al. \(2005\)](#) examined the public sector fiscal response to aid in Ghana. The paper used a vector autoregressive (VAR) methodology with 34 years of data to find that aid to Ghana has been corresponding with the reduction of domestic borrowing and tax increase i.e. aid has been associated with improved fiscal performance in Ghana. Using time-series data from 1968-1996 also, [Gounder \(2001\)](#) used an ARDL approach to cointegration to examine the nexus between aid and growth in Fiji. [Gounder \(2001\)](#) disaggregated aid into different categories (Grant aid, technical cooperation, bilateral aid and multilateral aid) and found that aid has a significant impact on economic growth in Fiji.

Nevertheless, not all the country specific studies have shown a positive relationship. [Ahmed \(1992\)](#) examined the relationship between aid, domestic savings and growth in Bangladesh to discover that aid has a negative relationship with growth due to institutional constraints. This is consistent with the results of [Quazi \(2005\)](#) and [Abu-Obaydullah \(2007\)](#) who found that aid had a miniature impact on Bangladesh's development. [Mbaku \(1993\)](#) also found a negative but significant relationship for Cameroon. However, when aid was broken down into categories such as (loan, grants and concessions) [Islam \(1992\)](#) established that loans had a positive impact on growth. The findings of [Mbaku \(1993\)](#) and [Islam \(1992\)](#) are a contribution to the literature but they failed to acknowledge the time-series nature of their data and establish if cointegration relationships existed. [Feeny \(2005\)](#) and [Nidup \(2015\)](#) used an Auto-regressive distributed lag model (ARDL) and found that aid did not have a positive impact on growth in Papua New Guinea and Bhutan respectively.

Specifically concentrating on Nigeria, [Fasanya and Onakoya \(2012\)](#) used a neo-classical framework approach to find that the nexus between aid and growth in Nigeria is positive, with a significant boost to the level of investment in the economy. [Nkoro and Furo \(2012\)](#) also came to similar conclusions. On the contrary, [Bakare \(2011\)](#) used a VAR model and treated the amount of aid Nigeria received from donor countries as endogenous to conclude that aid has a negative impact on growth. [Kolawole \(2013\)](#) examined the impact of extorted FDI from ODA on growth in Nigeria between 1978-2011, using a two-gap model and the error correction model to reveal that there is no causality between aid and growth and that aid has no impact on growth in the study.

In conclusion, the effect of aid on growth has been mixed, [Hoeffler \(2002\)](#) and [Kenny and Williams \(2001\)](#) made the case that cross-country evidence has been mixed and failed to take into account country-specific issues and that there appears to be no consensus in both the panel and cross-section data. Country specific studies are needed. This paper seeks to contribute to the existing work on the aid effectiveness relationship. [Fasanya and Onakoya \(2012\)](#), [Nkoro and Furo \(2012\)](#) and [Kolawole \(2013\)](#) failed to take into account the need for good macroeconomic policy and governance in boosting growth. This paper seeks to address it using [Pesaran and Shin \(1998\)](#) ARDL model, which no paper has done for Nigeria with the inclusion of the endogenous growth theory. The advantage of the ARDL model is that it is efficient when estimating small samples. [Table 2](#) provides the findings of other literature on aid effectiveness.



**Table-2.** Summary of other literature reviewed indicating a lack of consensus on aid efficiency.

Author	Year	Type of regression used	Results/Findings (Positive/Negative) <sup>1</sup>
Papanek	1973	Cross-country	positive
Fayissa & El-Kaissy	1999	Cross-country	positive
Snyder	1993	Cross-country	positive
Javid & Qayyum	2011	Time-series	negative
Ngang	2008	Time-series	positive
Khan et al.	1993	Time-series	negative
Juselius et al.	2013	Time-series	positive
Young & Sheehan	2014	Panel	Negative
Karras	2005	Panel	positive
Arndt et al.	2014	Panel	positive

(1)Positive: implies aid generates growth; Negative: implies aid has been an impediment to growth.

### 3. DATA & METHODOLOGY

In this section the data used and the econometric methodology and specification used are outlined. The first part of this section describes the data; the second part discusses the empirical model in question. The third and fourth sections look at the econometric methods used.

#### 3.1. Data

The data used in this study is time-series data from 1970-2014. The data was sourced from the annual publication by the [World Bank \(2016\)](#) in its statistics index, OECD data bank and the Central Bank of Nigeria statistical database. Gross domestic product (GDP), foreign direct investment (FDI), overseas developmental aid and data used in estimating the policy variable (trade openness, inflation, budget deficit) were sourced from the World Bank<sup>4</sup>.

The data used for the governance variable were obtained from the World Bank governance indicators as [Feeny \(2007\)](#) stated. This data was available from the year 1996 to 2012. The governance index includes six different measures, which are used in generating an equally weighted composite index. The estimate for the governance index ranges from (-2.5) to (+2.5). Negative values of the index mean poor governance and positive values mean good governance. The variables used to generate the index are: (i) Government corruption, (ii) Government effectiveness (iii) Political stability and absence of violence, (iv)Regulatory quality (v) Voice and accountability.

As in [Feeny \(2005\)](#) the index of the first year 1996 is used to interpolate for previous years given that the level of governance would have not changed by the missing periods.

Generating the macroeconomic policy index<sup>5</sup>, [Burnside and Dollar \(2000\)](#) specification for generating a policy variable is used. The technique used to generate it is called the principal component analysis. The approach is used to avoid high correlation between the macroeconomic variables used to generate the composite index. The variables used in generating the index were: (i) the degree of openness in the economy, captured by the trade to GDP ratio, (ii) the amount of budget surplus/deficit relative to GDP, (iii) the level of inflation in the economy, captured by the Consumer Price Index.

In agreement with [Burnside and Dollar \(2000\)](#) aid recipients with “good polices” were assumed to have open markets, large budgets surpluses and low inflation rates. Nevertheless, [Lensink and Morrissey \(2000\)](#) outlined issues with such assumptions, contending that some of the variables in question, which form the policy index were, weakly correlated to growth and that the assumption of just one policy index is flawed. Yet, it is roundly accepted that when estimating growth models, the impact of policy was to be controlled.

The first value of the principal component index was used for estimation of policy in this study, the eigenvalue presented below in the appendix shows that it explains 46% variation in of the selected policy variables

<sup>4</sup> See appendix A for full data sources

<sup>5</sup> See appendix B for Eigen values and variance.

### 3.2. Empirical Model.

This paper used an empirical model based on endogenous growth theory of economic growth. The theory holds that; economic growth is endogenous as not dependent on external factors in an economy. The main motivators of growth in this model were the investment in human capital, the degree of innovation and knowledge. The implication for this model is that macroeconomic policies that emphasize on competition, innovation change and openness will promote growth. Therefore, the endogenous growth model as [Dornbusch et al. \(2001\)](#) specified was due to macroeconomic policies of governments.

The production function used here is similar to [Feeny \(2005\)](#) who uses [Jones \(1998\)](#) aggregate production function.

$$y = EK^{\rho}(TL)^{1-\rho} \quad (1)$$

Where in [Equation 1](#) above the letter (E) denotes the impact of structure of the economy on the productivity of inputs, the letter (K) denotes the level of capital, (T) is a measure of the amount of technology in the economy, and (L) captures the share of labour in the economy. The parameter  $\rho$  is situated between the value 0 and 1. As [Jones \(1998\)](#) stated, the cost of starting a new business and investing in monthly profits was heterogeneous amongst different countries. [Jones \(1998\)](#) opined that the reasons these differences exist are due to government macroeconomic policies and institutions in place, which are referred as infrastructure in the economy. He argued that countries that generate capital, technology transfers and skills will be the one where: (i) there is absence of instability, (ii) there is rule of law and corruption, payment of bribes is not tolerated and (iii) The presence of an open economy with the rest of the world.

The empirical model based on endogenous growth is then;

$$\Delta GDPr = \phi + \chi_1 FDI + \chi_2 AID + \chi_3 TRADE + \chi_4 Governance + \chi_5 policy + \chi_6 Trend + \varepsilon \quad (2)$$

[Equation 2](#) above shows the empirical model based on endogenous growth. Where,  $\Delta GDPr$  is the growth rate of GDP, FDI is amount of investment into the economy relative to GDP, AID, which is the focus variable of the paper captures the ODA to GDP ratio. Demo, is the democracy variable, which captures the regime, be it military or civilian or periods of transition. Three variables are used to stress the empirical model as stressed by [Jones \(1998\)](#). Governance, the governance index policy, is the policy index and TRADE is ratio of exports in addition to imports as a ratio of GDP, this is a proxy for openness. Finally, a trend variable is included which intended to capture labour force and technological changes over time. The choices of these selected variables are from [Burnside and Dollar \(2000\)](#), [Feeny \(2007\)](#) and [Nidup \(2015\)](#).

To avoid the issue of double counting, when considering both aid and investment at the same time, [Gomanee et al. \(2002\)](#)'s generated procedure<sup>6</sup> was used. In the first stage, the investment & aid transmission was checked to see whether the level of investment in the economy was dependent on the amount of donor given aid. Investment was regressed with aid, using the level of investment as the regressor and the one-year lag of the investment variable. This regression also included control variables such the level of inflation captured by the CPI Index, the availability of credit in the economy, macroeconomic policies as outlined above and the Governance index. The result when carried out indicated a positive relationship between investment and the aid variable; nonetheless, it was statically insignificant at both 5% and 10%. Hence the need for the [Gomanee et al. \(2002\)](#) procedure was abandoned in this paper, [Feeny \(2005\)](#) showed how to deal with the problem should the results be significant.

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<sup>6</sup> See appendix C for results.

### 3.3. Econometric Method

This paper used Pesaran and Shin (1998) ARDL model. The model was used because of its suitability when modelling a time series estimations and it had a big advantage in that regardless of the order of the variables be it in level I (0) or first-difference I (1) it avoided the necessity of unit-root testing for spurious regression. Another benefit of the ARDL model was that it solves the problem of serial correlation. Finally, given the sample being used in this estimation was 34 years long, the ARDL gave good results and did not have sample bias.

Pesaran and Shin (1998) Use the subsequent version of an Error correction version of the model.

$$\Delta y = \phi + \sum_{i=1}^{k-1} A_1 \Delta y_{t-i} + \sum_{i=0}^{k-1} B_1 \Delta x_{t-i} + \delta_1 y_{t-k} + \delta_2 x_{t-k} + \mu_t \quad (3)$$

Equation 3 above captures the error correction model for the ARDL model. Where,  $\phi$  is the constant vector parameter, A and B are the names of the parameters in question,  $y_t$  captures the endogenous vector variable,  $x_t$  captures all the explanatory variables as outlined above and  $\delta_1$  and  $\delta_2$  capture the parameters for the long-term relationship.  $\mu_t$  is assumed to be serially uncorrelated and homoscedastic.

As noted above whilst introducing the model, Pesaran and Shin (1998) accentuated the relevance of stationarity in the data. Hence, the need for all variables in question to be in level or first difference. To check this property before proceeding to the full ARDL model, the Phillips and Perron (1988) (pp test) and Dickey and Fuller (1979) ADF test were used. The null hypothesis was that the variable is stationary; to proceed we have to “fail to reject the null”.

### 3.4. ARDL and Bounds Testing Procedure

Pesaran and Shin (1998) Cointegration<sup>7</sup> technique had two phases in estimating the long-term relationship. In the first stage, the existence of cointegration amongst variables (bounds testing) was tested using the Fischer F-test. The null hypothesis that the lagged regression in the error correction are zero i.e.  $H_0 = \delta_1 = \delta_2 = 0$  against an alternative hypothesis of  $H_0 \neq \delta_1 \neq \delta_2 \neq 0$  was tested. Pesaran and Shin (1998) provided critical values to test the hypothesis outlined with and without time trend. The critical values were grouped into “upper” and “lower” bounds, where, the upper bounds were assumed to be in first-difference and the lower bounds in levels. To reject the null hypothesis, the calculated F-statistic must be above the upper bound critical value. If the calculated F-statistic was found below the lower bound, a decision to fail to reject the null hypothesis was required for the model. As a final point, if the calculated F-statistic lay in-between the upper and lower bound, the estimation was indecisive and inadequate.

The second phase of the proceeded to if cointegration relationships are found, here, short-term and long-term estimates are found. Given the nature of the data being yearly, the lag length was automatically selected to be two periods on all variables being used. Subsequent to this, a lag criterion was chosen. It could have been either Schwartz criteria, Hannan Quinn criteria or the Akaike criteria. Given that the ARDL model is also an OLS model, stability and diagnostic checks were carried out on hetroskedasticity, serial correlation, functional form misspecification and the normality of the data.

#### 3.4.1. Stability Checks

A stability check was carried out on the model using the (Brown *et al.*, 1975) model of stability verification. The cumulative sum (CUSSUM) and cumulative sum of square (CUSSUMSQ) were called out on recursive regression residual. To accept that the models are stable, the plots must fall within 5% critical bounds of significance.

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<sup>7</sup> Cointegration refers to a linear combination of non-stationary variables.

#### 4. ESTIMATION AND EMPIRICAL RESULTS

In this chapter, the empirical results are discussed. The first section looks at the preliminary results, the second section looks at the unit test, and the third section looks at bound testing for cointegration, the fourth section looks at the long-term and short-term estimates of the model. The final section looks at the stability and diagnostic test in the model.

##### 4.1. Preliminary Results

###### 4.1.1. Summary Statistics

Table 3 provides the descriptive statistics of the variables used in this paper. Over the period 1970 to 2014, Nigeria had an average growth rate of 4.4 per cent. The highest growth achieved in Nigeria was in 2004 when it had a growth rate of 33.73 per cent. The minimum observation of GDP growth was a negative of 13.3%; this occurred in the year 1981. The amount of aid to GDP has averaged 2.2% over the same time-period. The highest percentage of aid to GDP was 7.85% in the year 2006, which can be seen in Figure 1.

Table-3. Summary Statistics of Variables.

Variable	Obs	Mean	Std. Dev.	Min	Max
gdpgr	45	4.445296	7.993644	-13.12788	33.73577
aid	45	2.247689	0.0137696	0.0005358	7.8581083
fdi	45	2.651049	2.174122	-1.150856	10.83256
governance	45	-0.5144924	0.8284031	-1.997	0.3753603
policy	45	0.1513307	0.8906537	-2.3332	1.984208
trade	45	48.27291	16.1326	19.6206	81.81285
trend	45	22	13.13393	0	44

###### 4.1.2. Correlation Matrix

A correlation coefficient of the variables used in the estimation is presented in Table 4. The correlation table below shows that aid, governance, and policy were positively correlated while trade and investment were negatively correlated with GDP.

Table-4. Correlation analysis.

Variables	gdpgr	aid	FDI	governance	policy	Trade	trend
Gdpgr	1.0000						
Aid	0.0318	1					
FDI	-0.2900	0.3122	1				
Governance	0.3349	-0.6464	-0.5616	1			
Policy	0.3855	0.475	-0.2851	-0.0443	1		
Trade	-0.2646	0.3628	0.3709	-0.5404	-0.2869	1	
Trend	-0.1102	0.8376	0.2574	-0.7513	0.3603	0.5172	1

##### 4.2. Unit Root Test

The unit root test was carried out using the Dickey and Fuller, (1979) and Phillips and Perron, (1988) unit root tests. The test had a null hypothesis of there is unit root. In order to proceed to the full ARDL model the null Hypothesis had to be rejected and the presence of second difference variables had to not be established I (2). Table 5 shows the results of the test. From the unit root test of both the ADF and PP<sup>8</sup> test, there was no presence of I(2) variables. The next stage was to proceed to the ARDL model.

<sup>8</sup> See appendix for equations of Augmented Dickey Fuller Test (ADF) and Phillips-Perron's (PP test)

Table-5. Unit root test.

ADF test (with intercept)			PP-test (with intercept)			
Variables	Levels	First Difference	Order	Levels	First Difference	Order
Gdpgr	-5.7975	-8.8017*	I(1)	-5.80694	-14.16196*	I(1)
Aid	-4.2382	-7.3363*	I(1)	-3.506905	-14.14205*	I(1)
FDI	-3.6292	-9.3707*	I(1)	-3.62909	-19.31846*	I(1)
Governance	-1.409384	-6.71905*	I(1)	-0.1409384	-6.716978*	I(1)
policy	-3.362736	-6.101806*	I(1)	-3.4754599	-8.784825*	I(1)
trade	-2.66023	-8.937214*	I(1)	-2.51723	-8.891712*	I(1)

Source: Author's computation

Note: (\* indicates level of significance at 5%)

#### 4.3. Bounds Testing for Cointegration

As stated in section 3, the ARDL model approach had two stages in estimating the long-term relationship. In the first stage, the existence of long-term relationship was tested using the bounds test. The bounds test F-statistic had to be greater than the upper bound critical values at 1%, 5% or 10%. The table below provides the results for the long-term models being tested.

- Model A: Equation 2
- Model B: Equation 2, without policy variable.
- Model C: Equation 2, without, governance and policy variables.

Table-6. ADRL Bounds testing results.

Model A		
k=5	F-statistic:	8.04
Critical values	Lower Bound	Upper Bound
1%	3.41	3.35
5%	2.62	3.79
10%	2.26	4.68
Model B		
k=4	F-statistic:	9.50
Critical values	Lower Bound	Upper Bound
1%	3.74	5.06
5%	2.86	4.01
10%	2.45	3.52
Model C		
k=3	F-statistic:	8.36
Critical values	Lower Bound	Upper Bound
1%	4.29	5.61
5%	3.23	4.35
10%	2.72	3.77

Critical values from Pesaran *et al.* (2001).

Table 6, presents the bounds test for Models A to C. The null hypothesis of no-long-term relationship was rejected for all models (A, B & C) at the 1% level of significance. Therefore, there were long-term relationships between the variables.

#### 4.4. Long-term and Short-term Models

##### 4.4.1. Long-term Model

Table 7 presents the first stage of the estimation, the long-term ARDL model for various Models (A, B&C). Regardless of the use of good macroeconomic policy and good governance, aid was found to support growth in the long-term and the findings were also statistically significant at 5%. This indicated that donor aid to Nigeria between 1970-2014 was successful in generating growth. The coefficient on the trade variable was found to be positive and statistically significant at 10%. The coefficient for the governance were all found to be positive in the long-term but statistically insignificant. A possible explanation for this was problems with the governance index.

The macroeconomic policy variable was found to be positive and statically significant at 5%. This was in agreement with cross-country studies such as [Burnside and Dollar \(2000\)](#) and [Collier and Dehn \(2001\)](#) who stressed the importance of good macroeconomic policy in fostering growth.

Table-7. Long-term Model.

Dependent variable GDP growth			
Variables	Model A	Model B	Model C
Aid	0.221836*(0.104028)	0.226136*(0.100941)	0.227202*(0.108684)
FDI	0.356042*(0.125553)	0.332457*(0.109681)	0.215666*(0.087539)
Governance	0.082748(0.339397)	0.087567(0.331432)	-
Policy	0.095779*(0.039102)	-	-
trade	0.529566***(0.22910)	0.660152*(0.363)	0.681154*(0.401)
trend	0.015421** (0.0811)	-0.020471** (0.083)	0.049283** (0.097)
constant	-0.337558(3.294458)	-1.104482(2.692613)	-0.008156(2.310601)
serial correlation	0.5450	0.5215	0.6889
Function form	0.4142	0.4521	0.1601
Normality	0.35799	0.415575	0.065717
Heteroskedasticity	0.2620	0.2186	0.6024

Notes: Number in parenthesis are standard errors (\* and \*\* indicate level of significance at 5% and 10% respectively). Serial correlation test is carried out using LM test for serial correlation of variables, to test for functional form Misspecification, Ramsey rest test is used. Normality is tested using Jaque & bera test. Finally, heteroskedasticity is tested using breusch-pagan test.

The results supported that Nigeria's GDP growth has occurred mainly through its exports sector, where it generates revenue from its vital resource; petroleum. Policy, investment and governance were found to be statistically insignificant. Surprisingly, the coefficient on trend variable was negative in Model B, however, in Model A and C it indicated that technical improvements and labour force have had a positive impact on growth in Nigeria. The results found above were in agreement with [Fasanya and Onakoya \(2012\)](#) and [Nkoro and Furo \(2012\)](#) who used different specifications to look at the impact of aid on growth in Nigeria. This was in contrast to the findings of [Bakare \(2011\)](#), [Kolawole \(2013\)](#) who failed to establish a positive relationship between aid and growth. With regards, to macroeconomic policy, this paper was in agreement with [Al-Khaldi \(2008\)](#) on the importance of good macroeconomic policy in fostering growth.

Diagnostics tests were carried out on the models and the presence of serial correlation was rejected as the models were well specified and we failed to reject the presence of homoscedasticity in the data. However, the residuals were not normally distributed. As [Greene \(2012\)](#) noted, this is not a major problem.

#### 4.4.2. Short-term

Table-8. Short-term estimates.

Dependent variable Dgdpr			
Variables	Model A	Model B	Model C
dAID	0.312472(0.225308)	0.239988***(0.121068)	0.305353(0.2283)
dFDI	-0.046870(0.063045)	-0.036356(0.073390)	-0.053571(0.064767)
dpolicy	-0.095268(0.221757)	-	-
dgovernance	0.994150*(0.396611)	1.072090*(0.450679)	-
dtrade	1.154446***(0.675023)	0.870246(0.544802)	0.234158(0.6911)
dtrade_1	1.809904*(0.549200)	1.691765*(0.544202)	1.725410*(0.604932)
trend	-0.00323***(0.001)	-0.004625***(0.024)	-0.0023604***(0.048)
ECM	-1.057702*(0.139271)	-1.065224*(0.141103)	-0.924943*(0.148470)
cons	-0.354124(3.477528)	-1.172135(2.916794)	-0.007471(2.116542)

Notes: Number in parenthesis are standard errors (\* and \*\* indicate level of significance at 5% and 10% respectively).

Source: Author's computation.

Table 8 above presents the short-term effects of the error correction models. The results were mostly in agreement with the long-term estimates, with little exemptions. Contrary to the long-term, the short-term



coefficients for foreign direct investments were negative and were found to be statically insignificant at 5%. This might be due to most foreign direct investment being used in Nigeria to finance long-term capital projects. However, in the three models, aid was still found to have positive impact on growth in the model, with it being statistically significant in Model B. The error correction term for models (A, B & C) was significant at 1%. The coefficient of the error correction mechanism was the adjustment mechanism captures the disequilibrium in Gross domestic product, which is captured in the next period. The results of the error correction mechanisms for the models estimated ranged from -1.065 to -0.92. This captured the shock to the steady state equilibrium. In addition, this suggested the validity of a long-term relationship amongst variables in the long-term equation.

4.5. Stability Diagnostics

To verify the stability of the models estimated<sup>9</sup>, Brown *et al.* (1975) CUSUM and CUSMSQ tests were carried out below as shown in Figures 4,5,6 & 7. The stability tests indicated that the estimated coefficients were stable, since they lay within the 5% critical value.

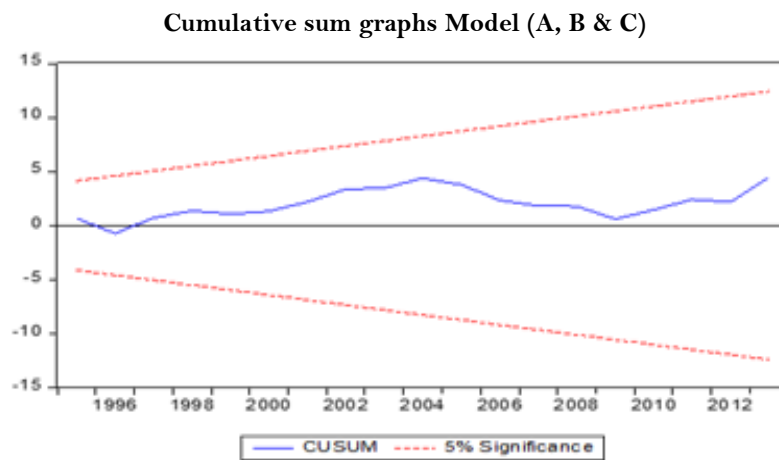


Figure-4. CUSUM, Model A.

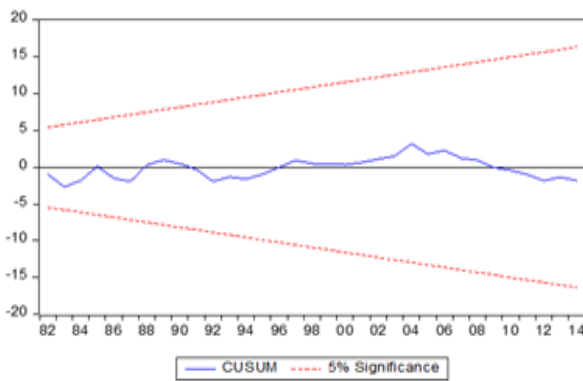


Figure-5. CUSUM, Model C.

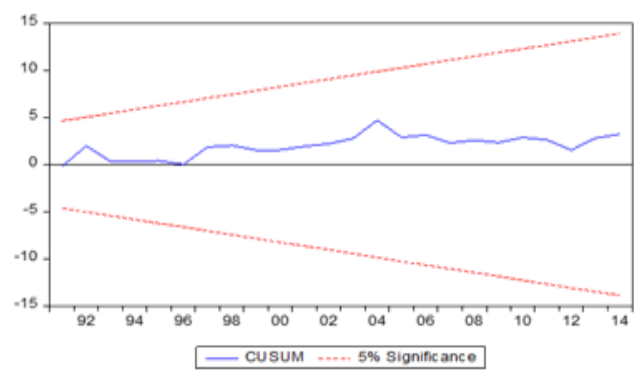


Figure-6. CUSSUM, Model B.

<sup>9</sup> See appendix for Graphs.

Cumulative sum of squares graph Model (A, B &amp; C)

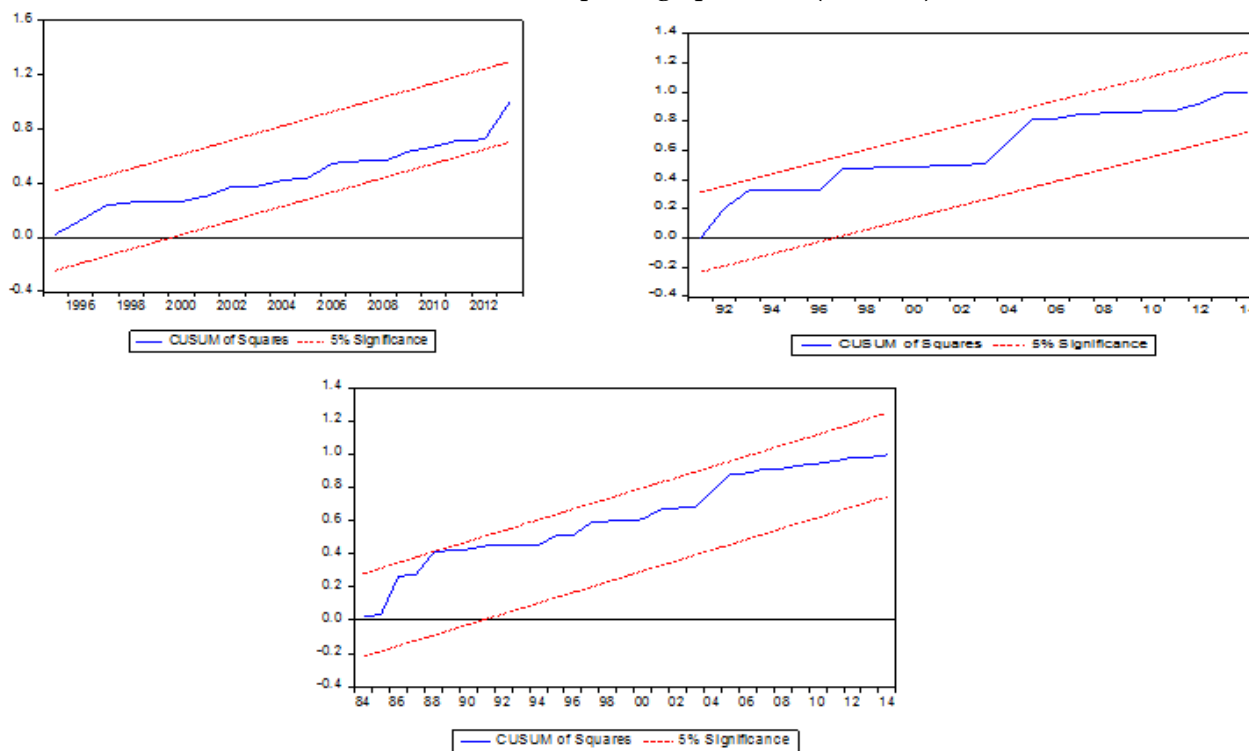


Figure-7. CUSUM, Model A, B &amp; C.

## 5. CONCLUSION

This paper set out to study the effect of aid on growth in Nigeria using the Pesaran and Shin (1998) and Pesaran *et al.* (2001) ARDL bounds testing approach to cointegration by applying time series analysis to data from 1970-2014. The secondary motivation of the paper was to ascertain whether *good governance* and *good macroeconomic policies* have had an impact on growth in the Federal Republic of Nigeria. The result of the bounds testing approach showed that a positive long-term relationship exists between aid and growth in Nigeria's case. This was verified by the error correction mechanism, which was significant. Furthermore, diagnostic tests, such as serial correlation, heteroskedasticity and functional form misspecification confirmed that the properties of ordinary least square (OLS) were not violated.

The findings revealed that changes in labour force and technological changes spur growth in Nigeria in the long-term. This was key as it indicated the need for Nigeria to have a bigger and well educated labour force and the importance of human capital in generating growth. In the short-term, foreign direct investment showed a positive relationship with growth while the governance variable was found to be positive. Trade was found to have a significant impact on growth in both the short-term and long-term. This was primarily due to Nigeria earning 65% of its revenues from exports (Oyedepo, 2012). Finally, the policy variable was also found to generate growth in Nigeria. This was in agreement with Burnside and Dollar (2000) and Feeny (2005) who stressed the importance of aid being conditional on macroeconomic policy in fostering growth.

The results of this study suggested that despite the fiscal challenges facing OECD countries they should continue to give aid to Nigeria to promote a neo-liberal developmental agenda. Aid was still useful in funding infrastructure projects, dealing with natural disasters, climate change and human capital development. In summary, OECD nations giving aid to Nigeria should expect gratitude from citizens in recipient countries in the form of support for international policies; secondly, more aid will lead to more trade with donor countries. Lastly, reducing global poverty is key to peace around the world.

This study had several limitations. More work needs to be done, as there were several problems that need to be addressed. The ARDL model had problems relating to multicollinearity amongst variables and deciding the optimal lag length in small sample estimation. Concerning the variables used, the construction of both the governance and policy index was problematic as it was not entirely appropriate to capture policy and governance issues in this estimation. There needs to be a better proxy for governance and policy, as outlined by [Lensink and White \(2000\)](#). The failure to disaggregate aid in the model was a major failing and more data on bilateral multilateral, loan and grants aid to Nigeria was needed to overcome the limitations of the study.

In conclusion, this paper contributed to the aid effectiveness literature on the nexus between aid and growth and the role that policy and governance play in fostering growth by examining the Federal Republic of Nigeria over the time-period of 1970-2014. Given the time period of the data used and the appropriateness of the ARDL model, this study concluded that aid has been positive towards growth in Nigeria and that donors should provide more aid to Nigeria.

**Funding:** This study received no specific financial support.

**Competing Interests:** The authors declare that they have no competing interests.

**Contributors/Acknowledgement:** Both authors contributed equally to the conception and design of the study.

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## Appendix

### A

#### Data Source

GDP growth (annual %)	World Bank national accounts data, and OECD National Accounts data files.
Trade (% of GDP)	World Bank national accounts data, and OECD National Accounts data files.
Governance Indicators	Worldwide Governance Indicators ( <a href="http://www.govindicators.org">www.govindicators.org</a> ).
AID (% of GDP)	OECD. <a href="http://www.oecd.org/dac/stats/idsonline">www.oecd.org/dac/stats/idsonline</a> .
Inflation	World Bank national accounts data, and OECD National Accounts data files.
Investment	World Bank national accounts data, and OECD National Accounts data files.
Interest rate	World Bank national accounts data, and OECD National Accounts data files.



**B***Principal component analysis (policy)*

Principal Components Analysis				
Sample: 1970 2014				
Computed using: Ordinary correlations				
Extracting 3 of 3 possible components				
Number	Value	Difference	Variance	Cumulative
1	1.371822	0.456941	0.4573	
2	0.914881	0.201583	0.305	0.4573
3	0.713298	---	0.2378	0.7622
				1
Eigenvectors (loadings):				
Variable	Component			
Budget deficit	-0.653859			
inflation	0.454591			
Openness	0.604826			

Source: authors computation.

**C***Generated regressor technique*

Dependent Variable: FDI				
Method: Least Squares				
Sample (adjusted): 1970 2014				
Variable	Coefficient	Std. error	t-statistic	prob.
C	-2.40E+10	1.35E+10	-1.774187	0.218
FDI (-1)	-1.228226	0.355498	-3.45494	0.0745
Interest	1.10E+08	1.61E+ 08	0.681012	0.5661
Governance	-1.49E+10	1.02E+10	-1.454379	0.2831
Domestic Cred	4.53E+08	89767005	5.042942	0.0371
Policy	-10132268	2.01E+08	-0.05032	0.9644
Aid	0.542603	0.164218	3.34172	0.1807
R- Squared	0.989242	Mean dependent var	5.84E+09	
Adjusted R-squared	0.951589	S.D dependent var	2.49E+09	
S.E of regression	5.47E+08	Akaike info criterion	43.0689	
Log likelihood	-207.3445	Hannan-Quinn criter.	42.80335	
F-statistic	26.2727	Durbin-Watson stat	2.6004425	
Prob (F-statistic)	0.037149			

**D***Unit Root**Augmented-Dickey fuller test*

Given,

$$y_t = \mu + \omega_t + \eta y_{t-1} + \eta_1 \Delta y_{t-1} + \dots + \eta_p \Delta y_{t-p} + \epsilon_t$$

The random walk is obtained by imposing,  $\mu = 0$  and  $\omega_t = 0$ . The random walk drift has  $\omega_t = 0$ ; the trend stationary model ventures both parameters free.

The test statistic to carry out the test is then

$$DF_t = \frac{\hat{\eta} - 1}{\text{Standard Error}(\hat{\eta})}$$

Based on the statistic

$$DF_{\eta} = \frac{T(\hat{\eta} - 1)}{1 - \hat{\eta}_1 - \dots - \hat{\eta}_p}$$

It has the advantage that it can accommodate higher autoregressive process in  $\epsilon_t$

Alternatively, by subtracting  $y_{t-1}$  from both sides.

$$\Delta y_t = \mu_t + \eta^* y_{t-1} + \sum_{j=1}^{p-1} \Pi_j \Delta y_{t-j} + \epsilon_t$$

Where,

$$\Pi_j = - \sum_{k=j+1}^p \eta_k \text{ and } \eta^* = \left( \sum_{i=1}^p \eta_i \right) - 1$$

The null hypothesis for the Augmented-Dickey fuller is then  $\eta^* = 0$  against an alternative of  $\eta^* < 0$ . If failure to reject the unit root holds,  $\eta^* = 0$  then first-difference may be carried out.

$$\Delta y_t = \mu_t + \omega_t + \eta^* y_{t-1} + \sum_{j=1}^{p-1} \Pi_j \Delta y_{t-j} + \epsilon_t$$

The test is carried out using the joint-hypothesis that  $\mu = \omega = 0$

#### Phillip's and Perron Test

The philp-perron's test has been used to improve on the ADF test as it captures finite sample properties.

Given,

$$y_t = \theta_t + \eta y_{t-1} + \eta_1 \Delta y_{t-1} + \dots + \eta_p \Delta y_{t-p} + \epsilon_t$$

Where  $\theta_t$ , may be 0,  $\mu$  or  $\mu + \omega_t$ . The (PP-Test) modifies the ADF test outlined above.

$$Z_t = \sqrt{\frac{C_0}{a}} \left( \frac{\hat{\eta} - 1}{v} \right) - \frac{1}{2} (a - C_0) \frac{Tv}{\sqrt{as^2}}$$

$$z_{\eta} = \frac{T(\hat{\eta} - 1)}{1 - \hat{\eta}_1 - \dots - \hat{\eta}_p} - \frac{1}{2} \left( \frac{T^2 v^2}{s^2} \right) (a - C_0)$$

Where,

$$C_0 = [(T - K)/T]s^2$$

$$a = C_0 + 2 \sum_{j=1}^L \left( 1 - \frac{j}{L+1} \right) c_j$$

$$c_j = \frac{1}{T \sum_{s=j+1}^T e_t e_{t-s}} \quad j = 0, \dots, p = jth \text{ autocovariance residulas}$$

$$s^2 = \frac{\sum e_t^2}{T - K}$$

$$v^2 = \text{variance of } \hat{\eta}$$

## E

#### Model Specification

$$GDpr_t = \phi + \chi_1 FDI_t + \chi_2 AID_t + \chi_3 TRADE_t + \chi_4 Governance_t + \chi_5 policy_t + \chi_6 Trend_t + \epsilon$$

## ARDL Model

$$\Delta GDpr_t =$$

$$\phi_0 + \sum_{i=1}^k \rho_{1i} \Delta GDpr_{t-1} + \sum_{i=0}^k \rho_{2i} \Delta FDI_{t-1} + \sum_{i=0}^k \rho_{3i} \Delta trade_{t-1} + \sum_{i=0}^k \rho_{4i} \Delta Aid_t + \sum_{i=0}^k \rho_{5i} \Delta trend_t + \sum_{i=0}^k \rho_{6i} \Delta policy_t + \sum_{i=0}^k \rho_{7i} \Delta Governance_t + \rho_8 GDpr_{t-1} + \rho_9 FDI_{t-1} + \rho_{10} trade_{t-1} + \rho_{11} Aid_{t-1} + \rho_{12} trend_{t-1} + \rho_{13} policy_{t-1} + \rho_{14} Governance_{t-1} + \mu_t$$

## Error-Correction Mechanism

$$GDpr_t = \phi_0 + \sum_{i=1}^k \rho_1 GDpr_{t-1} + \sum_{i=0}^k \rho_2 FDI_{t-1} + \sum_{i=0}^k \rho_3 trade_{t-1} + \sum_{i=0}^k \rho_4 Aid_t + \sum_{i=0}^k \rho_5 trend_t + \sum_{i=0}^k \rho_6 policy_t + \sum_{i=0}^k \rho_7 Governance_t + \mu_t \Delta GDpr_t = \phi_0 + \sum_{i=1}^k \rho_{1i} \Delta GDpr_{t-1} + \sum_{i=0}^k \rho_{2i} \Delta FDI_{t-1} + \sum_{i=0}^k \rho_{3i} \Delta trade_{t-1} + \sum_{i=0}^k \rho_{4i} \Delta Aid_t + \sum_{i=0}^k \rho_{5i} \Delta trend_t + \sum_{i=0}^k \rho_{6i} \Delta policy_t + \sum_{i=0}^k \rho_{7i} \Delta Governance_t + \psi ECT_{t-1} + \mu_t$$

Where  $\psi$  is the error correction term, this shows the speed of adjustment of the parameter to a stable state in the long-term per annum and  $ECT_t$  is modelled as;

$$ECT_t = GDpr_t - \phi_0 - \sum_{i=1}^k \rho_1 GDpr_{t-1} + \sum_{i=0}^k \rho_2 FDI_{t-1} + \sum_{i=0}^k \rho_3 trade_{t-1} + \sum_{i=0}^k \rho_4 Aid_t + \sum_{i=0}^k \rho_5 trend_t + \sum_{i=0}^k \rho_6 policy_t + \sum_{i=0}^k \rho_7 Governance_t$$

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