

## Economic Effect of Development Aids in Nigeria: A Co-Integration Analysis

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**Abstract:** This study employed co-integration and error correction model to examine the impact of development aids on Nigeria economic growth. The results show that aids contributed positively to output growth. Specifically, a 100% increase in aid will lead to increase in output by 1.3%. Structural adjustment policy evidenced in currency devaluation was found to make aid more effective.

**Key words:** Economic growth, development aid, Nigeria

### INTRODUCTION

In recent time, the debate over the economic effect of public capital particularly development aid and foreign direct investment has grown significantly both in terms of literature and policy recommendations. Nevertheless, it is still a topical issue whether development aids have improved economic performance in developing economy.

In development economics literature, development aid is typically thought of as a means of raising financial capital<sup>2</sup>. Cunngu and Swinnen<sup>[1]</sup> gave six importance of aid as:

- Alleviation of the recipient's resource constraint in order to increase the Gross Domestic Product (GDP)
- Augmenting of the country's stock of physical capital.
- Upgrading the stock of human capital
- Facilitation of technological transfers
- Provision of external finance when the involvement of international aid organizations promotes the recipient's credibility and
- Building up of confidence and improving the business climate of the recipient country.

In spite of the advantages, it has been argued that the inflows of development aid may also have a negative consequence on the recipient's economic performance. Critics of international aid programmes argue that they are often ill-targeted, create dependency, or distort priorities and that much aid

money is, in some cases, siphoned off by corrupt officials in the recipient countries. They therefore maintain that aid generally has a damaging role in development economics. In response to such criticisms, much greater scrutiny has been applied recently to aid packages and the conditions on which they are given.

There has also been greater encouragement of private investment in developing countries, in the belief that it is likely to be of more help in transforming their economies than aid. According to Djajic *et al.*<sup>[2]</sup> the argument is that in the presence of distortions, aid can be donor enriching and recipient's immiserising-the so called transfer paradox.

According to Herbst and Soludo<sup>[3]</sup> the key factor behind this unconventional result is the effect of aids on the international terms of trade.

In Nigeria, the issues of foreign aid leave much to be desired. Though the advantages cannot be contested, the inflow has been low since independence. For over 40 years, Nigeria has consistently received only one-fifteenth the average development assistance per African. As such, Nigeria has been made the de facto counterfactual scenario for international development. Such a low inflows is said to have mixed consequences as shown in Table 1.

Relative to the world means, Nigeria has actually narrowed its social gap for longevity and adult literacy over the last quarter-century, however, personal income and under five mortality rate gaps widened. Though the quadrupling in the price of oil in the 70s during the

Table 1: Nigeria: Development Indicators relative to the world average, 1975-2000: Nigerian asymmetric development: Progress and setbacks on a frayed aid shoestring

	Life expectancy at birth, years		Infant mortality rate, per 1,000 births		adult literacy rate (ages 15 and over)		GNI per capita (PPP, 2000 US \$)	
	1975	2000	1975	2000	1985	2000	1975	2000
Nigeria	44.0	51.3	120	110	40.7%	63.9%	\$1.068	\$896
World	59.9	66.4	96	56	77.1%	86.0%	\$5.526	\$7,446
Ratio, Nigeria:World	0.735	0.773	1.25	1.96	0.528	0.743	0.193	0.120
Nigeria: Progress or setback?	Progress		Setback		Progress		Setback	

Source: United Nations Development Programme, (1975 Incomes calculated from GDP per capita growth rates)

two-world oil crisis, 1973-1975 and 1979-81 gave the nation the illusion of being the giant of Africa, the truth is that this is not reflected in the Human Development Index. According to UNICEF, over a period of almost 4 decades (1960-1998) Nigeria had the worst of any country in Africa for the reduction of Under 5 Mortality Rate (USMR). While all countries recorded improvements, Nigeria was 34% and for the least developed countries, it was 41%. Even countries, which experience many wars such as Liberia did better than Nigeria.

Nigerian policy makers and foreign partners appear to be ignoring several facts that the country is home to more people living under \$1 per day (156 million in 1998) than any other nation on earth<sup>[4]</sup> that this group, incapable of securing credit must survive solely on subsistence agriculture<sup>[5]</sup> that the wealthiest 2% of Nigerians possessed incomes which is equal to total income of the poorest 55%<sup>[6]</sup>. Given lack of correlation between per capital development assistance and level of human development, the incorporation of aid consideration in the nation's development goals may be a major cause for optimism. Be that as it may, this study focus on the growth effect of development aids in Nigeria.

**Conceptual framework and empirical model:** The empirical analysis for this study is based on Burnside and Dollar<sup>[7]</sup>. It however departs from theirs in that it pays special attention to the importance of exchange rate adjustment policies for the relationships between aid and growth rather than interactions between aid and macroeconomics policies. In addition, it gives empirical evidence on development aid in Nigeria, an aspect where there is dearth of empirical literature.

To fix idea about how aid affects output changes, consider a simple specification of the recipient country's production function

$$Y = y(K, H, T) \quad (1)$$

Where Y is output and K, H, T are physical capital, labour augmenting human capital and state of technology respectively.

Taking the total differential

$$\partial Y = \frac{\partial Y}{\partial K} \partial K + \frac{\partial Y}{\partial H} \partial H + \frac{\partial Y}{\partial T} \partial T \quad (2)$$

Given that aid (A) in turn affect each one of the above growth components, the equation becomes

$$\partial Y = \frac{\partial Y}{\partial K} \frac{\partial K}{\partial A} \partial A + \frac{\partial Y}{\partial H} \frac{\partial H}{\partial A} \partial A + \frac{\partial Y}{\partial T} \frac{\partial T}{\partial A} \partial A \quad (3)$$

Dividing both sides by dA given the overall effect of aid on output growth as

$$\frac{\partial Y}{\partial A} = \frac{\partial Y}{\partial K} \frac{\partial K}{\partial A} + \frac{\partial Y}{\partial H} \frac{\partial H}{\partial A} + \frac{\partial Y}{\partial T} \frac{\partial T}{\partial A} = \gamma_K \alpha_K + \gamma_H \alpha_H + \gamma_T \alpha_T \quad (4)$$

Where  $\gamma_K, \gamma_H, \gamma_T$  denote the partial derivatives of the output function with factor inputs and  $\alpha_K = \frac{\partial K}{\partial A}, \alpha_H = \frac{\partial H}{\partial A}, \alpha_T = \frac{\partial T}{\partial A}$  indicate the marginal effect of aid on physical, capital and technology, respectively.

Following Burnside and Dollar and given variables of interest, the following general dynamics specification is used as the canonical model for the statistical analysis in this paper.

$$GDP_t = \beta_0 + \beta_1 GDP_{t-1} + \beta_2 AID_{t-n} + \beta_p POL_t + \beta_x X_t + \mu_t \quad (5)$$

Where  $GDP_t$  is growth at time t  $\beta_0$  is a  $1 \times 1$  scalar representing the level of growth when the effect of all independent variable is zero,  $AID_{t-n}$  is aid received at time t or aid lagged one year,  $POL_t$  is a vector of variables measuring economic policies  $X_t$  represents vector of additional exogenous explanatory variable and  $\mu_t$  is an error term identically and independently distributed with zero mean and constant variance

$$\mu_t \equiv N(0, \sigma_\mu^2)$$

Following Cungu and Swinnen<sup>[1]</sup> human capital and technology per se do not enter the growth equation because:

- The inclusion of the variables would almost cause aid to be insignificant
- It is difficult to interpret the effect of aid and policy variables in a growth regression that has human capital as an independent variable<sup>[8]</sup>

Nevertheless, Foreign Direct Investment (FDI) is included in the model to verify the robustness of the regression results.

In order to avoid spurious regression, all series are tested against non-stationarity using Augmented Dickey-Fuller (ADF) test. This is followed by co-integration and error correction analysis to obtain estimate of both long-run and short run effects of aid on output.

**Error correction and co-integration model:** The first step in co-integration analysis is to test the order of integration of the variables. A series is said to be integrated if it accumulated some past effects, so that following any disturbance, the series will rarely return to any particular mean value, hence is non-stationary. Non-stationarity of time –series has always been regarded as a problem in econometric analysis. Phillip<sup>[9]</sup> shows that, in general, the statistical properties of regression analysis using non-stationary time series are dubious notwithstanding promising diagnostic test statistics from such regression analysis. The order of integration is given by the number of times a series needs to be differenced so as to make it stationary. According to Charemza and Deadman<sup>[10]</sup> a stochastic process is said to be stationary if the joint and conditional probability distributions of the process are unchanged if displace in time. If series are integrated of the same order, a linear relationship between these variables can be estimated and examining the order of this linear relationship can test for co-integration. The grim fact is that economists look for the existence of stationary co-integrated relationships since only these can be used to describe long-run stable equilibrium state. The Granger representation theorem states that if a set of variables is co-integrated (1, 1): implying that the residual of the co-integrating is of order 1(0), then there Exists an Error Correction Model (ECM) describing the relationship.

**The empirical model:** Beginning with the dynamic models in equation 5 the following co-integration relations are estimated.

$$\begin{aligned} \text{GDP}_t = & a_0 + a_1\text{GDP}_{t-1} + a_2\text{AID}_t + a_3\text{EX}_t + \\ & a_4 \text{inflation}_t + a_5 \text{balance}_t + a_6 \text{surplus}_t \\ & + a_7 \text{GNP}_t + a_8 \text{FDI}_t + \mu_t \end{aligned} \quad (6)$$

$$\begin{aligned} \text{GDP}_t = & b_0 + b_1\text{GDP}_{t-1} + b_2\text{AID}_t + b_3\text{AID}_t^2 \\ & + b_4\text{EX}_t + b_5 \text{inflation}_t + b_6 \text{balance}_t \\ & + b_7 \text{surplus}_t + b_8 \text{GNP}_t + b_9 \text{FDI}_t + \mu_t \end{aligned} \quad (7)$$

$$\begin{aligned} \text{GDP}_t = & c_0 + c_1\text{GDP}_{t-1} + c_2\text{AID}_{t-1} \\ & + c_3\text{EX}_t + c_4 \text{inflation}_t + c_5 \text{balance}_t \\ & + c_6 \text{surplus}_t + c_7 \text{GNP}_t + c_8 \text{FDI}_t + \mu_t \end{aligned} \quad (8)$$

$$\begin{aligned} \text{GDP}_t = & d_0 + d_1\text{GDP}_{t-1} + d_2\text{AID}_{t-1} \\ & + d_3\text{AID}_{t-1}^2 + d_4\text{EX}_t + d_5 \text{inflation}_t \\ & + d_6 \text{balance}_t + d_7 \text{surplus}_t + d_8 \text{GNP}_t \\ & + d_9 \text{FDI}_t + \mu_t \end{aligned} \quad (9)$$

$$\begin{aligned} \text{GDP}_t = & e_0 + e_1\text{GDP}_{t-1} + e_2\text{AID}_{t-1} + e_3\text{AID}_{t-1} \\ & * \text{EX}_t + e_4\text{EX}_t + e_5 \text{inflation}_t + e_6 \text{balance}_t \\ & + e_7 \text{surplus}_t + e_8 \text{GNP}_t + e_9 \text{FDI}_t + \mu_t \end{aligned} \quad (10)$$

$$\begin{aligned} \text{GDP}_t = & f_0 + f_1\text{GDP}_{t-1} + f_2\text{AID}_{t-1} + f_3\text{AID}_{t-1} \\ & * \text{EX}_t + f_4\text{AID}_{t-1}^2 * \text{EX}_t + f_5\text{EX}_t + f_6 \text{inflation}_t \\ & + f_7 \text{balance}_t + f_8 \text{surplus}_t + f_9 \text{GNP}_t + f_{10} \text{FDI}_t + \mu_t \end{aligned} \quad (11)$$

Where

GDP<sub>t</sub> is the growth in National real GDP in year t

GDP<sub>t-1</sub> is the real GDP lagged one year

AID<sub>t</sub> is the aid variable in year t

AID<sub>t-1</sub> is the aid variable lagged one year

EX<sub>t</sub> is the real effective exchange rate in year t

inflation is the rate of inflation in year t

balance is the trade balance in year t

surplus is the government budget surplus/deficit in year t

GNP<sub>t</sub> is the gross national product per capita (PPP-adjusted)

FDI<sub>t</sub> is the foreign direct investment in year t

**Variable measurement and data source:** The dependent variable is the growth in real GDP expressed as the annual percentage change from previous year taken from the World Economic outlook database. The aid variable reflects net disbursements of official assistance from the OECD Development Assistance Committee database published in World Bank African Development Indicator.

The vector of  $POL_t$  in (5) contained four variables in the empirical model. First is the nation's real effective exchange rate of the national currency (naira) to US dollar obtained from Central Bank of Nigeria Statistical Bulletin. Others are annual rate of inflation, government budget surplus/deficit and the trade balance. All the variables are taken from the World Bank African Economic Indicators. While recognizing the importance of macroeconomic policies for growth, the study also considered the effect of interaction between aid and exchange rate on the output growth. The specification includes an interaction term to measure the impact of policies on the contribution of aid to growth. Since it could be argued that there might be non-linearities in the interaction terms and the marginal impact of aid would depend on the amount of aid received by a particular country, a quadratic interaction term is included in the regressions. Non-linearity in the aid term per se are also explored by including aid squared.

Finally, two additional variables are included which can be viewed as components of the X vector namely, the GNP per capita (PPP-adjusted) and foreign direct investment. The data are obtained from World Bank African Economic Indicators.

The analysis begins with examination of the time series properties of the variables used in this study. The time series properties are investigated and their order of integration determined using Augmented Dickey Fuller (ADF) unit root test. The ADF regression takes the form.

$$\Delta X_t = \beta_0 X_t + \beta_1 \sum \Delta X_{t-1} + \mu \quad (12)$$

Where  $X_t$  represents individual variable at time  $t$ ,  $\Delta$  indicates difference term. The test is against the null hypothesis  $H_0: \beta_1 = 0$ . Rejection of the null hypothesis suggests that the series is non-stationary and has to be differenced at least once in order to make it stationary. The ADF test is performed by including up to 2 lag length<sup>[11]</sup>. If  $H_0$  cannot be rejected, then,  $X_t$  contain a unit root and hence it is not stationary. If its first difference is then tested and found stationary,  $X_t$  is  $I(1)$ . If not  $X_t$  needs to be differenced further.

Given that  $X_t$  is  $I(1)$ , the analysis proceeds to test of co-integrating relationship. Without running test on causality we can reasonably assume that  $GDP_t$  is the dependent variable. Against the above background, the analyses proceed thus: the dynamic specification of the model in equations 6 to 11 were estimated. ADF test based on the residuals from the dynamic model was carried out to test for co-integration relation. The test regression is

$$\Delta Z_t = (\alpha - 1)Z_{t-1} + v_t \quad (13)$$

Table 2: Result of the unit root tests

Variable	Level	First difference
GDP	-4.3425*	-6.1095**
GDP <sub>t-1</sub>	-3.8042*	-5.3824**
AID <sub>t</sub>	-4.1328*	-7.7546**
AID <sub>t</sub> <sup>2</sup>	-5.4191**	-7.3655**
AID <sub>t-1</sub>	-5.3997**	-7.3898**
AID <sub>t-1</sub> <sup>2</sup>	-5.1775*	-7.3650**
AID <sub>t-1</sub> x EX	-0.02916	-4.1714*
AID <sub>t-1</sub> <sup>2</sup> x EX	-0.1346	-4.9362**
EX	-0.2837	-4.2536*
Inflation	-2.7357	-4.6340**
Balance	-3.8851*	-9.4299**
Surplus	-2.9537	-5.5703**
GNP	-2.7351	-6.9329**
FDI	-1.8093	-4.3190*

Table 3: ADF Test for co-integration

Regression model	Z-Coefficient
1	-4.4437*
2	-3.7600
3	-2.934
4	-3.4071
5	-3.1390
6	-1.9145

Co-integration analysis is possible only for model 1

Where  $Z_t$  is the residual in the regression. A definite feature of a co-integrating relation is that the error in such a relation should be  $I(0)$ .

**Time series properties:** The result of the unit root tests is given in Table 2. At 5% significance level the hypothesis of a unit root cannot be rejected at levels except for GDP and AID variables. On the other hand, the first differences of all the variables are stationary.

Basically, the presence of  $I(1)$  variables implies that most, if not, all test statistics will have non-standard distributions. Two things are feasible for estimation namely, reparameterization can be carried out and the parameters estimated and tested by applying Ordinary Least Square technique. We can test for co-integrating relation between corresponding variables. The latter is considered in this study since reparameterization may weaken economic interpretation of the coefficient estimates. The results of the test for co-integration is summarized in Table 3.

## RESULTS

The estimated results are presented in Table 4. Regressions (1) to (6) in Table 4 show the results of ECM and short-run dynamic models. A first conclusion from regression (1) is that AID has possible and significant effect on growth when used contemporaneously. In regression (2), the square measure of AID is also significant but the coefficient is negative. When aid was lagged one year (regression 3), the coefficient is still

Tabel 4: Dependent variable: Growth of GDP

Regression No:	1	2	3	4	5	6
Constant	17.472 (-1.241)	-19.825 (-1.785)	-38.083 (-9.512)	5.250 (0.288)	-55.447 (-18.147)	-18.818 (-1.465)
GDP <sub>(t)</sub>	(0.369)	-0.190 (-1.853)	-0.0548 (-1.392)	-0.263 (-2.166)	0.0407 (1.293)	-0.208 (-2.408)
AID	0.010* (3.176)	0.029 (2.752)	-	-	-	-
AID <sup>2</sup>	-	-0.00162** (-1.959)	-	-	-	-
AID <sub>(-1)</sub>	-	-	0.001 (1.674)	0.0527 (3.086)	-0.000737 (-0.627)	0.0272 (3.428)
AID <sub>(-1)</sub> <sup>2</sup>	-	-	-	-0.00326 (-2.287)	-	-
AID <sub>(-1)</sub> x EX	-	-	-	-	-0.012 (-7.236)	0.00272 (0.369)
AID <sub>(-1)</sub> <sup>2</sup> x EX	-	-	-	-	-	-0.00372 (-1.701)
EX	0.101 (0.522)	0.207 (1.629)	0.136 (2.693)	0.252 (1.621)	2.601 (7.640)	0.702 (0.657)
Inflation	0.077* (2.176)	0.027 (0.963)	0.043* (4.254)	0.063* (2.139)	0.0278 (3.740)	0.0607 (2.979)
Balance	0.00185* (2.695)	-0.00975* (3.410)	+0.00102* (8.657)	-0.00143* (4.152)	-0.00498 (4.98)	0.00113 (4.065)
Surplus	-0.00979 (-0.714)	-0.00123 (-0.120)	-0.00701 (-1.943)	-0.00244 (-0.223)	-0.00856 (0.309)	-0.00271 (-0.347)
GNP	60.686 (1.183)	69.499 (1.36)	147.09* (9.959)	-32.844 (-0.463)	211.88 (19.25)	62.846 (1.311)
FDI	-0.00619* (-2.579)	-0.00610* (-4.076)	-0.00615* (-9.643)	-0.00902* (-4.479)	-0.00494 (-10.200)	-0.00760 (-5.19)
ECM	1.089* (4.868)	-1.110 (8.22)	0.914 (24.602)	0.654 (7.849)	1.035 (32.917)	0.813 (11.458)
R <sup>2</sup>	0.838	0.945	0.989	0.920	0.995	0.968
F	7.463	19.013	125	12.65	209.79	11.458
DW	2.54	2.49	1.80	1.86	1.76	2.24

\* Indicates significant at 5% level, In parentheses are the t-statistics

positive but insignificantly associated with growth. In regression (4) one year lagged aid has a positive and significant effect on growth. The quadratic term is also significant. The coefficient is however negative indicating diminishing returns to aid. The interaction term (AID<sub>x</sub>EX) in regression (5) has positive and significant effect on growth. This suggests that positive impact of aid on growth is reinforced when currency is further devaluated. When the interaction term is in squared measure, as in regression (6) one year lagged and is still positive and significantly affect growth but the interaction terms are not significant even at 10% level of significance. Other variables are generally insignificant except for inflation, balance and FDI. In all the regression except regression 2, the coefficients of inflation is positive and significant at 5% level while the coefficients of FDI is negative all through. The solved static long run equation is

$$\begin{aligned} \text{GDP}_t = & -3.282 + 0.013\text{AID}_t - 0.0000116\text{surplus}_t \\ & + 0.089\text{inflation}_t + 3.917\text{GNP}_t + 0.000013\text{balance}_t \\ & + 0.0704\text{EX}_t - 0.0000592\text{FDI}_t \end{aligned} \quad (14)$$

WALD test  $\chi^2(7) = 14.433$  [0.0440] \*

In the long run, an increase in aid by 100% will lead to rise in GDP by about 1.3%. The results seem to underestimate the long-term effects perhaps because of the relatively small dimension of the sample.

## DISCUSSION

The results of this study indicate that development assistance to Nigeria has contributed positively to output growth. The impact seems to be stronger when in association with exchange rate-one of the key variables of interest of structural adjustment policy. Though there seem to be diminishing returns to aid, this finding suggests that development assistance is more effective when devaluation of the national currency has progressed further. In other words, aid and currency devaluation are mutually reinforcing.

In the long run, a 100% increase in aid will lead to increase in output by 1.3%. The results seem to underestimate the long-term effects perhaps because of the relatively small dimension of the sample.

A quick inference that can be easily deducted from the result is that the usual argument in favour of currency devaluation applies here. A more liberal economy facilitates exchange and technological spillovers and they

are able to absorb better what aid is trying to convey. Another implication is that during the years covered in the study aid might have contributed to faster capital accumulation, both physical and human as well as technological progress.

Given the result of the study, injection of more aid in Nigeria economy will hasten the growth faster. It is recommended therefore that donor countries should see from this perspective as Nigeria is still at the center of Africa development.

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