

Determinants of Economic Growth in Sub-Sahara African Countries: Panel Data Approach

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Abstract

The standard of living of a nation depends on the performance of the Gross Domestic Product (GDP). The contribution of economic determinant such as foreign direct investment, volume of import of goods and services, total investment, gross national savings, general government revenue, government total expenditure and general government gross debts has been attributed to the GDP outcome of countries considered in Sub-Sahara Africa. This study examined the impact of the aforementioned economic determinant on economic growth in Sub-Sahara Africa for the period of 1980 – 2018. Data were sourced online from World Bank Open data. Panel data analysis was adopted using statistical tools like Ordinary Least Square (OLS), Fixed Effect Model (FEC), and Least Square Dummy Variable (LSDV), to determine factors that contribute significantly to the GDP. Diagnostic checks were carried out for violation of classical assumptions which revealed the presence of Heteroscedasticity. Foreign direct investment has a positive significant impact on GDP while inflation contributes negatively to the GDP of the Sub-Sahara African Countries considered.

Keywords: Ordinary Least Squares (OLS), Fixed model, Least Square Dummy Variable (LSDV), Random model, Heteroscedasticity, Gross Domestic Product (GDP)

1 Introduction

Africa's economic, social and political history largely determines its current economic development. Despite International aid and support, developing countries such as Sub-Sahara Africa countries are not able to grow and prosper because of economic lookout. From 2000 till date, most African countries recorded a remarkable growth of which the economic standard fails to reduce inequality (UNCTAD, 2018).

Over the years, several programmes initiated by different governments aimed at improving the productive capacity of Africa economy, yet all these strategies have not yielded the desired results by accelerating the growth of the real GDP.

The World Bank report published in 2008 reviewed that half of the population in sub Saharan Africa were still living below the poverty line (World Bank, 2008).

In order to achieve a high level of growth in the economy, it is important to establish the factors responsible for the economic growth and the nature of their influence on the growth in Africa countries. This study attempted to examine the factors that determine economic growth in developing countries (Sub-Sahara Africa).

2. Literature Review

In 1984, Kavoussi reported that higher rates of economy growth were strongly associated positively export rate. Countries blessed with abundant resources benefit from the production and sales of such resources, yet countries in Africa blessed with abundant natural resources such as crude oil, diamond, gold, etc have not experienced substantial economic growth (Sachs and Warner, 1995). Robert Barro (1996) illustrated the theory of convergence in a study of 100 countries from 1960 to 1990, he posited with the theory that as the real GDP level rises, the growth rate falls.

Rappaport (2000) believed foreign direct investment may have benefits not only in the industrial sector that receives the investments but also on other domestic industries that benefit from spillover effects of improved capital and technological improvement. There is a linear inverse relationship between debt and growth which was examined by Kumar and Woo (2010) that a very high levels of debt to GDP ratio had significant negative effects on economic growth.

Ndambiri et al, (2012) examined the determinants of economic growth in 19 Sub-Saharan countries. They reported that physical capital formation, a vibrant export sector and human capital formation significantly contribute to the economic growth among Sub-Saharan countries. However, government expenditure, nominal discount rate and foreign aid significantly lead to negative economic growth. Chang and Mendy (2012) examined the empirical nexus between openness and economic growth in 36 selected African countries. Their study reported that foreign aid, trade labour employed, and degree of openness are positively linked with the economic growth of African countries.

According to Hossain and Mitra report published in 2013, posited that long run effects of trade openness, domestic investment and government spending on economic growth are significantly positive. In Sub-Saharan African countries, higher private and public investment has significantly contributed to the economic growth, while the government consumption exerts a drag on the growth and that more flexible exchange regimes are beneficial to the growth of the economy (Ghazanchyan and Stotsky, 2013).

The key determinants of economic growth in developing nations can be narrowed down to FDI inflows, abundance of natural resource, fiscal and monetary policy, and capital formation, while trade openness has been found not to be of significant importance to growth in the continent (Anyanwu, 2014). Nguyen *et.al*, (2014), investigated the relation between foreign investment and the economic growth. They posited that the easing of short term capital flows diminishes the positive effects of foreign investment. Javed *et al*,(2014), observed that global crises could give rise to regional distortions which limit factors responsible for economic growth.

However, this study observed that despite massive aid flows, most of the Sub-Saharan Africa countries have been left in a debt trap. This forms the bedrock of this study and will help to steer policy attention towards the key determinant of economic growth in Sub-Saharan Africa countries.

3. Methodology

3.1 Data Collection

The data collected covered from 1980 to 2018 spanning 39 years for developing countries based on their GDP per capital level. The countries considered in this study are Angola, Benin, Burkina Faso, Cameroun, Cote d' Ivoire, Ethiopia, Ghana, Kenya, Nigeria, Senegal, and South Africa. The data extraction was sourced from International Monetary Fund Surveillance database 2018.

3.2 The Model

The panel data models describe the individual behavior both across time and across individuals. The Panel Data Model can be written as:

$$Y_{it} = \alpha_i + X'_{it}\beta + \varepsilon_{it}, i = 1, 2, \dots, N, t = 1, 2, \dots, T \quad (3.1)$$

where Y_{it} is the response for unit (1) at time t, X_{it} is a k-dimensional vector of independent variables without a constant term, α_i is the individual specific intercept, β is a $(k \times 1)$ vector and ε_{it} is the error varies over i and t.

For panel data Models the usual convention is to stack observations in the opposite order of subscripts that is first collecting the observations across time for each individual as vector form. The observations for individual i can be given as:

$$Y_i = X_i\beta + \alpha_i i_T + \varepsilon_i \quad (3.2)$$

In matrix form;

$$Y_i \begin{matrix} (T \times 1) \\ = \\ \begin{bmatrix} y_{i1} \\ y_{i2} \\ \vdots \\ y_{iT} \end{bmatrix} \end{matrix}, X_i \begin{matrix} (T \times k) \\ = \\ \begin{bmatrix} x_{i1} \\ x_{i2} \\ \vdots \\ x_{iT} \end{bmatrix} \end{matrix} = \begin{matrix} \begin{bmatrix} x_{1i1} & x_{2i1} & \cdots & x_{ki1} \\ x_{1i2} & x_{2i2} & \cdots & x_{ki2} \\ \vdots & \vdots & \ddots & \vdots \\ x_{1iT} & x_{2iT} & \cdots & x_{kiT} \end{bmatrix} \end{matrix}, i \begin{matrix} (T \times 1) \\ = \\ \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix} \end{matrix}, \varepsilon_i \begin{matrix} (T \times 1) \\ = \\ \begin{bmatrix} \varepsilon_{i1} \\ \varepsilon_{i2} \\ \vdots \\ \varepsilon_{iT} \end{bmatrix} \end{matrix} \quad (3.3)$$

Stacking the matrix in equation (2.3), then;

$$Y = X\beta + \alpha + \varepsilon \quad (3.4)$$

In the traditional approach to panel data models, α_i is called a random effect when it is treated as a random variable and a fixed effect when it is treated as a parameter to be estimated for each cross-section observations. The study adopted the fixed effects model approach.

3.3 Fixed Effect Model

This approach assumes the differences across units of observation can be captured in the constant term. Each α_i is treated as an unknown parameter to be estimated. It is assumed that there is unit specific heterogeneity in the model which might be correlated with the regressors and need to be removed from the regression before estimation. The fixed effect model is defined as:

$$y_{it} = \alpha_i + \sum_{k=1}^K \beta_k x_{kit} + u_{it} \quad (3.5)$$

The fixed effects model is:

$$\text{ngdp}_{it} = \alpha_i + \beta_1 \text{fdi}_{it} + \beta_2 \text{inf}_{it} + \beta_3 \text{vigs}_{it} + \beta_4 \text{tinv}_{it} + \beta_5 \text{gns}_{it} + \beta_6 \text{gr}_{it} + \beta_7 \text{gte}_{it} + \beta_7 \text{ggd}_{it} + u_{it} \quad (3.6)$$

where ngdp is the gross domestic product of each country considered, fdi is the Foreign direct investment, vigs is the volume of import of goods and services, tinv is the total investment, gns is the gross national savings, gr is the general government revenue, gte is the government total expenditure and ggd is the general government gross debts.

4. Results and Discussion

The data considered panel data set consisting of 11 countries for the period of 1980 – 2018. The data set is an unbalanced panel with gross domestic product to be the dependent variable, while the independent variables are explained above using fixed

effects model approach. Table 1 presented the estimated results of OLS model, Least Squares Dummy Variable model (LSDV), fixed model and random model.

Table 2 presented the model comparison among the adopted model. Comparing the fixed model with the OLS model gives the test statistic value of 291.28 with P – value = $2.2e-16$, while fixed model with random model test statistic is 0.88903 with P-value = 0.02959. This concluded that the fixed model fit the data than OLS or random model. The result in Table 3 presented the cross section fixed effects estimate of each country considered.

Table 4 presented the diagnostic test of contemporaneous correlation, time fixed effect, cross dependence, serial correlation and heteroscedasticity test. The result SHOWED that there is no time fixed effect, no cross-sectional dependence, no contemporaneous correlation but there is presence of serial correlation and heteroscedasticity. To correct the problem of heteroscedasticity present in the data, the heteroscedasticity consistent covariance estimator was adopted presented in Table 5.

Result in Table 5 shows the standard error of HC0, HC1, HC2, HC3 and HC4 respectively. The standard error of HC0 for each of the independent variables are; 24.2447, 4.6215, 2.8732,, 0.1521, HC4 are; 28.1118, 5.7089, 3.9187, ..., 0.2649. Comparing the standard error of each of the heteroscedasticity consistent estimators, the HC0 is smaller compared to HC1, HC2, HC3 and HC4 estimator. Table 6 presented the HC0 estimate of the coefficients of each independent variables. The coefficient of foreign direct investment is 170.3228, inflation is -9.6411, government revenue is – 1.01170 and government total expenditure is 2.4732 significant at 5% respectively.

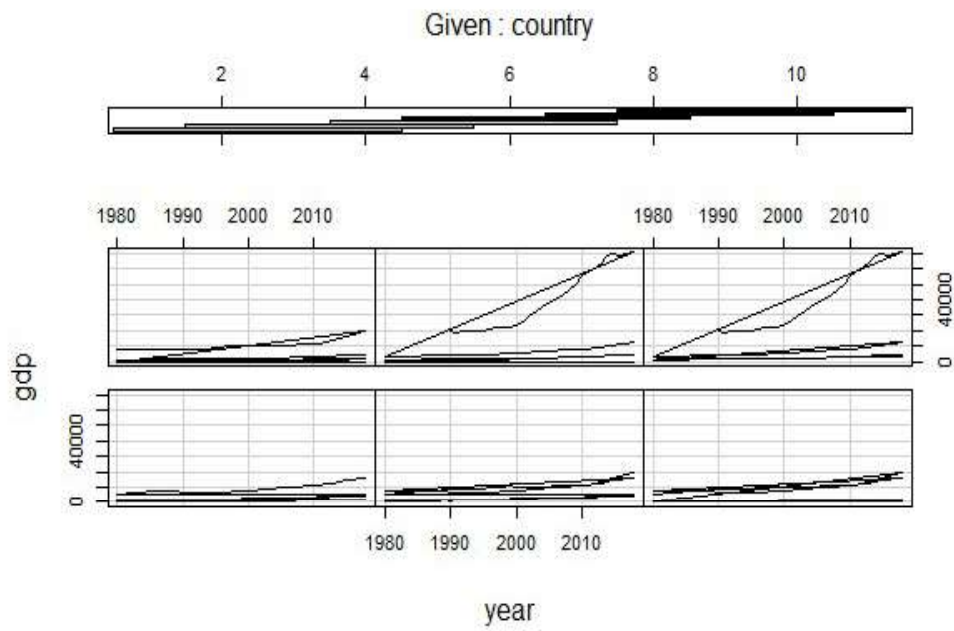


FIGURE 1: Correlation Plot of GDP by Country

Table 1: Coefficients Results of OLS, LSDV, Fixed and Random Model

	OLS model		LSDV model		Fixed model		Random model	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
Fdi	392.0636	0.00102*	170.3228	5.13e-06*	170.3228	5.129e-06*	203.478	2.547e-06*
Inf	-12.7649	0.03331*	-9.6411	0.000479*	-9.6411	0.0004787*	-11.8404	0.000241*
Vigs	-23.3747	0.26066	-0.3806	0.946902	-0.38056	0.946902	-1.6248	0.81222
Tinv	-133.1845	0.05636	-6.3185	0.785169	-6.31851	0.785169	-23.9882	0.38498
Gns	-202.7594	0.00402*	49.1938	0.064575	49.19376	0.0645750	56.06798	0.07568
Gr	-1.6402	0.01043*	-1.0117	5.93e-08*	-1.01169	5.932e-08*	-0.9744	5.844e-06*
Gte	7.4404	<2e-16*	2.4732	<2e-16*	2.47324	<2.2e-16*	2.7488	<2.2e-16*
Ggd	-0.6410	2.23e-05*	0.1976	0.000292*	0.19765	0.000292*	0.18141	0.004636*

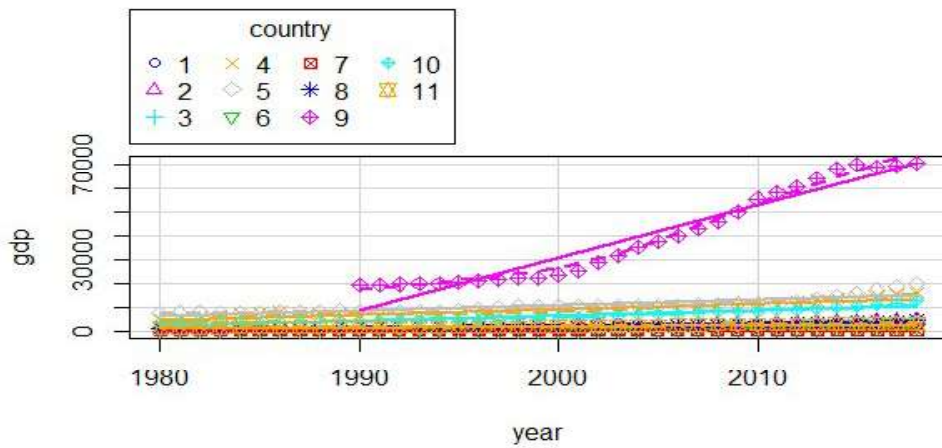


FIGURE 2: Scatter Line Plot of GP by Country

Table 2: Model Comparison

Model	Test Statistic	p-value	Remark
Fixed vs OLS model	291.28	2.2e-16	Fixed model is best fit
Fixed vs Random model	0.88903	0.02959	Fixed model is best fit

Table 3: Cross Section Fixed Effects Estimate

Country	Fixed Effect	Country	Fixed Effect
Angola	-4648.0784	Ghana	-983.4373
Bennin	1809.7744	Kenya	2353.8711
Burkina-faso	1710.2783	Nigeria	42877.0824
Cameroun	7845.4047	Senegal	4797.6902
Cote d'ivoire	6906.8249	South Africa	847.8425
Ethiopia	-332.8072		

Table 4: Diagnostic Test

	Test Statistic	p-value	Remark
Time fixed effects	0.88903	0.6299	No Time Effect
Cross Dependence	159.67	3.881e-12	No cross-sectional dependence
Contemporaneous correlation	1.4362	0.151	No contemporaneous correlation
Serial Correlation	113.8	2.2e-16	Presence of serial correlation
Heteroscedasticity	820.64	2.2e-16	Presence of heteroscedasticity

Table 5: HC Standard Error of the Coefficient

	HC0	HC1	HC2	HC3	HC4
Fdi	24.2447	24.7023	25.0428	25.9846	28.1118
Inf	4.6215	4.7088	4.8759	5.1634	5.7089
Vigs	2.8732	2.9275	2.9476	3.0913	3.9187
Tinv	20.9486	21.3439	21.9266	22.9724	23.9176
Gns	45.7668	46.6304	48.0517	50.5333	53.0370
Gr	0.3160	0.3220	0.3711	0.4443	0.6662
Gte	0.0918	0.0935	0.1185	0.1851	0.4685
Ggd	0.1521	0.1550	0.1672	0.1889	0.2649

Table 6: Test of Coefficients of HC0

	Estimate	Std. Error	t value	p-value
Fdi	170.3228	24.24479	7.0251	3.32e-11*
Inf	-9.64111	4.621544	-2.0861	0.03824*
Vigs	-0.38056	2.873241	-0.1324	0.8948
Tinv	-6.31851	20.94863	-0.3016	0.7633
Gns	49.19376	45.76684	1.0749	0.2837
Gr	-1.01170	0.316014	-3.2014	0.00159*
Gte	2.473242	0.091752	26.9558	<2.2e-16*
Ggd	0.197650	0.152123	1.2993	0.1954

5. Discussion

The economic determinant of countries performance considered were estimated using OLS model, Least squares dummy variable model, fixed model and random model of which fixed model best fit the data compared with other aforementioned models.

Based on the results of the coefficient estimate, a positive increase in foreign direct investment would significantly increase gross domestic product of the country by 17032.28%, government total expenditure by 247.3% and government gross debt by 0.03% while inflation and government revenue significantly reduce GDP by 964.1% and 101.2% respectively.

The cross section fixed effects estimate of Angola is -4648.07, Bennin Republic is 1809.77, Burkina-faso is 1710.27, Cameroun is 7845.40, Cote d' ivore is 6906.82, South Africa is 847.84, Nigeria is 42877.08 and Ethiopia is -332.8072 etc.

The diagnostic test reported the presence of heteroscedasticity of which heteroscedasticity consistent covariance estimator was used to estimate the serial

correlation. In the absence of heteroscedasticity the country's foreign direct investment has 17032% influence on GDP and government total expenditure has 247% influence on GDP of the country but inflation and government revenue has a negative influence on GDP by 964% and 101% respectively. The negative contribution of revenue revealed themisappropriation and poor accounting procedure of government revenue for the nation.

6. Conclusion

Foreign direct investment is a major economic determinant that positively influences the Gross Domestic Product (GDP) of major countries in Africa. The inflation rate of countries has an inverse proportion to the GDP of most countries in Africa and government revenue which supposed to influence economic GDP positively, exhibit a negative influence (Influences economic growth negatively).

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