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Accessing Threshold Issues in the Impact of Foreign Direct Investment on Economic Growth: Evidence from Sub-Saharan African Countries

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Abstract

This work examines the nexus connecting foreign direct investment (FDI) and economic growth in Sub-Saharan African (SSA) countries specifically to ascertain the threshold issues in the impact of FDI on the economic growth of SSA economies. Thus FDI has been known to be a critical, indispensable and integral part of foreign flows in the capital, which refers to ventures by multi-national corporations (MNCs) having their headquarters in the industrialized part of the world. Therefore, due to its growing importance, it becomes necessary to know the level at which FDI is not statistically significant to impact on the growth of most SSA economies. The study covered the time frame of 1990 to 2016 for 36 Sub-Saharan African countries. The data employed for this study was secondary data and was collected from the World Bank Development Indicator (2016). The econometric methodology used was the fixed effect model, random effect model, the Hausman test, the dynamic panel data model using the Generalized Method of Moments System (GMM SYS) and the Wald test. Coming from the static model, the output from the Hausman test suggested that the Random Effect Model is more efficient than the Fixed Effect model, however, the econometric results of both the static and the dynamic models revealed that FDI inflows significantly affect the economy of SSA positively. The result also revealed that there were no threshold issues in the impact of FDI on the growth of SSA economies. The study recommended that SSA countries should invest more in setting up institutions that will guarantee an investment-friendly environment so as to attract increased FDI inflows into such region, tailored down towards individual specific goals which will propel rapid economic growth in SSA countries. In addition, the region should channel past foreign aids to areas in which they were initially assigned.

Keywords: FDI, Economic Growth, Econometrics

JEL Classification: F21, 047, C100

Paper Classification: Research Paper

Introduction

Foreign Direct Investment (FDI) is obscured by many scholars to be a major factor of globalization and a means of integrating the globe at large. This has been seen to be the reason why it has become a tool of employment, a channel towards technological advancement, improvement in output growth, and ultimately growth and development of an economy (Asiedu, 2002). Foreign Direct Investment has been conceptually clarified as the investment of capital in economic ventures beyond the firm's or industry's base economy (Hill, Lester and Nordas, 2008). Thus OECD (2013), IMF (2011), and Adeoye (2014), conceptually clarified FDI to be a capital intensive venture with long term and far-reaching prospects which tend to reflect the objective of the direct investing firm/company with the purpose of vested interest to control the firm (recipient firm) which she is investing in for a long period of time. Thus, FDI has been known to be a critical, indispensable and integral part of foreign capital flows which refers to ventures by multi-national corporations (MNCs) having their headquarters in the industrialized part of the world (Kokko, A. & Blomström, M., 2002).

Studies jointly done by IMF/OECD in 2011 led to the conceptualization of the most widely accepted definition of FDI which has been known as the benchmark definition which posits that FDI is a multinational issue whereby an investor who resides in the domestic country, seeks for a long-term influence in the control of an affiliate firm in the recipient country. This definition has been widely accepted because, it was conceptualized by a teamwork of two foreign organizations with the purpose of giving a basis to domestic department of statistics, charged with the responsibility of gathering FDI statistics. Based on the clarification, it is seen that such long-term influence on the domestic/recipient firm is exercised, is mainly during voting or rights for management by the multinational firm. When it amounts to at least 10% of the sum voting shares rights of the international firm, then it can be said that the domestic firm has been influenced by foreign issues. From the foregoing, it is seen that economies that have emerged and those that are yet to emerge fight to attract a greater influx of FDI. This has been the reason why the quest is becoming enormous and fierce as FDI is greatly seen and believed to drive the recipient economies growth and development (UNCTAD, 2017).

Ajayi (2006) alluded to the fact that, the impact of FDI by multinational corporations (MNCs) to drive economic growth is really not an easy task to achieve, which was made from empirical findings and was observed that most of this investment is driven by industrialized countries who see its emerging counterpart as a virgin land full of untapped resources which she tends to harness.

Current happenings on the issues of international trade wars between the United State of America (USA) and China has clearly shown that trade which ought to be mutually beneficial has been faced with socio-political challenges/barriers. However, if such trade investment/agreement was to be done between an industrialized and emerging economies, it would receive little or no trade barriers, an example from China and Nigeria (largest market in Africa) in the latest trade agreement seen in her ease of doing business and currency swap deal with the aim of enhancing Africa-China investment as stated by the governor of the Central Bank of Nigeria Godwin Emefiele, stating that Chinese FDI to Africa continues to increase steadily, with a 14% year-on-year growth to US$4 billion in 2014, but currently signed a $2.5 billion currency swap agreement with China in April 2018. This has made China to emerge as Africa's biggest trade partner as South Africa, Angola and Nigeria remains its biggest trade partners in the continent, this has come to be seen that beyond trade, China remains a major development partner to Africa (Emefiele, 2019).

Despite all these, Sub-Saharan African economies have not in history been a great receiver of FDI inflows and so, they are always seen to take the back place in the scheme of things when it comes to the issue of FDI as compared to other regions of the world. Statistics have it that on an average basis annually, the whole of Africa as a region share of world FDI flows was 2.6% between 1980 and 1989; 19% between 1990 and 1999; and 3.2% between 2000 and 2009 covering the same periods, the Asian part of the world attracted FDI flows to the tone of 14.2%, 19.1%, and 19.1% of overall world inflows, respectively (UNCTAD Handbook of Statistics, 2010). A pertinent question to be asked is: What should be the reason why African countries don't attract much FDI when compared to other regions? The solutions that might be proffered to the above question has become very grey in economic literature both in practice and theory, the business world, politics and academics in the region and hence attract further analysis both empiricism and theory in the factors of the determination of FDI in African Countries Sub-Sahara Africa especially.

Studies such as Nwankwo (2013) ext. rayed the inter-connections between FDI and the sector in control of power in Nigeria, Salami and Oyewale (2013) studied the connectivity between FDI and employment generation in Nigeria, while Kola and Olalekan (2011) looked at the nexus between FDI and how small and medium scale enterprises can be developed in the Nigerian context. Also, Ali and Jayanta (2009) looked at the growth consequences of FDI evidence from Turkey. Closely related to the study is the work of Borensztein et al (1998), how does FDI influence the growth rate of an economy in a cross-country study among others.

However, there remains a gap in literature as regards the empirical investigation of the inter-connection among FDI and the economic growth of Sub Sahara African countries (SSA) and what influences its inflow into a country. As several existing works have extensively strayed the contribution of total investment expenditure to the growth of an economy, just few of them have looked at the difference between internal and external investment expenditure, and the effect as a whole as FDI affects development in the long run for sub-Sahara African countries to be specific. Additionally, the attention paid to the contributions of infrastructural investment in the growth of Sub-Sahara Africa has been minimal.

From the foregoing, the following questions are pertinent.

1. Is there any inter-connection between FDI and the growth of SSA economies?
2. Are there any threshold issues in the impact of FDI on the growth of SSA economies?

It is germane to note that among other studies, this research pioneers the SSA study on threshold issues in the impact of FDI on Economic growth.

Literature Review

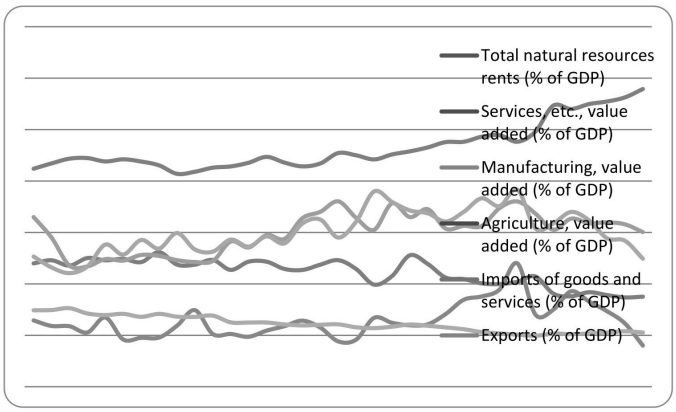
Recently, emerging economies have seen foreign direct investment (henceforth will be referred to as FDI) as sacrosanct in the attainment of economic growth and ultimately, development. Over few decades now, policymakers have tried to obscure an indisputable reason, of FDI being a major driver of growth in most economies as it tends to yield the required capital for investment, raises the fierceness of competitiveness in the recipient economy's industries, and helps domestic ventures to increase its level of productivity through the adaptation of more efficient technologies or by plugging capital in terms of investment in human capital and physical capital. It is also noteworthy to know that FDI assists growth rate in a manner that is sustainable because capital from FDI has proven to be less volatile hence having more level of stability relative to other forms of capital flows. The inherent advantages of FDI are as follows: (a) serves as a wellspring of capital in major investment deals which are believed to be capital intensive, (b) serves as a

means of solving the problem of unemployment which is rampant in SSA countries, (c) facilitates the access and link to international markets as it tends to bridge the financial gap between capital deficient economies and capital excess economies, and lastly (d) generates improved skills both in technological and efficiency externality to the domestic firms, as such economy becomes a hub of attraction for investment purposes.

Owing to the fact that there is a realized ability of FDI to spur the growth and the transformation process of economies, many emerging economies, SSA in particular, tend to source for such capital to increase the speed and rate at which they achieve development. Thus, encouraging and alluring FDI has therefore been an integral part of developmental strategies for most third world economies. In the case of Africa, the function of FDI as a wellspring of capital has become increasingly inevitable not really because of the anticipation that FDI helps to bridge the gap between the surplus and deficit economies but since it aids the achievement of Structural Development Goal targets. Acemoglu and Robinson (2002) alluded to the fact that it is imperative to note that most of SSA is characterized by low income and domestic savings ratio, hence the resource requirements and inability to generate capital within the domestic country, thus most of the capital used for growth and development in most emerging and third world countries, SSA in particular are not domestically generated but instead they come from abroad, mainly in the form of FDI. Therefore, the importance of FDI was obscured by Gorg and Greenaway (2004) as a compulsory factor and propellant which guarantees the growth of an economy thereby leading to economic development if sustained. As a result of this, many nations put attracting FDI into its nation as a priority, especially in emerging and third world countries of which so many SSA are. It is, therefore, ascribed this importance, not just because it raises capital formation but also because it has the potency to raise the quality of the capital stock available in the economy.

Studies reveal that overtime, though the education sector of most Sub-Sahara African countries has increased in size, it has deteriorated in terms of quality and relevance in the society. Also, the cost of living has increased in the region while poverty is at an unbearable level. Due to incessant conflicts, poor government policies and poor infrastructures, the business environment in the region has also worsened. Hence, more and more Sub-Sahara Africans tend to welcome policies that drive better business environments like the current currency swap between Nigeria and China thus placing Nigeria relevant in the international scene who is known to be a key player among Sub Saharan African countries, hence the ease of doing business between Nigeria and China. This may explain the expected increase in FDI inflows to Sub-Saharan Africa.

The Contributions of Some Sectors to the Sub-Saharan African Economy



Source: Author's Computation using Excel 7.0

Despite the abundant natural resources in Sub-Saharan Africa, total natural resource rents as a percentage of GDP has been relatively miniature. However, in 2008 natural resources rents (% of GDP) reached its highest value (23.97 per cent) but declined sharply to 14.033 per cent in 2009 but total natural resource rent as a percent of GDP increased to 18.55 per cent in 2011. Since 2011, it has been experiencing a downward trend and by 2016, it was 7.997 per cent which is far lesser than its 1981 value. The miniature contribution of natural resources rents to the growth of Sub-Saharan Africa countries despite SSA's abundance of natural resources may be due to the following (a) most of the region's natural resources are being exploited by foreign multi-national corporations, (b) most natural resource-rich areas of the region are characterized by the crisis, lack of governments' sincere commitment to allocate resources to the exploration and exploitation of some natural resources in the region, (c) unstable policy environment which discourages foreign and domestic investors in the sector. However, contributions from all sectors reveal a positive improvement through trending over the period of analysis.

Endogenous Growth Model

Since the study bothers on growth over specified periods, it makes two major simplifications and adjustments of the endogenous growth model as seen in equation 2.1 and 2.2. First, given a production function which assumes the classical generalized Cobb–Douglas function; that is, they are power functions, which has the summation of the exponents on the inputs not necessarily restricted to 1. Additionally, following the Solow model, it takes the portion of output saved, the portion of the labor force and the capital stock used in the research and development R&D sector as independent and fixed.

Thus, it can be specified as follows:

$$Y(t) = [(1 - a_K)K(t)]^{\alpha}[A(t)(1 - a_L)L(t)]^{1-\alpha}, \qquad 0 < \alpha < 1. \qquad (2.1)$$

This is the functional form of the restrictive Cobb-Douglas with exponent parameters as $1 - a_K$ and $1 - a_L$. Note that equation above implies constant returns to capital and labor and it can be re-specified as:

$$A(t) = B[a_K K(t)]^{\beta}[a_L L(t)]\gamma A(t)^{\theta}, \qquad B > 0, \qquad \beta \geq 0, \qquad \gamma \geq 0, \quad (2.2)$$

From equation 2.2, B is a shift parameter, the parameter θ reflects the effect of the existing stock of knowledge on the result of research and development. It is pertinent to note that the direction (with respect to sign) is not specific. Also, there could be a lag effect of past discoveries on future discoveries as it may provide ideas and tools that make it easier in the future. However, for the above case, θ is positive and the initial levels of A, K, and L are also given and strictly positive.

Empirical Literature

Studies connecting the impact of FDI on the growth in Sub-Sahara African Economies. Therefore, in academic, studies describing FDI and economic growth beyond geographical boundaries have been thin or none.

Lim (2001) studied the nexus between the determinants of FDI and economic growth. The output revealed that there were a lot of non-economic variables such as political and democratic variables that affect FDI. The result revealed that the variables were statistically significant in affecting FDI, but were never a cross country analysis. In the same vein, Ekpo (1997) x-rayed the relationship between Nigeria's receipt of FDI as it relates to some macroeconomic variables covering the time frame of 1970 -1994. The authority's result proved that political factor such as

military or civilian rule, economic factor such as the citizen's real income for capital investment including the prevailing inflation rate, the global rate of interest, availability and ease to access credit, and ultimately the debt structure were key determinants in explaining the systematic variations of FDI flows into Nigeria. Obadan, (2015) studied the determinants of FDI in Nigeria employing an error correction modeling and concluded that the size of market for exchange, prevailing policies that affect exchange and physical input for production were germane factors of FDI flow into Nigeria. In the same vein, Anyanwu (1998) using a vector econometric technique to study the determinants of FDI, and highlighted local home-based capital investment, trade openness and indigenization policy as a major factor that drives FDI in Nigeria. Oladipo (2013) employed the Generalized Method of Moment (GMM) in examining the macroeconomic determinant of foreign direct investment employed, annual time series spanning the years (1985-2010). He regressed Nigeria's FDI on her output as proxy by GDP, rate of inflation, trade openness, disaggregated government expenditure i.e (capital and recurrent expenditure), the level of poverty and the rate of exchange. The results of the GMM revealed that only the rate of exchange, interest rate, supply of money (M2) and trade openness affects and explains Nigeria's FDI flow, nothing that these variables positively and statistically influence foreign direct investment. Shockingly, the onetime lagged value of FDI negatively influences the current level of FDI.

Most recently, Izilein and Mohammed (2017) studied the imperativeness of sound democratic institutional structures and FDI for the increased growth of an economy. The researchers employed the Generalized Method of Moments (GMM) estimation techniques on a yearly time series data spanning from 1981-2015. The output supports that democratic institutions and FDI are statistically significant variables that guarantee sporadic in the Nigerian economic growth. Specifically, the output from employing the data from Nigeria revealed that the key characteristics of Africa, Nigeria inclusive was weak institutions, and it was found to have a destabilizing impact on her economic growth, though the impact was statistically significant and positive. Furthermore, Xiaoying Li and Xiaming Liu (2005) in a study tried to establish the effect of FDI on economic growth covering a good number of 84 countries also covering the time frame of 1970–1999 hence a panel data analysis. The researchers employed a single equation and simultaneous equation system techniques to establish the nexus between the variables. The output revealed a statistically significant dependent relationship between the growth of the economies studied and their respective FDI flows from the mid-1980s onwards. It was established that FDI does not only drive the growth of those economies directly but also indirectly through a link that is known to be interconnected which was found to be investment in human capital. Hence it was concluded that, for developing countries to experience a significant growth in the economy to welcome investment in human capital, because it is seen to have a positive impact on economic growth.

Mihaela Simionescu (2017) empirically investigated the nexus connecting economic growth and FDI inflows into selected 28 European countries covering the period of world economic crisis (2008-2014). Being a panel study of 7 years, it is expected to be plagued with a problem of short unbalanced data set, hence the Panel data approach and Bayesian techniques was employed to solve the problem. The output from the panel data estimate both the panel vector-autoregressive model and Bayesian random effect models identified a reciprocal and positive relationship between FDI and the growth of the 28 European Union countries beginning from 2008.

From the foregoing review of the empirical literature, Oladipo (2013) and Obadan (2015), examined FDI and economic growth for Nigeria, while Xiaoying Li and Xiaming Liu (2005) studied FDI and economic growth beyond country-level covering 84 countries. However, from the above literature, there has been the scarcity of literature in the study of threshold issues in

the impact of FDI on economic growth in any country, let alone SSA countries which this work examines. Therefore, this research pioneers the SSA study on threshold issues in the impact of FDI on economic growth.

Methodology

Following the works of Rapoport and Docquier (2006), Barajas (2009) in Adenutsi (2014), this work follows the endogenous growth model to examine the threshold issues in the impact of FDI flows on the economic growth of SSA countries. The above growth model is employed to establish the inherent potential benefit of FDI on long-run growth. Nothing that it becomes logical and direct in terms of per capita, because, quality rather than quantity of human capital is emphasized when it comes to economic growth since the country with the highest value of FDI may not actually be the highest recipient of FDI inflow per capita (Adenutsi, 2014).

Thus the model of this study is based on the works of Mankiw, Romer and Weil (1992), Guiliano and Ruiz-Arranz (2005), Jongwanich (2007), Fayissa and Nsiah (2008). This study adopts the model of Mustapha (2014) and Izilein (2017) which states that the extended version of the neoclassical economic growth model identifies the important assumption in the model which includes total factor output and channels for capital investment. Thus, the Mustapha's model is represented as:

$$Y_{i,t} = \alpha_0 + \mu i + \beta_i^* X_{i,t} + \varepsilon_{i,t} \quad ; \quad \varepsilon_{i,t} \approx N\ (0, \delta^2\eta) \qquad (3.1)$$

Where $Y_{i,t}$ = Natural logarithm of per capita GDP in the country i at time t;

$X_{i,t}$=Vector of the independent variables including foreign direct investment (FDI), gross fixed capital formation used to proxy investment in physical capital (GFCF), foreign aid (FAID), population growth (POGR) and foreign exchange rate (EXH).

μ_i = Country specific, time-invariant effect; β_i^* = Scalar vector of coefficients of β_1……β_5

$\varepsilon_{i,t}$ =Error term with E ($\varepsilon_{i,t}$)= 0 and var ($\varepsilon_{i,t}$) = $\delta^2\eta$,

$\Delta yt = \alpha 0 + \alpha 1 Xi + ut$ (1) Where: Δyt = Income growth which is a proxy for the growth of an economy; Xi = an index of democratic institutional development variables, FDI and other variables of interest which may be included.

Thus, with some modifications, both the Mustapha and Izeilen would be employed.

PCGDP= f (FDI, GFCF, FAID, POGR, EXH)

Thus, the signs are given as

β_1, β_2, β_3 and $\beta_4 > 0$, while $\beta_5 < 0$.

The coverage of the study is 36 Sub-Sahara African countries covering 26 years, hence a panel data. The model can be specified econometrically below as: (3.2)

$$\ln PCGDP_{it} = \beta_1 \ln FDI_{it} + \beta_2 InGFCF_{it} + \beta_3 \ln FAID_{it} + \beta_4 \ln POGR + \beta_5 \ln EXH_{it} + \varepsilon_{it} \qquad (3.2)$$

Where: ln stands for logarithms; i is the country index; t stands for time in years; PCGDP is the per capita GDP; FDI is the Foreign Direct Investment; GFCF stands for gross fixed capital formation (used to measure investment in physical capital); FAID represents foreign aid or official development assistance; POPGR stands for population growth; EXH is the foreign exchange rate $\varepsilon_{it} = U_i + V_t + W_{it}$.

The method employed for this analysis includes the fixed effect, the Random effect and the dynamic panel data or Generalized Method of Moments System (GMM SYS) estimator being a cross-country study across Sub-Saharan African countries.

Results and Discussions

Here the empirical results as well as their analysis are presented beginning with the descriptive statistics.

Descriptive Statistics

The statistical behavior of the data employed for this analysis, which would reveal the policy potency of its output. From appendix 1, the variables of interest are found to be normally distributed. The mean, median, maximum and minimum values are used to describe the central tendency of the large data set, so as to be able to observe a period of deviations. Therefore, the average values of RGDP, FDI, EXCH, FAID, GFCF and POGR are 7.121614, 6.697173, 0.332794, 19.72657, 2.729584 and 1.194416 respectively. The standard deviation is used as a measure of dispersion between variables and for appendix 1, they are 0.992622, 10.43694, 6.583688, 0.456882, 0.500277 and 0.089264 respectively.

The skewness of a data set shows the extent a given distribution set differs from a normal distribution. The null hypothesis is stated with respect to its distribution being jointly equal to zero. Also, for a normal distribution the skewness coefficient values is expected to lie between -3 and +3, therefore from appendix 1 also, the coefficient values of skewness for the six variables are 0.0926644, 1.423128, -1.506438, 0.268534, -0.317735 and -0.939012. They all lie between the acceptance region, revealing that the data is normally distributed.

Also, if the probability value is less than the Jarque Bera chi-square, then the null hypothesis of the regression which states that the variables are not normally distributed is rejected. From the result, it is apparent that the variables are of a normal curve neither leptokurtic nor mesokurtic. In line with the skewness, kurtosis is a measure of the 'peakedness or tailedness' of a real-valued random distribution from its mean. Conclusively, the skewness coefficient indicates normal curves as supported by the Jarque Bera probability values of less than 0.05 for all the variables.

Unit Root Test

The panel unit root test was conducted for the variables because, they are time series variables, hence the need to secure stationarity. Thus, based on the result Exchange rate, Gross Fixed Capital Formation was found to be stationary at level, while were stationary at second difference leaving government health expenditure to be stationary at first difference. Then having secured stationarity, panel analysis proper was done as shown in Appendix 2.

The Static Models (Dependent Variable – RGDP)

Appendix 3 presents the results of the static panel data models (fixed effect and random effect models).

The results of the fixed effects and the random effects models show that foreign direct investment has a positive effect on the RGDP. In other words, foreign direct investment inflows into Sub-Saharan Africa positively impact on the economy of the region. This is conforming to a priori expectation. The positive effect is small though significant. For the fixed effects and the random effects models, a 10% rise in FDI inflows into SSA countries will lead to approximately 28% and 0.11% rise in RGDP per capita respectively.

For both the fixed effect and the random effect models, the official Real exchange rate (EXCH) positively impacts on RGDP per capita (RGDP) in Sub-Saharan Africa. This aligns with the apriori expectation. However, for the fixed effect model, a 10% rise in exchange rate (EXCH) will lead to a 58% increase in RGDP per capita while for the random effect model, a 10% rise in FDI will lead to a 2% rise in per capita RGDP in Sub-Saharan Africa. The impact is large and significant even at the 1% significance level.

Both the fixed effects and the random effects models indicate that gross fixed capital formation (GFCF) has a direct positive effect on per capita RGDP in Sub-Saharan Africa. This aligns with the a-priori expectation. Its coefficient is highly significant at the 1% level of significance. For the fixed effects model, a 10% rise in gross fixed capital formation (GFCF) will lead to a 78% increase in per capita RGDP while for the random effects model, a 10% rise in GFCF will lead to a 9% increase in per capita RGDP in Sub-Saharan Africa.

However, contrary to expectation, the results of the fixed effects and random effects models show that foreign aid (FAID) negatively affects per capita RGDP in Sub-Saharan Africa. The coefficient is significant even at the 1% level of significance. The fixed effects model shows that a 10% rise in FAID will lead to a 45% decrease in RGDP while the random effect model shows that a 10% rise in FAID will lead to a 0.6% decrease in per capita RGDP in Sub-Saharan Africa.

Finally, as indicated by both models (fixed effects and random effects), population growth has a significant positive effect on RGDP in Sub-Sahara Africa and its coefficient is highly significant easily passing the significance test at the 1% level. This is in line with the a-priori expectation. However, for the fixed effect model, a 1% rise in population growth will lead to an 8.7% rise in per capita RGDP while for the random effect model, a 1% rise in POGR will lead to a 9.6% rise in per capita RGDP in Sub-Saharan Africa.

The coefficient of determination (R2) of 0.96 for the fixed effects model shows that the explanatory variables account for about 96% of the systematic variations in the dependent variable (RGDP). The remaining 4% is accounted for by the stochastic error term. On the other hand, for the random effects model, the coefficient of determination (R2) of 0.48 indicates that the explanatory variables (FDI, LEXCH, LNGFCF, LNFAID and LNPOGR) account for about 48% of the systematic variations in the dependent variable (RGDP). The F-statistic of 684.8111 and 52.89161 of the fixed effects and the random effects models respectively, indicate that the overall regression models are highly significant easily passing the significance test at the 1% level of significance as supported by their various p-values of less the 5%. Thus, the null hypothesis of no existing log-linear relationship between per capita RGDP and the explanatory variables can be rejected at the 1% level of significance.

Correlated Random Effects - Hausman Test

The null hypothesis of the Hausman test is that the random effects model is appropriate. The results of computed Hausman test as shown in appendix 4 gives a probability value of 1.0000, hence, the null hypothesis is accepted and it is concluded that the random effect regression model is efficient.

Presentation and Interpretation of the Results of the Dynamic Model (GMM–Generalized Method of Moments)

The generalized method of moments system (GMM SYS) estimator has been advanced as a useful technique of addressing the problems of endogeneity and orthogonality between the stochastic error term and the explanatory variables (Izilein and Mohammed 2017).

Appendix 5 presents the results of the dynamic panel data model using the GMM SYS estimation technique. The results of the dynamic panel data model shows that in line with expectation, the one period lagged value of RGDP positively and significantly affects per capita RGDP. Like both the fixed effect and random effect models, FDI has a positive effect on the RGDP in Sub-Saharan Africa. In other words, FDI inflows into Sub-Saharan Africa positively impacts on the economy of the region. This falls in line with the a priori expectation. Like the static models, its coefficient is significant, easily passing the significance test at the 1% level. A 10% increase in foreign direct investment inflows into Sub-Saharan Africa leads to approximately 0.06% increase in RGDP per capita, also, its 1-period lag effect (FDI) is seen to be positively related to RGDP per capita which falls in line with theoretical expectation and is highly significant at the 1% level. This means that a rise in FDI inflow will steer economic growth in SSA countries in the preceding year, especially, when productive capital is introduced, embracing technological advancement and the use of experts to boost economic growth via innovative channels. (Izilein and Mohammed 2017). Thus, FDI has a delayed or lag effect or spillover effect on economic growth as supported by Tsai (2012) that FDI has a positive external effect on human capital formation, technological advancement of nations, managerial expertise which will induce growth in SSA countries.

Also, the diagnostic test results for the GMM model also reports the Wald X2 test statistic which measures the overall applicability of the model and tests the null hypothesis that all coefficients of a model are simultaneously zero. Thus, for the GMM model, the null hypothesis is conclusively rejected supporting the validity of the model.

Given that in most GMM models, over-identification (OID) can be a persistent problem, hence, the study employed the J-test statistic to check if the GMM result is plagued with such weakness, however, the J-statistics reported below the DSGMM result shows that the null hypothesis of valid OID restriction is not rejected for the model, thus this supports the validity of the model.

Arellano and Bond (1999) alluded to the fact that the moment conditions of a GMM model can only be valid if there is no serial correlation between and amongst the idiosyncratic errors of the model. Thus, the Arellano-Bond test statistic clears all disputes revealing that the null hypothesis of the Arellano-Bond serial correlation test is not rejected, hence also validating the use of the instrument.

Test for Threshold Levels at 5% and 10%

Since the Hausman test recommended the use of Random effect model, the threshold level is based on the random effect so as to ascertain what level of FDI is no longer significant in affecting RGDP in Sub-Sahara Africa hence the Threshold Issue in the hypotheses. The result is shown in appendix 6. A critical assessment of the result revealed that between the 5% and 10% Random effect model, there is an insignificant difference between both models. Most importantly, the result reveals that FDI is significant in affecting RGDP at all levels even as low as 5% and 10% as supported by their statistical significance of 24.021 and 24.022 and their respective P-values. Thus from the foregoing we fail to reject but accept the null hypothesis that there are no threshold issues between FDI and economic growth in Sub-Sahara Africa.

White Test

The white test is a statistical test of error, used to ascertain if the variance/deviation in an estimated regression model is constant, which forms one of the bases for a best linear unbiased estimator i.e. homoscedastic. However, this test was conducted, and the result is shown in Appendix 7.

It is pertinent to note that the null hypothesis of the white test states that there is no presence of hetro-skedasticity in the estimated model. Therefore, the result above reveals that we fail to accept the null hypothesis of the presence of hetero-skedasticity because the p-value of both the Pagan, Scaled and C.D test a component of the white test are all less than 0.05 pointing that the estimated model is homoskedastic i.e. constant variance.

Policy Implications

The Fixed effect and the Random effect for the static analysis including the Dynamic system estimator as estimated, presented and analyzed in previous sections are amendable to policy implication. In the first place, this study has shown that foreign direct investment is positively and significantly related to the Economic growth of Sub-Sahara African Nations. Therefore, increased FDI inflows into Sub-Sahara African regions improve the region with its antecedent spill-over effect/benefits. In particular, if FDI rises by 10%, economic growth rises by 0.06%. Thus, policy towards the increased sustainable increase in economic growth as measured by per capita income should be driven towards encouraging increased FDI inflows into the country since it is seen to positively and significantly impact on economic growth.

Another policy implication which follows from the Threshold analysis is that there are no threshold issues in the impact of FDI on the Economic growth of SSA countries. Thus, any level of FDI inflows either 5 or 10% significantly impacts on Economic growth. Therefore, the government of these SSA countries should ensure a stable policy and investment-friendly environment for increased FDI influx into nations to boast level of Growth and development.

Another policy implication which follows the GMM SYS is the GFCF, FAID, POGR and EXCH are significant in affecting the Economic Growth of SSA countries. Hence, policy towards increased government expenditure on Physical capital which includes capital expenditure on infrastructure, increased foreign aid, controlled effective population growth and the stable exchange rate should be implemented void of rep-tapism so as to achieve its desired objective.

Conclusion

This work focused on how to investigate threshold issues in the impact of FDI on Economic growth of SSA countries using panel data for both the static and dynamic system model. This was necessary because it was seen that FDI has a statistical positive effect on the economic growth of most SSA countries, hence the question, what percentage of FDI inflows will have no impact on the growth of SSA economies. The study covered the period 1990 to 2015 for 36 Sub-Sahara African countries. The data used were secondary panel data from the World Bank Development Indicator (2016). The logarithm of Real Gross Domestic Product (RGDP) which is the dependent variable was used to measure economic growth in Sub-Saharan Africa. The explanatory variables were foreign direct investment (FDI), gross fixed capital formation (GFCF) used to measure physical capital and infrastructure, population growth (POGR), foreign aid (FAID) and official Real exchange rate. All variables were in their logarithm forms except FDI in the models of this study. The econometric methodology used were the fixed effects model, random effects model, the Hausman test, the dynamic panel data model using the Generalized Method of Moments System (GMM SYS). The policy implications on most SSA countries include;

I. The econometric results of both the static (fixed effects and random effects) and the dynamic panel data models revealed that foreign direct investment inflows significantly affect the economy of Sub-Saharan Africa positively.

II. Exchange rate, gross fixed capital formation and population growth were found to have positive impacts on Sub-Sahara African economy, as their individual effects are found to be significant.

III. For the static models, the Hausman test revealed that the Random effect model is more efficient than the fixed effect model.

IV. The Wald test carried for our dynamic panel data model revealed that the coefficients of the model are not simultaneously equal to zero.

V. The threshold test for FDI economic growth relationship revealed that there is no threshold issues in the impact of FDI on economic growth in SSA countries, meaning that at all levels of FDI it significantly affects the economic growth of SSA countries.

However, the studies revealed that there are no threshold issues in impact of FDI on the economic growth of SSA countries. Therefore, for Sub-Saharan Africa to enhance the economy, the various governments of the region need to set up institutions and policies that will encourage and promote foreign direct investment, foreign aid and physical capital. To encourage FDI into the region, governments of SSA should (i) create a conducive environment that will enhance business activities and profit-making. To do this, maximum security should be put in place in the region. (ii) There should be sincere measures and strong commitment from both the governments and people of the region (SSA) to tackle the issue of incessant crisis (religious, ethnic and political) ravaging the region. This will create peace and stability in the region which is very pertinent and mandatory for investment and will thus attract FDI inflows to SSA.

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Appendix

Table 1: Descriptive Statistics

LNRGDP	FDI	LNEXCH	LNFAID	LNGFCF	LNPOGR	
Mean	7.121614	6.697173	0.332794	19.72657	2.729584	1.194416
Median	6.910261	4.685539	4.315079	19.83081	2.695602	1.229570
Maximum	8.477333	40.16725	5.097769	20.93370	3.570893	1.274217
Minimum	5.681122	-5.977515	-16.71415	18.99217	1.347074	0.998933
Std. Dev.	0.992622	10.43694	6.583688	0.456882	0.500277	0.089264
Skewness	0.092644	1.423128	-1.506438	0.268534	-0.317735	-0.939012
Kurtosis	1.349948	5.111385	3.878821	2.930230	3.488006	2.570069
Jarque-Bera	107.5231	489.8055	384.1401	11.43910	25.03697	144.7609
Probability	0.000000	0.000000	0.000000	0.003281	0.000004	0.000000
Sum	6665.830	6268.554	311.4955	18464.07	2554.890	1117.974
Sum Sq. Dev.	921.2535	101849.3	40527.53	195.1731	234.0088	7.450056
Observations	936	936	936	936	936	936

Source: Author's Computation using Eviews 9

Table 2: Unit Root Testing

Variables	Levin, lin & chut	Methods	Critical values	p-values	Comment
LNEXCH	-22.6681 (0.0000)	Lm,Pearson&W stat ADF Chi Square PP- Chi Square	-17.4019 412.414 336.746	0.0000 0.0000 0.0000	1(0)
LNFAID	-20.9994 (0.0000)	Lm,Pearson&W stat ADF Chi Square PP- Chi Square	-21.2248 512.557 881.746	0.0000 0.0000 0.0000	1(1)
FDI	1.81588 (0.9653)	Lm,Pearson&W stat ADF Chi Square PP- Chi Square	-16.8603 397.708 1035.25	0.0000 0.0000 0.0000	1(1)
LNGFCF	-6.04594 (0.0000)	Lm,Pearson&W stat ADF Chi Square PP- Chi Square	-8.43674 192.096 177.911	0.0000 0.0000 0.0000	1(0)
LNPOGR	-9.19315 (0.0000)	Lm,Pearson&W stat ADF Chi Square PP- Chi Square	-8.89097 201.538 75.4383	0.0000 0.0000 0.36790	1(0)
LNRGDP	-7.55893 (0.0000)	Lm,Pearson&W stat ADF Chi Square PP- Chi Square	-10.2844 233.865 365.642	0.0000 0.0000 0.0000	1(1)

Source: Author's Computation using Eviews 9

Table 3: The Static Models (Dependent Variable – RGDP)

Fixed Effect Model				Random Effect Model			
Variable	**Coefficients**	**t-statistics**	**Prob value**	**Variable**	**Coefficients**	**t-statistics**	**Prob value**
LNRGDP(-1)	0.754962	7.823411	0.0000	LNRGDP(-1)	0.754962	2.144513	0.0000
FDI	0.281540	2.112513	0.0000	FDI	0.011540	8.949812	0.0000
LNEXCH	0.588773	8.755612	0.0000	LNEXCH	0.028773	7.604313	0.0000
LNFAID	-0.451340	6.814513	0.0000	LNFAID	-0.061340	5.990911	0.0000
LNGFCF	0.786504	5.889811	0.0000	LNGFCF	0.096504	4.475413	0.0000
LNPOGR	0.879140	4.696513	0.0000	LNPOGR	0.969140	5.731912	0.0000
C	1.642211	7.823411	0.0000	C	1.642211	7.963411	0.0000
R-Squared	0.969142			R-Squared	0.478405		
Adjusted R-Squared	0.967727			Adjusted R-Squared	0.469360		
F-statistic	684.8111			F-statistic	52.89161		
Prob (F-statistic)	0.000000			Prob (F-statistic)	0.000000		

Source: Author's Computation using Eviews 9

Table 4: Correlated Random Effects - Hausman Test.

Chi-Sq. Statistic	Prob.
390.716830	1.0000

Source: Author's Computation using Eviews 9

Table 5: The Dynamic Model-GMM SYS (Dependent Variable – RGDP)

Variable	Coefficients	t-statistics	Prob value
LNRGDP(-1)	0.664861	1.084509	0.0000
FDI	0.014131	5.745408	0.0000
FDI(-1)	0.000673	1.8774191	0.0000
LNEXCH	0.113535	2.398708	0.0000
LNEXCH(-1)	-0.055670	-1.164708	0.0000
LNFAID	0.030284	-2.1694277	0.0000
LNFAID(-1)	-0.138176	-6.1042579	0.0000
LNGFCF	0.047607	5.7740317	0.0000
LNGFCF(-1)	-0.115974	-1.170908	0.0000
LNPOGR	0.124621	3.283513.	0.0000
LNPOGR(-1)	0.445799	12.904461	0.0000
C	5.240327	1.714808	0.0000
R-Squared 0.991926 Adjusted R-Squared 0.991826 J-statistic 888.0000 J-Statistic (Prob) 0.00001 D.W Stat 2.162963			

Wald X2 Test.			Alrellano-Bond Serial Correlation Test.		
Statistics	d.f	p-value	Lag	Statistic	p-value
1764.694	2	0.0000	1	-1.002392	0.3162

Source: Author's Computation using Eviews 9

Table 6: Test for Threshold Levels at 5% and 10%

Random Effect Model at 5%				Random Effect Model at 10%			
Variable	**Coefficients**	**t-statistics**	**Prob value**	**Variable**	**Coefficients**	**t-statistics**	**Prob value**
LNRGDP(-1)	-0.430969	-13.35535	0.0000	LNRGDP(-1)	-0.215484	-13.35535	0.0000
FDI	0.056244	24.02149	0.0000	FDI	0.056244	24.02249	0.0000
LNEXCH	-0.835703	-23.77522	0.0000	LNEXCH	-0.835703	-23.77522	0.0000
LNFAID	-0.195155	-6.025792	0.0000	LNFAID	-0.195155	-6.025792	0.0000
LNGFCF	2.623335	11.50034	0.0000	LNGFCF	2.623335	11.50034	0.0000
LNPOGR	-0.430969	-13.35535	0.0000	LNPOGR	-0.215484	-13.35535	0.0000
C	21.13210	26.80538	0.0000	C	21.13210	26.80538	0.0000
R-Squared 0.850865 Adjusted R-Squared 0.850063 F-statistic 1061.190 Prob (F-statistic) 0.000001				R-Squared 0.750868 Adjusted R-Squared 0.720063 F-statistic 1256.198 Prob (F-statistic) 0.000000			

N.B All tables were computed by Author using E-view 9.0

Table 7

Test	Statistics	d.f	Prob.
Breusch-Pagan LM	1586.001	390	0.0000
Pesaran scaled LM	258.8795		0.0000
Pesaran CD	74.3215		0.0000

Source: Author's Computation Using Eviews 9

Author's Profile

John Okafor is a Doctorate student in the Department of Economics and Statistics, University of Benin, Benin City, Nigeria. He obtained his first and second degree in the same university and has proven to be a scholar in international trade, health economics and econometrics. During his first degree (B.Sc) at the University of Benin, Nigeria, Okafor John did his first work that x-rayed health and poverty incidence in Nigeria (an Econometric Assessment). The research revealed that there was a vicious cycle of poverty, which was seen as the cause of poor health outcomes in Nigeria, hence the health poverty linkage. He achieved this using a slight modification of the Grossman Health model using the vector Error Correction model. Furthermore, he looked at Foreign Direct Investment (FDI) and Economic growth across Sub-Saharan African (SSA) Countries during his Master's program (M.Sc). There he found that FDI is a key determinant that drives economic growth in SSA countries. Currently he is integrating FDI and health as it affects SSA countries for his doctorate program.

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