

**FOREIGN DIRECT INVESTMENT AND ECONOMIC GROWTH IN  
DEVELOPING COUNTRIES: PANEL ESTIMATION FOR SUB-SAHARAN  
AFRICAN COUNTRIES**

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**Abstract**

It has been widely claimed that foreign direct investment (FDI) stimulates economic growth. In this study, an attempt is made to verify this for ten selected Sub-Saharan African (SSA) countries using data spanning from 2008 to 2013 obtained from world development indicators. Preliminary analysis conducted indicates that the regression assumption tests as the ARCH test for heteroscedasticity, the Lagrangian multiplier test for higher autocorrelation and the Ramsey Reset test for mis-specification of models show that ordinary least square (OLS) estimation is appropriate. The result of panel multiple regression analysis using the pooled OLS, fixed and random effects is reported. The Hausman's test shows that the fixed effect model is more reliable. The findings reveal that though FDI positively stimulate growth in SSA but it is not a significant determinant of growth performance in SSA. The study recommends that SSA countries should endeavour to increase their share of world's FDI through the use of appropriate and responsive policies.

**Keywords:** FDI, Growth, and Panel Least Square

**Introduction**

The issue of capital flows is considered to be the most accessible route for economic growth. The structural transformation in the global economy in terms of changes in market orientation has recognized the importance of foreign direct investment (FDI) as one of the possible channels to stimulate growth. FDI's are investments involving transfer of assets, including financial capital, advanced

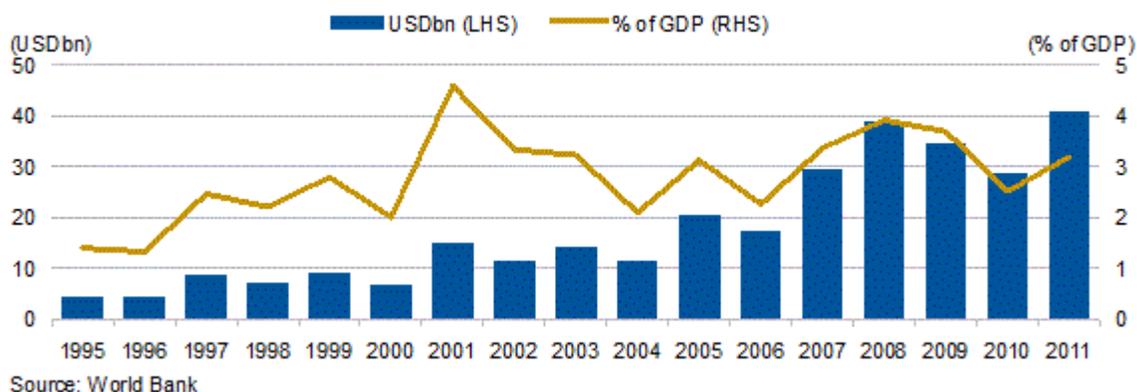
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technology and know-how, better management practices, etc. Such investments are carried out by an entity (a firm or an individual) in foreign firms, involving an important equity stake in, or effective management control (United Nations Conference on Trade and Development, UNCTAD, 2007). FDI can transfer technologies and its spillovers affect domestic firms, which may make them more competitive and of a higher standard to that necessary to compete with foreign firms and products. These may then be made generally available in the economy, and lead to an increase in the standards of production. The UNCTAD (2008) reports that FDI inflows have the potential to create employment, increase productivity, transfer skills and technology, boost exports and continue the long-term economic growth and development of developing countries. FDI is also seen as the largest source of external financing for developing countries and Africa in particular.

For decades, most African countries strive to attract FDI with the view of accelerating growth process. This has led to many countries improving their business climate to attract more FDI. Infact, one of the pillars for launching the New Partnership for Africa's Development (NEPAD) was to accelerate FDI inflows to the region (Funke and Nsouli, 2003). In 2006, about 40 Sub-Saharan African (SSA) countries introduced 57 new measures of attracting FDI, of which 49 encouraged inward FDI (UNCTAD, 2007). The increase in FDI inflows largely reflected relatively high economic growth and strong corporate performance in many parts of the world. In 1970, the first year that FDI flew into the continent was officially documented and data became available, the total amount of FDI inflows that year was US\$1.26 billion. FDI inflows to the various regions of the world have grown dramatically in the past two decades. The total world FDI inflows, which stood at US\$59 billion in 1982, grew dramatically to US\$648 billion in 2004 and reached its peak of US\$1,833 billion in 2007 (UNCTAD, 2008). FDI inflows increased from US\$18 billion in 2004 to US\$36 billion in 2006. This was due to increased interest in natural resources, improved prospects for corporate profits and a more favorable business climate. With a share of approximately 5% of global flows, FDI in Africa remains relatively small, as compared to flows to and among industrialised and other major emerging economies. The regional distribution of FDI in Africa based on UNCTAD 2009 estimates were: North US\$24 billion, West US\$26 billion, East US\$6 billion, Central US\$4 billion and Southern US\$27 billion. In 2010 the total annual figure was US\$55.04 billion.

FDI in Africa have traditionally been focused on a small number of target jurisdictions, with South Africa and Nigeria being the top destinations. South Africa received nearly a fifth of FDI into the continent in 2011 with investments of US\$10.3b. However, new FDI 'hotspots' are emerging and Mozambique, another major investment destination, attracted approximately US\$7.1b (up 30% from 2012 figures) as a result of the growth in its coal and gas markets. Other countries which have received significant foreign investment include Ghana, Uganda and Zambia. FDI trends differ significantly between North Africa and sub-Saharan Africa. As a result of political uncertainty in the region, FDI projects in North Africa declined by almost 30% as a whole. Other major African economies have also seen a decline in investment, with FDI inflows to Nigeria falling by approximately 20% to US\$5.5billion

Fig.1: Net FDI inflow to SSA Countries



Despite the increased flow of investment to developing countries, African countries are still characterized by low per capita income, high unemployment rates as well as low and falling growth rates of GDP. These are developmental problems that FDI is supposed to ameliorate to a great extent. Against this backdrop, this paper looks into the long run dynamics between FDI and economic growth for 10 countries in SSA region for the period 2008 - 2013. The paper is divided into five sections. Section I is the introduction already discussed. Section II provides an overview of selected empirical studies. Section III discusses the methodology and model adopted alongside data and methodology. Empirical results are presented in section IV and finally, Section V concludes.

### Literature Review

Despite the considerable volume of research on the subject, there is conflicting evidence in the literature regarding the effect of FDI on economic growth. Nair-Reichert and Weinhold (2001) test causality for cross country panels, using data from 1971 to 1995 for 24 countries. They emphasize heterogeneity as a serious issue and used what they refer to as the mixed fixed and random (MFR) coefficient approach in order to test the impact of FDI on growth. The MFR approach allows for heterogeneity of the long run coefficients, thereby avoiding the biases emerging from imposing homogeneity on coefficients of lagged dependent variables. They find that FDI on average has a significant impact on growth, although the relationship is highly heterogeneous across countries.

Kumar and Pradhan (2002) explored on the role of FDI on the trade- led growth hypothesis in three counties, namely Australia, Canada and Israel for the period 1965-2001. The study was based on panel cointegration and causality tests. The results show long-run cointegration relationship of FDI and growth after allowing for heterogeneous country effect. The causality test confirms the presence of long-run and short-run bi-directional causality between openness and economic growth. It also confirms the

presence of unidirectional causality from economic growth to FDI, but not vice versa. At individual level, FDI was found to cause economic growth on Australian economy only. The conclusion was that economic growth may harm openness and foreign direct investment in the three countries investigated.

Kawaii (2005) analyzes whether FDI promote economic growth by using threshold regression analysis. According to the analysis it shows that FDI alone play uncertain role in contributing to economic growth based on a sample of 62 countries during the period observed from 1975 to 2000 and find that initially GDP and human capital are important factor in explaining FDI. Further, FDI is found to have a positive and significant impact on growth when host countries have a better level of initial GDP and human capital.

Hansen and Rand (2006) using a sample of 31 developing countries and using estimators for heterogeneous panel data, found a bi-directional causality between FDI/GDP and the level of GDP. They interpret this result as evidence in favour of hypothesis that FDI has an impact on GDP via knowledge transfers and adoption of new technology. Al-Iriani and Al-Shami (2007) testing for the relationship between FDI and growth in the six countries comprising the Gulf Cooperation and using heterogeneous panel analysis methods indicate a bi-directional causality. Their results support the endogenous growth hypothesis for this group of countries.

Herzer, Klasen, and Lehmann (2008) investigate the impact of foreign direct investment on economic growth using detailed sectoral data for FDI inflows to Indonesia over the period 1997-2006. Using the methodology of augmented production function specification and regression methodology with time fixed effects, they concluded that in the aggregate level, FDI has a positive effect on economic growth. However, when accounting for the different average growth performance across sectors, the beneficial impact of FDI was considered to be no longer apparent. When examining different impacts across sectors, estimation results showed that the composition of FDI matters for its effect on economic growth. Few sectors reflected a positive impact of FDI and one sector even showed a robust negative impact of FDI on economic growth.

Vijayakumar and Sridharan, (2010) study the causal relationship between Foreign Direct Investment and Growth in the BRICS countries (Brazil, Russia, India, China and South Africa). The study used quarterly data from 1996 to 2007 for Brazil, 1994 to 2007 for Russia, 1992 to 2007 for India, 1999 to 2007 for China and 1990 to 2007 for South Africa. The study employs the Industrial Production Index (IPI) as a measure of economic growth. Johansen's cointegration model and vector error correction model (VECM) were used as estimation techniques. The empirical results found that Growth leads to FDI bi-directionally for Brazil, Russia and South Africa and FDI leads Growth uni-directionally for India and China respectively.

Moyo (2013) contributes the effect of foreign direct investment on GDP in Zimbabwe, the result exhibits that FDI has too much significant and positive impact on economic growth, thereby he supports policies that promote inward FDI if their country is to meet its economic growth targets. He adds that private investment and government expenditure have positive and significant impact on gross domestic product GDP. Adewumi (2013) using graphical and regression analysis to find the correlation between

FDI and GDP in this case the empirical analysis by employing time series data from eleven developing countries shows negative but significant result for the period 1970-2003. Azam and Sallahuddin (2013) examined the impacts of corruption, foreign direct investment (FDI) and workers remittances on economic growth in a set of five South and South East Asian countries during the period ranging from 1985 to 2011. By using panel data, fixed effects and random effects models, the study obtained evidence of the positive and statistically significant effects of FDI and workers' remittances on economic growth. Empirical results also show negative and statistically significant impact of endemic corruption on economic growth during the study period.

Sarmidi, Shaari and Farshid (2014) investigate the impact of FDI on economic growth for Afghanistan and three Central Asian countries using panel data for the period of 1997 to 2012. They employed both the fixed effect and random effect in order credible results. The results suggest the interactions of FDI with GDP have been strongly positive and significant during the period, whilst the other explanatory variables such as export and official development assistance (ODA) robustly follow the same trend as FDI and GDP.

### **Model Specification and Estimation Method**

#### **Model Specification**

The model to be estimated is:

$$PCY_{it} = \beta_1 + \beta_2 FDI_{it} + \beta_3 NRR_{it} + \beta_4 POP_{it} + \beta_5 INF_{it} + \beta_6 INT_{it} + U_{it} \quad (3.1)$$

Where PCY, FDI, POP, INF, NRR and INT are per capita income, Foreign Direct Investment, Population, Inflation rate, Natural Resource Rent and Interest rate, respectively.  $U_{it}$  is the Error term for country  $i$  at time  $t$ . The  $\beta_1$  to  $\beta_6$  are country specific parameters.

#### **Estimation Method**

The empirical method adopted for estimation is the panel data approach. Panel data techniques are now widely used to estimate dynamic econometric models in order to capture dynamic effects which are its basic advantage over cross-sectional data (Bond, 2002). Its advantage over aggregate time series data includes the possibility that underlying micro-economics dynamics may be obscured by aggregate basis. Specifically, panel data offers options of investigating heterogeneity effects resulting from the cross-sectional components of the sample and the adjustment dynamic resulting from time series component. The panel data dynamics is presented in fixed and random effects and these effects are based largely on the assumption about the error term. For the Pooled regression, the OLS is applied to stacked data (i.e., ignores the cross-section and time series independence of data). The model provides consistent and efficient estimates of the common intercept and slope vector.

The Model Representations for Polled OLS is:

$$y_{it} = \alpha + \beta_j' x_{jit} + \varepsilon_{it}, \quad i=1,2,\dots,n; \quad t=1,2,\dots,T; \quad j=1,2,\dots,K. \quad (3.2)$$

where  $\varepsilon_{it} \square iid(0, \sigma^2)$ ;  $E[\varepsilon_{it}] = 0$ ,  $Var[\varepsilon_{it}] = \sigma^2$  and  $Cov[\varepsilon_{it}, \varepsilon_{js}] = 0$  if  $t \neq s$  or  $i \neq j$ .

The estimated coefficients are obtained using the formula  $\hat{\beta} = (\mathbf{X}'\mathbf{X})^{-1} \mathbf{X}'\mathbf{y}$

Next, to estimate the fixed effect model (FEM), there are a variety of linear panel data models which are formulated based on different assumptions. The pooled panel regression model ( $y_{it} = \alpha + \beta' \mathbf{x}_{it} + \varepsilon_{it}$ ) can be reformulated into three mean deviation models to produce Total-Within -and Between-Units (groups) estimates. The intercept term drop out and the coefficients  $\beta$  (focus of interest) from these models can be estimated, at least consistently if not efficiently by OLS. The estimates of  $\beta$  obtained from these models are useful for derivation of important results and for analysis of random effects in panel data models.

Let  $\bar{y} (\equiv \bar{y}_{it})$ ,  $\bar{x} (\equiv \bar{x}_{jit}, j=1,\dots,k)$  and  $\bar{\varepsilon} (\equiv \bar{\varepsilon}_{it})$ , then this model is expressed as:

$$(y_{it} - \bar{y}) = \beta' (\mathbf{x}_{it} - \bar{\mathbf{x}}) + (\varepsilon_{it} - \bar{\varepsilon}) \quad (3.3)$$

The estimate of  $\beta$  is the same as that obtained by applying OLS to nT observations in 'total mean' deviation form in (3.3). With the least squares<sup>2</sup> estimator of  $\beta$  from the sample given by:

$$\mathbf{b}^{total} = [\mathbf{S}_{xx}^{total}]^{-1} \mathbf{S}_{xy}^{total} \equiv (\mathbf{x}'\mathbf{x}^t)^{-1} (\mathbf{x}'\mathbf{y}^t).$$

For the random effect model (REM), unlike the FEM which allows each unit to have its own intercept, REM assumes that these intercepts are not fixed but randomly distributed from a larger population of units. This in effect implies that the unobserved unit heterogeneous variables are uncorrelated with the regressors. The REM regression is

$$y_{it} = (\alpha + u_i) + \beta' \mathbf{x}_{it} + \varepsilon_{it} \quad (3.4)$$

Note that OLS applied to the random model yields inefficient estimates and biased inference procedures. As such, the estimator that yield estimates that have asymptotic properties (i.e., consistent and efficient, BLUE) is the Generalized Least Squares (GLS) estimator given by

<sup>2</sup> The matrices of sums of squares and cross products that would be used in this case will be

$$\mathbf{S}_{xx}^{total} = \underbrace{\sum_{i=1}^n \sum_{t=1}^T (\mathbf{x}_{it} - \bar{\mathbf{x}})(\mathbf{x}_{it} - \bar{\mathbf{x}})'}_{(\mathbf{x}'\mathbf{x}^t)} \quad \text{and} \quad \mathbf{S}_{xy}^{total} = \underbrace{\sum_{i=1}^n \sum_{t=1}^T (\mathbf{x}_{it} - \bar{\mathbf{x}})(y_{it} - \bar{y})'}_{(\mathbf{x}'\mathbf{y}^t)}$$

$$\hat{\beta} = (\mathbf{X}'\mathbf{\Omega}^{-1}\mathbf{X})^{-1} \mathbf{X}'\mathbf{\Omega}^{-1}\mathbf{y}; \text{ where}$$

$$\mathbf{\Omega}^{-1} = \begin{pmatrix} \sum_{(T \times T)}^{-1} & \mathbf{0} & \dots & \mathbf{0} \\ \mathbf{0} & \sum_{(T \times T)}^{-1} & & \mathbf{0} \\ & \vdots & \dots & \vdots \\ \mathbf{0} & \mathbf{0} & & \sum_{(T \times T)}^{-1} \end{pmatrix} = \mathbf{I}_{(n \times n)} \otimes \sum_{(T \times T)}^{-1}$$

$$\text{and } \sum_{(T \times T)}^{-1} = (\sigma_{\varepsilon}^2 \mathbf{I}_T + \sigma_u^2 \mathbf{i}_T \mathbf{i}_T')^{-1} = \frac{1}{\sigma_{\varepsilon}^2} \left[ \left( \mathbf{I}_T - \frac{1}{T} \mathbf{i}_T \mathbf{i}_T' \right) + \lambda \frac{1}{T} \mathbf{i}_T \mathbf{i}_T' \right] \quad \text{with} \quad \lambda = \frac{\sigma_{\varepsilon}^2}{\sigma_{\varepsilon}^2 + T \sigma_u^2}$$

Lastly, to tests for fixed effects versus random effects, the Hausman test is the most commonly used. Under the null hypothesis that the random effects model is the correct one, the Hausman test is given by the following formula

$$H = [\hat{\mathbf{b}}_{FE} - \hat{\beta}_{RE}]' \Psi^{-1} [\hat{\mathbf{b}}_{FE} - \hat{\beta}_{RE}] \xrightarrow{Asym.} \chi^2(k-1)$$

where  $[\hat{\mathbf{b}}_{FE} - \hat{\beta}_{RE}]$  is a vector of the difference in slope coefficients between the fixed effects estimator  $\hat{\mathbf{b}}_{FE}$  and the random effects estimator  $\hat{\beta}_{RE}$ , while  $\Psi$  is the difference in the variance matrix of slope coefficients between the fixed and random effects (i.e.,  $\Psi = \text{Var}[\hat{\mathbf{b}}_{FE} - \hat{\beta}_{RE}]$ ).

The alternative test which guarantees a positive definite covariance matrix is

$$H = (\hat{\mathbf{b}}_{LSDV} - \hat{\beta}_{MEANS})' \left[ \text{var}[\hat{\mathbf{b}}_{LSDV}] + \text{var}[\hat{\beta}_{MEANS}] \right]^{-1} (\hat{\mathbf{b}}_{LSDV} - \hat{\beta}_{MEANS}) \xrightarrow{Asym.} \chi^2(k-1)$$

where  $\hat{\beta}_{MEANS}$  is the group means estimator.

In addition to this the diagnostic check we be done. That is the study will also be conducted detailing the results and analyses for the Autoregressive conditional Heteroscedasticity (ARCH) for heteroscedasticity test, the Lagrangian multiplier (LM) test for higher order autocorrelation and the Ramsey reset test for the model specification.

### Data Sources

Secondary data are used in the study. The balanced panel consists of annual data for FDI inflows for selected 10 SSA countries for the period of 2008 – 2013. The data are gathered and verified from various sources including International Financial Statistics by IMF, World Development Indicators and World Debt Tables.

## The Results

This section contains the panel regression results and interpretation of the results. It entails the application of statistical techniques to provide the basis for the testing of the research hypotheses, which invariably formed the basis for recommendations and conclusion at the end of the research.

**Table 1: Panel Regression Results for PCY**

Variables	Pooled OLS (Stalked OLS)	Panel Least Square (Fixed effects)	Panel Least Square (Random effects)
FDI	2.1832 (0.164)	0.1831 (0.3821)	2.1872 (0.6444)
NRR	-0.099 (0.010)*	-0.075 (0.084)	0.6811 (0.000)*
POP	0.116 (0.000)*	-0.485 (0.000)*	0.887 (0.3421)
INFL	-1.3142 (0.0000)*	-0.4284 (0.0000)*	-4.3142 (0.5132)
INT	1.4838 (0.000)*	2.1846 (0.2142)	0.1836 (0.8146)
R <sup>2</sup>	0.8421	0.9842	0.7681
$\bar{R}^2$	0.8244	0.9756	0.7481
S.E.E	0.8191	0.9242	2.1321
D.W	1.8421	2.1846	1.9612
F. Stat	8.16	4.1832	6.1214
Pr(F. Stat)	0.004	0.003	0.012
( ) represents the probability values of the estimated coefficients; * statistically significant at 1%.			

**Source:** Author's computation (2015) using E-view 7.0.

The table shows the result for the model which examines the effect of FDI and some selected macroeconomic variables on economic growth for ten SSA countries. The R<sup>2</sup> for the three estimations shows that the fixed effects is able to explain 98.42% of the variation in PCY with an adjusted value of 97.56%, while the pooled OLS explains about 84.21% with an adjusted value of 82.44%. The random effect has the lowest R<sup>2</sup> value of 76.81% with an adjusted R<sup>2</sup> of 74.98%. However, the F-stat for all the three estimations are all significant as their P-values are all less than 0.5 and this therefore portends that a linear and systematic relationship which is significant exist between the dependent viable and the independent variables. The Durbin-Watson statistics for fixed effects (1.84), pooled OLS (2.18) and random effects (1.96), and these indicates the absence of serial dependence in the residual.

Furthermore, in order to examine the impact of the included regressors on the dependent variable we observed the estimated coefficients. As observed, FDI has

positive coefficients in the three estimated models. Its coefficients in the pooled OLS, fixed effect and random effects are respectively 2.1832, 0.1831, and 2.1872. However, the coefficient of FDI has probability values in the three models that is, in excess of 0.05, hence FDI is not statistically significant in any of these models. NRR has negative coefficients in the pooled OLS and fixed effect models. Its coefficients in these models are respectively  $-0.099$  and  $-0.075$ . The coefficient of NRR in the random effect model is positive being put at 0.6811. NRR has coefficients that are significant in the pooled OLS and random effect model, but its coefficient is not significant in the fixed effect model. POP has positive coefficients in the pooled OLS and random effect model, but its coefficient is not significant in the fixed effect model. POP has positive coefficients in the pooled OLS and random effect models with coefficients respectively as 0.116 and 0.887. Its coefficient is negative in the fixed effect model put at  $-0.485$ . POP is statistically significant at 1% in both the pooled OLS and the fixed effect model.

Inflation rate has negative coefficients in the three estimated models. Its coefficients in the pooled OLS, fixed effect and random effect models are respectively  $-1.3142$ ,  $-0.4284$  and  $-4.3142$ . The P-value of inflation in the pooled OLS and fixed effect models are 0.000, hence at 1% inflation is statistically in both models. The P-value for inflation in the random effect model is 0.5132, hence inflation is not significant in the random effect model. INT has positive coefficients in the three estimated models. Its coefficients are respectively 1.4838, 2.1846 and 0.1836, in the pooled OLS, fixed effect and random effect models. The probability value for INT in the pooled OLS is 0.000, showing that it is statistically significant at 5%. However, the probability values in the fixed effect and random effect models are respectively 0.2142 and 0.8146. Thus, INT is statistically insignificant in both the fixed effect and random effect models. However, If we go by the identification test, that is the Hausman's chi-square statistics, (0.037), the fixed effects result is more reliable and actually performs better than the random effects and pooled estimations and the results explain a significant higher proportion of systematic variations in per capita income (PCY). Also, the variance inflation factor (VIF) of the independent variables does not provide any evidence of multicollinearity in the model.

The ARCH test for heteroscedasticity was performed on the residuals as a precaution. The results showed probabilities in excess of 0.05, which leads us to reject the presence of heteroscedasticity in the residuals. The Lagrange Multiplier (LM) test for higher order autocorrelation reveals that the hypotheses of zero autocorrelation in the residuals were not rejected. This was because the probabilities were greater than 0.05. The LM test did not therefore reveal serial correlation problems for the model. The performance of the Ramsey Reset test showed high probability values that were greater than 0.05, meaning that there is no evidence of mis-specification.

In line with the Hausman test, the structural parameters of the fixed effects estimation are preferred and are used for the discussion. The fixed effect results have shown that FDI has positive relationship with per capita income using ten selected countries all in SSA. However, the coefficient of FDI is statistically insignificant. Thus,

while FDI has the tendency to stimulate growth in SSA, it has not been a critical factor in African growth process. This may be due to the minuscule fraction of FDI that SSA has Africa received (Obadan, 2012; Todaro, 1997, IMF, 1977). SSA's receipt of global FDI has been quite unimpressive, reflecting a case of global financial marginalization. In addition, FDI flows to SSA have been biased in favour of the extractive industry (UNCTAD, 2005). The biased flow of FDI into the extractive industry reflects the rent-seeking behavior of foreign investors and it is largely responsible for the undiversified state of African economy (UNCTAD, 2005).

### **Conclusion**

In this study, an attempt was made to examine the impact of FDI on growth in SSA. The study conducted preliminary analysis, which shows that the regression assumptions were all validated. The Variance inflation factor shows the absence of the problem of multicollinearity, the ARCH test shows there is absence of heteroscedasticity, the LM test shows the absence of higher order autocorrelation and finally, the Ramsey Reset test shows the absence of mis-specification error. The Hausman test showed that the fixed effect model is influenced by cross-section specific effects which are realizations of independent random variables with mean zero and finite variance and uncorrelated with idiosyncratic residual. The fixed effect models show that FDI has a positive coefficient, but it is statistically insignificant. This suggests that though FDI has the tendency to stimulate growth in Africa, it is not a critical factor in Africa's growth process.

### **Recommendations**

The study suggests that this could be as a result of the unimpressive flow of FDI into SSA and the biased flow of FDI into the extractive industry reflecting rent-seeking investors. Thus, for effective utilization of FDI towards growth stimulation, we recommend that the SSA countries must endeavour to create conducive environment in order to increase their share of world's FDI flows. This can be achieved through the use of programmatic policies.

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