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Growth Effects of Foreign Direct Investment (FDI) From China and Other Sources in Africa: The Role of Institutional Quality

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Abstract

This study examines the effects of Foreign Direct Investment (FDI) from China, United States (US), European Union (EU) and the rest of Asia on economic growth conditional on the institutional quality of sub-Saharan Africa for the period (2003-2012). We develop theoretical argument from the existing literature to show that institutional heterogeneity may be one of the description for mixed findings of previous empirical studies on the growth effects of Chinese FDI in Africa. We use rule of law to proxy for institutional quality. Using Panel Threshold Regression (PTR) model, we show that FDI from all these sources have a positive impact on growth only above certain thresholds of rule of law and these thresholds differ from one source to the other. However, for FDI from China and the rest of Asia, the difference is marginal. That is, the growth effect of FDI from Asia is positive in countries with governance rating of at least -0.89 while negative in countries falling within a range of -1.35 and -0.89. In terms of FDI from EU and US, beneficial outcomes on growth are realized in countries with governance rating of at least -0.90 and -0.62, respectively. These results confirm that China and the rest of Asia do invest in both weak and strong governance countries in sub-Saharan Africa although the impact is different. Whereas, US and EU seem to invest only in strong governance African countries. However, the former is more sensitive to institutional quality than the latter.

Keywords: Foreign Direct Investment, Panel Threshold Regression, Rule of law

1. Introduction

The controversy surrounding the impact of Chinese FDI on growth in Africa can hardly be solved when all the African countries are regarded as one. The fact of the matter is that each African country is different from the other, and the structural relationships may vary from one country to the other. In line with the growing emphasis on the catalytic role of institutions on FDI-led growth (Peres et al. 2018; Jude & Leveuge 2015; AbuAl-Foul & Soliman 2014; Li & Hook 2014; Unisa Yusufu 2013), this study associates African countries' heterogeneity to

the quality of institutions. In essence, Su & Ado (2016) suggest that an institutionally based approach may be most relevant in better explaining China's Investment in Africa. This suggestion can equally apply to other sources of FDI in Africa.

Various studies which explored the role of institutions on FDI-growth nexus used classical fixed-effects models to capture the impact of the interaction term between FDI and Institutional variable (Peres et al. 2018; Li et al. 2014; Unisa Yusufu 2013). Classical fixed-effects models cannot capture for varying slopes rather they reflect the heterogeneity of different countries in intercepts. Panel Threshold Regression (PTR) model of Hansen (1999) provides a solution to this problem. PTR allows the estimated coefficients of some regressors to take different values subject to the value of another observable independent variable reaching the threshold. Thus, the model assumes that the threshold for regime switching is clearly defined. Gonzalez et al. (2005) relaxed this assumption to incorporate smooth transition regression (STR) in panels. The latter substituted indicator function in the PTR model with smooth distribution function to allow the estimated coefficients to gradually adjust as the system switches from one regime to the other. This approach is used in the studies of Jude et al. (2015) and AbuAl-Foul et al. (2014)

The aforementioned studies used aggregate FDI data yet we seek to identify thresholds for a specific source of FDI in Africa. We seek to show how institutional quality in African countries can influence the growth effects of each source of FDI in the weak and strong institutions regimes. This implies that the threshold for regime switching should be clearly defined for each source of FDI and therefore PTR is appropriate for this study.

The rest of this paper is organized as follows. Section 2 provides a literature review on the role of institutions towards FDI-led growth. We also discuss the relationship between institutions and FDI; and the direct relationship between institutions and economic growth. Section 3 describes the methodology, specifies the model and the estimation technique. Section 4 reports estimations results and finally, section 5 gives conclusion and recommendations based on main findings.

2. The role of institutions on FDI-led growth

It is widely acknowledged that institutions are upheld to make a difference to individual actors in society (North 1990). This follows that various sources of FDI as actors in a society are likely to act differently conditional to the institutional structure of the host society. The empirical literature is still scarce to substantiate this argument although the existence of debate in the subject cannot be ruled away. For instance, Ayodele & Sotola (2014) claim that China does invest in African countries where Western investors are not willing because Chinese investors hardly take account of institutional quality. Likewise, Chen et al (2015) assert that the Chinese portion of FDI in weak governance African countries surpasses that of Western investors. The latter further argue that the impact of Chinese FDI on growth is approximately the same between weak and strong governance countries in Africa. However, Renard & John (2011) suggest that the benefits of China's investment can be realized if Africa works on improving its governance.

Institutions on their own have been proven to be crucial economic growth factors in various studies. For sub-Saharan Africa in particular, McMillan & Harttgen (2014) and Rodrik (2014) argue that the growth miracle which took place between (2000-2009) was mainly driven by institutional reforms. Although the surge of FDI from China and other sources cannot be taken for granted, Rodrik (2014) suggests that institutions provide a base and framework for interaction with foreign investors. This could imply that FDI can either be unhealthy or beneficial to growth depending on the institutional quality of the host country. Weak governance performance tends to be associated with corruption, government ineffectiveness, poor regulation quality, ineffective rule of law, political instability and poor accountability among other governance factors. It is therefore unusual for FDI to be beneficial on the growth of such countries although Chen et al (2015) urge otherwise in the case of Chinese FDI in weak governance African countries.

Jude et al. (2015) demonstrate various aspects in which the conditioning role of institutions on FDI-led growth nexus takes place. First, the country's productivity prospects are shaped by institutions, hence, may attract more

FDI. Second, weak institutions are detrimental to the business environment and therefore FDI-financed firms are highly sensitive to the governance framework of the host country. The first aspect concurs to the finding of Peres et al. (2018) which support the significance of institutions in attracting FDI in developing countries. Furthermore, Morrissey & Udomkerdmongkol (2012) argue that the extent to which FDI crowds out domestic investment is related to institutional quality in host countries. For sub-Saharan Africa in particular, Unisa Yusufu (2013) shows that institutional quality does not only attract FDI but also can amplify the growth effects of FDI in the continent.

Unisa Yusufu (2013) adopted the Solow model to investigate the channels through which FDI can promote growth in Sub-Saharan Africa over the period (1981-2010). The channels investigated include human capital, institutions, infrastructure, and financial development. While using the system GMM method, the findings show that only institutions and financial development have a positive impact on the FDI-growth relationship in Sub-Saharan Africa. Likewise, Li et al. (2014) utilize the system GMM to estimate the role of institutions for the growth-enhancing effect of FDI in a panel of 78 countries over the period (1981-2005). The results highlight the complementary effect in the middle of FDI and institutional quality where the impact of FDI on growth actually depends on the quality of institution in the host countries.

Generally, GMM implies a linear reciprocal action between FDI and institutions in generating growth. In other words, a reform in institutional quality is assumed to have constant impetus on the marginal effect of FDI. Accordingly, the implied threshold only points out where the total marginal effects of FDI eventually turn positive. This idea was challenged by AbuAl-Foul et al. (2014) and Jude et al. (2015) through PSTR model of Gonzalez et al. (2005), using evidence from MENA countries for the period (1984-2011) and 94 developing countries over the period (1984-2009), respectively. Their results demonstrate how institutional quality reform does neither act linearly on the marginal effect of FDI nor reciprocate proportionally with effort, rather subject to the distributional position of the institutional variable.

Furthermore, the studies also demonstrate how the recognized threshold is not necessarily the one that tips over the coefficient of FDI from negative to positive, as it is an endogenous one that shows the shift in the slope of the FDI-growth regression (a shift that theoretically could occur between two positive slopes as well). Regardless of these notable differences in methodologies, the ultimate conclusion attained using both the system GMM estimator and the PSTR estimator reflect institutions as a modulator for FDI-led growth.

3. Methodology

This study follows Neuhaus (2006) by inputting inward stock of FDI in place of Human Capital in the augmented Solow Model of Mankiw et al. (1992). Hence we account for two types of physical capital stocks which are, domestic capital (K_d) and foreign capital (K_f). However, we go beyond FDI aggregate data and look at bilateral FDI data compiled by UNCTAD for the period (2001-2012). Thus, we build 12 years synthetic panel that allows us to overcome the very short time span of available bilateral FDI data between Africa and its key FDI sources.

$$Y(t) = K_d(t)^\alpha K_f(t)^\beta A(t)L(t)^{1-\alpha-\beta} \quad (1)$$

Where Y is aggregate output, K is the stock of physical capital, A is the productivity parameter, L denotes labor input and the subscript t represents time. α and β represent production elasticities and they are assumed to vary for the two types of physical capital stocks. Bassanini & Scarpetta (2001) point out that $A(t)$ consists of two elements. One that accounts for various policy oriented variables such as institutional framework, inflation, terms of trade and other trade openness variables. The other element reflects exogenous technical progress, that is, all other unexplained trend growth variables which the model does not explicitly account for.

Our model follows the neoclassical growth theories, therefore, we utilize changes in the log of per capita GDP in real terms as our dependent variable ($\ln y_{it} - \ln y_{it-1}$). The specification of our regressors incorporates fundamental determinants of the steady state, that is, lagged dependent variable (y_{it-1}), population growth rate

(n), changes in technology (g), the rate of depreciation for capital stock (d) and domestic investment savings rate (s_d). The subscript (s_f) denotes for foreign investment savings rate. Other control variables ($X_{i,t}$) represent the components of $A(t)$ and they are discussed below. The basic model can be summarised using the following econometric statement:

$$\ln y_{it} - \ln y_{it-1} = \alpha + \beta \ln y_{it-1} + \gamma \ln s_{d,it} + \phi \ln s_{f,it} + \varphi \ln(n_{it} + g + d) + \varphi' \ln X_{it} + \lambda_t + \eta_i + \varepsilon_{it} \quad (2)$$

where $\lambda_t, \eta_i, \varepsilon_{it}$ proxy for period-specific effects that are assumed to affect all countries for example technology shocks, unobserved country-specific effects, and white noise error term respectively. In line with augmented Solow model of Mankiw et al. (1992), we assume the depreciation rate of the physical capital stock (d) and changes in technology (g) to be constant over time and equal to 0.05. Thus, Equation (2) can be presented as follows:

$$\ln y_{it} = \alpha + (\beta + 1) \ln y_{it-1} + \gamma \ln s_{d,it} + \phi \ln s_{f,it} + \varphi \ln(n_{it} + 0.05) + \varphi' \ln X_{it} + \lambda_t + \eta_i + \varepsilon_{it} \quad (3)$$

3.1 Data and variable description

This study measures per capita GDP in real terms for income levels, Gross Capital Formation as a percentage of GDP for domestic investment savings rate and the share of inward stock of FDI in GDP for the foreign investment savings rate. We use stock rather than flow data of FDI to capture for perpetual and some of the immeasurable effects of FDI on growth. Neuhaus (2006) argue that that the ratio of inward stock of FDI to GDP is more accurate than flows in capturing for perpetual and some immeasurable effects of FDI on economic growth. FDI is differentiated between FDI from a particular source and FDI from the rest of the world (ROW) to sub-Saharan African countries. FDI from ROW is controlled by subtracting source's FDI from the total inward stock of FDI to Africa. For population growth, we add 0.05 before generating logs. The components of X_{it} include total natural resource rents as a percentage of GDP, changes in terms-of-trade and inflation rate. All these control variables are in logarithms except for changes in terms-of-trade, as the variable exhibit a large number of negative values. We use rule of law as the institutional quality variable. The summary of all the variable descriptions and data sources is provided in Table 1 below.

Table1: Variable Descriptions and Data Sources

VARIABLE	DESCRIPTION	SOURCE
GDP per capita	Gross Domestic Product (GDP) per capita, constant 2010 US\$	WDI (2019)
Domestic Investment	Gross Capital Formation,% of GDP	WDI (2019)
Population Growth	Population growth rate in %	WDI (2019)
Terms of Trade Growth	Changes in terms of trade in %, based on an index 2000=100	WDI (2019)
Inflation	GDP deflator, annual change in %	WDI (2019)
Institutional Quality	Rule of Law: The estimates range from approximately -2,5 to 2.5 indicating weak and strong governance performance respectively	WDI (2019)
FDI ROW	Total inward stock of FDI from the rest of the world(Total inward stock of FDI less inward stock of FDI from China/USA/EU/Asia), % GDP	UNCTAD stat (2019)
FDI (CHINA/USA/EU/ROA)	Inward stock of FDI from China, USA, European Union and the Rest of Asia respectively,% of GDP	UNCTAD stat (2019)
Total Natural Resource Rent (% of GDP)	Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents.	WDI (2019)

The sample of this study is restricted by the availability of sound FDI bilateral data between African countries and the FDI sources considered in this study. The list of the sub-Sahara Africa countries utilises is given in Table 2 below.

Table 2: Sample

Angola	Benini*	Botswana	Burkina Faso	Burundi	Cameroon	Cape Verde	Central Africa Republic
Chad	Comoros	Congo	Cote D'Ivoire	DRC	Equatorial Guinea	Eritrea	Ethiopia
Gabon	The Gambia	Ghana**	Guinea	Guinea-Bissau*	Kenya	Lesotho	Liberia
Madagascar	Malawi	Mali*	Mozambique	Niger	Nigeria	Rwanda*	Sao Tome & Principe*
Senegal*	Seychelles	Sierra Leone	South Africa	Swaziland	Togo*	Uganda	Tanzania
Zambia	Zimbabwe						

Notes: *countries with less than three observations of FDI from all the FDI sources for the period (2001-2012).

The estimation of PTR using STATA is very sensitive to missing values hence, these countries were removed to obtain a strongly balanced panel data. We hardly could ipolate and epolate for the missing FDI values of the removed countries. **The country was removed for the estimation of PTR relating to Chinese FDI only. For 2SLS analysis, we prefer to use the whole sample although the difference between the estimated coefficients obtained using the whole sample and those obtained using the reduced sample is statistically insignificant.

3.2 Model Specification

The main aim of this paper is to establish threshold level/s at which institutional quality can influence the growth effects of various FDIs in Africa. This requires a model with varying slopes so that it can capture the conditioning effects of institutions in Africa on the FDI-growth nexus in the 'weak governance performing' and 'strong governance performing' regime, respectively. The classical fixed effects cannot be appropriate because the model reflects the heterogeneity of different countries in intercepts. Hansen (1999) proposed the Panel threshold regression (PTR) model which allows the estimated coefficients of some regressors to take different values subject to the value of another observable independent variable reaching the threshold. Thus, the model assumes that the threshold for regime switching is clearly defined. Later Gonz'alez et al. (2005) relaxed this assumption to incorporate smooth transition regression (STR) in panels, allowing the estimated coefficients to gradually adjust as the system switches from one regime to the other. However, the assumption relaxed by the latter accommodates the major objective of this paper hence we will stick to the former. PTR can account for different links in terms of statistical significance, magnitude and signs among or between variables of interest in distinct regimes.

Allowing for fixed individual effects (μ_i) and given a non-time invariant institutional indicator ($q_{i,t}$) as a threshold variable, the PTR divides the observations into two or more regimes, depending on whether each observation is above or below a threshold level. The econometric equation of PTR model with two extreme regimes can be defined as follows;

$$y_{it} = \mu_i + \beta'_{it} s_{f,it} g(q_{it}; c) + \varphi' X_{it} + \varepsilon_{it} \quad (4)$$

Where X_{it} proxies for fundamental Solow growth variables and other control variables discussed above excluding institutional quality indicator. The role of the threshold variable explains its absence in the main equation (Jude et al. 2015; AbuAl-Foul et al. 2014). This also controls for reverse causality and collinearity between governance indicator and other economic growth variables. The subscript $s_{f,it}$ represents the inward stock of FDI while ε_{it} is the error term. The binary transition function $g(q_{it}; c)$ divides the single threshold equation (4) into two regimes with coefficients β_1 and β_2 , where c is the threshold parameter. This translate equation (4) into the following equation:

$$y_{it} = \begin{cases} \mu_i + \beta'_1 s_{f,it} + \varphi' X_{it} + \varepsilon_{it} & \text{if } q_{it} \leq c \\ \mu_i + \beta'_2 s_{f,it} + \varphi' X_{it} + \varepsilon_{it} & \text{if } q_{it} > c \end{cases} \quad (5)$$

Equation (5) can be thought of as linear heterogeneous panel model with coefficients that vary across cross-section units and over time. Where the slope parameters satisfy;

$$\frac{\partial y_{it}}{\partial s_{f,it}} = \beta_{it} = \begin{cases} \beta_1 & \text{if } q_{it} \leq c \\ \beta_2 & \text{if } q_{it} > c \end{cases} \quad (6)$$

For multiple thresholds that is, models with $r + 1 > 2$ regimes or threshold parameters c_1, \dots, c_r , the general specification is as follows:

$$y_{it} = \mu_i + \sum_{j=1}^r \beta'_j s_{f,it} I_{(c_{j-1} < q_{it} \leq c_j)} + \varphi' X_{it} + \varepsilon_{it} \quad (7)$$

where $I_{(c_{j-1} < q_{it} \leq c_j)}$ represents the indicator function and $c_0 = -\infty$ while $c_{r+1} = +\infty$.

Equation (7) ought to be fitted sequentially for instance in the case of a double threshold that is, three regimes model the specification is presented below;

$$y_{it} = \mu_i + \beta'_1 s_{f,it} (q_{it} < c_1) + \beta'_2 s_{f,it} (c_1 \leq q_{it} < c_2) + \beta'_3 s_{f,it} (q_{it} \geq c_2) + \varphi' X_{it} + \varepsilon_{it} \quad (8)$$

where $c_1 < c_2$.

Notwithstanding uncertainty about the endogeneity bias and potential reverse causality, this study uses lagged FDI and lagged institutional quality indicator. This translates our equations of interest (equations (4) and (7)) into the following equations, respectively:

$$y_{it} = \mu_i + \beta'_{it} s_{f,it-1} g(q_{it-1}; c) + \varphi' X_{it} + \varepsilon_{it} \quad (9)$$

$$y_{it} = \mu_i + \sum_{j=1}^r \beta'_j s_{f,it-1} I_{(c_{j-1} < q_{it-1} \leq c_j)} + \varphi' X_{it} + \varepsilon_{it} \quad (10)$$

3.3 Estimation Procedure

The first test is conducted to determine the significance of the threshold effect in equation (9) (Hansen, 1999). Gonz'alez et al. (2005) refer to the procedure as a test for linearity against the equation (9). Jude et al. (2015) suggest the procedure as a homogeneity test of the FDI-growth coefficient conditional on threshold variable (q). Despite differences in terminology, the threshold effect hypothesis in the equation (9) can be presented as follows;

$$H_0: \beta_1 = \beta_2$$

The rejection of H_0 is a confirmation that the two regimes nonlinear threshold model is appropriate otherwise, equation (9) collapses into a linear panel regression model with fixed effects. However, the main challenge is the presence of the nuisance parameter in H_0 . That is, the threshold parameter c is not identified under H_0 Davies (1987). This problem renders the asymptotic distribution of F_1 statistic non-standard and in particular, dominates the Chi-squared distribution. One solution to the nuisance parameter issue is to use a bootstrap procedure proposed by Hansen (1996). The latter demonstrates that this bootstrap simulation produces first-order asymptotic distributions and therefore test statistic F_1 and the corresponding p -value attained from the bootstrap are asymptotically valid. The null hypothesis is rejected if the test statistic $F_1 >$ its critical value.

Based on equation (10), the second step is conducted to discriminate between single and double threshold regression. In this context, H_0 : Single threshold regression. The hypothesis of the two regimes is rejected in favor of three regimes if $F_2 >$ its critical value. A sequential procedure based on F_2, \dots, F_j (until the corresponding H_0 is accepted) allows the determination of the number of thresholds or regimes hence the appropriate regression. The corresponding asymptotic p -value for F_2, \dots, F_j can again be estimated using bootstrap analog (Hansen 1999).

4. Estimated Results

This study uses rule of law as a proxy of institutional quality in Africa hence, the threshold variable. The variable has been drawn from six World Bank governance performance indicators based on the results of the pairwise correlation matrix (Note 1). Although all the indicators are positively correlated to each other and statistically significant at 1%, rule of law has the highest correlation with the rest of the indicators. This is an indication that reform in rule of law is likely to have a positive bearing on all other governance indicators.

Table 3 summarises the statistics of the threshold variable according to its minimum value, 25% quantile, 50% quantile, 75% quantile and the maximum value. The statistics are provided both in logs (row (1)) and in raw data (row (2)).

Table 3: Summary statistics of the threshold variable

Variable	Minimum value	25% quantile	50% quantile	75% quantile	Maximum value
ln lagged Rule of Law (1)	-1.329	-0.134	0.279	0.572	1.025
Lagged Rule of Law (2)	-1.855	-1.248	-0.856	-0.384	0.668

Note: Authors own calculation based on rule of law data extracted from WDI (2019). The governance performance rating follows that of the World Bank where all governance indicators are rated on a scale ranging from -2.5 for weak and 2.5 for strong governance performance.

With reference to the World Bank rating, the result shows that on average sub-Saharan African countries have a minimum, 50% quantile and maximum governance performance of -1.86, -0.86 and 0.67, respectively. Based on this scale, 50% quantile separates between weak and strong governance performing countries in the context of sub-Saharan Africa. Under a weak regime, the institutional quality of countries falling below 25% quantile is very weak. On the other dimension, countries above 75% quantile have very strong governance performance.

Table 4 shows the results of the hypothesis of no threshold effects and the tests to determine the number of thresholds. These estimation procedures were conducted separately for each source of FDI.

Table 4: Test for threshold effects and number of regimes

	Chinese FDI	US FDI	EU FDI	ROA FDI
Test for Single threshold (two regimes)				
F ₁	15.32	12.31	13.93	16.51
P-Value	0.040**	0.060*	0.060*	0.020**
1% critical values	18.09	17.77	15.32	20.51
5% critical values	14.05	13.99	13.94	14.72
10% critical values	12.60	10.48	10.83	11.42
Test for Double threshold(three regimes)				
F ₂	18.63	9.73	9.88	16.19
P-Value	0.020**	0.200	0.180	0.020**
1% critical values	21.64	14.50	16.62	23.43
5% critical values	15.42	12.55	13.87	13.97
10% critical values	13.69	10.68	10.56	11.45
Test for Tripple threshold(four regimes)				
F ₃	12.85			4.04
P-Value	0.560			0.820
1% critical values	36.43			92.08
5% critical values	34.25			79.29
10% critical values	30.17			49.49

Notes: P -values and critical values are computed from 50 bootstrap simulations. F_1 represents the Fisher type statistic associated with the test of H_0 of no threshold against a single threshold. F_2 corresponds to the test of a single threshold against a double threshold and F_3 corresponds to the test of double threshold against a triple threshold. *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

The results show that the hypothesis of no threshold effects is rejected across all sources of FDI. For Chinese FDI and FDI from the rest of Asia, the test statistics F_1 are both significant at 5% with corresponding bootstrap p -values of 0.04 and 0.02, respectively. The test statistics F_1 of FDI from US and EU are both statistically significant at 10% with an equal corresponding bootstrap p -value of 0.06. Based on these results, the growth effects of FDI from various sources in Africa is proven to be conditional to institutional quality in the continent. A panel threshold model is thus appropriate with rule of law as the threshold variable.

To determine the number of thresholds, the test statistics F_2 for Chinese FDI and FDI from the rest of Asia are both significant at 5% with an equal corresponding bootstrap p -value of 0.02. The test statistics for a third threshold F_3 are however statistically insignificant implying that two thresholds are appropriate for PTR analysis of these sources of FDI. For FDI from US and EU, the results show that the tests for a second threshold F_2 are statistically insignificant implying that a single threshold is favorable for the PTR analysis of these FDI sources.

Results of the threshold parameter estimates and their respective asymptotic 95% and 99% confidence interval are exhibited in Table 5 below.

Table 5: Threshold parameter estimates

		Point estimate	95% Confidence Level	99% Confidence Level
Chinese FDI	Single threshold	0.206	[0.166, 0.228]	[0.145, 0.228]
	Double threshold	-0.297	[-0.388, 0.251]	[-0.388, -0.251]
US FDI	Single threshold	0.404	[0.364, 0.411]	[0.068, 0.411]
EU FDI	Single threshold	0.202	[0.156, 0.219]	[0.107, 0.218]
ROA FDI	Single threshold	0.206	[0.069, 0.223]	[-0.030, 0.223]
	Double threshold	-0.264	[-0.479, -0.234]	[-0.309, -0.234]

The point estimates relating to Chinese FDI are -0.297 and 0.206 corresponding to World Bank governance performance rating of approximately -1.377 and -0.891 respectively. Table 3 conveys the information that -0.297 lies below the 25% quantile while 0.206 lies slightly below the 50% quantile. For FDI from the rest of Asia, the point estimates are -0.264 and 0.206 corresponding to the governance performance rating of approximately -1.352 and -0.891. The estimates of the latter resemble that of the former and this is not surprising since China is an Asia country. Thus three regimes indicated by the point estimates are those with 'very weak', 'weak' and 'strong' institutional quality.

The results also show that estimated threshold parameters relating to FDI from US and EU are 0.404 and 0.202 corresponding to World Banking governance performance rating of -0.622 and -0.896, respectively. Referring to the position of these parameters from Table 3, we derive that 0.404 falls way above the 50% quantile while 0.202 lies slightly below the 50% quantile. Thus two regimes indicated by the point estimates are those with 'weak' and 'strong' institutional quality. The asymptotic confidence intervals for the threshold are very tight across all the estimations, indicating little uncertainty about the nature of this division.

Table 6 reports the main results of the PTR estimations. The regressions were conducted separately for FDI from China, US, EU and the rest of Asia and the estimates are presented in columns (1)-(4), respectively. Based on the results obtained in Table 4, column (1) and (4) shows estimates derived from a double threshold regression while column (2) and (3) exhibits estimates derived from a single threshold regression model.

Table 6: Fixed Effects PTR Results with FDI from China, US, EU and the rest of Asia.

Dependent Variable: In real GDP per Capita		(1)	(2)	(3)	(4)
Lagged Dep Var		0.748*** (0.036)	0.773*** (0.041)	0.767*** (0.042)	0.765*** (0.042)
In Domestic Investment		0.014*** (0.004)	0.014*** (0.004)	0.014*** (0.004)	0.013*** (0.004)
In Population Growth		0.016 (0.009)	0.009 (0.007)	0.012 (0.009)	0.008 (0.007)
In Natural Resource Rents		0.004 (0.009)	0.005 (0.010)	0.007 (0.009)	-0.004 (0.009)
In inflation		-0.0004 (0.000)	-0.0004 (0.000)	-0.0004 (0.000)	-0.0004 (0.000)
Terms to Trade growth		0.019*** (0.005)	0.021*** (0.005)	0.021*** (0.005)	0.022*** (0.004)
In FDI ROW		-0.176*** (0.038)	-0.146*** (0.047)	-0.132*** (0.037)	-0.164*** (0.031)
In FDI China		0.093 (0.124)			
In FDI US			-0.042 (0.065)		
In FDI EU				-0.083* (0.045)	
In FDI ROA					-0.296* (0.146)
In $FDI^j I_{(j)}$	β_1	0.027 (0.031)	-0.001 (0.019)	0.002 (0.030)	-0.005 (0.029)
	β_2	-0.114** (0.047)	0.060*** (0.017)	0.109*** (0.024)	-0.274*** (0.086)
	β_3	0.122*** (0.026)			0.131*** (0.025)
Observations		340	350	350	350
Countries		34	35	35	35
R-Squared (within)		0.871	0.862	0.866	0.872

Notes: The subscript j denotes FDI from a specific source while $I_{(j)}$ represents the indicator/transition function. For Chinese FDI, β_1 : ($q_{it} < -0.297$), β_2 : ($-0.297 \leq q_{it} < 0.206$) and β_3 : ($q_{it} \geq 0.206$). For FDI from the rest of Asia, β_1 : ($q_{it} < -0.264$), β_2 : ($-0.264 \leq q_{it} < 0.206$) and β_3 : ($q_{it} \geq 0.206$). For US FDI, β_1 : $q_{it} \leq 0.404$ and β_2 : $q_{it} > 0.404$ while for EU FDI, β_1 : $q_{it} \leq 0.202$ and β_2 : $q_{it} > 0.202$. Robust standard errors are in parentheses. *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

For the regressions relating to Chinese FDI and FDI from the rest of Asia, the β_1 , β_2 , and β_3 estimated coefficients are associated to the regimes with 'very weak', 'weak' and 'strong' institutional quality, respectively. For the regressions relating to FDI from US and EU, the β_1 and β_2 estimated coefficients correspond to the regimes with 'weak' and 'strong' governance performance, respectively.

4.1 Discussion of the main parameters

The estimated coefficients of β_1 are statistically insignificant across all the sources of FDI. This might be an indication that all the sources of FDI hardly invest in very weak governance performing countries although what could be very weak for EU and US can be mean for China and the rest of Asia. For FDI from China and the rest of Asia, the estimated coefficients of β_2 are negative and statistically significant at 5% and 1%, respectively while of β_3 are positive and highly significant. Thus, the growth effects of FDI from Asia including China are realized in African countries that are above 25% quantile in terms of institutional quality. However, the impact is negative as long as the institutional quality is approximately below the 50% quantile. This finding contradicts the assertion made by Chen et al (2015) that Chinese FDI boost growth on both weak and strong governance countries. The results of this study show that only countries which are above 50% quantile yield positive growth effects of FDI from China and the rest of Asia. Our finding is consistent to the study of Renard et al. (2011) which argued that full benefits of Chinese FDI can be realized if African countries work on improving their institutional quality.

For regressions relating to FDI from US and EU, the estimated coefficients of β_2 are positive and highly significant. Notwithstanding that, the point estimate of the regression relating to FDI from US (0.404) is twice more than of FDI from US (0.202) (see Table 5). Table 3 shows that 0.404 lies far above 50% quantile while 0.202 lies slightly below the quantile. This is an indication that favorable growth outcome of FDI from US can be realized only in strong governance performing African countries whereas FDI from EU enhances growth even in some countries with weak institutions. Precisely, those countries which are slightly below the 50% quantile tend to yield economic growth benefits from EU FDI.

In line with Ayodele et al. (2014) our results show that China do invest in some African countries which EU and US seem to shy away and these are countries associated with weak governance. This finding is indicated by the statistically significant and insignificant estimated coefficients of β_2 for Chinese FDI and; FDI from EU and US, respectively. In addition, the countries falling slightly above 50% quantile are regarded as weak by US. This result is indicated by the position of US FDI threshold point estimate from the 50% quantile. Fortunately, these countries are covered under the benefits coming from the EU and Asia FDIs.

4.2 Discussion of control variables

The results also show that the estimated coefficients of the convergence term, domestic investment, and terms of trade growth are standard relative to literature and highly significant across all regressions. Contrary to theory, the estimated coefficient of population growth is positive albeit statistically insignificant and small. The estimated coefficients of inflation and natural resource rents are very small and statistically insignificant. The estimated coefficients of FDI from the rest of the world separately controlling for all the sources of FDI considered in this study are all negative and highly significant. The estimated coefficients of FDI from China and US are statistically insignificant while those of FDI from EU and the rest of Asia are negative and statistically significant at 10%.

4.3 Robustness checks

We check the robustness of the PTR estimates using 2SLS estimator to account for probable endogeneity arising from specific FDI variables. The regressions are conducted with interaction terms between each source of FDI and rule of law in Africa. The estimated results are presented in Table 7 below. Column (1)-(4) presents the estimated results with respect to FDI from China, US, EU and the rest of Asia, respectively.

Table 7: Fixed-Effects 2SLS results with interaction terms.

Dependent Variable: In real GDP per Capita				
	(1)	(2)	(3)	(4)
Lagged Dep Var	0.726*** (0.056)	0.724*** (0.060)	0.725*** (0.058)	0.733*** (0.058)
ln Domestic Investment	(0.013)** (0.005)	0.012*** (0.004)	0.013*** (0.005)	(0.013)*** (0.005)
ln Population Growth	-0.004 (0.017)	0.010 (0.023)	0.013 (0.019)	0.005 (0.018)
ln Natural Resource Rents	0.002 (0.016)	0.001 (0.017)	-0.004 (0.017)	0.001 (0.017)
ln inflation	0.003 (0.007)	0.003 (0.007)	0.004 (0.007)	0.003 (0.007)
Terms to Trade growth	0.012 (0.008)	0.012 (0.008)	0.013 (0.008)	0.013 (0.009)
ln FDI ROW	-0.062 (0.040)	-0.097 (0.073)	-0.067* (0.042)	-0.070* (0.039)
ln FDI China	-0.211** (0.093)			
ln FDI US		-0.058 (0.112)		
ln FDI EU			-0.039 (0.052)	
ln FDI ROA				0.017 (0.130)
ln FDI ⁱ *ROL	0.028 (0.022)	0.036 (0.031)	0.026 (0.025)	0.030 (0.025)
Observations	252	227	240	244
Countries	42	42	42	42
R-Squared (within)	0.802	0.793	0.802	0.803
Hausman/C test (p-value)	0.000	0.001	0.000	0.001
Hansen test (p-value)	0.965	0.247	0.258	0.457

Notes: The subscript j represents a specific source of FDI. FDI^i*ROL is the interaction term between an FDI from a specific source and rule of law in Africa. Robust standard errors are in parentheses. *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level. In all regressions from column 1-4, specific FDIs are instrumented using their first three lags and the p-values of the Hausman test are <10% implying that 2SLS estimates are preferred to standard OLS fixed-effects estimates. All p-values of the Hansen test are >10% implying that the instruments used are valid.

The results show that only the estimated coefficient of Chinese FDI is negative and significant at 5% while those of other FDI sources are statistically insignificant. In terms of FDI from the rest of the world, the estimated coefficients are negative and significant at 10% only in the regression relating to FDI from EU and the rest of the world. Terms to trade growth estimated coefficient enter the model as expected albeit insignificant across all specifications while other control variables are robust. The estimated coefficients of all interaction terms are statistically insignificant. This result conveys the weakness of using the classical fixed-effects model to investigate the role of institutional quality on FDI-growth nexus.

Despite the noted differences, both the fixed-effects 2SLS and fixed-effects PTR estimators concur on the same conclusion in that the direct impact of FDI from various sources in Africa is either negative or at best

insignificant. This finding reinforces the argument that favorable growth effects of FDI on growth are not automatic rather subject to the institutional quality of the host country (AbuAl-Foul et al. 2014; Jude et al. 2015).

5. Conclusion and recommendations

In line with the growing emphasis on the catalytic role of institutions on FDI-led growth, we associate African countries' heterogeneity to the quality of institutions and show how it can influence the growth effects of each source of FDI in the weak and strong institutions regimes, respectively. For this purpose, we use the PTR model with rule of law as a proxy for institutional quality to 35 sub-Sahara African countries over the period (2003-2012). The sources of FDI considered in this study are China, US, EU and the rest of Asia. Conclusions drawn from our main findings are as follows;

The growth effects of FDI from both China and the rest of Asia are analysed in three regimes with approximately the same threshold parameters. Due to this result, China is bundled together with the rest of Asia. The first regime constitutes of countries with very weak institutional structures and the impact of FDI from Asia on growth of these countries is non-significant. On average, countries belonging to the first regime have a governance performance of at most -1.35. The second regime constitutes of weak governance performing countries ranging between -1.35 and -0.89 on average. The impact of FDI from Asia is deleterious on the economic growth of these countries. The last regime constitutes of strong governance countries, performing above -0.89 on average and these are the countries which claim growth benefits from Asia FDI.

Moreover, the impact of EU and US is unique from that of Asia in two ways. First, their impact on growth in Africa is divided upon weak and strong governance performing countries. Second, their impact of weak governance performing countries is non-significant. Our findings confirm that US and the EU investments' are channelled towards African countries with relatively effective rule of law although the former is more sensitive than the latter. Whereas China do investment both in weak and strong governance countries.

The difference between FDI from the EU and US lies in the threshold required to yield favorable growth outcome in strong governance performing countries. For FDI from US, the threshold point estimate is approximately -0.62 on average compared to -0.90 for EU. Thus FDI from US can enhance growth only in countries with high-quality institutions while EU investment can boost growth starting from countries which are slightly below the 50% quantile. In a nutshell, US is more sensitive to institutional quality than EU and Asia, respectively. We therefore recommend that for African countries to win out of FDI from EU, Asia and US they have to reform their institutions to an average performance rate of at least -0.90, -0.89 and -0.62, respectively.

Another contention yet to be cleared is that Chinese Investment in Africa is earmarked for natural resources. Chen et al. (2015) argue that the motive is indifferent from Western investors. Generally, FDI earmarked for natural resources is considered unhealthy for the host economy due to resource curse (Hayat 2014) however, the threshold of the case is not known. Hence, future researches can look at this aspect and take natural resource factor as a threshold variable.

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Notes

Note1: Results of the pairwise correlation matrix are not presented in this paper however they can be made available on request.