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Article

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GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

Foreign direct investment and poverty in sub-Saharan African countries: The role of host absorptive capacity

Sodiq Arogundade^{a*}, Biyase Mduduzi^a and Hinaunye Eita^a

Abstract: This study examines the role of human capital and institutional quality on the impact of foreign direct investment (FDI) on poverty in sub-Sahara Africa (SSA). In achieving this, a balanced panel of 30 SSA countries from 1996 to 2018 was explored using fixed-effect instrumental regression, fixed effect panel threshold model, and the heterogeneous Granger-causality test. There are three main important findings from this empirical study: (1) FDI does not have a direct impact on the incidence and intensity of poverty. (2) the impact of FDI is contingent on the absorptive capacity of the host country. The study further reveals that FDI will alleviate poverty conditions if interacted with human capital and institutional quality at a given threshold. (3) bidirectional causality between FDI and poverty. This study recommends that in addition to FDI's promotional policies, governments of SSA countries need to improve investment in human capital. It is also important for SSA countries to embark on public sector reforms, as investments do not thrive in an environment characterized by high corruption or political instability.

ABOUT THE AUTHORS

Sodiq Arogundade is currently at the final stage of his PhD programme at the University of Johannesburg, South Africa. He has more than six years (6) of work experience in research and consulting. He currently works as a research associate at the South African Research Chairs Initiative (SARChI) and as an assistant lecturer in the School of Economics, University of Johannesburg. His area of specialisation includes development finance, international trade, and applied econometrics.

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PUBLIC INTEREST STATEMENT

The controversies that trail whether FDI's impact is conditional on certain intermediating variables have become a recurring discourse in the FDI-poverty literature. While the quality of institutions has prominently featured as playing a vital role, the level of human capital has also been highlighted as a good candidate. This study examines the role of host absorptive capacity in the FDI-poverty nexus. The empirical findings suggest that FDI does not directly impact poverty, and the impact is conditional on certain intermittent variables such as human capital and institutional quality. This implies that the more SSA countries improve their economies, the more they reap the benefit of FDI in terms of technological spillovers, job creation, and poverty reduction. In attracting a significant amount of FDI capable of reducing the intensity and incidence of poverty, this study recommends that improving the investment climate of SSA countries should not be compensated for the FDI promotional policies, as investment promotional measures without a suitable enabling environment would be counterproductive.

Subjects: Economics; Macroeconomics; Econometrics; International Economics; Development Economics

Keywords: Poverty; Foreign direct investment; Absorptive capacity; Instrumental regression; Fixed-effect panel threshold model; heterogenous Granger-causality test; sub-Saharan African countries

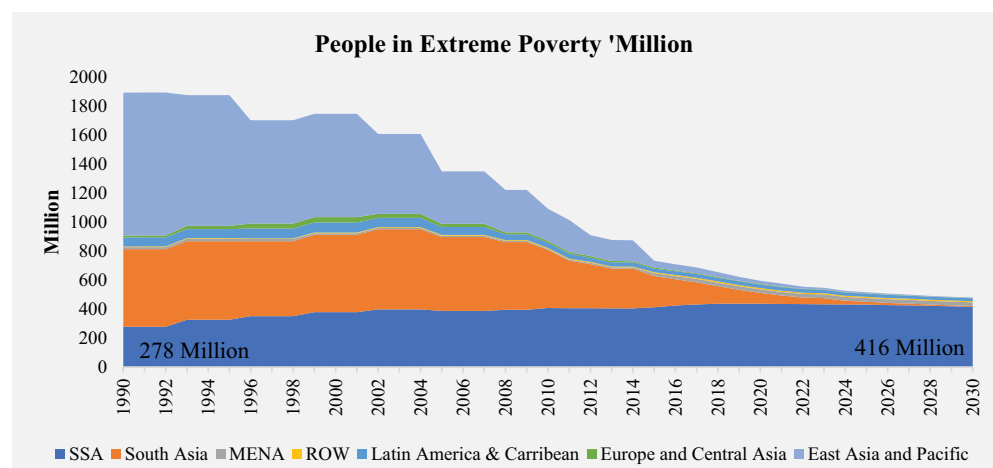
JEL classification: F23; I30; E24; E02

1. Introduction

Foreign direct investment (FDI) has become one of the most important external sources of finance in developing countries. This is because of its potential in transferring knowledge and technology, enhancing competition, boosting entrepreneurship and productivity, and increasing the revenue of government through taxes paid by foreign investors (United Nations, 2003). The importance of this source of external finance has triggered many developing economies, especially in Africa, to adopt FDI-friendly policies. In 2017, about 65 economies in the world adopted at least 126 investment policy measures and reforms, some of which include the establishment of new special economic zones (SEZs), simplifying administrative investment procedures, privatization of state-owned assets, and liberalization of domestic markets (see UNCTAD, 2018 for a detailed account of these measures). This has tremendously improved the flow of FDI to SSA, from an average of \$36.03 billion in 1990 to \$610.54 billion in 2018 (UNCTAD, 2019). However, despite an appreciable increase in FDI inward stock, poverty conditions in the region continue to deteriorate. As shown in Figure 1, the number of extremely poor population rose from 278 million in 1990 to 437 million in 2018 (World Bank, 2018). The World Bank also predicted that by 2030, approximately 9 out of 10 extremely poor people would live in SSA. The question this study seeks to address is, why has the rise in the flow of FDI not been able to alleviate poverty conditions in the region, and can it be that host countries do not have enough absorptive capacity to exploit the benefit FDI can offer? However, empirical studies aimed at investigating the benefits of FDI in reducing poverty have reported either a negative effect (Bharadwaj, 2014; Bilal Khan et al., 2019; Fowowe & Shuaibu, 2014; Lazreg & Zouari, 2018; Soumaré, 2015) or a positive effect (Anetor et al., 2020; Arabyat, 2017; Dhrifi et al., 2020; Gohou & Soumare, 2012; Rye, 2016).

The reason why there are conflicting results on the impact of FDI on poverty may be because FDI's influence may not be direct. It may instead be contingent on the condition of local economies. Scholars like Meyer and Sinani (2009) have argued that the level of development of host

Figure 1. Poverty in sub-Saharan Africa.
Source: World Bank, 2018.



country plays a crucial role in determining the extent to which the benefits of FDI are harnessed. The levels of human capital and institutional framework are believed to be the key domestic factors that will condition the impact of FDI. For example, the empirical studies by Yebuo (2020), Jude and Leveuge (2017), and Agbloyor et al. (2016) argue that a specific optimal institutional development is a precondition of the growth-enhancing effect of FDI. At the same time, studies like Bonga-Bonga & Phume, (2017), Li and Liu (2005), and Blomstrom et al., (1993) have estimated a certain threshold of human capital for FDI to enhance growth.

Since most of the aforementioned studies argue that what is good for growth is also good for the poor, and since economic growth may not necessarily result in poverty reduction, it is essential we examine the role of human capital and institutional quality on the nexus between FDI and poverty reduction. Furthermore, the study estimates the absorptive capacity threshold for FDI to alleviate poverty (number of poor people and the magnitude of poverty). The study also assesses whether there are regional differences on the impact of FDI on poverty in SSA. In addition to this, the study determined the direction of causality between FDI and poverty. Conducting this study for Africa is critical for the following reasons, (i) the region is plagued with poor welfare conditions and arguably the least in the world (ii) the prevalence of flawed institutional framework and low human capital is an impediment to FDI spillovers in the region. Thus, attracting multinational corporations to invest under these circumstances may not yield the anticipated results, as investment thrives in a competitive environment.

The author is not aware of any literature that has specifically examined the impact of local economic conditions on the FDI-poverty nexus, especially within the context of Africa. The closest attempt is that of Lehnert et al. (2013) and Pérez-Segura, (2014). These studies were conducted for developing countries, excluding many African countries. Furthermore, these studies adopt a linear interaction model to capture the role of institution on the FDI-welfare nexus. Since the linear interaction imposes restriction that the impact of FDI varies monotonically with the conditioning variables, the fixed-effect panel threshold model, which captures the relationship between FDI, host absorptive capacity, and poverty in SSA countries, is adopted.

This study examines the role of human capital and institutional quality on the FDI-poverty nexus. The empirical findings suggest that FDI does not directly impact poverty, and the impact is conditional on certain intermittent variables such as human capital and institutional quality. This implies that the more SSA countries improve their economies, the more they reap the benefit of FDI in terms of technological spillovers, job creation, and poverty reduction. Further empirical results suggest a bidirectional causality between FDI and poverty. The rest of this paper is structured as follows: Section 1.1 provides stylized facts on FDI issues in the region. Section 2 briefly discusses the related literature on FDI and poverty. The discussions on the methodology and the estimation techniques are discussed in section 3. Section 4 presents the empirical estimation, while section 5 concludes and provides critical policy implications.

1.1. Stylized fact

Despite the significant improvement in FDI flow in SSA in recent decades, the region remains largely marginalized in terms of financial globalization. One sign of this is that the region captured only 2.36 % of global foreign direct investment in 2018 (Statistics, 2019). In increasing the flow of FDI, many SSA governments have adopted a series of reforms and policies to attract FDI, as it is considered by policymakers to be very critical in closing the savings gap.¹ However, the flow of FDI to the region has been unevenly distributed among a few resource-intensive countries. These countries have been able to attract a significant proportion of FDI inflows at the expense of countries with limited resources. As shown in Table 1, in 2018, the top 10 FDI recipients received 72.39 % of the total FDI inflows to SSA. Four African countries, namely: South Africa, Nigeria, Mozambique, and Ghana, accounted for 50 % of the total FDI inflows to the region.

Table 1. Top 10 FDI recipients in SSA, 2010, 2015, and 2018

2010	%	2015	%	2018	%
South Africa	43.54	South Africa	24.59	South Africa	21.10
Nigeria	14.63	Nigeria	17.41	Nigeria	16.33
Angola	7.87	Angola	6.27	Mozambique	6.66
Liberia	2.47	Mozambique	5.68	Ghana	5.92
Ghana	2.44	Ghana	5.12	Congo	4.19
Tanzania	2.35	Congo DR	3.88	Congo DR	3.93
Eq. Guinea	2.28	Tanzania	3.45	Angola	3.88
Condo DR	2.27	Zambia	3.20	Ethiopia	3.64
Congo	2.25	Congo	2.96	Tanzania	3.39
Zambia	1.80	Eq. Guinea	2.59	Zambia	3.35
Total	81.91		75.13		72.39

Source: Authors' computation from the UNCTAD database (2019)

Figure 2 shows a scatter plot of the poverty rate² and institution quality.³ It is evident that countries (Central Africa, Burundi, Congo Democratic Republic, Nigeria, and Mozambique) with relatively high poverty rates tend to have poor institutional quality. However, countries (Mauritius, South Africa, and Ghana) with strong institutional quality are associated with a relatively low poverty rate. The level of institutional quality is strongly correlated with the performance of economies, i.e., countries with sound institutions like efficient and good governance, low corruption, rule of law, and property rights, tend to enhance the process of technology spillovers to local firms. However, countries with poor institutions may deny domestic firms from taking advantage of MNCs' knowledge spillovers (Agbloyor et al., 2016; Brahim & Rachdi, 2014). Therefore, it is anticipated that the impact of FDI on poverty reduction would differ across countries and regions with heterogeneous levels of institutional quality.

Figure 3 shows a scatter plot of poverty rate⁴ and human capital.⁵ Countries (Mozambique, Mali, Niger, and Burkina Faso) associated with deficient human capital development have a relatively high poverty rate. While countries (Ghana, Mauritius, and South Africa) with high human capital development have a low level of poverty. Empirical evidence has also been documented on the importance of human capital development in the economy (Obialor, 2017; Ogundari & Awokuse, 2018). Given the emerging concerns on general development issues in SSA, a fastidious empirical study that examines the channels of the FDI-poverty nexus is important.

Figure 2. Poverty and institutional quality in SSA.
Source: Authors' computation based on World Governance Indicator and World Bank Povcal database (2019). Note: The average of both institutional quality and headcount index were calculated for each country in the last five years.

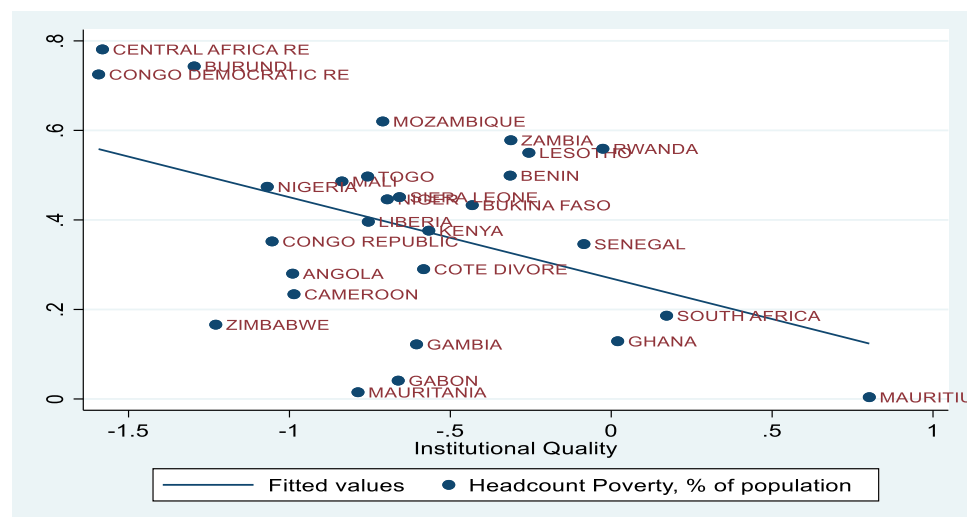
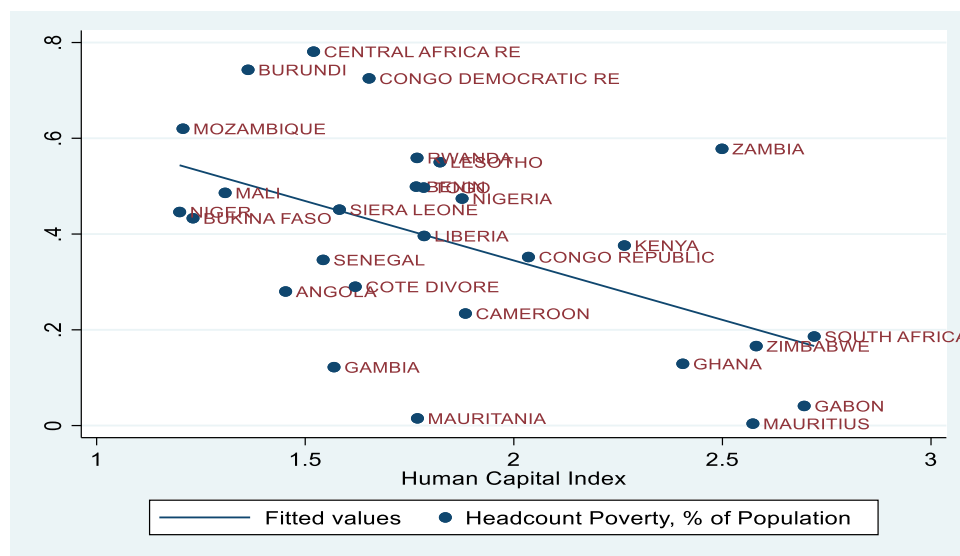


Figure 3. Poverty and human capital development in SSA.
Source: Authors' computation based on World Bank Povcal Database and Penn World Table PWT (2019) **Note:** The average of both human capital and headcount index were calculated for each country in the last five years.



2. Literature review

The theoretical nexus between FDI and poverty can be explained within the foundation of neo-classical or endogenous growth theory. The theory argues that an increase in productivity and economic growth will alleviate poverty and welfare. The proponents of this view posit that a rise in national income tends to benefit the most impoverished population, especially in countries with low-income inequality (Koopmans, 1965; Lucas, 1988; Romer, 1994; Solow, 1956). In addition to the traditional growth theories, Meyer (2004) argues that FDI's impact on poverty can be divided into two categories, namely vertical and horizontal. The horizontal spillover effect occurs from the technological spillover from foreign firms to local firms (Farole & Winkler, 2012). Knowledge spillover takes place through the movement of labour and domestic firms trying to imitate the product innovation of foreign firms (Görg & Greenaway, 2004; Jian-Ye Wang & Magnus, 1992; Meyer, 2004). The horizontal spillover also occurs through the employment of local labour and the training provided to the labourers (Calvo & Hernandez, 2006; Meyer, 2004). This improves the level of human capital and the welfare of the employees in the host countries. The improvement in human capital has two impacts on the welfare of labour. Firstly, it improves the quality of human capital for the local labour. Secondly, the labours are paid competitive wages (Borensztein et al., 1998). The vertical spillover, according to Meyer (2004), results from the interaction between the foreign firms and economic agents in the host country. This can further be divided into forward and backward linkages (Görg & Greenaway, 2004; Liu et al., 2009; Sumner, 2005). The backward linkage involves sourcing raw/intermediate goods from the local firms. This increases the demand for intermediate goods and consequently expands local firms' production (Görg & Greenaway, 2004). The forward linkage involves the growth of the local firms that use the output from the multinational corporations (MNCs).

2.1. Empirical review on FDI and poverty

Several attempts have been made to examine the impact of FDI on poverty. However, there are conflicting results on the impact of FDI. Some studies support the FDI-poverty reduction hypothesis, while others argue that FDI increases poverty. For instance, Lazreg and Zouari (2018) assess the relationship between FDI and poverty reduction in Tunisia from 1985 to 2015. Using fully modified ordinary least squares (FMOLS), the study discovers that foreign direct investment significantly impacts poverty alleviation. Similarly, Bharadwaj (2014) examine the effect of FDI on poverty in a sample of 35 developing countries from 1990 to 2004; the study concludes that FDI is beneficial to poverty reduction. Soumaré (2015) investigates the impact of FDI on the welfare of Northern African countries from the period of 1900-to 2011. The study explored

a dynamic panel regression and concluded that FDI is beneficial to welfare improvement in the region. In addition to this, Fowowe and Shuaibu (2014) used generalized methods of moments (GMM) to investigate the impact of FDI on the poor. The study also confirms the beneficial impact of FDI on the poor. Uttama (2015) examined the impact of FDI on poverty among the ASEAN countries. Using a spatial panel data model from 1995 to 2011, the study confirms that FDI alleviates poverty in the region. The findings provide similar results even when spatial interactions are considered. Bilal Khan et al. (2019) also examined the relationship between FDI and poverty in Pakistan using the ARDL model. The results suggest that FDI contributes to poverty reduction in both the short-run and long-run. Joshua et al. (2021) examine the impact of FDI and external debt on sustainable growth in Africa. Using the autoregressive distributed lag (ARDL), the empirical findings of the study indicate that FDI and external debt are crucial in achieving economic expansion in the region.

However, apart from studies that support the FDI-poverty reduction hypothesis, a few studies have found that FDI does not significantly influence poverty. Starting with the study of Rye (2016), who investigated the effect of foreign direct investment on poverty using a sample of 134 countries in the world. The study explores instrumental regression, and it was discovered that FDI does not significantly influence poverty. Similarly, Arabyat (2017) examines the impact of FDI on poverty reduction in developing countries using a panel error correction model. The conclusion from this study suggests that FDI does not significantly influence poverty. Gohou and Soumare (2012) used two-stage least squares regressions to assess the impact of FDI on poverty. Using a sample of 52 countries in Africa between 1990 to 2007, the study found that FDI's impact on poverty is insignificant. Similarly, Quinonez et al. (2018) examine the impact of FDI on poverty incidence in Latin America for a panel of 13 economies. The study concludes that FDI does not significantly reduce poverty in Latin America. Anetor et al. (2020) used the Feasible Generalized Least Square (FGLS) technique to examine the impact of FDI, trade, and foreign aid on poverty in SSA. The results suggest that FDI and foreign aids increase poverty and that the level of FDI required to alleviate poverty has not been attained.

Some studies have also attempted to examine the causal relationship between FDI and poverty. For instance, Magombeyi and Odhiambo (2017) explore the causal relationship between FDI and poverty in South Africa using time series analysis. Analysis from the ARDL model indicates a unidirectional causality from poverty reduction to FDI. However, Dhrihi et al. (2020) found a bi-directional causality between poverty and FDI for a sample of developing countries.

The conflicting results on the impact of FDI could be because of the differences in geographical context, type and nature of FDI, and the estimation techniques used. It may also be because FDI's impact is conditional on the absorptive capacity of the host country. Studies like Dada and Abanikanda (2021), Yebuoa (2020), Jude and Levieuge (2017), and Agbloyor et al. (2016) emphasize the role of institutional quality on FDI-growth nexus, while studies like Bonga-Bonga & Phume, (2017), Li and Liu (2005), and Blomstrom et al., (1993) empirically assess the role of human capital on the impact of FDI on growth. However, since economic growth does not necessarily lead to poverty reduction, the role of human capital and institutional quality on the nexus between FDI and poverty reduction must be examined. Unfortunately, to the best of the authors' knowledge, there is no literature on the role of institutional quality and human capital on the FDI-poverty nexus within the context of Africa. Other studies like Lehnert et al. (2013) and Pérez-Segura, (2014) empirically assess the role of institutional quality on the nexus between FDI and human development. However, these studies use a linear interaction model. Since linear interaction restricts that the impact of FDI varies monotonically with the conditioning variables, the panel threshold model, which captures the relationship between FDI, host absorptive capacity, and poverty, is adopted.

This study contributes to the literature by identifying the impact of human capital and institutional quality on the FDI-poverty nexus in SSA, determining the absorptive capacity threshold for

FDI to be effective in alleviating poverty, determining the direction of causality between FDI and poverty, and (4) assessing whether there is a regional difference on the impact of FDI.

3. Data and methodology

3.1. Data

This study explores a balanced panel dataset of 30 countries⁶ (see Appendix 1 for full details of the countries) in SSA, with annual data over the period of 1996 to 2018. The choice of countries and period were contingent on data availability. Furthermore, the regional analysis was conducted to examine if there are regional differences in the impact of FDI. In the analysis of this study, poverty is measured using two indicators, and this allows us to establish the robustness of our empirical results. Precisely, we follow Gnanngnon (2022) and Agarwal et al. (2017) approach by using the headcount ratio, which measures the incidence of poverty and the poverty gap index, which measures the intensity of poverty. Both the headcount and poverty gap indexes are measured using the international poverty line of \$1.90 per day. This study follows Nunnenkamp (2004) and Ford et al. (2008) by measuring FDI as inward FDI stock as a percentage of GDP. Using FDI stock also reduces the problem of endogeneity biases that may be associated with the FDI-welfare nexus (Nunnenkamp, 2004). Two alternative proxy for human capital were used to establish the robustness of our empirical results. Precisely, we imitate Levine and Renelt (1992) and Mankiw et al. (1992) by using tertiary enrolment rates, which capture investment in human capital. The second measure of human capital used is the modified Barro and Lee (2013) human capital index, which is an indicator of educational attainment. Li and Liu (2005) and Miao Wang and Sunny Wong (2009), among others, have used the same variable as a proxy for human capital. This study follows Okada (2013) and Ahmad et al. (2015) arguments that aggregate measures of institutional quality indicators may fail to properly capture the effect of institutions. Hence control of corruption and political stability index were used as proxies for institutional quality. These indexes range from—2.5 (weak) to 2.5 (strong). We follow Kaulihowa (2017) by using the growth rate of GDP per capita as a proxy for economic growth and the total active labour force as a proxy for labour.

Table 2. Summary statistics of the variables

Variables	Observations	Mean	Min.	Max.	Sign	Data Sources
FDI Inward Stock (% of GDP)	690	43.96	0.468	1,039	±	UNCTAD
Economic Growth	685	1.782	−36.56	21.03	−	W/B, WDI
Headcount Ratio (% of Pop.)	690	47.5	0.3	96.4	N/A	W/B, Povcalnet
Poverty Gap (% of Pop.)	690	20.3	0.1	66.0	N/A	W/B, Povcalnet
Labour Force '000	690	8194	368	60,700	−	W/B, WDI
Human Capital Index	661	1.677	1.053	2.809	−	PWT, 9.1
Control of Corruption Index	690	−0.634	−1.723	0.809	−	WGI, 2019
Political Stability Index	690	−0.589	−2.845	1.200	−	WGI, 2019
Tertiary Enrolment Rate	690	6.587	0.321	42.34	−	WGI, 2019

NB: United Nations Conference on Trade and Development (UNCTAD), World Bank World Development Indicator (W/B, WDI), Penn World Table Version (PWT), World Governance Indicator (WGI)

3.1.1. Descriptive statistics of the variables

This section discusses descriptive statistics of the key variables used in the model over the period of 1996-to 2018. Among the statistics examined are the averages, maximum, and minimum values of the pooled sample. The descriptive outcomes in Table 2 show that the average values for poverty from 1996 to 2018 and across the 30 countries stood at 47.5% and 20.3% for poverty headcount and poverty gap, respectively. Mauritius has the minimum headcount and poverty gap rate, with 0.3% and 0.1% of her population. However, countries with the highest poverty rate (headcount and poverty gap) are Liberia and the Congo Democratic Republic. In the review period, the average value of FDI is 43.96%; Burkina Faso has the lowest, with 0.47%, while Liberia has the highest, with 1,039% of GDP. Human capital index has an average value of 1.68, Burkina Faso has a minimum value of 1.05, while South Africa has the maximum value. The average value of tertiary enrollment rate is 6.59% of gross enrolment; Malawi has the least with 0.32%, while Mauritius has the highest with 42.34%. Congo Democratic Republic has the least control of corruption and political stability index of -1.723 and -2.845. In contrast, Namibia has the highest, with 0.81 and 1.20 for the control of corruption and political stability index, respectively. The a priori expectations and sources are also listed in Table 2.

3.2. Methodology

In assessing the direct impact of FDI on poverty in SSA, this study uses a fixed effect instrumental model (FE-IV). The motivation for using this model is due to the possible simultaneity bias between FDI and poverty and addressing the problem of heterogeneity in the model. This study relies on a proper exclusion restriction; the instrumental variables of lagged FDI⁸ must meet two conditions to be a valid instrument. The first condition is the instrument relevance condition (see equation 1.0), while the second condition is the instrument exogeneity condition (see equation 1.1). The assumption of this study is that lagged FDI affect outcome variables through the first-stage estimations. The compact form is expressed thus as:

$$\text{cov}(FDI_{i,t-n}, FDI_{i,t}) \neq 0 \quad (1.0)$$

$$\text{cov}(FDI_{i,t-n}, \varepsilon_{i,t}) = 0 \quad (1.1)$$

The general equation used for OLS estimation:

$$Pov_{i,t} = \beta_0 + \beta_1 Pov_{i,t-1} + \beta_2 FDI_{i,t} + \beta_4 X_{i,t} + \tau_t + \varphi_i + \mu_{i,t} \quad (2.0)$$

$$FDI_{i,t} = \emptyset + \alpha_1 FDI_{i,t-n} + X_{i,t}^* \gamma + \tau_t + \varphi_i + V_{i,t} \quad (2.1)$$

Where $Pov_{i,t}$ is poverty rate in country i at period t ; $Pov_{i,t-1}$ is poverty rate in country i at period $t - 1$; $FDI_{i,t}$ is FDI inward stock as a percentage of GDP in country i at period t . $X_{i,t}$ is the vector control variables, which includes GDP growth, labour, institutional quality and human capital. τ_t is time fixed effect, φ_i is time-invariant country-specific effect. Equation (2.1) is the first stage of the FE-2SLS model, while equation (2.0) is the second stage. This study uses the probability value of the F-test in equation (3) as an instrument relevance test, while the Durbin-Hausman test was used to determine endogeneity.

The FE-IV for the FDI-poverty model in equation (2.0) is extended to include an interactive term. This implies estimating the effect of FDI on poverty through absorptive interaction. The model is specified in the following form:

$$Pov_{i,t} = \beta_0 + \beta_1 Pov_{i,t-1} + \beta_2 FDI_{i,t} + \beta_3 FDI^* ABS_{i,t} + \beta_4 X_{i,t} + \mu_i + \varphi_t + \mu_{i,t} \quad (3)$$

The absorptive interaction (ABS) in equation (3) includes institutional quality (political stability and control of corruption) and human capital (human capital index and tertiary enrolment rate). Following Alfaro et al. (2003), FDI and each absorptive interaction were included in equation (3). This is to ensure that the interaction term does not proxy for either FDI or the absorptive capacity measures. The hypothesis is that $\beta_1 > 0$ and $\beta_2 < 0$ for FDI to reduce poverty at high level of absorptive capacity. $X_{i,t}$ is the same as the explanatory variables in equation (2.0).

The linear interactive model specified in equation (3) assumes that the effect of FDI on poverty varies monotonically with the absorptive capacity indicators (human capital and institutional quality). However, there may be a possibility that the poverty reduction gains from FDI are unlocked only when the host countries have reached a certain optimal threshold. In addition to this, linear interactive models suffer from high multicollinearity, which leads to large standard errors on the model parameters (Brambor et al., 2006). In addressing these problems, this study used the fixed-effect panel threshold model developed by Hansen (1996, 1999, 2000). The threshold model adopted is specified as follows:

$$Pov_{i,t} = \begin{cases} \beta_1 X_{i,t} + \beta_1' \dot{X}_{i,t} + e_{i,t} & \text{if } ABS_{i,t} \leq \gamma \\ \beta_2 X_{i,t} + \beta_2' \dot{X}_{i,t} + e_{i,t} & \text{if } ABS_{i,t} > \gamma \end{cases} \quad (4)$$

Where $Pov_{i,t}$ denotes the poverty measures, $X_{i,t}$ is the explaining variables (FDI), $\dot{X}_{i,t}$ represents the control variables specified in equation (2.1), $e_{i,t}$ is the error term, $ABS_{i,t}$ represents the threshold variables, and γ is the threshold regime dependent variable. The fixed-effect panel threshold model of the relationship between poverty measures, FDI, and the absorptive capacity indicators takes the following form:

$$Pov_{i,t} = \mu_i + \beta_1 FDI_{i,t} I(ABS_{i,t} \leq \gamma) + \beta_2 FDI_{i,t} I(ABS_{i,t} > \gamma) + \psi X_{i,t} + e_{i,t} \quad (5)$$

The compact form of equation (5) can be expressed thus as:

$$Pov_{i,t} = \mu_i + \beta_1 FDI_{i,t}(\gamma) + \psi X_{i,t} + e_{i,t} \quad (6)$$

Where the error term $e_{it} = \mu_i + \varphi_t + \mu_{i,t}$, $\mu_{i,t}$ is $i.i.d(0, \sigma_{i,t}^2)$. Is the time-fixed effect, μ_i denotes the individual-specific effects. $I(\cdot)$ is an indicator which takes the value of 1 if the argument in the indicator function holds and 0 otherwise. The threshold variables $ABS_{i,t}$ (institutional quality and human capital) divides the sample into regimes with different regression slope parameters β_1 and β_2 . $X_{i,t}$ is a vector of explanatory variables. In estimating the threshold γ and solving for individual fixed effects (μ_i), this study adopts the traditional method in removing the individual-specific mean. Hence, taking the mean of equation (5) over time (t) takes the following form:

$$\overline{Pov}_{i,t} = \mu_i + \beta_1 \overline{FDI}_{i,t}(\gamma) + \psi \overline{X}_i + \bar{e}_i \quad (7)$$

Equation (8) is further obtained after taking the difference between equations (7) and (6)

$$Pov_{i,t}^* = \omega_1 FDI_{i,t}^*(\gamma) + \delta X_{i,t}^* + e_{i,t}^* \quad (8)$$

Where $Pov_{i,t}^* = Pov_{i,t} - \overline{Pov}_{i,t}$, $FDI_{i,t}^* = FDI_{i,t} - \overline{FDI}_{i,t}$, $X_{i,t}^* = X_{i,t} - \overline{X}_i$. The slope coefficient of β_1 and ψ can be estimated using ordinary least square (OLS) estimation for a given γ . For more details on the threshold effect test or whether the coefficients are the same in each regime, see, Abdulqadir (2020).

Finally, the Dumitrescu and Hurlin (2012) extended version of the granger causality test is employed to investigate the direction of causality between FDI and poverty incidence. The underlying regression for this bi-variate test is as follows:

$$y_{i,t} = \alpha_i + \sum_{k=1}^K \beta_{i,k} y_{i,t-k} + \sum_{k=1}^K \gamma_{i,k} x_{i,t-k} + \varepsilon_{i,t} \quad (9)$$

For individual country i and time t , the observed (stationary) variables are y and x , respectively, and the lag order, K , is considered to be the same for all countries in the balanced panel. The intuition or method of the D-H causality is in similitude to the traditional Granger causality test. The null hypothesis of no causality for any individual panel is compared with the alternative hypothesis of causality for some of the countries in the panel.

4. Empirical results and discussions

4.1. Baseline results

Table 3 presents the baseline results on the direct impact of FDI on poverty in SSA. The estimated coefficient of FDI suggests that FDI has a positive and statistically significant impact on poverty incidence and intensity, with or without control variables. This result is consistent with Rye (2016), Arabyat (2017), and Gohou and Soumare (2012), and Quinonez et al. (2018), that attribute profit repatriation of multinational companies, crowd-out effect of foreign investment on domestic capital and low level of host absorptive capacity as the factors responsible for FDI to increase poverty in the region. The significance and positive sign of initial poverty across models and poverty measures signify the importance of initial poverty conditions as one of the key drivers of current poverty in the region. This is consistent with the study of Son and Kakwani (2004) that the initial levels of economic development matter. Furthermore, the coefficients of active labour force show that a rising labour force reduces poverty in the region. This is in tandem with Colen et al. (2008) argument that a rising active labour force has the potential of reducing unemployment rate and poverty.

The rate of economic growth is also pivotal to poverty reduction. As suggested by the estimates, growth in GDP per capita has a negative and statistically significant relationship with poverty in SSA. This is in tandem with the study of Son and Kakwani (2004) and Škare and Družeta (2016) that an increase in economic activity through an increase in aggregate demand, factor productivity, and reduction in unemployment rates is capable of alleviating poverty level. Human capital has a positive and significant impact on poverty, regardless of the proxy of human capital used. This means that both investments in education and educational attainment do not necessitate a reduction in poverty. Studies like Olopade et al. (2019) and Balamurali et al. (2015) found similar results, and their argument is that investment in human capital without a commiserate increase in job creation will not reduce poverty. The coefficient of control of corruption and political stability, which are a measure of institutional quality, suggests a significant and negative relationship with all the measures of poverty, though political stability is not significant. The results reveal that countries with robust systems of institutional quality can promote economic growth, minimize income distribution, and reduce poverty. This is in tandem with the study of (Perera et al., 2013; Sobhee, 2017; Tebaldi & Mohan, 2010).

4.2. Role of host absorptive capacity on FDI-poverty nexus in SSA

Since the baseline model clearly established that FDI does not directly impact poverty reduction in SSA. The study further investigates whether each of the two channels—quality of institutions and human capital development—do combine with FDI to reduce poverty in the region. Table 4 reveals the results of the panel estimation of poverty equation in equation (3), each including an interactive term between FDI and institutional quality and human capital development. The main parameters of interest are the estimated coefficients of FDI and the interaction term. As mentioned earlier, in order to ensure that FDI and human capital

Table 3. Estimating the direct impact of FDI on poverty in sub-Saharan Africa

	(1)	(2)	(3)	(4)	(5)	(7)
VARIABLES	Headcount Poverty			Poverty Gap		
FDI	0.0017** (0.0008)	0.0001** (0.0001)	0.0001* (0.0001)	0.0011** (0.0005)	0.0001*** (0.00004)	0.0001*** (0.00003)
Poverty ($t - 1$)		0.899*** (0.0182)	0.9235*** (0.0170)		0.921*** (0.0161)	0.9335*** (0.0140)
Labour Force		-0.0738*** (0.0152)	-0.0471*** (0.0107)		-0.0300*** (0.00918)	-0.0181*** (0.0062)
GDP Per Capita Growth		-0.0032*** (0.0002)	-0.0032*** (0.0002)		-0.00182*** (0.0001)	-0.0018*** (0.0001)
Human Capital Index		0.0198 (0.0136)			0.0114 (0.00904)	
Tertiary Enrollment Rate			0.00002 (0.0004)			0.0001 (0.0002)
Control of Corruption		-0.0117** (0.00541)			-0.0067* (0.0036)	
Political Stability Index			-0.0007 (0.0024)			-0.0011 (0.0015)
Constant	0.351*** (0.0379)	1.127*** (0.223)	0.7514*** (0.1680)	0.124*** (0.0238)	0.444*** (0.131)	0.2855*** (0.0962)
R-Squared	0.003	0.779	0.902	0.001	0.865	0.945
Prob > χ^2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Exogeneity of FDI	0.0003	0.0200	0.0256	0.0005	0.0014	0.0074
Instrument relevance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	420	421	450	420	421	450
Number of Countries	30	30	30	30	30	30

Standard errors in parentheses, *** denotes significance at 1 %, ** at 5 % and * at 10%. All regressions are estimated using a fixed-effect instrumental regression estimator. Lag of FDI was used as Instruments in all the estimations. Exogeneity test of FDI is the p-value of Durbin-Hausman-Wu F-test. This test shows that FDI is endogenous in all the estimations. Instrument relevance is the probability value of the F-test in the reduced model.

interaction term does not proxy for FDI or human capital, both variables were included in the regression as independent regressors. The results suggest that FDI when interacted with human capital (human capital index and tertiary enrolment rate), has a negative and significant impact on both incidence and intensity of poverty. This suggests that improvement in human capital has a positive and significant effect on the nexus between FDI and poverty reduction nexus in SSA. This finding is consistent with the study of Blomstrom et al., (1993), Borensztein et al. (1998), Bonga-Bonga & Phume, (2017), and Li and Liu (2005) that FDI's impact on growth and welfare is conditional on the level of human capital in host country.

The coefficient of FDI interacted with institutional quality measured by control of corruption, and political stability suggests a negative and statistically significant relationship with the measures of poverty. This posits that an improvement in the quality of institutions has a positive and significant effect on the nexus between FDI and poverty reduction nexus in SSA. This finding conforms with the results of Jilenga and Helian (2017), Agbloyor et al. (2016), and Hayat (2019) that countries with strong institutional quality have the potential of exploring the FDI-poverty reduction nexus through the enhancement of spillovers, promoting healthy competition and capital accumulation.

4.3. Fixed-effect panel threshold

Although the linear interactive analysis in Table 4 provides informative results, it places restrictions that the poverty effect of FDI monotonically reduces with the absorptive capacity indicators. In overcoming this challenge, this study further tested for the existence of a threshold level of the absorptive capacity indicators in the FDI-poverty nexus, using a fixed-effect threshold model. Table 5 provides the estimates of the fixed-effect panel threshold model specified in equation (5), where the absorptive capacity indicators, human capital and institutional quality, are used as threshold variables. The second and third row display the estimated threshold of each of the measures of human capital and institutional quality, as well as the corresponding confidence interval at 95%. The slope parameters $\hat{\beta}_1$ and $\hat{\beta}_2$ estimates denote the regime-dependent marginal impact of FDI on poverty.

The point estimate threshold value of the control of corruption index is -1.4 for both poverty incidence and intensity. Additionally, the threshold value of political stability is -0.94 and -1.31 for poverty incidence and intensity, respectively. This suggests that if the quality of institutions is maintained at this annual range, FDI will reduce the incidence and intensity of poverty in the region. Concerning the regime-dependent marginal effect, FDI increases poverty when the institutional quality measures are below the threshold. Above the estimated threshold, FDI's impact is negative and statistically significant. Therefore, the same level of FDI may exert a different impact on poverty alleviation in different countries with varying levels of institutional quality. This result corroborates with the empirical outcome of Dada and Abanikanda (2021), Yebuoa (2020), Jude and Leveuge (2017), and Agbloyor et al. (2016) that host countries must achieve an estimated threshold of institutional quality before they could reap the benefits of FDI.

Furthermore, the absorptive capacity threshold points of human capital development, measured by the human capital index, are 1.74 for poverty incidence and 1.27 for the intensity of poverty. Moreover, the threshold value of the tertiary enrolment rate is 2.61 and 5.82% of gross enrolment for poverty incidence and intensity, respectively. This study's findings show that if human capital accumulates at an annual rate of the estimated threshold, FDI will alleviate poverty in the region.

Regarding the regime-dependent marginal effect, FDI has a negative and significant impact on the poverty measures when human capital (human capital index and tertiary enrolment rate) is higher than the estimated threshold. This finding is in tandem with the empirical findings of Bonga-Bonga & Phume, (2017) and Li and Liu (2005) that host countries must attain an estimated level of human capital before they can reap the benefits of FDI.

5. 4.4: Causality results of FDI, institutional quality, human capital, and poverty in Africa

The final phase of this study's econometric procedure is to determine the direction of causality among the main variables of interest, such as FDI, institutional quality,⁹ human capital¹⁰ and poverty.¹¹ This causality results would assist SSA governments and policymakers in identifying which variable to target first. The Dumitrescu-Hurlin panel causality results presented in

Table 4. Role of host absorptive capacity on the impact of FDI on poverty in sub-Saharan Africa

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Headcount Poverty			Poverty Gap			
FDI	0.0036*** (0.0014)	0.0007*** (0.0002)	-0.0001* (0.0001)	-0.0001*** (0.00004)	0.0023*** (0.0009)	0.0003*** (0.0001)	-0.0001** (0.00003)	-0.0001** (0.00003)
Poverty ($t-1$)	0.930*** (0.0362)	0.8851*** (0.0342)	0.947*** (0.0118)	0.881*** (0.0176)	0.956*** (0.0337)	0.9187*** (0.0170)	0.943*** (0.0102)	0.912*** (0.0151)
Labour Force	-0.0352 (0.0295)	-0.0854*** (0.0256)	-0.0189** (0.00920)	-0.0530*** (0.0141)	-0.0014 (0.0181)	-0.0308 (0.0098)	-0.0025 (0.0057)	-0.0131 (0.0087)
GDP Per Capita Growth	-0.0037*** (0.0004)	-0.0032*** (0.0003)	-0.0024*** (0.0002)	-0.0032*** (0.0002)	-0.0022*** (0.0003)	-0.0018*** (0.0001)	-0.0015*** (0.0001)	-0.0018*** (0.0001)
Human Capital Index	0.124** (0.0502)		0.0102 (0.0100)	0.0117 (0.0130)	0.0752** (0.0304)		0.0066 (0.0066)	0.0058 (0.0086)
Tertiary Enrollment Rate		0.0008 (0.0007)				0.0006 (0.0003)		
Control of Corruption Index	-0.0052 (0.0103)	-0.0070 (0.0082)	-0.0020 (0.0041)		-0.00184 (0.0066)	-0.0038 (0.0043)	-0.0039 (0.0025)	
Political Stability Index				0.0092*** (0.0032)				0.0047** (0.0021)
FDI*HUC	-0.0024*** (0.0009)				-0.0016*** (0.0006)			
FDI*TERR		-0.00002** (0.00001)				-0.00001*** (0.000002)		
FDI*COC			-0.0001** (0.00003)				-0.0001*** (0.00002)	
FDI*PS				-0.0002*** (0.00004)				-0.0001*** (0.00002)
Exogeneity test of FDI	0.0000	0.0000	0.6975	0.0011	0.0000	0.0000	0.0880	0.0003
Number of Countries	30	30	30	30	30	30	30	30

Notes: Each column shows the coefficient from a separate regression and standard errors are in parentheses. *** denotes significance at 1 %, ** at 5 % and * at 10%. All regressions are estimated using fixed-effect instrumental regression estimator. FDI*HUC, FDI*TERR, FDI*COC and FDI*PS represent interaction of FDI with human capital index, tertiary enrolment rate, control of corruption index and political stability index, respectively. Lag of FDI was used as Instruments in all the estimations. Exogeneity test of FDI is the p-value of Durbin-Hausman-Wu F-test, this test shows that FDI is endogenous in all the estimations, except column (3). Instrument relevance, coefficient of constant and the R-squared were not reported due to brevity, however available on request.

Table 5. Fixed-effect threshold estimates of FDI and poverty in SSA

VARIABLES	(1)		(2)		(3)		(4)		(7)		(8)		(9)		(10)	
	HC	PG	HC	PG	HC	PG	HC	PG	HC	PG	HC	PG	HC	PG	HC	PG
Threshold Variable	Control of corruption		Political stability		Human capital index		Tertiary enrolment rate									
Threshold ($\hat{\gamma}$)	-1.43	-1.45	-0.94	-1.31	-0.94	-1.31	-0.94	-1.31	1.74	1.27	1.74	1.27	2.61	5.82	2.61	5.82
CI	[-1.46, -1.42]	[-1.49, -1.45]	[-1.09 - 0.92]	[2.48, -2.30]	[-1.09 - 0.92]	[2.48, -2.30]	[-1.09 - 0.92]	[2.48, -2.30]	[1.73, 1.75]	[1.24, 1.27]	[1.73, 1.75]	[1.24, 1.27]	[2.47, 2.64]	[5.18, 5.84]	[2.47, 2.64]	[5.18, 5.84]
$\hat{\delta}_1$ ($ABS \leq \hat{\gamma}$)	3.56e-05	0.000121*	9.14e-05	0.000220***	9.14e-05	0.000220***	9.14e-05	0.000220***	-0.000227**	-0.000539***	-0.000227**	-0.000539***	-0.000991***	0.000211***	-0.000991***	0.000211***
	(9.64e-05)	(6.81e-05)	(9.54e-05)	(7.26e-05)	(9.54e-05)	(7.26e-05)	(9.54e-05)	(7.26e-05)	(9.58e-05)	(0.000110)	(9.58e-05)	(0.000110)	(0.000269)	(6.35e-05)	(0.000269)	(6.35e-05)
	-0.000386***	-0.000264***	-0.000401***	-0.000294***	-0.000401***	-0.000294***	-0.000401***	-0.000294***	-0.000865***	-0.000122*	-0.000865***	-0.000122*	-0.000197**	-0.000110	-0.000197**	-0.000110
	(0.000106)	(7.50e-05)	(0.000106)	(8.09e-05)	(0.000106)	(8.09e-05)	(0.000106)	(8.09e-05)	(0.000155)	(6.99e-05)	(0.000155)	(6.99e-05)	(8.86e-05)	(8.19e-05)	(8.86e-05)	(8.19e-05)
Single threshold effect test ^a	34.60	58.15**	53.13*	51.94**	53.13*	51.94**	53.13*	51.94**	58.92*	38.62	58.92*	38.62	20.15	58.40*	20.15	58.40*
Covariates																
Labour	-0.120***	-0.0765***	-0.118***	-0.0813***	-0.118***	-0.0813***	-0.118***	-0.0813***	-0.118***	-0.0805***	-0.118***	-0.0805***	-0.0610***	-0.0333***	-0.0610***	-0.0333***
	(0.0130)	(0.00922)	(0.0129)	(0.00921)	(0.0129)	(0.00921)	(0.0129)	(0.00921)	(0.0130)	(0.00930)	(0.0130)	(0.00930)	(0.0134)	(0.00958)	(0.0134)	(0.00958)
Control of corruption	-0.00847	-0.00823							-0.0217	-0.0240**	-0.0217	-0.0240**	-0.0285*	-0.0206*	-0.0285*	-0.0206*
	(0.0164)	(0.0116)							(0.0161)	(0.0115)	(0.0161)	(0.0115)	(0.0147)	(0.0106)	(0.0147)	(0.0106)
Human capital	0.00648	0.00180	0.00393	0.00112	0.00393	0.00112	0.00393	0.00112	0.0155*	-0.0159**	0.0155*	-0.0159**				
	(0.00894)	(0.00632)	(0.00883)	(0.00636)	(0.00883)	(0.00636)	(0.00883)	(0.00636)	(0.00905)	(0.00697)	(0.00905)	(0.00697)				
Economic growth	-0.00133*	-0.000911	-0.00111	-0.000930*	-0.00111	-0.000930*	-0.00111	-0.000930*	-0.00128	-0.000743	-0.00128	-0.000743	-0.00105	-0.000870*	-0.00105	-0.000870*
	(0.000792)	(0.000560)	(0.000781)	(0.000563)	(0.000781)	(0.000563)	(0.000781)	(0.000563)	(0.000789)	(0.000566)	(0.000789)	(0.000566)	(0.000721)	(0.000519)	(0.000721)	(0.000519)
Political stability			0.0229***	-0.00209	0.0229***	-0.00209	0.0229***	-0.00209								
			(0.00768)	(0.00530)	(0.00768)	(0.00530)	(0.00768)	(0.00530)								
Tertiary enrolment rate													-0.0123***	-0.00671***	-0.0123***	-0.00671***
													(0.000955)	(0.000733)	(0.000955)	(0.000733)
Constant	2.297***	1.369***	2.290***	1.450***	2.290***	1.450***	2.290***	1.450***	2.260***	1.437***	2.260***	1.437***	1.462***	0.739***	1.462***	0.739***
	(0.200)	(0.142)	(0.198)	(0.141)	(0.198)	(0.141)	(0.198)	(0.141)	(0.201)	(0.143)	(0.201)	(0.143)	(0.203)	(0.145)	(0.203)	(0.145)
Observations	690	690	690	690	690	690	690	690	690	690	690	690	690	690	690	690
R-squared	0.189	0.199	0.208	0.188	0.208	0.188	0.208	0.188	0.194	0.178	0.194	0.178	0.325	0.311	0.325	0.311
Number of countries	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30

Notes: Each column shows the coefficient from a separate regression and standard errors are in parentheses. The regime-dependent marginal effects of FDI on poverty are denoted by $\hat{\delta}_1$ and $\hat{\delta}_2$. *** denotes significance at 1 %, ** at 5 % and * at 10%. The null hypothesis of the threshold effect test is that there is no threshold effect in equation (5). HC = headcount poverty, PG = poverty gap. a: The single threshold effect test indicates the presence of threshold effect in the model with the exception of column 8 and 9.

Table 6. Dumitrescu-Hurlin (2012) heterogenous granger-causality results

	(1)	(2)	(3)	(4)
Variables	HC	FDI	INST	HUC
HC	-	4.8932*** (2.6645)	3.3313*** (2.1707)	5.7616*** (2.9390)
FDI	23.0559*** (8.4060)	-	1.4420 (1.5735)	3.7216*** (2.2941)
INST	11.1632*** (4.6465)	4.0978*** (2.4130)	-	4.2920*** (2.4744)
HUC	19.8046*** (7.3782)	7.1163*** (3.3672)	1.9531*** (1.7351)	-

Note: The test statistics is the w-stat. z-stat is in parentheses, *** denotes significance at 1 %, ** at 5 % and * at 10%. lag length of 2 was used. HC = headcount poverty, INST = institutional quality, HUC = human capital, FDI = foreign direct investment

Table 6 indicate bidirectional causality between the incidence of poverty. This result is consistent with the empirical outcome of Dhrifi et al. (2020), who found a bi-directional causality between poverty and FDI in developing countries. Similar empirical outcome was obtained for poverty incidence and human capital, institutional quality, and human capital.

However, a unidirectional causality is recorded between FDI and institutional quality. In attracting a significant amount of FDI, this study suggests that SSA countries should implement “open door” policy to increase the appetite of foreign investors. Hence, a country willing to benefit from the advantages of FDI and ultimately poverty reduction should create a conducive environment by investing in human capital and improving institutional quality.

5.1. Regional analysis

After examining the impact of FDI on poverty in SSA as a group, this section further examines whether there is a regional difference in terms of the impact of FDI. This is to uncover whether regional characteristics play a role in the utilization of FDI spillover, and to also determine which region FDI could have the most impact. This study further seeks to know if the results of analysis involving the interconnections between FDI and host absorptive capacity are sensitive to regional categorization. The poverty indicator used is the poverty headcount ratio since the policy action among development experts will be to reduce the total number of the poor. We also used only the human capital index and control of corruption index as threshold variables.

As shown in Table 7, it is interesting to note that the direct impact of FDI on poverty differs across the sub-region. The impact of FDI on poverty in Southern, Eastern and Central Africa is negative and statistically significant. However, the coefficient of FDI on poverty in West Africa is positive and significant. The fact that Central and Eastern Africa are poorer than Western and Southern Africa means FDI reduces poverty more in poorer countries than reduction. This has also been validated for Eastern Europe (Buch et al., 2001). This study further discovers that the interaction of FDI with either institutional quality or human capital has a negative and significant impact on poverty in Western and Southern Africa. However, the impact is not significant in Eastern and Central Africa. We believe this may be due to the low inflow of FDI and absorptive capacity in these regions. The overall findings of the regional analysis suggest that regional characteristics differ in terms of the impact of FDI in alleviating poverty. This finding is consistent with the argument and empirical outcomes of Gohou and Soumare (2012) that regional differences matter on the spillover effect of FDI in poverty reduction in Africa.

Table 7. Regional analysis on the impact of FDI on poverty in sub-Saharan Africa

Variables	West Africa			Southern Africa			Eastern Africa			Central Africa		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
FDI	0.0004** (0.0002)	-0.0004*** (0.0001)	0.0036*** (0.0011)	-0.0006** (0.0003)	-0.0013* (0.0007)	0.0042** (0.0021)	-0.0001*** (0.00003)	-0.0016 (0.0034)	0.0005 (0.0005)	-0.0003** (0.0001)	-0.0010 (0.0012)	0.0020 (0.0036)
Poverty(t-1)	0.855*** (0.0341)	0.959*** (0.0486)	0.892*** (0.0324)	0.891*** (0.0508)	0.896*** (0.0411)	0.918*** (0.0206)	0.873*** (0.907)	0.554 (0.0655)	0.986*** (0.0461)	0.859*** (0.0558)	0.9716*** (0.1008)	0.9873***
Labour Force	-0.119** (0.0531)	-0.00765 (0.0404)	-0.0894 (0.0565)	-0.133*** (0.0336)	-0.0662* (0.0391)	-0.0564* (0.0327)	-0.0148 (0.0153)	0.00557 (0.131)	0.0529** (0.0226)	-0.1198** (0.0463)	-0.0127 (0.0619)	0.0190 (0.1179)
COC	-0.0149 (0.0127)	-0.0039 (0.0107)	-0.0144 (0.0126)	-0.0430*** (0.0131)	0.0261 (0.0451)	-0.0578*** (0.0194)	-0.0069 (0.0043)	0.0113 (0.0331)	0.0036 (0.0064)	-0.0014 (0.0160)	0.0243 (0.0333)	-0.0006 (0.0182)
GDP Per Capita	-0.0032*** (0.0005)	-0.0024*** (0.0003)	-0.0033*** (0.0005)	-0.0030*** (0.0003)	-0.0031*** (0.0005)	-0.0029*** (0.0005)	-0.0009*** (0.0002)	-0.0015* (0.0008)	-0.0018*** (0.0004)	-0.0036*** (0.0003)	-0.0040*** (0.0003)	-0.0040*** (0.0003)
Human Capital	0.0664 (0.0579)	0.0285 (0.0437)	0.185** (0.0751)	0.0324* (0.0179)	0.0587* (0.0323)	0.0974*** (0.0332)	-0.0206 (0.0191)	-0.0881 (0.0560)	-0.0590* (0.0339)	0.3755*** (0.0928)	-0.0575 (0.1299)	-0.2502 (0.3508)
FDI*COC		-0.0002*** (0.0001)			-0.0016* (0.0009)			-0.0016 (0.0036)			-0.0006 (0.0010)	
FDI*HUC			-0.0023*** (0.0007)			-0.0018** (0.0009)			-0.0005 (0.0004)			-0.0010 (0.0018)
Constant	1.721** (0.749)	0.0913 (0.565)	1.108 (0.787)	2.007*** (0.497)	0.957* (0.582)	0.649 (0.526)	0.326 (0.218)	0.313 (2.537)	0.313 (2.537)	1.2795** (0.5923)	0.3493 (0.7706)	0.1460 (1.3051)
Prob> χ^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R-Squared	0.335	0.967	0.587	0.021	0.897	0.855	0.995	0.957	0.946	0.423	0.974	0.995
Exogeneity of FDI	0.0017	0.0760	0.0033	0.0120	0.0695	0.0155	0.3973	0.3962	0.0642	0.1357	0.2234	0.1535
Instrument relevance	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	183	196	170	96	60	60	133	133	70	80	60	56
Number of Countries	13	13	13	6	6	6	7	7	7	4	4	4

Notes: Each column shows the coefficient from a separate regression and standard errors are in parentheses for each of the regions. *** denotes significance at 1 %, ** at 5 % and * at 10%. All regressions are estimated using fixed-effect instrumental regression estimator. Lag of FDI was used as instruments in the estimation of this study. Exogeneity test of FDI is the p-value of Durbin-Hausman-Wu F-test, this test shows that FDI is endogenous in all the estimations, except column (7,8,10,11, and 12). Instrument relevance is the probability value of the F-test in the reduced model. FDI*HUC, FDI*COC represent interaction of FDI with human capital index and control of corruption index, respectively.

6. Summary and conclusion

This study investigates whether an increase in human capital and institutional quality increases the efficacy of FDI in reducing poverty in SSA, and if the impact of FDI on poverty takes effect after human capital and institutional quality exceed a certain threshold. In achieving this, the study employs three different models: (1) the fixed effect instrumental regression model, which is to address the problem of endogeneity, as well as removing unobserved fixed effect in the model, (2) fixed-effect panel threshold model, and (3) the Dumitrescu and Hurlin (2012) causality test to determine the direction of causality between FDI and poverty.

The empirical findings from this study are as follows: (1) FDI does not have a direct impact on the incidence and intensity of poverty, since the baseline results suggest a positive relationship between FDI and poverty, (2) The impact of FDI on the poverty measures is conditional on intermittent variables such as institutional quality and human capital, and host countries must maintain an annual threshold value of -1.4 for control of corruption index and -0.94 for political stability index. The results further suggest that SSA countries must maintain an estimated value of 1.2 for human capital index and 5.82% of tertiary enrolment rate. This implies that countries with a higher level of absorptive capacity stand to benefit from increased FDI flows, whereas countries with low absorptive capacity tend to be hurt from increased FDI inflows. Analysis from the regional classification suggests that FDI's impact in alleviating poverty differs across the regions. Hence specific regional policies are needed to combat poverty, and (3) the granger causality test indicates a bidirectional causality between FDI and poverty.

In conclusion, the findings from this study have produced various useful policy implications. Governments of sub-Saharan African countries battling poverty can leverage foreign direct investment as a tool for alleviating poverty in their respective countries. This can be done if they are able to give more attention to their local economic conditions, which include improving their human capital development and the quality of their institutions. This study recommends that in addition to FDI's promotional policies, governments of SSA countries need to further liberalize, privatize, and securitize critical sectors in their economies in order to provide needed capital for human capital investment. Furthermore, improvement in institutional factors such as control of corruption and political stability will quickly pay off in reaping gains from FDI.

This study has some shortcomings which can be addressed in future research. Other intermittent or mediating variables such as financial development, globalization, and environmental quality have all been shown to be crucial. Future research could investigate the impact of these variables on the nexus between FDI and poverty. Furthermore, the fixed effect instrumental regression can address the cross-country heterogeneity problem. However, country-specific studies are also worthwhile for more targeted policy implications.⁷

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Notes

1. The savings-investment gap in SSA between the period of 2010–2018 was -1.51% of GDP (Bank, 2018).
2. measured by head count poverty as a percentage of population
3. measured by the average of the six dimensions of institutional quality
4. measured by head count poverty as percentage of population
5. measured by the Barro-lee human capital index
6. The selected countries account for 79.82% of total stock of FDI inflows in SSA in 2018. This makes our sample more representative.
7. This index leans on the (Barro & Lee, 2013) measurement of average years of schooling, and a Mincer's equation estimates which assumed a presumed rate of return to education (Psacharopoulos, 1994).

8. Studies like (Alfaro & Charlton, 2007; Tarsalewska, 2008) have also used lagged FDI as instrument in their studies. Their argument is that multinationals are attracted by countries that already have substantial inflows of investments.
9. measured by the Control of corruption index
10. measured by the Baro-lee human capital index
11. measured by the headcount ratio

Data availability statement

The data that support the findings of this study are available on request from the corresponding author.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendix 1: United Nations regional classification

Central Africa	East Africa	Southern Africa	West Africa
Cameroon	Burundi	Angola	Benin
Central African Republic	Kenya	Lesotho	Burkina Faso
Congo Democratic Republic	Mauritius	Namibia	Côte d'Ivoire
Congo Republic	Malawi	South Africa	Gambia
Gabon	Mozambique	Zambia	Ghana
	Rwanda	Zimbabwe	Liberia
			Mali
			Mauritania
			Niger
			Nigeria
			Senegal
			Siera Leone
			Togo



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