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DOES FOREIGN DIRECT INVESTMENT SPUR ECONOMIC GROWTH? NEW EMPIRICAL EVIDENCE FROM SUB-SAHARAN AFRICAN COUNTRIES

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ABSTRACT
In this study we re-examine the relationship between foreign direct investment (FDI) and economic growth in 27 sub-Saharan African (SSA) countries during the period 1990–2019. Unlike some previous studies, we clustered SSA countries into two groups, namely low-income and middle-income countries. We also employed three panel data techniques in a stepwise fashion, namely the dynamic ordinary least squares (DOLS), the fully modified ordinary least squares (FMOLS), and heterogeneous Granger non-causality approaches. Our results show that while the positive impact of FDI on economic growth is supported by both DOLS and FMOLS techniques in low-income countries, in middle-income countries only the DOLS technique supports this finding. This shows that the impact of FDI may be sensitive to the level of income of the recipient country. Overall, the results show that FDI inflows play a larger role in stimulating economic growth in low-income SSA countries than in middle-income SSA countries. These findings are also corroborated by heterogeneous Granger non-causality results. However, these findings are not surprising, given that many low-income countries tend to be more dependent on inward FDI inflows to stimulate their economic growth than middle-income countries. Policy recommendations are discussed.

Key Words: FDI, economic growth, sub-Saharan African countries, panel data analysis
***JEL Classification*:** C59, F21, F43

1. Introduction

The relationship between FDI and economic growth has been investigated extensively in the literature. Both the neoclassical and endogenous growth models have shown that there is a symbiotic relationship between FDI and economic growth. Findlay (1978), for example, argues that FDI can lead to an increase in the rate of technological progress in the host country in a number of ways, namely management practices and a 'contagion' effect, which arises owing to the adoption of more-advanced technology from the source country (see also Odhiambo, 2021). In other studies it has been found that FDI increases the accumulation of capital in the host country by providing it with new technologies and inputs (see Blomström, Lipsey & Zejan 1996;

Borenztein, DeGregorio & Lee, 1998, amongst others). In addition, FDI may serve as a source of productivity gains to the domestic firms of the host country through the spillover effect (see Chanegriha et al., 2020). As an example, studies have shown that multinational corporations (MNCs) impact positively on human capital through the training of unskilled and skilled labour (see Anwar & Nguyen, 2010). Research and development activities, which are usually undertaken by MNCs, may also result in the growth of human capital in host countries, which may eventually boost their economic growth in the long run (see Blomström & Kokko 2001). Technology transfers from MNCs to host countries have been found to be the most important channels through which the presence of MNCs creates positive externalities in the host countries (see OECD, 2002). FDI has also been linked not only to more efficient productive methods, but also to efficient management (see Escobari & Vacaflores, 2015). FDI can, inter alia, lead to direct or indirect job creation, an increase in exports, and an improvement in levels of technology, thereby leading to economic growth (Jordaan, 2012). In some studies it has also been argued that FDI is an important channel by which technology can be transferred to the recipient country, since it has been found in some countries that the FDI contribution to growth is higher than the domestic investment (see Borensztein et al., 1998). In summary, theoretical arguments on the link between FDI and growth can be broadly discussed from four viewpoints. These are the Modernisation Theory (see Calvo & Sanchez-Robles, 2002; Kumar & Pradhan, 2002; and Nath, 2005), the Dependency Theory (see Bornschier & Chase-Dunn, 1985; and Amin, 1974), the Neoclassical Growth Theory (Solow, 1956; and Swan, 1956), and the Endogenous Growth Theory (Romer, 1986; and Lucas, 1988). According to the endogenous theories, based on Romer (1986) and Lucas (1988), FDI involves the transfer of technology as well as the training of labour, which contribute significantly to human capital accumulation, thereby inducing technological progress and long-term growth (see also Tsaurai & Odhiambo, 2012).

Although a plethora of studies exist on the FDI–growth nexus in some developing countries, most of the previous studies have focused mainly on Asian countries (see, for example, Baharumshah & Almasaied, 2009; Wang, 2009; Hoang et al.,2010; Muhammad & Khan, 2019; and Ang, 2009, amongst others). In addition, most previous studies focus mainly on either the causal relationship between FDI and growth or on the impact of FDI on growth. Very few studies have gone the full distance to examine both the impact and the causal relationship between FDI and economic growth in SSA countries. Moreover, some of the previous studies suffer from methodological weakness. As an example, some studies use cross-sectional data, which may not fully explore the dynamic relationship between FDI and economic growth. The weaknesses of cross-sectional data have been extensively discussed in the literature (see Odhiambo, 2008; Ghirmay, 2004; Quah, 1993; Casselli et al., 1996). By lumping together countries which are at different levels of development, the cross-sectional approach fails to account for country-specific effects inherent in the FDI–growth nexus. Moreover, it has been shown that the cross-section approach may produce inconsistent and misleading estimates owing to the potential biases that may arise owing to the existence of heterogeneity among the study countries (see also Odhiambo, 2008; Ghirmay, 2004). Even in instances where a panel dataset has been used, some of the methodological weaknesses associated with a long panel dataset, such as cross-sectional dependency, have not been addressed fully. Other studies also over-rely either on fixed effects or random effects panel estimation techniques, which may not account for the endogeneity inherent in panel data.

The current study is therefore aimed at innovatively addressing some of these weaknesses by examining the FDI–growth nexus in 27 SSA countries[1] using a wide range of estimation techniques. In addition, the study divides the studied countries into two groups, namely a low-income group comprising 13 countries and a middle-income group comprising 14 countries. The selection of the study countries and the study period were largely driven by the availability of data for low-income and middle-income SSA countries. This study is timely, given the proposed African Continental Free Trade Area (AfCFTA). [2] The AfCFTA will involve deep reforms necessary to enhance long-term growth in African countries, which include cutting the red tape and simplifying customs procedures. The implementation of AfCFTA is therefore expected to boost economic growth in Africa, reduce poverty, and broaden its economic inclusion. According to the current projections, the implementation of AfCFTA is expected to boost Africa's income by $450 billion by 2035 (World Bank, 2020).

[1] The countries used in this study are Sierra Leone, Burkina Faso, Burundi, Sudan, Chad, Madagascar, Malawi, Mali, Togo, Mozambique, Gambia, Niger, Rwanda, Kenya, Benin, Senegal, Tanzania, Cameroon, Comoros, Republic of the Congo, Cote d'Ivoire, Eswatini, Nigeria, Ghana, Gabon, Botswana, South Africa.

[2] See also Ofari & Asongu (2022).

To address the limitations of previous studies, the dynamic ordinary least squares (DOLS), the fully modified ordinary least squares (FMOLS), and the heterogeneous non-causality approaches have been used in a step-wise fashion. Other tests, such as cross-section dependence tests, have also been incorporated into the current study. Four tests are used to test for cross-section dependence, namely Breusch-Pagan LM, Pesaran scaled LM, Baltagi et. al. (2012), and Pesaran CD. Given the weaknesses associated with first-generation unit root tests in the presence of cross-section dependence, the current study has used the second-generation unit root tests associated with Bai and Ng (2004), Panel Analysis of Non-stationarity in Idiosyncratic and Common components (PANIC), and Pesaran (2007) CIPS (cross-sectionally augmented IPS) alongside the first-generation unit root tests to examine whether the variables used in this study are conclusively I(0) or I(1).

The study closest to this study is Opoku et al. (2019). However, the current study differs fundamentally from Opoku et al. (2019) in several ways. First, while Opoku et al. (2019) focus mainly on the sectoral transmission channels by which FDI affects growth, the current study focuses on the intertemporal relationship between FDI and growth using both the impact model and the causality model. Second, unlike Opoku et al. (2019) who mainly used system GMM, the current study uses DOLS, FMOLs, and heterogenous Granger-causality to examine the nexus between FDI and growth, while accounting for cross-sectional dependence using the second-generation unit root and cointegration tests. Third, unlike Opoku et al. (2019), the current study divides SSA data into two groups, namely low-income and middle-income groups, to examine whether the relationship between FDI and economic growth depends on the countries' income level. To our knowledge, this may be the first study of its kind to empirically examine, in detail, the nexus between FDI and growth in SSA countries using disaggregated data and an array of modern panel data techniques.

The remainder of the paper is organised as follows. Section 2, reviews the literature on the impact of FDI on economic growth. Section 3 presents the methodology and the empirical model specification in a step-wise fashion. Section 4 deals with the empirical analysis, as well as a discussion of the results. The study concludes in section 5.

2. Empirical Literature

Studies that have been conducted on the relationship between FDI and growth can be broadly clustered into two groups, namely studies whose findings are consistent with a positive relationship between FDI and growth, and studies in which the findings support a mixed, negative, or insignificant relationship. Adams (2009), for example, while examining the link between FDI, domestic investment, and economic growth in SSA using OLS and fixed-effects estimation techniques during the period 1990–2003, finds that FDI correlates positively with economic growth in the OLS model, but only after controlling for country-specific effects. Baharumshah & Almasaied (2009) examine the role of FDI in economic growth in Malaysia. Using data from 1974 to 2004, the study finds FDI to have a positive impact on growth; however, its impact is found to be smaller than that of non-FDI investment. While analysing the relationship between FDI and economic growth in 79 countries during the period 1980–2003, Batten & Vo (2009) find that the impact of gross FDI flow on economic growth is stronger in countries that have a higher level of educational attainment. The same results apply to countries that are more open to international trade and have higher levels of stock market development. Wang (2009), using data from 12 Asian economies over the period 1987–1997, finds strong evidence showing that manufacturing sector FDI has a positive impact on growth in the host countries. Hoang et al. (2010), using the panel data model to examine the impact of FDI on growth in Vietnam's 61 provinces during the period 1995–2006, find FDI to have a strong positive impact on growth. Nistor (2014), using Romanian data from 1990 to 2012, finds that FDI inflows have a positive impact on gross domestic product in the country under study. Adams & Opoku (2015), while examining the effect of FDI on economic growth and how regulatory regimes affect the FDI–growth relationship in SSA using the GMM estimation technique, find that neither FDI nor regulations have a significant effect, but their interaction has a significant positive effect on economic growth. Pegkas (2015), in examining the link between FDI and growth in Eurozone countries in 2002–2012, finds that, consistent with some theoretical explanations, FDI is a significant determinant of economic growth. While using various panel data estimation techniques, Muhammad & Khan (2019) find, inter alia, that FDI inflows to Asian host countries have a positive impact on growth. Nketiah-Amponsah & Sarpong

(2019), investigating the impact of infrastructure and FDI on growth using data from 46 SSA countries, find that FDI enhances economic growth only when interacting with infrastructure. Opoku et al. (2019) examine the relationship between FDI, sectoral effects, and economic growth in 38 African countries during the period 1960–2014. Using a system GMM, the study finds that although FDI has an unconditional positive impact on economic growth, its growth-enhancing impact becomes imaginary with the introduction of conditional sectoral effects. Pradhan et al. (2017), in investigating the causal relationship between trade openness, foreign direct investment, financial development, and economic growth in 19 Eurozone countries during the period 1988–2013, find that FDI inflows have propelled economic growth in the studied countries in the short run. Pradhan et al. (2018) examine the interactions between the diffusion of mobile phones, foreign direct investment, financial development, ICT goods imports, and economic growth in the G-20 countries during the period 1990–2014. Using a multivariate framework, the study finds, inter alia, that there is a long-run unidirectional causality from foreign direct investment to economic growth in the studied countries. Pradhan et al. (2019), examining the heterogeneous relationship between financial development, foreign direct investment (FDI), and economic growth using a sample of G-20 countries over the period 1970–2016, find that both FDI and financial development matter in the determination of long-run economic growth in the studied countries. Asongu & Odhiambo (2020), examining the relationship between FDI, ICT, and economic growth in 25 sub-Saharan African countries using the GMM approach, find that both internet penetration and mobile phone penetration overwhelmingly modulate FDI to induce overall positive net effects on all three economic growth dynamics. Ibhagudi (2020), examining the effect of FDI on economic growth in sub-Saharan African countries using a threshold regression framework, finds that FDI accelerates economic growth when SSA countries have achieved certain threshold levels of inflation, population growth, and financial market development. More recently, Arvin et al. (2021), examining the links between ICT connectivity and penetration, trade openness, foreign direct investment, and economic growth using data from the G-20 countries during the period 1961–2019, find inter alia that economic growth is dependent on FDI in the long run in the studied countries.

Apart from the above-mentioned studies, a few studies cast doubt on the positive impact of FDI on economic growth. These studies find the relationship between FDI and economic growth to be mixed, negative, or not significant at all. These include studies such as Eller et al. (2006), Ang (2009), Alvarado et al. (2017), and Carbonell & Werner (2018), among others. Eller et al. (2006), for example, while analysing the effect of financial sector FDI on growth through the efficiency channel using data from 11 Central and Eastern European countries, find FSFDI to have a hump-shaped impact on economic growth in the studied countries. Ang (2009) examines the roles of FDI and financial development in economic development in Thailand during the period 1970–2004. Using the unrestricted ECM estimator, the study finds that while financial development stimulates economic development, FDI negatively impacts output expansion in the long run. Alvarado et al. (2017) examine the impact of FDI on growth in 19 countries in Latin America during the period 1980–2014. Using panel data econometric techniques, the study fails to find any clear direction in the impact of FDI on growth in the studied countries. Moreover, the study finds that the impact of FDI on economic growth is sensitive to the countries' level of development. Carbonell & Werner (2018), using data from Spain during the 1984(Q1)–2010(Q4) period, fail to find any evidence which shows that FDI stimulates growth. The authors attribute this finding to the fact that the bulk of Spanish FDI inflows are from foreign takeovers which are largely in the construction sector.

3. Methodology

In this study, panel data have been used to analyse the nexus between FDI and growth in SSA. The advantages of using panel data have been covered extensively in the literature (see Rahman et al., 2021).

The panel model employed to analyse the relationship between FDI and economic growth in the selected SSA countries can be expressed as follows:

$$\mathrm{Y_{it}} = \mathrm{\gamma_{it}} + \delta_{it} + \beta_{1i}FDI_{it} + \beta_{2i}Trade_{it} + \beta_{3i}Labour_{it} + \beta_{4i}GFCF_{it} + \mu_{it} \qquad (1)$$

where *i* refers to cross-sectional observation, *t* indicates the time period, *Y* = per capita GDP, *FDI* = Foreign direct investment (% of GDP), *Trade* = Exports + Imports (% of GDP), *Labour* = Labour force, *GFCF* = Gross fixed capital formation, $\delta_{it} and\ \beta_{1i}$= country-specific effects and deterministic trend effects, respectively, and μ_{it} = error term.

In this paper we use real GDP per capita as a proxy for economic growth. This proxy has been used extensively in the literature (see Asongu, 2013; Odhiambo, 2014, 2022; Asongu et al., 2022;). FDI, on the other hand, is measured by FDI inflows as a percentage of GDP (see Asongu et al., 2020; Odhiambo, 2021). According to the attendant literature, FDI is expected to spur economic growth inter alia through technology diffusion and increases capital accumulation in the host country through the introduction of new inputs and technologies (see Blomstrom et al., 1992; Borenszteinet al., 1998; Odhiambo, 2021). Consequently, the coefficient of the FDI is expected to be positive and statistically significant. The control variables used in this study are trade, labour, and gross fixed capital formation. The justification for including these variables was informed by both the theoretical and empirical literature. The inclusion of trade in the growth equation is informed by the role that trade plays in economic growth and development. An increase in trade is expected to have a positive impact on economic growth. Put slightly differently, trade has been found to be an engine of development (see Frank, 1968). Hence, the coefficient of trade is expected to be positive and statistically significant. The impact of labour productivity on economic growth has also been supported by the attendant literature. In particular, labour quality has been found to have a positive impact on economic growth, as countries with higher labour quality are likely to be associated with higher productivity growth (see Barro, 2001). Consistent with extant literature, an increase in gross fixed capital formation is expected to lead to an increase in economic growth as it leads to more jobs and hence an increase in employment. Consequently, the coefficient of gross fixed capital formation is expected to be positive and statistically significant (see also Levine & Renelt, 1992; Mankiw et al., 1992).

Consistent with previous studies, the model presented in Equation (1) can be estimated using the DOLS. The advantage of the DOLS is that it can correct endogeneity, serial correlation, and simultaneity problems via differenced leads and lags (see also Maji et al., 2019). In this way, the DOLS can generate an unbiased estimate (see Mc-Coskey & Kao, 1998; Kao & Chiang, 2000; Maji et al., 2019). For robustness check, the FMOLS has also been applied alongside the DOLS in this analysis. The main difference between DOLS and FMOLS relates to how the autocorrelation is corrected in the regression. FMOLS, for example, is regarded as a nonparametric correction that adjusts for autocorrelation (Bellocchi et al., 2021). DOLS, on the other hand, which has been found to outperform both the OLS and FMOLS estimators, allows for the addition of more lagged and lead variables in the regression. A summary of the variables used in this study is presented in Table 1.

Table 1: Variable Description, Expectations, and Sources

Variable	Description	Expectation	Source
y/N	Economic growth	NA	WDI
FDI	Foreign direct investment	+	WDI
Trade	Total trade	+	WDI
LABOUR	Labour force	+	WDI
GFCF	Gross fixed capital formation	+	WDI

Heterogenous Granger Causality

The heterogeneous panel Granger non-causality estimator, based on Dumitrescu & Hurlin (2012), is used to examine the causal relationship between FDI and economic growth. The advantage of this technique is that it considers the CSD ratio. It has also been found to account for both the time dimension and the size of cross-sections. The Dumitrescu & Hurlin (D-H) panel Granger non-causality model can be expressed as follows:

$$y_{it} = \alpha_i + \sum_{k=1}^{K} \delta_i^k \, y_{i(t-k)} + \sum_{k=1}^{K} \beta_i^k \, x_{i(t-k)} + \varepsilon_{i,t} \qquad (2)$$

where *y* and *x* = variables, t = time dimension, i.e., $t = 1$……………..T, and *i*= individual, i.e., i = 1…………………………N.

Based on D-H, the null hypothesis of no causality for each panel group (H_0: $\beta_i = 0,\ i = 1, 2 \ldots \ldots \ldots \ldots, N$)) is tested against the alternative hypothesis of causality between the variables within the panel group for each country (i.e., H_1: $\beta_i = 0, i = 1, 2, \ldots \ldots \ldots \ldots, N;\ \beta_i \neq 0$; $i = N_1 + 1, N_1 + 2$, …………., N).

The study employs annual data from 1990–2019. The data were sourced from the World Bank's World Development Indicators. The World Bank data were supplemented by national databases.

4. Empirical Analysis

4.1 Cross-Section Dependence

Before proceeding with the unit root test, it is important to conduct a panel cross-section dependence test in order to account for possible cross-section dependence among the countries under study. Cross-section dependence could result from factors such as international trade, financial integration, and globalisation, which may result in external shocks from other countries (see Chang et al., 2013). Studies have also shown that ignoring cross-section dependency in a panel estimation can have serious consequences as it may lead to substantial bias and size distortions (Pesaran, 2006). For this reason, four tests for cross-section dependence have been employed to test the existence of cross-section dependence in the estimation. These are Breusch-Pagan LM, Pesaran scaled LM, Bias-corrected scaled LM, and Pesaran CD. The results of the cross-section dependence test are reported in Table 1.

Table 1: Cross-section dependency tests

	Cross-section dependency results			
Series	Breusch-Pagan LM	Pesaran scaled LM	Bias-corrected scaled LM	Pesaran CD
	Low-income countries (LICs)			
y/N	988.2482*** (0.0000)	72.8782*** (0.0000)	72.6541*** (0.0000)	15.7539*** (0.0000)
FDI	369.0149*** (0.0000)	23.2998*** (0.0000)	23.0757*** (0.0000)	13.1697*** (0.0000)
Trade	456.8627*** (0.0000)	30.3333*** (0.0000)	30.1092*** (0.0000)	13.3799*** (0.0000)
GFCF	346.0813*** (0.0000)	21.4637*** (0.0000)	21.2396*** (0.0000)	9.31481*** (0.0000)
Labour	1078.9830*** (0.0000)	80.1428*** (0.0000)	79.9186*** (0.0000)	7.7265*** (0.0000)
	Middle-income countries (MICs)			
y/N	1490.4070*** (0.0000)	103.7309*** (0.0000)	103.4896*** (0.0000)	24.6420*** (0.0000)
FDI	450.3611*** (0.0000)	26.6376*** (0.0000)	26.3962*** (0.0000)	15.1154*** (0.0000)
Trade	517.8897*** (0.0000)	31.6432*** (0.0000)	31.4018*** (0.0000)	14.3418*** (0.0000)
GFCF	395.0901*** (0.0000)	22.5407*** (0.0000)	22.2993*** (0.0000)	10.2377*** (0.0000)
Labour	1197.9120***	82.0498***	81.8084***	8.2117***

	(0.0000)	(0.0000)	(0.0000)	(0.0000)

The results reported in Table 1 for LICs and MICs show that the four cross-section dependence tests have largely rejected the null hypothesis of no cross-section dependence in both LIC and MIC. This indicates that there is cross-section dependence in the data used. These results suggest the use of second-generation unit root tests in order to account for the presence of cross-section dependency.

4.3 First- and second-generation panel unit root tests

Having detected the presence of cross-section dependence, it is important to use the second-generation panel unit root tests together with the first-generation tests when conducting unit root tests. The results of the stationarity tests are reported in Tables 2 and 3, respectively.

Table 2: The results of the first-generation panel unit root tests

	Low-Income SSA Countries				**Middle-Income SSA Countries**			
	LLC t-Statistics		**IPS**		**LLC t-Statistics**		**IPS**	
	Level	**First Difference**	**Level**	**First Difference**	**Level**	**First Difference**	**Level**	**First Difference**
y/N	1.5353	–12.1949***	–0.5198	–2.9640***	–1.0270	–5.4511***	–0.5198	**–2.9649*** **
FDI	–0.5571	–9.0254***	0.3120	–3.6716***	–0.5571	–9.0254***	0.3120	**–3.6716*** **
Trade	–0.7709	–6.0932***	–0.9676	–5.2117***	–0.7709	–6.0932***	–0.9676	**–5.2117*** **
Labour	0.4763	–6.6544***	–0.1662	–8.1589***	–0.5341	–5.2148***	1.1085	**–3.5198*** **
GFCF	–0.7540	–8.4388***	–1.0569	–10.1556***	–1.0768	–6.7191***	–1.1018	**–10.5788*** **

Note: *** indicates rejection of the respective null hypothesis at the 1% significance levels, respectively.

Table 3: The results of second-generation panel unit root tests

	Low-Income SSA Countries				**Middle-Income SSA Countries**			
	Bai and Ng – PANIC		**Pesaran – CIPS**		**Bai and Ng – PANIC**		**Pesaran – CIPS**	
	Level	**First Difference**	**Level**	**First Difference**	**Level**	**First Difference**	**Level**	**First Difference**
y/N	–0.5588	–2.1440**	–0.7176	–3.8776***	0.5445	–2.8226***	–1.4741	**–2.8796** **
FDI	1.3460	–2.0235**	1.2430	–6.1520***	1.5756	–2.6100***	–1.6391	**–3.3036*** **
Trade	1.1204	–2.0120**	–1.4500	–6.6349***	–1.3304	–2.2770**	–0.2481	**–3.2435*** **
Labour	0.3172	–3.4070***	–1.5941	–3.1816***	–0.8297	–2.0599**	–0.7854	**–3.6498*** **
GFCF	–0.3135	–2.8151***	–1.0217	–5.1948***	0.4673	–2.5046**	–0.7706	**–3.7075*** **

Note: ** and*** indicate rejection of the respective null hypothesis at the 5% and 1% significance levels, respectively.

The results of the first generation unit root tests reported in Table 2 show that the variables are conclusively I(1). These results have also been confirmed by the second-generation unit root tests reported in Table 3, which show that both PANIC and Pesaran–CIPS reject the stationarity in levels in favour of stationarity in the first difference.

4.4 Panel Cointegration Test

Since the variables included in this study have been found to be I(1), it is important to test whether the variables y/N, FDI, Trade, Labour and Inv are cointegrated. For this purpose, the study uses three tests, namely the Pedroni (1999; 2004), the Kao (1999), and the Westerlund (2005) class of tests. The results of the Pedroni, Kao, and Westerlund cointegration tests are reported in Table 4, panels 1, 2, and 3, respectively.

Table 4: Panel cointegration results

PANEL 1: Pedroni cointegration test				
	Low-income countries		**Middle-income countries**	
	Statistic	**Probability**	**Statistic**	**Probability**
Pedroni panel cointegration test – within-dimension				
Panel v-Statistic	–1.9318	0.9733	–2.3918	0.9916
Panel rho-Statistic	–0.4581	0.3235	–1.6736	0.0471
Panel PP-Statistic	–9.0726	0.0000	–27.1338	0.0000
Panel ADF-Statistic	–4.8301	0.0000	–12.9086	0.0000
Pedroni panel cointegration test – between-dimension				
Group rho-Statistic	1.0818	0.8603	0.3157	0.6239
Group PP-Statistic	–17.9627	0.0000	–19.2619	0.0000
Group ADF-statistic	–6.2293	0.0000	–5.5543	0.0000
PANEL 2: Kao residual cointegration Test				
	Low-income countries		**Middle-income countries**	
	Statistic	p-value	Statistic	p-value
ADF	–4.2862	0.0000	–3.0510	0.0011
PANEL 3: Westerlund (2005) cointegration Test				
	Low-income countries		**Middle-income countries**	
	Statistic	p-value	Statistic	p-value
Variance ratio	–3.4880	0.0002	–3.2378	0.0006

The results of the Pedroni cointegration test reported in Table 4 (Panel 1) show that all the variables included in our model for LICs and MICs are cointegrated. This is confirmed by the Panel PP-Statistic, Panel ADF-Statistic, Group PP-Statistic, and Group ADF-Statistic, which are all significant at the 1% level in LICs and MICs. In other words, the results show that four of the seven Pedroni residual cointegration tests confirm that the variables are cointegrated in both income groups. The Kao (1999) and Westerlund (2005) tests reported in panels 2 and 3 also show that the variables are cointegrated in both income groups. This finding is confirmed by the ADF statistics in the Kao cointegration test and the variance ratio in the case of the Westerlund (2005) test, which are both found to be statistically significant.

4.5 Dynamic OLS (DOLS) and fully modified OLS (FMOLS)

In this section, DOLS and FMOLS are used to examine the impact of FDI on economic growth in LICs and MICs. These two techniques account for endogeneity and serial correlation. The results of DOLS and FMOLS are reported in Table 5.

Table 5: DOLS and FMOLS results

Explanatory variable	Low-income countries (LICs)				Middle-income countries (MICs)			
	DOLS		FMOLS		DOLS		FMOLS	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
FDI	1.5753***	5.0490	4.5333**	2.1979	4.9207**	2.4436	–4.3580	–1.4007
TRADE	0.4967***	4.3156	1.7594***	3.6309	–3.6249***	–12.4217	–3.0713***	–3.4221
LABOUR	2.3170**	2.1507	5.4579***	17.3822	14.7700***	6.1535	24.2382**	2.3384
GFCF	–0.0626	–0.3673	4.9157***	4.8073	11.5269***	12.6763	8.6798***	4.7962

Note: *** and ** indicate significance at 1% and 5% levels, respectively

The results in Table 5 clearly show that the impact of FDI on economic growth in SSA countries is not unanimous and depends on the countries' income level. In the case of LICs, FDI is found to have a positive impact on growth when DOLS and FMOLS are used as estimators. This finding is confirmed by the coefficient FDI in the economic growth equation, which is found to be positive and statistically significant in the DOLS and FMOLS panels. Specifically, the coefficient of FDI is positive and statistically significant at 1% and 5% in the DOLS and FMOLS panels, respectively. Contrary to the results for the LICs, the results for MICs show that FDI has a positive impact on growth only when the estimations are conducted using DOLS estimators. This finding is evidenced by the coefficient of the FDI, which is positive and statistically significant in the DOLS panel, but not in the FMOLS panel. This finding shows that while it can be concluded that FDI has an overall positive impact on economic growth in many SSA countries, LICs tend to benefit more from FDI than MICs. While the overall positive impact of FDI on economic growth is contrary to studies such as Ang (2009) for the case of Thailand, it is consistent with studies such as Baharumshah &

Almasaied (2009) for the case of Malaysia, and Hoang et al. (2010) for the case of Vietnam, among others. The remaining results show that in the case of LICs, trade and labour have a positive impact on economic growth in DOLS and FMOLS models. This finding is supported by the coefficients of trade and labour in the growth equation, which are positive and significant at the 1% level in the DOLS and FMOLS panels. Unlike in the case of trade and labour, gross fixed capital formation has been found to have a positive impact on economic growth only when FMOLS is used as an estimator, but not when DOLS is used. This has been supported by the coefficient of gross fixed capital formation, which is positive and statistically significant in the DOLS specification, but not in the FMOLS specification.

For MICS, the results indicate that trade has a negative effect on economic growth, irrespective of whether DOLS or FMOLS is used as an estimator. This is supported by the coefficient of trade in the economic growth equation, which is negative and significant in the DOLS and FMOLS panels. This finding, though contrary to our expectation, is consistent with some previous studies, such as Rigobon & Rodrik (2005), who find openness (trade/GDP) to have a negative impact on income. This finding is also unsurprising, considering the nature of the trade balance in some SSA countries. Since some SSA countries are largely operating on a trade deficit rather than a trade surplus, it is likely that the cumulative deficit accrued over time by some middle-income countries could have a negative bearing on their economic growth trajectories, thereby leading to a negative relationship between trade and growth. The results also show that in MICS, labour and gross fixed capital formation have a positive impact on economic growth in the DOLS and FMOLS models. This is confirmed by the coefficients of labour and gross fixed capital formation in the economic growth equation, which are found to be positive and statistically significant in both DOLS and FMOLS panels.

4.6 Heterogeneous Panel Causality Analysis

In this study, the Dumitrescu-Hurlin (D-H) panel Granger-causality model, which supports cross-sectional heterogeneity, is used to explore the causal relationships between FDI and economic growth, as well as other variables included in the economic growth model. Since the D-H panel Granger-causality test requires the data series to be stationary, we have to convert our series into the first difference. The results of the Granger-causality between FDI and economic growth, and other variables are summarised in Table 6.

Table 6: Heterogeneous panel causality test

	Low-income countries (LICs)			Middle-income countries (MICs)		
Null Hypothesis:	Zbar-Stat.	Prob.	Causality	Zbar-Stat.	Prob.	Causality
DFDI does not homogeneously cause Dy/N	2.3752	0.0175	DFDI→ Dy/N	1.0054	0.3147	DFDI [0] Dy/N
Dy/N does not homogeneously cause DFDI	–1.5763	0.1149		–0.4279	0.6687	
DGFCF does not homogeneously cause Dy/N	0.4460	0.6556	DGFCF [0] Dy/N	–0.0390	0.9689	Dy/N →DGFCF
Dy/N does not homogeneously cause DGFCF	–0.5347	0.5928		1.8687	0.0617	
DLABOR does not homogeneously cause Dy/N	0.0234	0.9813	Dy/N→DLABOUR	1.9303	0.0536	Dy/N ↔ DLABOUR
Dy/N does not homogeneously cause DLABOUR	1.8218	0.0685		2.0668	0.0388	
DTRADE does not homogeneously cause Dy/N	1.1349	0.2564	DTRADE [0] Dy/N	0.4546	0.6494	Dy/N→DTRADE
Dy/N does not homogeneously cause DTRADE	–0.1659	0.8682		1.9765	0.0481	

The empirical results reported in Table 6 show that the causality between FDI and growth in SSA is sensitive to the income group of the studied countries. For LICs there is a distinct unidirectional causality from FDI to economic growth. This finding is confirmed by the Zbar-Statistic, which is significant in the economic growth equation but not in the FDI equation. For the MICs, the empirical results indicate no causality between FDI and economic growth in either direction. This is confirmed by the Zbar-Statistic, which is insignificant in both FDI and economic growth equations. Other results show that 1) economic growth Granger-causes gross fixed capital formation in MICs, but in LICs there is no causality between the two variables; 2) economic growth Granger-causes labour force participation in LICs, but in MICs there is a bi-directional causality between the two variables; and 3) economic growth Granger-causes trade in MICs, but in LICs there is no causality between the two variables.

5. Conclusion

This study examines the relationship between FDI and economic growth in 27 SSA countries during the period 1990–2019. SSA data is divided into two income groups, a low-income group and a middle-income group. To address the weaknesses of some of the previous studies, the DOLS, the FMOLS and the heterogeneous non-causality approaches are used in a stepwise fashion in the study. In addition, cross-sectional dependence is tested using four tests: Breusch-Pagan LM, Pesaran scaled LM, Bias-corrected scaled LM, and Pesaran CD. The results of the study clearly show that the impact of FDI on economic growth differs significantly in LICs and MICs. For the LICs, the results show that FDI has a distinct positive impact on economic growth, irrespective of whether DOLS or FMOLS are used as estimators. However, for the MICs the results are not unanimous. The results show that FDI has a positive impact on economic growth only when the estimation is conducted using the DOLS estimator. The heterogeneous non-causality test based on Dumitrescu & Hurlin (2012) corroborates these results: it shows that while FDI Granger-causes growth in LICs, in MICs there is no causal relationship between FDI and growth. These findings show that LICs benefit more from FDI than MICs, and thus the impact of FDI may be sensitive to the level of income of the recipient country. In the main, the results show that FDI inflows play a larger role in stimulating economic growth in low-income SSA countries than in middle-income SSA countries. This finding is unsurprising, given that many low-income countries tend to be more dependent on inward FDI inflows to stimulate their economic growth than middle-income countries. It is therefore recommended that low-income SSA countries should continue to intensify their investment promotion strategies in order to attract more pro-growth investment, while middle-income countries should devise appropriate polices aimed at ensuring that their FDI inflows are pro-growth and do not substitute their domestic investment.

Although all efforts have been made to make this study analytically defensible, like many other empirical studies, it has some limitations. The main limitation is a lack of adequate and reliable data, which forced the study to restrict its study period as well as the number of countries included. These restrictions played a major role in determining the most appropriate estimation techniques used. It is therefore recommended that future studies consider expanding the horizon of the current study by applying other models, such as non-linear ARDL, to determine how negative and positive FDI shocks affect the dynamic relationship between FDI and economic growth in the studied countries.

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