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Moderating Effect of Economic Freedom on the Relationship Between Domestic Investment and Foreign Direct Investment

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Abstract

This paper explores the role of economic freedom in explaining the relationship between foreign direct investment and domestic investment for a panel of 18 African countries for the period running from 1996 to 2021. In particular, the paper uses the JKS panel Granger causality test to underpin the direction of causality between the variables. This procedure is adopted because it is robust under cross-sectional dependence and allows for slope heterogeneous coefficients. The study used the Feasible Generalized Least Squares (FGLS) estimator for parameter estimates. The robustness of the results from the FGLS model was checked through the Panel Corrected Standard Error (PCSEs) estimator. The results from the multivariate functions of the JKS test show that domestic investment and economic freedom jointly Granger-cause foreign direct investment. Similarly, foreign direct investment and economic freedom are found to jointly Granger-cause domestic investment. The results further show evidence of bidirectional causality between foreign direct investment, economic freedom, and domestic investment. The results from both the FGLS and PCSEs estimators indicate that domestic and foreign direct investment have significantly positive effects on each other. However, economic freedom has significant positive and negative effects on domestic and foreign direct investments, respectively. The policy implications are discussed.

Keywords: foreign direct investment, domestic investment, JKS panel causality test, FGLS, PCSEs

JEL codes: F2, F21, E22, O55

1. Introduction

An economic policy change by one nation often has implications for others. With increasing interdependences of nations amongst each other bolstered by trade liberalizations and globalization, economic freedom becomes a vital variable that is assumed to consequently impact foreign direct investments, gross domestic investments, and economic growths of countries. While most advanced economies continue to have higher economic growth, most African countries

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continue to lag behind in growth. Among the factors frequently cited for the slow economic growths of African countries are capital stock deficiency, lack of entrepreneurial and managerial talents, lack of skilled personnel and technical know-how, limited size of the markets, weak infrastructures, low economic freedom index scores, corruptions, social and institutional set-ups, and explosive population growths. In addition, economic reform processes in Africa continue to face serious macroeconomic challenges such as tackling large fiscal and external current account imbalances, reducing inflationary pressures, increasing domestic savings and investment, and addressing external debt management problems.

Irrespective of the vast factors impeding economic development and growth in Africa, one still has to tackle the question of whether economic freedom can help to mitigate or exacerbate the slow economic growth issues confronting African countries. Furthermore, does a high economic freedom index score attract foreign direct investment (FDI), increase gross domestic investment (GDI), and promote economic growth? Is there any relationship between Economic freedom (EF), Gross domestic investment (GDI), and Economic growth (EG) in our selected 18 African countries namely- Benin, Botswana, Burkina Faso, Cote d'Ivoire, Cameroon, Gabon, Ghana, Guinea, Kenya, Mali, Morocco, Mozambique, Niger, Nigeria, Senegal, South Africa, Uganda, and Zimbabwe? Indeed, these are questions yet to be answered. Using the available economic data of these countries from 1996-2021, our study intends to explore the role of economic freedom in explaining the relationship between foreign direct investment and gross domestic investment.

While our interest in conducting this study is to add to the body of economic literature and provide contributions towards the raging debates regarding the role of economic freedom on FDI and GDI, our study will also focus on the role of economic freedom in explaining the relationship between foreign direct investment and gross domestic investment. Other relevant questions will be whether economic freedom induces inflows of FDI, and if FDI crowds-out or crowds-in gross private domestic investment? With regards to the above questions posed, several studies have indicated that FDI can generate positive externalities by providing financing, complementing domestic investment, and enhancing competitiveness (Adams, 2009; Kobrin, 2005). Yet, many studies counter most of these arguments and categorically believe that FDI crowds-out domestic investment. Our study will address these questions by employing the JKS panel Granger causality tests advanced by Juodis, Karavias, and Sarafidis (2021) for relationship directionalities and the Feasible Generalized Least Squares model for parameter estimates.

The rest of the paper is organized as follows. Following the present introduction, section 2 reviews the literature. Section 3 presents the econometric methodology of the study. Section 4 furnishes the data description and sources. Section 5 discusses the empirical results. Section 6 offers the conclusions and policy implications of the study.

2. Literature reviews

Economic freedom as a term entails equal opportunity for all to participate in commercial affairs, to initiate financial transactions, and to create business enterprises. Heritage Foundation defines economic freedom as the fundamental right of every human to control his or her own labor and property. In an economically free society, individuals are free to work, produce, consume, and invest in any way they please. Governments must allow labor, capital, and goods to move freely, and refrain from coercion, or constraint of liberty beyond the extent necessary to protect and maintain liberty itself. A Heritage Foundation report by O'Grady (2015) stated that the top 20% countries on their high economic freedom index scores have twice the per capita income of those in the second quintile, and five times that of the bottom 20%. Economies based on a free market

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tend to experience greater levels of investment, more rapid growth, and higher average incomes. Based on numerous economic studies, a strong economic freedom index score fosters robust economic growth. Furthermore, an environment of high economic freedom index will also attract the inputs necessary for increasing economic growth.

Several economic studies have revealed that environments of economic freedom attract the inputs necessary to produce economic growth. Also, free countries with market economies tend to have greater wealth per capita, cleaner environment, higher life expectancy, and less poverty. One study conducted to clarify some of these statements was done by Dkili and Dhiab (2018). They embarked on this study based on the fact that Gulf countries tend to attract huge amounts of foreign direct investments. They wanted to confirm if the high economic freedom index was a strong contributing factor to the large foreign direct investment influx to the Gulf region. Their study selected 5 member countries of Gulf Cooperation Council (GCC) namely- Saudi Arabia, United Arab Emirates, Qatar, Kuwait, Oman, and data covering 1995 to 2017 period. They applied the multivariate panel unit root tests, cointegration, Fully Modified Ordinary Least Square (FMOLS), and Dynamic Ordinary Least Square (DOLS) methodologies to investigate if economic freedom attracts FDI and consequently leads to economic growths in the region. The results from their study concluded that a higher or greater level of economic freedom actually supports higher economic growth in the region. Also, the existence of economic freedom and foreign direct investments combined with advanced infrastructure increased economic growth. However, they also stated that these countries are generally characterized by the attractiveness of FDI due to the availability of advanced infrastructures and energy resources. Also, these countries have improved global ranking in the Ease of Doing Business Index by the World Bank.

The effect of foreign direct investment (FDI) on gross domestic investment (GDI), especially in African countries, continues to be a highly debated issue. Chitambara (2021) study investigated the impact of FDI on GDI and the role of local conditions on selected 48 African countries. The local conditions determined the extent to which the host countries can absorb and benefit from FDI. Using the countries data from 1980-2016 and applying the two-steps GMM estimation techniques, the study found that FDI and GDI have a negative relationship. FDI has a crowding-out effect on the host country's GDI. Regarding local conditions, the study found that improved institutions and trade openness can mitigate the negative effects of FDI on domestic investment while lack of financial market development exacerbates the negative effect.

The issue of whether FDI crowds-out or crowds-in private domestic investments continues to attract attentions and discussions, Nwala (2008) empirically investigated the relationship between U.S. foreign direct investments (FDI) and economic growth in the ASEAN4 countries of Malaysia, Indonesia, Thailand, and the Philippines. The study used annual panel data covering the 1990-2005 period. An augmented Solow production frontier model that made output a function of capital stock, labor, human capital, and productivity was estimated using both OLS and Seemingly Unrelated Regression (SUR) techniques. The results showed that a negative relationship existed between the ASEAN4 countries' economic growth and the US foreign direct investments. FDI can be growth enhancing, if it complements domestic investment; otherwise, it crowds it out, and decreases domestic savings thereby resulting in negative economic growth.

Adams (2009) also contributed to the discussions by investigating the relationship between FDI and domestic investment. His study analyzed the impact of foreign direct investment (FDI) and domestic investment (DI) on economic growth in Sub-Saharan Africa for the period 1990–2003. The results showed that DI is positive and significantly correlated with economic growth in

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both the OLS and fixed effects estimation. However, FDI is positive and significant only in the OLS estimation. The study also found that FDI has an initial negative effect on DI and subsequent positive effect in later periods for the panel of countries studied. The sign and magnitude of the current and lagged FDI coefficients suggest a net crowding out effect. The review of the literature and findings of the study indicate that the continent needs a targeted approach to FDI, increase absorption capacity of local firms, and cooperation between government and MNE to promote their mutual benefit.

Ang (2009) also contributed to the discussion regarding the relationship between private domestic investment, public investment, and foreign direct investment in Malaysia. Using multivariate cointegration techniques, he found that a fairly strong cointegrated relationship existed between the three variables during the period of 1960-2003. The results also indicated that both public investment and FDI are complementary to rather than competing with FDI. The study further revealed that public investments also crowd in private domestic investments. A 1% increase in public investment resulted in a 0.281% increase in private domestic investment. This finding of a crowding-in effect is in line with the majority of studies such as Aschauer (1989) and Erenburg (1993).

Shortfalls in domestic savings within African countries are prevalent and capital inflows from foreign aids tend to help reduce the negative economic effects resulting from these challenges. Proponents of positive contributions from capital inflows, specifically emanating from foreign aids and a times local savings, suggest that both of them contribute to the improvement of the host country's economic growth through deep market competition, increased market formation, increased domestic investment, and technology transformation. Elian and Suliman (2015) tested for the casual direct and interactive association between capital inflow, foreign aids, and domestic savings, and trade-led growth nexus within the context of a market-oriented economy. They utilized the Toda- Yamamoto (1995) causality test since it avoids the shortfall associated with the standard Granger (1969) causality and found that there are bi-directional causalities between foreign aid and economic growth. However, one way causality is concluded between foreign aids and openness of an economy. Foreign aid Granger causes openness, and no reverse order was observed. They also concluded that foreign aid and openness of an economy are predominant conditions for economic growth.

As the exploration regarding the effects of FDI on Private domestic investments by economists continue, Chena et al. (2017) emphasized that foreign direct investments (FDIs) can have positive or negative spillover effect in China. However, they emphasized that the entry mode of the foreign investor will determine the directional effect of FDI on domestic investment. Using quarterly data from 1994-2014, their study answered the question of whether FDI crowds-in or crowds-out private domestic investment in China. They found that equity joint venture (EJV) crowds in domestic investment while wholly foreign funded enterprise crowds it out. Therefore, for FDI to have a positive spillover benefit effect in China, the foreign investor's entry mode must be an EJV.

A final study that added to the debate regarding the relationships between economic freedom, foreign direct investment, and economic growth was by Ciftci and Ciftci (2022). Their study used the panel Granger causality test which considered heterogeneity and cross-sectional dependency across panel members to investigate the causality relationships between economic freedom, foreign direct investment, and economic growth for the top FDI attracting countries during 1995-2019 period. Their findings provided weak evidence for the causal links between Economic freedom, foreign direct investment, and economic growth for the overall score of economic freedom index.

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Overall, their study concluded that the direction of causality seems to be country and economic freedom index specific. It can therefore be fair to state that the impacts of FDI on economic growth certainly depends on the level of economic freedom of each country.

3. Methodology

3.1 Cross-sectional dependence tests

The empirical analysis of the paper commences with the application of a battery of cross-sectional dependence tests namely − the Breusch and Pagan (1980), Pesaran (2004) and Baltagi, *et al.* (2012). The Cross-sectional dependence tests are given by equation (1):

$$y_{it} = \alpha_i + \beta' x_{it} + \mu_{it} \quad (1)$$

In equation (1), y is the dependent variable, i represents the cross-sectional dimension, t is the time index, x_{it} is a kx1 vector consisting of independent variables, α_i and β_i individually, represent the individual intercepts and slope coefficients that may differ between members of the panel. The null hypothesis (H_o)under the LM CD test is that $Cov(u_{it}, u_{ij}) = 0$, for all t and i≠j. However, the alternative hypothesis (H_1) is that $Cov(u_{it},u_{jt}) \neq 0$, for at least one pair of i≠j. The LM CD test statistic is based on equation (2):

$$LM = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (\hat{p}_{ij}^2) \quad (2)$$

In equation (2), N denotes the number of cross sections, T stands for the sample size and $\hat{\rho}_{ij}$ is the correlation coefficient of the residuals. The LM CD test statistic is distributed as $\chi n(n-1)/2$. The LM CD test statistic is recommended when N is small, and T is sufficiently large. To correct for this weakness, Pesaran (2004) introduced the scaled version of the Breusch and Pagan (1980) LM test statistic. The LM CD test is still appropriate even in the cases where T→∞ and N→∞. The scaled version of the LM CD test is given by:

$$CD_{lm} = \sqrt{T/_{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (\hat{p}_{ij}^2) \quad (3)$$

The CD_{lm} statistic is by assumption asymptotically normally distributed. Furthermore, the CD_{lm} is nevertheless valid even in the cases where either T>N or N>T. Even though the CD_{lm} test can be applied when N and T are both large; it suffers from size distortions, especially when N is large, and T is small. To address this shortcoming, Pesaran (2004) developed the following CD test:

$$CD = \sqrt{2T/_{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (T\hat{p}_{ij}^2 - 1) \quad (4)$$

Pesaran (2004) has shown that this test is robust even in heterogeneous dynamic models including multiple breaks in slope coefficients and/or error variances, provided the unconditional means of y_{it} and x_{it} are time-invariant and their innovations are symmetrically distributed. The null hypothesis of the various CD procedures discussed in this study is that there is no cross-sectional dependence among the members of the panel.

According to Pesaran, *et al.* (2008) the standard CD procedure suffers from low power. To overcome this problem, they proposed the bias-adjusted LM test given by:

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$$LM_{adj} = \sqrt{\frac{2}{N(N-1)}} \sum_{t=1}^{N-1} \sum_{j=i+1}^{N} (\hat{\rho}_{ij}) \frac{(T-k-1)\hat{\rho}_{ij}^2 - \mu_{Tij}}{\nu_{Tij}} \quad (5)$$

Where μ_{Tij} and ν_{Tij} are the exact mean and variance of $(T-k-1)\hat{\rho}_{ij}^2$. The LM_{adj} test is asymptotically normally distributed. The null hypothesis under the LM_{adj} is that there is no cross-sectional dependence among the members of the panel.

3.2 Slope homogeneity test

To test for slope homogeneity, the study applies the Swamy (1970) and Pesaran and Yamagata (2008) procedures. The Swamy (1970) procedures do perform well when *N* is small compared to *T*. Pesaran and Yamagata (2008) developed the delta (Δ) test with the intention of improving the Swamy test. The Δ procedure can be used to test for slope homogeneity even in large panels. In short, the Δ test is the standardized reproduction of the Swamy (1970) procedure, implied by the expression:

$$\tilde{S} = \sum_{i=1}^{N} (\hat{\beta}_i - \tilde{\beta}_{WFE})' \frac{X_i' M_\tau x_i}{\hat{\sigma}_i^2} (\hat{\beta}_i - \tilde{\beta}_{WEF}) \quad (6)$$

where $\hat{\beta}_i$ is the pooled OLS estimator, $\tilde{\beta}_{WFE}$ represents the weighted fixed effect pooled estimator, M_τ signifies the identity matrix and $\hat{\sigma}_i^2$ is the estimator of the error variance, σ_i^2.

The Pesaran and Yamagata (2008) slope homogeneity procedures namely, the standard delta ($\widetilde{\Delta}$) and the delta adjusted ($\tilde{\Delta}$adj) tests are based on the following equations:

$$\tilde{\Delta} = \sqrt{N}\left(\frac{N^{-1}\tilde{S} - k}{\sqrt{2k}}\right) \quad (7)$$

$$\tilde{\Delta}_{adj} = \sqrt{N}\left(\frac{N^{-1}\tilde{S} - E(\tilde{z}_{it})}{\sqrt{var(\tilde{z}_{it})}}\right) \quad (8)$$

where the mean $E(\tilde{z}_{it})$ = k and the variance $var(\tilde{z}_{it})$ = 2k(T-k-1)/(T+1). The details about these procedures can be found in Pesaran and Yamagata (2008).

3.3 Panel JKS causality test

For panel causality, this study adopted the test proposed by Juodis, *et al.* (2021), known as the JKS Granger non-causality procedure. Xiao, *et al*. (2023) maintain that the JKS procedure offers superior power and size performance compared to existing tests because it uses a pooled estimator that has a faster $\sqrt{NT}$ convergence rate. Other attractive features of the JKS Granger non-causality test include the fact that it can be used in multivariate settings and corrects for both homogeneous and heterogeneous alternatives. Above all, the procedure corrects for the presence of cross-sectional dependence and cross-sectional heteroskedasticity that might be present in the panel. The JKS Granger causality procedure utilizes the Half–Panel Jackknife method. The general representation of the JKS Granger non-causality test is given by:

$$y_{i,t} = \emptyset_{0,i} + \sum_{p=1}^{p} \emptyset_{p,i}\, y_{t-p} + \sum_{p=1}^{p} \beta_{p,i}\, x_{i,t-p} + \varepsilon_{i,t} \quad (9)$$

For i =1,…,*N* and t = 1,…,*T*. $\phi_{0,i}$ are individual specific effects, $x_{i,t}$ is considered to be a scalar, $\varepsilon_{i,t}$ are the error terms, $\phi_{p,i}$ are the heterogeneous autoregressive coefficients, and $\beta_{p,i}$ are

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the Granger causality parameters to be estimated for all variables in the model. The null hypothesis involves testing H_0: $\beta_{p,i} = 0$ for all $i\ and\ p$. The alternative hypothesis on the other hand, involves testing that H_1: $\beta_{p,i} \neq 0$ for some $i\ and\ p$. In terms of the notations used in this study, equation (9) can be rewritten as follows:

$$FDI_{i,t} = \emptyset_{0,i} + \sum_{p=1}^{p} \emptyset_{p,i}\, yFDI_{t-p} + \sum_{p=1}^{p} \beta_{1,p,i}\, DI_{i,t-p} + \sum_{p=1}^{p} \beta_{2,p,i}\, EF_{i,t-p} + \varepsilon_{i,t} \quad (10)$$

$$DI_{i,t} = \emptyset_{0,i} + \sum_{p=1}^{p} \emptyset_{p,i}\, yFDI_{t-p} + \sum_{p=1}^{p} \beta_{1.,p,i}\, DI_{i,t-p} + \sum_{p=1}^{p} \beta_{2,p,i}\, EF_{i,t-p} + \varepsilon_{i,t} \quad (11)$$

Where FDI represents foreign direct investment, GDI is the domestic investment proxied by gross fixed capital formation, EF stands for economic freedom, and $\varepsilon_{i,t}$ is error term.

For parameter estimation, this study implements the Feasible Generalized Least Squares (FGLS) model proposed by Parks (1967). Rosenfeld and Fornango (2007) suggest that the parameter estimates from the FGLS model are generally unbiased and consistent even in the presence of correlated and heteroskedastic error terms across the panel. Bai, *et al.* (2021) suggest that the FGLS estimator is appropriate when the number of time periods (T) is greater than or equal to the number of cross-sections (N). The general expression of the FGLS estimator is given by:

$$y_{it} = \alpha + \beta x_{it} + \mathcal{E}_{it} \qquad \text{i=1…., N; t = 1……, T} \quad (12)$$

Where y_{it} represents the dependent variable; x_{it} denotes a k x 1 vector consisting of the explanatory variables; β represents a k x 1 vector containing the coefficients of the explanatory variables; α_i is the intercept while $\mathcal{E}_{it}$ is the error term.

For estimation purposes, equation (12) can be rewritten as follows to reflect the notations used in this study:

$$FDI_{it} = \alpha + \beta_1 GDI_{it} + \mathcal{E}_{it} \quad (13a)$$

$$GDI_{it} = \alpha + \beta_1 FDI_{it} + \mathcal{E}_{it} \quad (13b)$$

$$FDI_{it} = \alpha + \beta_1 GDI_{it} + \beta_2 EF_{it} + \mathcal{E}_{it} \quad (14a)$$

$$GDI_{it} = \alpha + \beta_1 FDI_{it} + \beta_2 EF_{it} + \mathcal{E}_{it} \quad (14b)$$

Where FDI represents foreign direct investment, GDI is the domestic investment proxied by gross fixed capital formation, EF stands for economic freedom, and $\varepsilon_{i,t}$ is error term. Equations (13a) and (13b) are estimated without EF as a control variable. However, equations (14a) and (14b) are estimated with EF as an additional independent variable to assess its role in explaining the relationship between domestic investment and foreign investment.

4. Data and descriptive statistics

The data consists of annual observations on foreign direct investment, domestic investment (proxied by gross fixed capital formation), and the index of economic freedom. The study period runs from 1996 through 2021. The sample comprises 18 African countries namely − Benin, Botswana, Burkina Faso, Cote d'Ivoire, Cameroon, Gabon, Ghana, Guinea, Kenya, Mali, Morocco, Mozambique, Niger, Nigeria, Senegal, South Africa, Uganda, and Zimbabwe. The data on foreign direct investment and domestic investment were retrieved from the World Bank World

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Development Indicators website. The economic freedom index variable was taken from the website of the Heritage Foundation. Both foreign direct investment and domestic investment variables were expressed as percentages of GDP. Table 1 provides the descriptions and sources of the three variables in the study.

Table 1. Variable Descriptions and Sources

Acronym	Definition	Source
EF	EF represents the economic freedom index used to measure the level of freedom of economic activities in a country.	Heritage Foundation
FDI	FDI are the net inflows of investment (% of GDP).	World Development Indicators
GDI	GDI is the domestic investment proxied by gross fixed capital formation.	World Development Indicators

Notes: The definitions of the variables were retrieved from the World Bank and the Heritage Foundation

Table 2 displays the descriptive statistics for foreign direct investment, economic freedom, and domestic investment. The mean values for economic freedom, foreign direct investment, and domestic investment are 56.34, 2.89, and 20.64, respectively. The minimum and maximum statistics reveal that the values of the three variables have fluctuated over the study period. As an example, it can be observed from Table 2 that the value of domestic investment varied from a minimum of 20.64 percent to a maximum of 52.42. The standard deviations for economic freedom, foreign direct investment, and domestic investment are 6.96, 4.46, and 6.09, respectively. The computed Kurtosis statistics for economic freedom, foreign direct investment, and domestic investment are all greater than 3 suggesting that the distributions of the three variables may be associated with heavy tail. The Jarque-Bera statistics for economic freedom, foreign direct investment, and domestic investment are 777.40, 14522.21, and 97.74, respectively. These test statistics are all statistically significant at the 1 percent level, indicating that the null hypothesis that variables are normally distributed should be rejected.

Table 2: Descriptive Statistics

Statistic	EF	FDI	GDI
Mean	56.34	2.89	20.64
Maximum	72.00	39.46	52.42
Minimum	21.00	-5.01	2.00
Std. Dev.	6.96	4.46	6.09
Kurtosis	8.49	28.76	4.98
Jarque-Bera	777.40***	14522.21***	97.74***
Probability	0.00	0.00	0.00
Observations	468	468	468

*** indicates rejection of the null hypothesis of no cross-sectional dependence at the 1%. EF = economic freedom, FDI = foreign direct investment, and GDI = domestic investment (proxied by gross fixed capital formation).

Table 3 presents the Pearson correlation coefficients between economic freedom, foreign direct investment, and domestic investment. The results show that the correlation (-0.01) between economic freedom and foreign direct investment is negative and statistically insignificant. However, the correlation (0.35) between economic freedom and domestic investment is positive and statistically significant at the 1 percent level. Similarly, the correlation (0.32) between foreign direct investment and domestic investment is positive and statistically significant at the 1 percent level. Although the results from the Pearson correlation tests have provided cursory evidence of statistically significant relationship between foreign direct investment and domestic investment, a

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more thorough theoretically grounded framework that could account for cross-sectional dependence that might be present in the panel is required.

Table 3: Pairwise Pearson Correlation

Variable	EF	FDI	GDI
EF	1.00		
FDI	-0.01	1.00	
GDI	0.35***	0.32***	1.00

*** indicates level of significance at the 1% level. EF = economic freedom, FDI = foreign direct investment, and GDI = domestic investment (proxied by gross fixed capital formation).

5. Empirical results and discussions

The empirical results of this study are presented and discussed in this section. This study implements the Breusch-Pagan LM, Pesaran scaled LM, and Pesaran CD cross-sectional dependence tests. The results from the various cross-sectional dependence tests are presented in Table 4. The computed Breusch-Pagan (BPLM) test statistics are 604.83, 357.78, and 580.36, respectively for economic freedom, foreign direct investment, and domestic investment. Similarly, the test statistics from the CDlm tests are 25.83, 11.71, and 24.43, respectively for economic freedom, foreign direct investment, and domestic investment. For Pesaran (2004) CD procedure, the computed test statistics are 25.47, 11.35, and 24.07, respectively for economic freedom, foreign direct investment, and domestic investment. Altogether, the test statistics from the three cross-sectional dependence procedures are statistically significant at the 1 percent level, and hence indicate that the null hypothesis of no cross-sectional dependence among the countries in the panel should be rejected.

The cross-sectional dependence tests for the entire model are presented in Panel D of Table 4. The computed test statistics are 278.61, 7.18, and 4.58, respectively for the Breusch-Pagan LM, Pesaran scaled LM, and Pesaran CD procedures. The cross-sectional dependence test statistics for the entire model are all statistically significant at the at the 1 percent level. These results corroborate those for the individual variables. Concisely, these results imply that shocks to either economic freedom, foreign direct investment, or domestic investment in any of the panel members can be easily transmitted to others.

The results from the slope homogeneity procedures are displayed in Table 5. The computed test statistics from the delta ($\widetilde{\Delta}$), delta adjusted ($\tilde{\Delta}$adj) and the *Swamy* ($\widetilde{S}$) procedures are 1.57, 1,67, and 591.30, respectively. These test statistics are statistically significant at least at the 10 percent level. These results suggest that the null hypothesis of slope homogeneity should be rejected in favor of the alternative hypothesis of slope heterogeneity. The results imply that the slopes for the panel members are heterogeneous, suggesting that the direction of causal linkages between economic freedom, foreign direct investment, and domestic investment may differ across the 18 African countries under study.

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Table 4: Cross-Sectional Dependence Test Results

	Test Stat	Probability
Panel A: Economic Freedom (EF)		
LM_{BP} (Breusch and Pagan 1980)	604.83***	0.00
CDlm (Pesaran 2004)	25.83***	0.00
CD (Pesaran 2004)	25.47***	0.00
Panel B: Foreign Direct Investment (FDI)		
LM_{PB} (Breusch and Pagan 1980)	357.78***	0.00
CDlm (Pesaran 2004)	11.71***	0.00
CD (Pesaran 2004)	11.35***	0.00
Panel C: Domestic investment (GDI)		
LM_{BP} (Breusch and Pagan 1980)	580.36***	0.00
CDlm (Pesaran 2004)	24.43***	0.00
CD (Pesaran 2004)	24.07***	0.00
Panel D: Model		
LM_{BP} (Breusch and Pagan 1980)	278.61***	0.00
CDlm (Pesaran 2004)	7.18***	0.00
CD (Pesaran 2004)	4.58***	0.00

*** indicates rejection of the null hypothesis of no cross-sectional dependence at the 1% .

Table 5: Slope Homogeneity Test Results

	Test Stat	Probability
$\tilde{\Delta}$	1.57*	0.06
$\tilde{\Delta}_{adj}$	1.67**	0.05
$\tilde{S}$	591.30***	0.00

***, ** and * indicate the rejection of the null hypothesis of slope homogeneity at the 1%, 5% and 10% level, respectively.

The study next applies the Breitung and Das (2005), the cross-sectionally augmented IPS (CIPS) test advanced by Pesaran (2007), and the Hadri-Kurozumi (2012) panel unit root tests. These panel unit root tests were adopted because of their ability to correct for serial correlation that might exist among panel members. The null hypothesis under the Breitung and Das (2005) and the CIPS procedures is that the series are nonstationary. While the alternative hypothesis is that the series of interest is stationary. For the Hadri-Kurozumi (2012) panel unit root test, the null hypothesis is stationarity, while the alternative hypothesis is nonstationarity.

Table 6 presents the panel unit root test results. From panels A and B of Table 6, the computed panel unit root test statistics from the Breitung and Das (2005) and CIPS show that the null hypothesis of a unit root should be rejected in favor of the alternative, at least at the 10 percent level of significance for economic freedom, foreign direct investment, and domestic investment. Similarly, the computed test statistics for the Hadri-Kurozumi (2012) panel unit root test failed to reject the null hypothesis of stationarity for economic freedom, foreign direct investment, and domestic investment. The test statistics are statistically insignificant based on the reported test statistics and their accompanying p-values. Taken together, the results indicate that the economic freedom, foreign direct investment, and domestic investment variables are level stationary.

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Table 6: Panel Unit Root Test Results

	EF		FDI		GDI	
Method	*Statistic*	*P-value*	*Statistic*	*P-value*	*Statistic*	*P-value*
Panel A: Breitung and Das (2005)						
t_{ols}	-2.04**	0.02	-2.80***	0.00	-1.66**	0.05
t_{rob}	-1.53*	0.06	-1.69**	0.04	-3.05***	0.00
Panel B: CIPS - Pesaran (2007)						
Lag = 0	-2.58***	0.00	-5.70***	0.00	-0.34	0.37
Lag =1	-2.45***	0.001	-2.50***	0.00	-1.33*	0.09
Panel C: Hadri-Kurozumi (2012) Panel Unit Root Tests						
Z_A^{SPC}	-1.17	0.88	-1.18	0.88	-1.20	0.89
Z_A^{LA}	-1.13	0.87	-0.96	0.83	-1.33	0.91

***, **, and * indicate rejection of the null hypothesis of a unit root process at the 1%, 5%, and 10% level, respectively. The null hypothesis of the Hadri-Kurozumi panel unit root test is stationarity. EF = economic freedom, FDI = foreign direct investment, and GDI = domestic investment (proxied by gross fixed capital formation).

Having established the order of integration, the study next discusses the results from the JKS panel Granger causality tests. Table 7 presents the JKS panel Granger causality tests. Panel A of Table 7 displays the results from the multivariate function. The lag lengths were determined by the Bayesian information criterion (BIC). From the results, the null hypothesis that domestic investment and economic freedom do not jointly Granger-cause foreign direct investment is rejected at the 1 percent significance level. Similarly, the null hypothesis that foreign direct investment and economic freedom do not jointly Granger-cause domestic investment is also rejected at the 1 percent significance level. Taken together, the results from the multivariate function provide evidence of bidirectional causality between foreign direct investment and domestic investment.

Table 7: JKS Granger Non-Causality Test Results

Null hypothesis (H_o)	Lags	HPJ Wald Test	*P-value*	*Decision*	*Conclusion*
Panel A: Multivariate non-causality tests					
GDI and FE ↛ FDI	4	88.37***	0.00	Reject H_o	Bidirectional causality
FDI and FE ↛ GDI	4	156.55***	0.00	Reject H_o	GDI↔FDI
Panel B: Bivariate non-causality tests					
FDI↛ GDI	3	9.19**	0.03	Reject H_o	Bidirectional causality
GDI ↛ FDI	4	26.01***	0.00	Accept H_o	GDI↔ FDI
EF ↛ FDI	4	28.56***	0.00	Reject H_o	Bidirectional causality
FDI ↛ EF	4	11.41**	0.02	Reject H_o	EF ↔ FDI
EF ↛ GDI	3	28.56***	0.00	Reject H_o	Bidirectional causality
GDI ↛ EF	4	53.35***	0.00	Reject H_o	EF ↔ GDI

*** and ** indicate rejection of the null hypothesis of non-causality at the 1% and 5%, level, respectively. EF = economic freedom, FDI = foreign direct investment, and GDI = domestic investment (proxied by gross fixed capital formation). The lag length was determined by the Bayesian information criterion (BIC).

Panel B of Table 7 presents the bivariate Granger non-causality tests. From the results, the null hypothesis that foreign direct investment does not Granger-cause domestic investment is rejected at the 5 percent level of significance. Similarly, the null hypothesis that domestic investment does not Granger-cause foreign direct investment is rejected at the 1 percent level of significance. The results further show evidence of causality running from economic freedom to foreign direct investment and vice versa. Finally, the results provide evidence that economic

freedom Granger causes domestic investment and vice versa. Taken together, the results in Panel B of Table 7 provide evidence of bidirectional causality between foreign direct investment and domestic investment. In other words, domestic investment and foreign direct investment are complementary. This finding is consistent with the results from the multivariate function. The finding of bidirectional causality between the two variables indicates that they have predictive power over each other.

This study next uses the Feasible Generalized Least Squares (FGLS) estimator developed by Parks (1967) to determine the sign (positive or negative) of the relationship between foreign direct investment and domestic investment. The FGLS model has been shown by Bai, et al. (2020) and Ikpesu, et al. (2019) to provide efficient estimates in the presence of heteroskedasticity, serial and cross-sectional correlations. The results from the FGLS model are displayed in Table 8. The result from the baseline model of equation (1) reveals that domestic investment (GDI) has a significant and positive effect on foreign direct investment. The regression coefficient (0.22, t-ratio =38.73) on GDI is positive and statistically significant at the 1 percent level. Similarly, the result from the baseline model of equation (2) indicates that foreign direct investment has a significantly positive influence on domestic investment. The regression coefficient (0.43, t-ratio = 31.69) on FDI is positive and statistically significant at the 1 percent level.

The result from the augmented model of equation (3) shows that domestic investment has a positive and significant impact on foreign direct investment. The regression coefficient (0.25, t-ratio = 60.02) on GDI is positive and statistically significant at the 1 percent level. This result implies that a 1 percentage increase in GDI increases foreign direct investment approximately 25 percent. However, economic freedom (EF) has a negative and significant effect on foreign direct investment. The regression coefficient (-0.08, t-ratio = -14.14) on EF is negative and statistically significant at the 1 percent level. This result suggests that a 1 percentage increase in economic freedom negates foreign direct investment by 8 percent. The negative effect of economic freedom on foreign direct investment can be attributed to the fact that most of the sample countries tend to have minimal regulations and weak institutions. These factors could lead to an unstable business environment, lack of investor protection, and increased corruption, and hence serve as a deterrent to foreign investors.

The result from the augmented model of equation (4) shows that foreign direct investment has a positive and significant effect on domestic investment. The regression coefficient (0.43, t-ratio = 22.73) on FDI is positive and statistically significant at the 1 percent level. This result implies that a 1 percentage increase in foreign direct investment leads to approximately 43 percent increase in domestic investment. The results further reveal that economic freedom has a significantly positive influence on domestic investment. The regression coefficient (0.30, t-ratio=29.57) on EF is positive and statistically significant at the 1 percent level. Taken together, the results from the FGLS models suggest that foreign direct investment and domestic investment have predictive power over each other. The inclusion of the economic freedom variable in the augmented equation improved the predictive power of the models. For example, the R2 improved from 10 percent to 23 percent with respect to the equations for GDI. There is also an improvement in the regression coefficients.

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Table 8: Feasible Generalized Least Squares Results

	Baseline Models				Augmented Models with Economic Freedom			
	Equation (1) − FDI		Equation (2) − GDI		Equation (3) − FDI		Equation (4) − GDI	
Variable	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat
Constant	-1.76***	15.01	19.39***	507.79	2.06***	5.77	2.49***	4.28
GDI	0.22***	38.73	-	-	0.25***	60.02	-	-
FDI	-	-	0.43***	31.69	-	-	0.43***	22.73
EF	-	-	-	-	-0.08***	-14.14	0.30***	29.57
Wald x^2	1499.48***	-	1004.30***	-	1331.09***	-	1843.71***	-
P-B LM	1109.23***		968.80***		1029.03***		420.18***	
Hausman	1.349(0.25)		1.839(0.18)		2.96(0.23)		12.91(0.01)	

*** indicates level of significance at the 1%. EF = economic freedom, FDI = foreign direct investment, and GDI = domestic investment (proxied by gross fixed capital formation).

To check the robustness of the results provided by the FGLS model, the study applied the Panel Corrected Standard Error (PCSEs) estimator. The PCSEs model has been shown by a number of authors including Bailey and Katz (2011), Millo (2017), Reed and Webb (2010) to have the ability to correct for heterogeneity, heteroskedasticity, and cross-sectional dependence that might be present in panels. The results from the PCSEs model are presented in Table 9. Again, the result from the baseline model of equation (1) shows that GDI has a significant and positive impact on foreign direct investment. The regression coefficient (0.23, t-ratio = 5.64) on GDI is positive and statistically significant at the 1 percent level. Equally, the result from the baseline model of equation (2) reveals that foreign direct investment has a significantly positive effect on domestic investment. The regression coefficient (0.43, t-ratio = 6.17) on FDI is positive and statistically significant at the 1 percent level.

The result from the augmented model of equation (3) shows that domestic investment has a positive and significant influence on foreign direct investment. The regression coefficient (0.27, t-ratio = 5.97) on GDI is positive and statistically significant at the 1 percent level. This result implies that a 1 percentage increase in GDP increases foreign direct investment by approximately 27 percent. However, economic freedom has a negative and significant effect on foreign direct investment. The regression coefficient (-0.09, t-ratio = -3.27) on EF is negative and statistically significant at the 1 percent level. This result suggests that a 1percentage increase in economic freedom negates foreign direct investment by 9 percent. The result from the augmented model of equation (4) shows that foreign direct investment has a positive and significant effect on domestic investment. The regression coefficient (0.44, t-ratio = 6.71) on FDI is positive and statistically significant at the 1 percent level. This result implies that a 1percentage increase in foreign direct investment leads to approximately 44 percent increase in domestic investment. The results further reveal that economic freedom has a significantly positive influence on domestic investment. The regression coefficient (0.31, t-ratio=10.03) is positive and statistically significant at the 1 percent level.

In all, the results from the PCSEs estimator corroborate those from the FGLS model. From the reported R2s, the predictive powers of the models improved with the inclusion of economic freedom. It can be observed that the R2 improved from 10 percent to 12 percent for foreign direct investment. Similarly, the R2 improved from 10 percent to 23 percent for domestic investment. From the results provided by the JKS panel causality test, the FGLS and PCSEs models, we can surmise that economic freedom is consequential in explaining the relationship between foreign direct investment and domestic investment for the sample countries.

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Table 9: Panel-Corrected Standard Error (PCSEs) Results

	Baseline Models				Augmented Models with Economic Freedom			
	Equation (1) − FDI		Equation (2) − GDI		Equation (3) − FDI		Equation (4) − GDI	
Variable	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat
Constant	-1.89**	-2.18	19.39***	66.11	2.35*	1.77	1.79	0.99
GDI	0.23***	5.64	-	-	0.27***	5.97	-	-
FDI	-	-	0.43***	6.17	-	-	0.44***	6.71
EF	-	-	-	-	-0.09***	-3.27	0.31***	10.03
Wald x^2	31.83***	-	38.09***	-	35.73***	-	178.31***	-
R^2	0.10		0.10		0.12		0.23	

***, **, and * indicate level of significance at the 1%, 5%, and 10%, respectively. EF = economic freedom, FDI = foreign direct investment, and GDI = domestic investment (proxied by gross fixed capital formation).

6. Conclusions and policy implications

This paper has examined the relationship between domestic investment and foreign direct investment with economic freedom as the mediating variable. The study period spans 1996 through 2021. The panel consists of 18 African countries namely Benin, Botswana, Burkina Faso, Cote d'Ivoire, Cameroon, Gabon, Ghana, Guinea, Kenya, Mali, Morocco, Mozambique, Niger, Nigeria, Senegal, South Africa, Uganda, and Zimbabwe. The paper used the JKS panel Granger causality test to ascertain the causal relationship between domestic investment and foreign direct investment. For parameter estimates, the study applied the Feasible Generalized Least Squares (FGLS) model. To check the robustness of the results from the FGLS model, the study implemented the Panel Corrected Standard Error (PCSEs) model. The study also applied a number of cross-sectional dependence tests to check for evidence of serial correlation in the panel. The results from the cross-sectional dependence tests rejected the null hypothesis of no cross-sectional dependence in all of the cases. Also, the results from the slope homogeneity tests indicated that the slopes of the variables in the panel are heterogeneous. The results from the panel unit root tests suggest that domestic investment, economic freedom, and foreign direct investment are all level stationary.

The results from the JKS Granger causality test provide evidence of bidirectional causal relationship domestic investment and foreign direct investment with or without economic freedom. Similar results were also found between economic freedom and domestic investment and between foreign direct investment and economic freedom. The results from the FGLS estimator indicate that domestic investment and foreign direct investment have significantly positive impact on each other. Economic freedom was found to exert a significantly positive influence on domestic investment. On the other hand, economic freedom has a significantly negative effect on foreign direct investment. In all, the results from this study provide evidence that economic freedom plays a crucial role in the relationship between domestic investment and foreign direct investment.

From a policy perspective, the authorities and policymakers should be formulating and implementing policies that promote economic freedom, such as reducing excessive regulations and promoting property rights. A more business-friendly environment can encourage both domestic and foreign investors to allocate capital efficiently. Governments of the sample countries can use economic freedom as a selling strategy in attracting foreign direct investments. Similarly, these countries should also endeavor to ensure political stability in order to attract both domestic and foreign investors to invest in their economies.

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Declaration of Interest

The authors report no potential conflict of interest.

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