



# Financial Economics Letters

Homepage: <https://www.anserpress.org/journal/fel>



## External Reserve and the Elasticity of Substitution between Domestic and Foreign Investment in Africa

Richard Umeokwobi <sup>a,\*</sup>, Victor Ocheni <sup>a</sup>, Isah Auwal <sup>a</sup>

<sup>a</sup> *Monetary Policy Department, Central Bank of Nigeria, Abuja, Nigeria*

*This is the view of the authors and not the institution they represent*

---

### ABSTRACT

The Paper investigates the elasticity of substitution between foreign direct investment (FDI) and private domestic investment on the external reserves of some selected 14 African countries. To achieve the objective of the best substitutability of investment suitable for Africa, using data on gross fixed capital formation as a proxy for private domestic investment, inflation, external reserves, and foreign direct investment. From the Empirical literature reviewed, studies on the substitutability of investments in external reserves in Africa have not yet been addressed. The Dynamic General Methods of Moments (DGMM) was employed for the analysis since the African countries are more than the scope of the study which ranges from 2010 to 2022. The results show that foreign direct investment is preferred to private domestic investment in Africa. Additionally, the elasticity of substitution from FDI to domestic private investment was found to be stronger and more elastic than the contrary. Therefore, the study recommends that African countries should focus on strengthening fixed assets to create more revenue from additional fixed assets which would impact more on the external reserves of Africa, by attracting foreigners.

### KEYWORDS

Africa; External Reserve; Elasticity of Substitution; Investment and DGMM

---

\* Corresponding author: Umeokwobi Richard

E-mail address: [roumeokwobi@cbn.gov.ng](mailto:roumeokwobi@cbn.gov.ng)

All Authors contributed equally.

ISSN 2972-3426

doi: 10.58567/fel03030002

This is an open-access article distributed under a CC BY license  
(Creative Commons Attribution 4.0 International License)



Received 21 February 2024; Accepted 27 June 2024; Available online 3 December 2024; Version of Record 15 September 2024

## 1. Introduction

The global economy has recently been faced with different economic crises ranging from the lockdown of COVID-19 to the Russia-Ukraine war which significantly subdued growth in the affected economies. Similarly, most emerging markets and developing economies (EMDEs) with emphasis on African countries, have been faced with the dilemma of what investment would aid their reserve in order to boost their economic outlook, especially in the post-pandemic era. Over the years, African countries were faced with dwindling external reserves, thus, most growing economic theories are of the view that alternative sources of foreign exchange earnings should be enormous (as noted in the works of Acquah & Ibrahim 2020; and Adedeji & Ahuru 2016). This becomes necessary for a good economic outlook through external reserve accretion, macroeconomic stability, and a favourable output gap. Most African countries encourage domestic investment as a major component of economic growth to reduce the pressure on their external reserve (Adeniyi, Omisakin, Egwaikhide & Oyinlola, 2012).

The fact remains that most African countries are largely import-dependent, which has a negative effect on their external reserve and dampens the economic outlook of the nations', especially during exchange rate shocks. This situation has demanded an increase in domestic direct investment, which constitutes public and private investment, and domestic portfolio investment, which constitutes stock, bonds, and other financial assets, which could be a way of improving the external reserves of emerging countries. Domestic direct investment is believed to boost domestic production in EMDEs by reducing importation, and also boosting export earnings, which would lead to the reduction of capital flight in the domestic economy. All these would likely build up the external reserves in EMDEs (see, for example, Antwi & Zhao, 2013; Antwi, Boateng & Salley, 2021 and Antwi, Mills & Zhao 2013). This also largely depends on the policies put in place by these countries to encourage residents in the EMDEs to reduce investment overseas. i.e., a drop-in capital outflow.

Studies in the literature established that periods of global crisis drive down foreign investment, especially portfolio investments in emerging economies (Anyanwu, & Yameogo, 2012; Ato-Mensah, & Long 2021, among others). These Emerging economies are mostly faced with external shocks from the global economies because they are price takers and not price setters. Also, due to structural challenges noted in most African countries, fiscal instability and corruption, combined with trade flows and terms of trade fluctuations, all mitigate the inflow of foreign direct investment. Foreign portfolio investment is very volatile (see, Awunyo & Sackey 2018; Barrie, 2020; and Bello & Eregha 2014) and thus, should be handled with caution because most emerging economies benefit from such temporary investments due to its favorable yields in the short-term.

The motivation of this study is based on the view that foreign investment inflows lead to a high reserves position and stability of foreign exchange markets in African countries. These countries, over the years, have made policies that would encourage foreign portfolio inflows into their economies, but these volatile flows are usually faced with high outflow reversals (as noted in, Ganawah & Koroma, 2022). A notable example is the case of the 2007/2008 global financial crisis (GCF) and the COVID-19 pandemic in 2020. To assess and measure the level of substitutability of various inputs to a production or utility function, several literatures have relied on the elasticity of substitution as a key parameter both at the domestic macro level and international spectrum (for instance, see Eregha, 2017; Evans, Frank, & Rebecca 2017; Faroh, & Shen, 2015; Fornah & Yuehua 2017; and Ganawah & Koroma, 2022). However, this has not received full attention in the literature relating to domestic and foreign external reserves, especially among emerging economies.

In the dynamic nature of Africa's economic landscape, the co-movements between external reserves and the elasticity of substitution between domestic and foreign investment stands as a critical nexus influencing the trajectory of economic development. As African nations strive for sustainable growth and resilience in an increasingly interconnected global economy, the strategic management of external reserves and the nuanced balance between home-grown and foreign capital become paramount considerations. The concept of external

reserves, capturing a nation's financial fortitude in foreign currencies, resonates with profound implications for monetary stability, international trade, and the ability to withstand external shocks (as in, Ijirshar et al, 2019). Simultaneously, the elasticity of substitution between domestic and foreign investment captures the adaptability of a country's economic fabric, reflecting its capacity to seamlessly integrate both local and international capital into the developmental equation (see, Ireferin & Yaaba 2011; Kulu, et al, 2021). This exploration embarks on a comprehensive journey into the heart of these intertwined phenomena, aiming to unravel their significance and explore their implications for Africa's economic narrative. Against the backdrop of a continent marked by diversity, both in terms of resources and economic structures, understanding the delicate dance between external reserves and investment substitution becomes imperative.

Based on the above background, this paper investigates how the external reserves of African countries respond to changes in domestic and foreign investment behaviours. Thereby indicating the sort of monetary policy framework and adjustment that should be implemented to achieve stability. From our search in the literature, there were no previous studies checking the elasticity of substitution between domestic and foreign investment on the external reserves of African countries. Therefore, we expect that the outcome of our investigation is expected to be our contribution to knowledge, as well as promote a framework for external reserve build-up and a stable and robust economic performance in African countries. Therefore, the underlying interrogation is what weight the central banks should attribute to domestic investment over foreign investment drive. The answer to these questions can be addressed by comparing the elasticity of external reserve responsiveness under different coefficients of investments both foreign and domestic. This would further provide a better understanding of monetary policy and policy focus on investment. This is crucial because of the opportunity cost involved when there is a distortion in monetary policy targeting.

In order to achieve this objective, the concept of elasticity of substitution was introduced to measure how Africa's external reserve responds to changes in domestic and foreign investment behaviour. The elasticity of substitution should portray where appropriate responses should be directed and the stability of monetary policy decisions in order to achieve external reserve sustainability. The result of the elasticity, whether low or high, would show the degree of substitutability between domestic and foreign investment to the external reserves in Africa. For example, a higher sensitivity of external reserves to foreign investment in Africa suggests that local investors suffer a higher degree of disadvantage in respect to favourable business environment. The rest of the paper is structured as follows: Section 2 materials and method. Section 3 result and discussion, while Section 4 provides conclusion and policy recommendations.

## 2. Literature Review

Even though the existing literature in this subject area has been scanty over time, there has been ongoing substantial debates in the literature in this regard especially for African countries. Thus, some studies have empirically been conducted in Africa over decades focusing on examining the relationship among Foreign Direct Investment (FDI), private domestic investment and economic growth. Moreover, these studies established different findings using variant methodological approaches which poses the need to investigate the existing puzzle. Meanwhile, based on the overall empirical findings among studies that covered different African countries, the literature is still inconclusive on the actual direction of the substitution between FDI and private domestic investment on external reserves, while in some studies, conflicting findings were found. Thus, the aim was to reassess the degree of impact and elasticity of substitution between FDI and private domestic investment on external reserves using 14 African countries as case study in a panel approach. These countries include Ghana, Sierra Leone, Nigeria, Kenya, and The Gambia, among others.

This paper uses a distinct methodological approach to address the ongoing debate in the literature of African studies. For this purpose, we group relevant studies based on similarities in findings for simplicity purpose. For example, some studies attempted to assess the importance of FDI on economic growth in Ghana, by including capital investment, technology, and management knowledge, and mostly cover different periods from 1980 - 2021. The main finding of these studies is that FDI has significant impact on economic development of Ghana (see, Bond, 2002; Borensztein, & Lee 1998; Brima, 2015; Djokoto, & Dzeha, 2012; Evans, Frank, & Rebecca, 2017; Duramany, et al, 2021; and Enu, Havi & Hagan 2013).

In a separate approach, focusing on Ghana's economy, Kulu, Mensah and Senah (2021) analysed the effect of FDI on economic growth from 1995 to 2019, using the ARDL model. The result of the estimation shows that FDI has a positive and significant impact on the economic growth of Ghana. These findings are similar to the works of Antwi et al (2013) and Yeboah & Anning (2020), although, the latter studies employed a cointegration method to investigate the level of relationship between FDI, economic growth, and gross national income, which was proxied by FDI, GDP, and GNI. The result shows that a long-run equilibrium and causal relationship exists between FDI, GDP, and GNI, while in the short run, the effects of GDP and GNI on FDI are nearly imaginary. However, studies such as Djokoto & Dzeha, 2012; Awunyo-Vitor and Sackey 2018; Enu, Havi, and Hagan 2013 found that FDI had a negative impact on agriculture and food insecurity with significant long-run relationship, while democracy, trade, exchange rate, size of the economy and inflation increased the inflow of FDI in Ghana. Similar findings were buttressed by Antwi, Boateng & Salley, 2021; and Anto-Mensah & Long 2021.

For the case of Nigeria, Ireferin & Yaaba (2011) and Osigwe et al. (2015) found that real gross domestic product and oil exports were positive in determining the level of external reserves based on the parsimonious Error Correction Model, which shows the presence of a long-run relationship. This is similar to the findings of Fornah & Yuehua (2017); Mansaray-Peace (2019) and Peace (2019) for Sierra Leone, the estimation shows that FDI inflows into Sierra Leone are stable and that there is a unidirectional relationship between FDI and economic growth, and FDI has a positive impact on economic growth. However, some studies establish contrary findings for Sierra Leone. For example, Brima (2015) and Ganawah & Koroma (2022), found that credit to the private sector and broad money supply all influenced economic growth in the short run, and gross capital formation and FDI acted as stimulators to the economic growth of Sierra Leone in the short run. This is similar to the works of Duramany-Lakkoh, Jalloh, & Jalloh (2021); Faroh & Shen (2015); Barrie (2020), and Velonjara & Gondje-Dacka (2019) using VAR found a positive relationship between FDI and manufacturing sector output, while inflation and export reported to have a negative relationship with FDI. Also, trade openness and exchange rate are the key determinants of FDI inflow in Sierra Leone while other variables such as inflation, gross domestic product, and interest rate are found to have an insignificant impact on FDI.

Similarly, some combined studies employed Distributed Lags (ARDL) and the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models to analyse the impact of FDI on economic growth of Ghana, Nigeria, Zimbabwe, and Angola using relevant data for the period 1980 - 2018. The results of the studies show that FDI has a positive and significant impact on economic growth in the short run, while domestic trade and trade openness portrayed a positive impact on the economic growth of Ghana in the long run (as in, Mansaray, 2018; Mansaray, 2019; and Opoku et al 2018).

Additionally, Borensztein, Gregorio, and Lee (1998), tested the effect of FDI on economic growth, in a cross-country regression framework, using 69 countries. The study found that FDI is an important driver for the transfer of technology, contributing relatively more to growth than domestic investment. Similarly, Orji, Uche, and Ilori (2014), used the Seemingly Unrelated Regression Estimation (SURE), technique to examine the impacts of four different types of foreign capital inflows which are FDIs, official development assistance, foreign private investments, and remittances on the output of West African Monetary Zone (WAMZ) economies, covering the

periods 1981 to 2010. The outcome shows that there are differences in the growth impact from the foreign capital inflows, official development assistance contributed more to Sierra Leone and Ghana, while FDI to Nigeria and Gambia.

Meanwhile, Acquah and Ibrahim (2019), examined the relationship between FDI, economic growth and financial sector development from 1980 to 2016 in 45 African countries. The result shows that the financial sector dampens the positive effect of FDI on economic growth. On the contrary, Ijirsha et al (2019) employed the dynamic panel models - the pooled mean group and mean groups to assess the effect of growth differentials of Domestic Investment and FDI of 41 selected African countries. The study found that inflows from FDI crowds in domestic investment in Africa, and there is a significant difference in the growth effects of FDI and domestic investment, while the joint effects of both investments on growth are meant to be statistically significant (similar to the findings of Opoku, Ibrahim, and Sare 2018 and Eregha 2017 for WAMZ region).

Overall, despite several discussions in the literature, this study sets to be different by incorporating some relevant variables in the estimation of the panel GMM model which was not properly addressed by some existing studies especially those that focused only on specific countries using time series approach. The use of GMM enables the model to clearly establish the path of the substitution effects among variables that interact in the model as contrary to common models such as OLS regression, ARDL and VAR mostly used in the literature. Also, the inclusion of these variables captures the true nature of the countries in question due to their nature of dependency and the interplay between foreign and domestic investment over time could show some level of robustness in the output of this paper. In addition, discussion in this area has been inconclusive and to a large extent, unanswered, as most existing studies were not able to establish the actual direction of external reserves nor the elasticity of substitution between foreign and domestic investment among African countries and how such interaction affects external reserves, which is the main focus of this paper. Thus, this study sets out to establish empirical evidence using 14 African countries to examine the substitution between FDI and private domestic investment on external reserves. This becomes necessary as countries, especially in Africa, continue to witness external balance challenges that significantly affect their external reserve positions over time. Thus, a study of this nature that specifically focuses on identifying the magnitude and direction in the elasticity of substitution of foreign and domestic investment on external reserves is constantly needed.

### **3. Materials and methods**

#### *3.1. Theoretical framework*

Domestic investment and foreign investment are important in an economy, and both can affect each other in an economy. If there is an improvement in private investment, the domestic economy also appreciates and attracts foreign investment. The roles of domestic investment aggregately motivate foreign investors (see, Nikuman and Verick, 2008). On the other hand, an increase in foreign investment might crowd out private investment (as in Velonjara & Gondje-Dacka 2019; and Yeboah & Anning 2020). The neo-classical theory of production function initially put forward by Cobb-Douglass in 1928 has been widely used in the literature (for instance, see, Ganawah, & Koroma, 2022; Ijirsha, Anjande, Fefa & Mile 2019; Ireferin & Yaaba, 2011; Kulu Mensah & Sena, 2021; Mansaray 2018; Mansaray-Pearce, 2019; and Opoku, Ibrahim, & Sare, 2018, among others). Thus, forming the basis for adapting the neo-classical approach with some modifications.

##### **3.1.1. The Neo-Classical (Cobb-Douglas)**

As widely used in the literature, this study employs the Cobb-Douglas (1928) approach where output is

generated from different combinations of labor and capital. The approach has greater advantages over some more recent complicated models, especially due to its empirical support, simplicity, steady-state analysis, convergence hypothesis, and analytical clarity (relevant studies include, Evans, Frank, & Rebecca, 2017; Mansaray 2018; and Mansaray-Pearce, 2019 and more recently, Duramany, et al, 2021 and Kulu Mensah & Sena, 2021). Thus, the factor combination of capital and labor, which was termed technological possibilities, was transformed from Solow's model which was estimated as a production function:

$$Y = F(K, L) \quad (1)$$

Where: Y = Output; K= Capital; and L=Labour

The Cobb-Douglas was estimated from Solow's model to become.

$$y = k^r l^{1-r} \quad (2)$$

Which can be rewritten as

$$y = k^r \div l^r \quad (3)$$

Where:  $r$  = elasticities

The Cobb-Douglas equation is of the view that output depends directly on labour (L) and capital (C), and the other part is accounted by A which is called the residual or technical change. The Cobb-Douglas is therefore estimated as:

$$q = AL^a c^u \quad (4)$$

Where:  $u = (1 - a)$  = elasticity

A= technical change or rate of technical progress

Since our study is on external reserve and the level of elasticity between domestic and foreign investment. Equation (3) could then be modified into:

$$exr = A. gfcf^a fdi^u \quad (5)$$

Exr would be used to proxy external reserve, gfcf would be used to proxy private domestic investment, while fdi would be used to proxy FDI, a is the elasticity. Therefore,  $u = (1 - a)$  = elasticity

The Cobb-Douglas production function is a widely used economic model that can be applied to study the relationship between external reserves and the elasticity of substitution between domestic and foreign investment in Africa. The Cobb-Douglas production function is simple yet flexible, allowing it to be easily adapted to different economic contexts. It describes how the output is produced given inputs such as capital and labor, which can be extended to include domestic and foreign investment as inputs.

### 3.2. Model Specification

The model to be estimated is:

$$exr_{it} = B_1 + B_2 fdi_{it} + B_3 gfcf_{it} + B_4 inf_{it} + U_{it} \quad (6)$$

The paper would adopt the empirical method as cited in (Bond, 2002), who claims that panel data techniques are widely used to estimate dynamic economic models to capture dynamic effects, which is the advantage over the cross-sectional data. The suggested model under the condition of the GMM estimator can be presented as follows.

$$exr_{it} = B_1 + B_2exr_{it-1} + B_3fdi_{it} + B_4gfcf_{it} + B_5inf_{it} + \sum_{h=1}^k Y_h X_{h,i,t-\tau} + V_{it} \tag{7}$$

$$exr_{it} - exr_{it-1} = B_2(exr_{it-1} - lnexr_{it\tau-2\tau}) + B_3(fdi_{it} - fdi_{it-\tau}) + B_4(gfcf_{it} - gfcf_{it-\tau}) + B_5(inf_{it} - inf_{it-\tau}) + \sum_{h=1}^k B_6 (X_{h,i,t-\tau} - X_{h,i,t-2\tau}) + (v_{it} - v_{it-\tau}) \tag{8}$$

Where B are the coefficients to be estimated, X is the vector of control variables (exr, fdi, gfc, inf), τ is the coefficient of regression and v is the two-way disturbance term.

### 3.3. Data sources

Data was sourced from the World Bank database for selected African countries, which include Ghana, Nigeria, Sierra Leone, South Africa, Rwanda, Kenya, Angola, Zambia, The Gambia, Zimbabwe, Algeria, Ethiopia, Botswana, Tanzania, and Cameroon for variables such as external reserve, FDI, gross fixed capital formation and inflation rate, ranging from 1960 to 2021. Table 1 represents the context of all the variables used in the study.

**Table 1.** Context of abbreviation.

Variables	Context	Source
Fdi	Refers to the investment made by a company or individual from one country into business interests located in Africa. This type of investment typically involves acquiring ownership or control of a business, establishing new operations or investing in physical assets such as machinery, buildings, or infrastructure.	World bank
Gfcf	Refers to the net increase in physical assets within a specific period, typically a year. This economic indicator measures the value of acquisitions of new or existing fixed assets minus disposals of fixed assets. Fixed assets include infrastructure, machinery, buildings, vehicles, and other equipment that provide long-term value and contribute to production process domestically. Proxy for private domestic investment.	World bank
Gfcf	Refers to the net increase in physical assets within a specific period, typically a year. This economic indicator measures the value of acquisitions of new or existing fixed assets minus disposals of fixed assets. Fixed assets include infrastructure, machinery, buildings, vehicles, and other equipment that provide long-term value and contribute to production process domestically. Proxy for private domestic investment.	World bank
Inf	Refers to the rate at which the general level of prices for goods and services rises, eroding purchasing power over time. It is typically measured by the Consumer Price Index (CPI) or other indices that track changes in prices of a selected basket of goods and services over a period.	World bank

## 4. Results and Discussion

This section explains the different results of the estimation test, which are the descriptive statistics, unit root test and the difference generalized methods of moments.

### 4.1. Descriptive Statistics

The table 2 below shows the different characteristics of the pooled data, that is the value of the mean, median, maximum, and minimum.

**Table 2.** Descriptive statistics.

Variable	Obs	Mean	Std. dev.	Min	Max
<i>xrv</i>	184	1.91e+10	3.68e+10	3.34e+07	2.01e+11
<i>inf</i>	193	13.60512	44.63879	-2.430968	557.2018
<i>fdi</i>	184	-1.05e+09	3.73e+09	-4.13e+10	8.75e+09
<i>gfc</i>	189	2.21e+10	2.73e+10	1.82e+08	1.46e+11

Source: authors computation

From the above table, it can be seen that *xrv* has the highest mean value of about 19100000000, followed by *gfc* which had a mean value of 22100000000. The mean value shows that *fdi* has the least mean value of -10500000000. The variable in the pooled data, with the highest standard deviation is *xrv* with a value of 36800000000, followed by *gfc* and then *fdi*. The variable with the least standard deviation is *inf*. The descriptive statistics shows that the *fdi* is the variable with the least minimum value, it has a minimum value of about -41300000000, followed by *inf* with a value of -2.4309. The variable with the highest maximum value is *xrv*, with a value of 201000000000, followed by *gfc* with a value of 146000000000, and the least maximum variable is 557.20.

#### 4.2. Fisher-type unit-root test

For unbalanced data in the panel, the fisher type unit root is a more suitable statistical test for unit root testing among the pooled data. Fisher type unit root test is a statistical test that combines the p-values from N independent unit root test. Table 3 was used to show the fishers unit root table.

**Table 3.** Fisher type unit root table.

Variable	level				first difference			
	p	z	L	pm	p	z	L	pm
<i>xrv</i>	29.05	1.43	1.69	-0.12	121.36***	-7.66***	-8.52***	11.79***
<i>inf</i>	45.09	-1.02	-1.23	1.95	140.30***	-6.86***	-9.29***	14.24***
<i>fdi</i>	103.79***	4.34***	-6.08***	9.52***				
<i>gfc</i>	28.18	1.35	1.61	-0.23	190.25***	-10.21***	-13.50***	20.69***

Source: Authors computation

The above table (table 3) shows that the pooled variable for *xrv* is not stationary at levels but were stationary at first difference at one percent level of significance. The same goes for *inf* and *gfc*, which showed to be significant at first difference. In the pooled data, only *fdi* appears to be significant at level.

#### 4.3. Difference Generalized Method of Moments

Due to the fact that the number of countries in our analysis is more than the scope of study, this necessitates the use of the difference generalized method of moments in order to help with the problem of autocorrelation and potential endogeneity. This study would base its analysis on Roodman (2009), which was the extension of a two-step GMM model. For robustness check, the one-step and two-step GMM models would be estimated, and the best GMM for the analysis would be interpreted.

The result of the DGMM is shown in Table 4; it was shown that the Arellano bond test is significant for both the one-step and two-step DGMM; this is because the AR (2) probability of all the steps are all above five per cent. The Hansen's test is a statistical test used for testing over-identifying restrictions in a statistical model, the result shows that the model is free from over-identifying. This is because the values of the Hansen probability, all through the GMM, are all significant; as the values are all greater than 0.05.



**Table 4.** DGMM for exr in Africa.

VARIABLES	(1) DGMM1	(2) DGMM1-CL-a	(3) DGMM2	(4) DGMM2-CL-a
L.dxr	0.590*** (0.0654)	1.039*** (0.150)	0.589*** (0.0646)	0.998** (0.475)
Fdi	-0.0614*** (0.0159)	-0.193*** (0.0426)	-0.0609*** (0.0163)	-0.172 (0.159)
Dgfc	-0.0604 (0.0688)	-0.187** (0.0862)	-0.0602 (0.0688)	-0.165 (0.103)
Dinf	4.546e+06 (4.883e+06)	2.217e+06 (3.977e+06)	1.691e+06 (4.562e+06)	1.212e+06 (9.305e+06)
Hansen_test	11.01	8.980	11.01	8.980
Hansen Prob	1	0.0616	1	0.0616
Sargan_test	193.1	42.26	193.1	42.26
Sargan Prob	0	1.47e-08	0	1.47e-08
AR(1)_test	-2.121	-2.121	-0.923	-0.923
AR(1)_P-value	0.0339	0.0339	0.356	0.356
AR(2)_test	-1.161	-0.875	-1.256	-1.047
AR(2)_P-value	0.245	0.382	0.209	0.295
No. of Instruments	51	8	51	8

Robust standard errors in parentheses \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

This paper would accept the one-step DGMM as the extension of Roodman (2009), as it satisfies the conditions of the Sargent test and Arellano bond test. The one-step DGMM extension of the Roodman (2009) also showed to have three significant variables. The one-step DGMM showed that foreign direct investment and gross fixed capital formation have a negative impact on exchange rate; they both showed to be significant at one per cent and five per cent, respectively. Inflation showed to have a positive impact on exchange rate in Africa but not significant. The result showed that a change in foreign direct investment in Africa would bring about a reduction of 0.19 million dollars in the exchange rate of Africa, while a change in gross fixed capital formation would bring about a reduction of 0.18 million dollars in the exchange rate of Africa. Furthermore, in order to examine the elasticity of substitution between private domestic investment and foreign direct investment appropriately, the elasticity of substitution could be expressed as;  $\frac{B_3}{B_4}$  and,  $\frac{B_4}{B_3}$ , where  $B_3$  is the elasticity of foreign direct investment and  $B_4$  is the elasticity of gross fixed capital formation. From the empirical analysis  $B_3$  is -0.193 and  $B_4$  is -0.187 and  $B_2$ , the elasticity of substitution is then expressed in a table as (table 5);

**Table 5.** Elasticity of substitution.

Variables	coefficients	level of elasticity	Remarks
Fdi/gfc	-0.193/-0.187	1.032	Elastic
Gfc/fdi	-0.187/-0.193	0.969	Inelastic

Source: authors computation

From the result in Table 5, the elasticity of substitution is used to denote the various substitution between domestic and foreign investment and vice versa in the study. From the first equation, the substitution of foreign direct investment on gross fixed capital formation in Africa is positive and elastic, which means that a greater percentage of foreign direct investment to private domestic investment would be more favourable on external reserve in Africa. With the second substitution of gross fixed capital formation on foreign direct investment appearing to be inelastic, which means the substitution would bring about a decrease on external reserve. While

that of foreign direct investment on private domestic investment is perfectly inelastic on external reserve, which means it would have a positive but little increase on external reserve in Africa. The substitution of foreign direct investment on gross fixed capital formation is elastic on external reserve this means that a change in the substitutability of foreign direct investment on private domestic investment would bring about a greater change on external reserve, which showed to be positive. While the substitution of private domestic investment on foreign direct investment is inelastic, which means that private domestic investment is a necessary investment, and a change in the substitutability would bring about a little change on external reserve.

## 5. Conclusion and Recommendation

The paper investigates the impact of the elasticity of substitution between private domestic investment and foreign direct investment on the external reserves of selected African countries. To achieve the stated objective of this study, we conduct a pre-estimation test to explain the characteristics of the variables in the model to also identify country-specific heterogeneity. Additionally, the Fisher-type unit root test was used to check the unit root of the variables in the unbalanced panel data and the use of DGMM became necessary since the number of entities exceeded the periods of the study. Subsequently, for the result of the DGMM, the one-step DGMM was appropriate for the analysis in our study and established the need for every economy to achieve increase in foreign direct investment without hurting domestic private investment. Thus, specifically, this study offers practical policy options that would ensure a sustainable increase in both foreign direct investment and domestic private investment while focusing more on the area of foreign direct investment. Meanwhile, the elasticity of substitution from foreign direct investment to domestic private investment was found to be stronger and more elastic than the contrary. The aim is to create an environment that minimizes risks, maximizes returns, and demonstrates a commitment to long-term economic growth, this involves collaboration between the government, private sector, and other stakeholders among African countries. Attracting foreign direct investment involves creating a favourable environment that reassures investors and offers them opportunities for growth and profitability. This ensures sustainable growth in the foreign reserves of the selected country, which has a multiplier impact on the overall macroeconomic goals, especially in ensuring economic stability in Africa, albeit this may have implications for the competitiveness of the country in terms of exports.

Furthermore, policy options are directed to the governments in Africa to prioritize foreign domestic investment over private domestic investment, because of its potential to bring about a long-lasting increase in external reserve of African countries. This could be achieved by making Africa conducive for investors; which would eventually attract forex, and build up the external reserves of Africa. Thus, an increase in foreign direct investment equally boosts employment for local citizens. Finally, gross fixed capital formation, which measures the net addition to fixed assets, when substituted with foreign direct investment, was inelastic on external reserve in Africa as established in this study, suggesting a lack of fixed assets in African countries. Therefore, African countries should focus also on strengthening fixed assets in order to create more revenue from additional fixed assets which would impact more on the external reserves of Africa, by attracting foreigners.

## Funding Statement

This research received no external funding.

## Acknowledgments

Acknowledgments to anonymous referees' comments and editor's effort.

## Conflict of interest

All the authors claim that the manuscript is completely original. The authors also declare no conflict of interest.

## Author contributions

Authors contributed equally

## References

- Acquah, A. M., and Ibrahim, M. (2020). Foreign direct investment, economic growth and financial sector development in Africa. *Journal of Sustainable Finance & Investment*, 10(4), 315-334. <https://doi.org/10.1080/20430795.2020.1815005>
- Adedeji, G. D., and Ahuru, R. R. (2016). Foreign direct investment and economic growth in developing countries: Panel estimation for Sub-Saharan African countries. *International Journal of Developing and Management Review*. <https://www.ajol.info/index.php/ijdmr/article/view/137826>
- Adeniyi, O., Omisakin, O., Egwaikhide, F. O., and Oyinlola, A. (2012). Foreign direct investment, economic growth and financial sector development in small open developing economies. *Economic Analysis and Policy*, 4(1), 105-127. [https://doi.org/10.1016/S0313-5926\(12\)50008-1](https://doi.org/10.1016/S0313-5926(12)50008-1)
- Ajide, K. B., and Eregha, P. B. (2014). Economic freedom and foreign direct investment in ECOWAS countries: A panel data analysis. *Applied Econometrics and International Development*, 14(2), 164-174. <https://www.semanticscholar.org/paper/ECONOMIC-FREEDOM-AND-FOREIGN-DIRECT-INVESTMENT-IN-A-Ajide-Eregha/06471c492bdb42ed15b0f9efcb713e64cb66cae9>
- Antwi, S., and Zhao, X. (2013). Impact of foreign direct investment and economic growth in Ghana: A cointegration analysis. *International Journal of Business and Social Research (IJBSR)*, 3(1), 64-74. <https://www.semanticscholar.org/paper/Impact-of-Foreign-Direct-Investment-and-Economic-in-Antwi-Zhao/76ae2957990561c7f72bf871b68947ee44691db3>
- Antwi, S., Boateng, P. Y., and Salley, A. (2021). The effect of foreign direct investment on economic growth in Ghana: The role of exchange rate volatility. *Bulletin of Applied Economics*, 8(1), 81-96. <https://doi.org/10.7595/243517>
- Antwi, S., Mills, E. A., Mills, G. A., and Zhao, X. (2013). Impact of foreign direct investment on economic growth: Empirical evidence from Ghana. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 3(1), 18-25. <https://www.semanticscholar.org/paper/Impact-of-Foreign-Direct-Investment-on-Economic-Antwi-Mills/7c0799554ab63640d0b7b74f955f2836ba2a2906>
- Anyanwu, J. C., and Yameogo, N. D. (2012). What drives foreign direct investments into West Africa? An empirical investigation. *African Development Bank*, 1-25. <https://doi.org/10.1111/1467-8268.12141>
- Ato-Mensah, S., and Long, M. (2021). Impact of FDI on economic growth, employment, and poverty reduction in Ghana. *Open Journal of Business and Management*, 9, 1291-1296. <https://doi.org/10.4236/ojbm.2021.93069>
- Awunyo-Vitor, D., and Sackey, R. A. (2018). Agricultural sector foreign direct investment and economic growth in Ghana. *Journal of Innovation and Entrepreneurship*, 1-15. <https://doi.org/10.1186/s13731-018-0094-3>
- Barrie, M. S. (2020). An empirical analysis of the determinants of real GDP growth in Sierra Leone from 1980-2018. *ZBW – Leibniz Information Centre for Economics*, Kiel, Hamburg. <https://www.semanticscholar.org/paper/An-empirical-analysis-of-the-Determinants-of-Real-Barrie/f9bc7ca893a804fc22d2748890ad01f13f1ff347>
- Bond, S. (2002). Dynamic panel data models: A guide to micro data methods and practice. *Portuguese Economic Journal*, 1(2), 141-162. <https://doi.org/10.1007/s10258-002-0009-9>
- Borensztein, E., De Gregorio, J., and Lee, J.-W. (1998). How does foreign direct investment affect economic growth? *Journal of International Economics*, 45, 115-135. [https://doi.org/10.1016/S0022-1996\(97\)00033-0](https://doi.org/10.1016/S0022-1996(97)00033-0)
- Brima, S. (2015). Macroeconomic determinants of foreign direct investment in Sierra Leone: An empirical analysis. *International Journal of Economics and Finance*, 7(3).
- Djokoto, J. G., and Dzeha, G. C. (2012). Determinants and effects of foreign direct investment in Ghana – Review of literature. *Developing Country Studies*, 2(11), 25-35. <https://www.semanticscholar.org/paper/Determinants-and-Effects-of-Foreign-Direct-in-Ghana-Djokoto-Dzeha/32420262ecd99e5397cbfdbf70da5956cb61bfa6>
- Duramany-Lakkoh, E. K., Jalloh, M. S., and Jalloh, A. (2021). Foreign direct investment and manufacturing sector in Sierra Leone: A vector auto-regression analysis approach. *Journal of Mathematical Finance*, 11, 620-650. <https://doi.org/10.4236/jmf.2021.114034>

- Enu, P., Havi, E. D., and Hagan, E. (2013). The impact of foreign trade on economic growth in Ghana (1980-2012). *International Journal of Academic Research in Economics and Management Sciences*, 2(5), 174-191. <https://hrmars.com/index.php/IJAREMS/article/view/371/The-Impact-of-Foreign-Trade-on-Economic-Growth-in-Ghana-1980-2012>
- Eregha, P. B. (2017). Exchange rate policies and FDI flow in WAMZ. *Working Paper Series N°254, African Development Bank*, Abidjan, Côte d'Ivoire.
- Faroh, A., and Shen, H. (2015). Impact of interest rates on foreign direct investment: Case study Sierra Leone economy. *International Journal of Business Management and Economic Research*, 6(1), 124-132. <https://www.semanticscholar.org/paper/Impact-of-Interest-Rates-on-Foreign-Direct-%3A-Case-Faroh-Shen/d6716cfd3615f6f7ca50aeb3467224f9ad866a87>
- Fornah, S., and Yuehua, Z. (2017). Empirical analysis on the influence of interest rates on foreign direct investment in Sierra Leone. *International Journal of Research in Business Studies and Management*, 4(12), 28-35. <https://www.semanticscholar.org/paper/Empirical-Analysis-on-the-Influence-of-Interest-on-Fornah/d5211f798dcfd0e8db96ba428db0c677ad7ff40d>
- Ganawah, M. I., and Koroma, A. B. (2022). Financial sector development and economic growth nexus: Empirical evidence from Sierra Leone. *Journal of Economics and Management Research*, 3(1), 1-12. <https://www.semanticscholar.org/paper/Financial-Sector-Development-and-Economic-Growth-Ganawah-Koroma/d039c624c8f42a157a6a6b877d81c33ec1f953f0>
- Ijirshar, V. U., Anjande, G., Fefa, J., and Mile, B. N. (2019). The growth-differential effects of domestic investment and foreign direct investment in Africa. *CBN Journal of Applied Statistics*, 1(2), 139-167. <https://www.semanticscholar.org/paper/The-Growth-Differential-Effects-of-Domestic-and-in-Ijirshar-Anjande/7c184565a99a6bd47ae7e26e51883354ba22b282>
- Irefin, D., and Yaaba, B. N. (2011). Determinants of foreign reserves in Nigeria: An autoregressive distributed lag approach. *CBN Journal of Applied Statistics*. <https://www.semanticscholar.org/paper/Determinants-of-foreign-reserves-in-Nigeria%3A-An-lag-Irefin-Yaaba/ff9e33a41743a149f924f66af46a7b5a752f3724>
- Isah, A., Tonuchi, J. E., and Dairo, R. (2022). Review of Ricardian equivalence in theory and practice: Empirical data from Nigeria. *Applied Journal of Economics, Management and Social Sciences*, 3(1). <https://doi.org/10.53790/ajmss.v3i1.24>
- Kulu, E., Mensah, S., and Sena, P. M. (2021). Effects of foreign direct investment on economic growth in Ghana: The role of institutions. *Economics Development*, 20(1), 23-34.
- Mansaray, B. B. (2018). The effect of foreign direct investment on the economic growth of Sierra Leone. *International Journal of Information Research and Review*, 5(8), 5628-5631.
- Mansaray-Pearce, S. (2019). The influential factors of foreign direct investment, and its impact on Sierra Leone's economy. *International Journal of Research in Business Studies and Management*, 6(6), 50-60.
- Muhammad, S. Y., Auwal, I., Kumo, B. A., and Fadimah, Y. (2023). Oil price and stock market nexus in Nigeria: An asymmetric cointegration based on non-linear ARDL approach. *International Journal of Research and Innovation in Social Science*, 7(11), 573-591.
- Muhammad, S. Y., Isah, A., and Kumo, A. B. (2023). Impact of international trade on economic growth: Evidence from Nigeria.
- Opoku, E. S., Ibrahim, M., and Sare, Y. A. (2018). Foreign direct investment, sectoral effects and economic growth in Africa. *Economic Research Southern Africa*, 1-27. <https://doi.org/10.1080/10168737.2019.1613440>
- Orji, A., Uche, A. S., and Ilori, E. A. (2014). Foreign capital inflows and growth: An empirical analysis of WAMZ experience. *International Journal of Economics and Financial Issues*, 4(4), 971-983.
- Roodman, D. (2009). A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics*, 71(1), 135-158. <https://doi.org/10.1111/j.1468-0084.2008.00542.x>
- Tee, E., Larbi, F., and Johnson, Rebecca. (2017). The effect of foreign direct investment (FDI) on the Ghanaian economic growth. *Journal of Business and Economic Development*, 2(5), 240-246.
- Velonjara, H. M., and Gondje-Dacka, I. (2019). Foreign direct investment and economic growth in low-income and lower middle-income economies in West Africa. *Journal of Economics and Development Studies*, 7(4), 53-61.
- Yeboah, E., and Anning, L. (2020). Investment in Ghana: An overview of FDI components and the impact on employment creation in the Ghanaian economy. *Economics, Management and Sustainability*, 5(1), 6-16. <https://doi.org/10.14254/jems.2020.5-1.1>
- Yusuf, B., Afimo, O., and Isah, A. (2022). Assessment of interest rate channel effectiveness in the transmission of monetary policy in Nigeria. *Applied Journal of Economics, Management and Social Sciences*, 3(5), 27-42. <https://doi.org/10.53790/ajmss.v3i5.63>