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Article

Evaluating the causal link between FDI inflows and domestic interest rate in Nigeria

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Abstract: Investigating the relationship between domestic interest rate and inflows from foreign direct investment (FDI) in a country is paramount for policy formulation. While a preponderance of extant literature has evaluated the impact of interest rate on the penetration of FDI owing to existing theories that support such link, studies that focus on the role of FDI inflows in influencing domestic interest rate is scanty. Dearth of studies in this area limits an understanding of the actual link between the two variables. This study therefore adds to the existing literature by verifying both theoretical and conceptual views concerning how FDI inflows and domestic interest rate are related in Nigeria. In addressing the identified gap in knowledge, the study used the vector error correction model (VECM) Granger causality with annual series which covered the period from 1981 to 2022. Finding indicates a bi-directional causality existing between domestic interest rate and FDI inflows. The paper thus concludes that much as domestic interest rate influenced FDI inflows (supporting the theoretical postulations), a reverse causality running from FDI inflows to domestic interest rate was equally revealed to exist. The study thus recommends that instead of manipulating the monetary policy instruments to attract FDI and as well handle the consequences accompanying its massive penetration, efforts should be directed at providing institutional reforms and upgrading the infrastructure in the country.

Keywords: FDI inflows; interest rate; monetary policy; VECM

1. Introduction

In recent times, the Nigerian economy has witnessed huge penetrations of foreign capital that have complemented its domestic resources. Such capital penetrations come in diverse forms which include: foreign direct investment (FDI), external debt, foreign portfolio investment (FPI), remittances, among others [1]. Among these sources of capital inflows, it should be noted that attracting FDI inflows has often been the focus of most countries; especially developing countries like Nigeria that need to improve its productive capacity. As observed by [2], FDI inflows into an economy complement the supply of funds for investment, thus encouraging capital formation. It stimulates local investment as it provides linkages in the production chain when foreign firms purchase inputs that are produced domestically by local firms. Zvezdanovic [3] observed that FDI inflows have assisted many poor countries to improve their economic growth by providing developmental projects that encourage productivity and job provision for the citizens

of the host country. From another perspective, Karau and Ng'ang'a [4] noted that FDI inflows strengthen the balance of payments position of the host country as they raise exports and in addition, lead to the transfer of technology just as they encourage new management techniques. If FDI inflows is this important to an economy, it them implies that adequate research effort has to be devoted to finding its roles in the economy.

The Nigerian economy still struggles to stand on its toes to compete favourably with its peers in terms of sustainable domestic productive capacity. Several attempts have been made to attract FDI in order to shore up the country's productive resources, yet the country still lags behind in terms of becoming self-sustaining in domestic productivity. This has encouraged massive importation, leading to exchange rate depreciation and high rate of unemployment. In examining the determinants of FDI inflows, interest rate has received so much emphasis. On the theoretical basis, the Mundell-Flemming model which was jointly developed by the duo of Robert Mundell and Marcus Fleming in the 1960s laid much emphasis on the role of domestic interest rate in attracting FDI inflows into an economy. There has been this observation the rise in a country's interest rate above the prevailing world interest rate, would position such country to attract FDI inflows. This theoretical viewpoint and others before and after it has been the basis for much of the empirical works that have examined how interest rate influences FDI inflows. Such studies tend to consider the nexus between the two variables to be one-directional, flowing from interest rate to FDI inflows. However, in recent times, some scholars such as [5] and [6] have come to the conclusion that by raising domestic money supply, FDI inflows has the tendency to lower domestic interest rate. Such emerging views, when aligned with the traditional view which holds that interest rate causes FDI inflows; implies that there is a possibility of a reverse causality running from FDI inflows to domestic interest rate. If such is the case, it has some policy implications, especially for a country like Nigeria which relies much on monetary policy measures to stabilize the macroeconomic environment.

The focus of the present paper is to evaluate the causal link between FDI inflows and domestic interest rate in Nigeria. Extant literatures in Nigeria have mainly concentrated on how domestic interest rate influences FDI inflows [7–9]. Some studies have equally focused on FDI inflows and economic growth nexus, while others aimed at examining the nexus between the official rate and domestic investment [10,11]. To the best of the knowledge of the authors, the literature has been silent on whether there is a possibility for the existence of a reverse causality running from FDI inflows to domestic interest rate in Nigeria. A focus on this area would be necessary to provide a balanced argument for the actual relationship between the two variables. Concentrating only on how interest rate influences FDI inflows implies a one-way causal link running from interest rate to FDI inflows and such could impede monetary policy implementation. This present paper therefore contributes to the literature by integrating both the theoretical propositions regarding the role of domestic interest rate in attracting FDI inflows and the conceptual views regarding the possibility of FDI inflows to influence domestic interest rate. Such approach provides a balanced argument regarding the relationship between the two

variables and as such findings could be helpful in framing up appropriate policies to move the two variables in the desired direction.

To evaluate this, the study applied the vector error correction model (VECM) form of Granger causality. The motivation for choosing Nigeria in this paper is because the country is among the highest recipients of capital inflows in Africa and the authors argue that fluctuations in FDI inflows could pose a threat to price stability which is the main monetary policy target of the monetary authorities. Thus, the main objectives of the study are to evaluate both the short-run and long-run causal link between FDI inflows and real interest rate in Nigeria. The study is guided by the null hypothesis which states that there is an absence of a causal link between domestic interest rate and FDI inflows in either of the time horizons.

1.1. Stylized facts

Figure 1 indicates that as FDI inflows trended upward, real interest rate trended downward and vice-versa. For instance, from 1990 to 2005 when real interest rate was high, FDI inflows was low. It was only in 2007 through 2009 when the two variables moved in similar direction, but from 2010 to 2012 when FDI inflows was high, real interest rate was low. From 2013 through the entire study period, real interest rate was high while FDI inflows trended low. Worthy of note is that FDI inflows attained its peak in 2009 and 2011, respectively. However, after 2011 it continued to trend downward. The message that the information on **Figure 1** is passing is that the relationship between domestic interest rate and FDI inflows is negative, thus implying that FDI inflows; just like every other components of capital inflows, improves the liquidity position of the country which ends up lowering domestic interest rate. On the other hand, the periods from 2007 through 2009 present an abnormal case compared to other periods as both inflows from FDI and interest rate moved in similar direction. The study contends that booming capital market within this period with its accompanying high domestic interest rate attracted much capital inflows into the economy until the bubble got busted on the back of the financial recession that ensued later. It is noticed that from 2010 interest rate began to trend downwards while the fall in FDI inflows began in 2012.

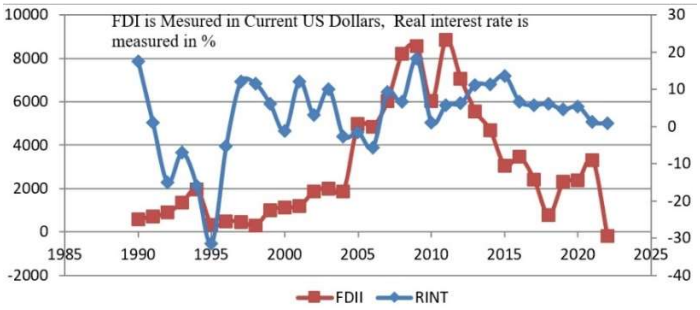

Figure 1. Movement in FDI and real interest rate.

Source: WDI (2022).
Note: FDII—foreign direct investment inflows, RINT—real interest rate.

Figure 2 shows the nexus among real interest rate, FDI inflows and exchange rate. As has been noted earlier, if there is an increase in the prevailing interest rate in an economy, such development encourages foreign investors to push more

investments into the economy. However, low domestic interest rate could have an adverse effect on the penetration of FDI. The transmission mechanism through which this takes place is the exchange rate. Rising domestic interest rate encourages an appreciation of a country's local currency which could attract FDI into such economy. This possibility is shown in the direction of the arrow in **Figure 2**. From another perspective, a low domestic interest rate would lead to the depreciation of domestic currency which may retard FDI inflows as shown the direction of the arrow.

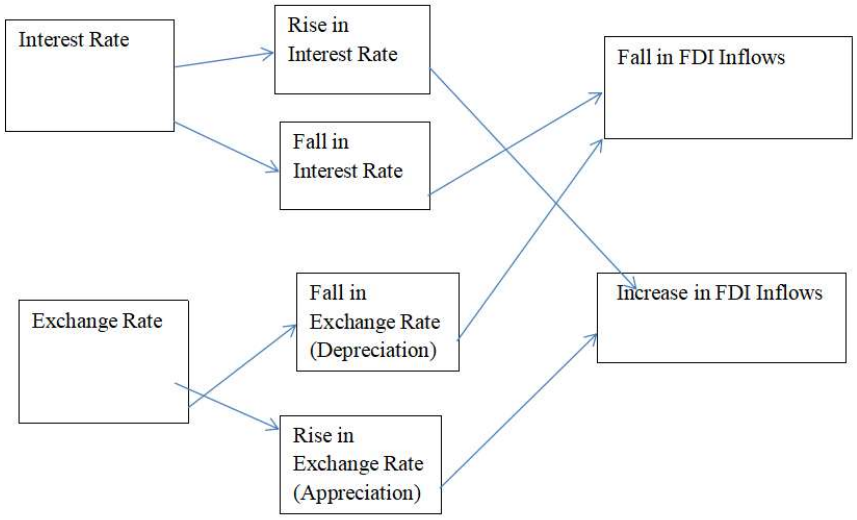

Figure 2. Nexus among FDI inflows, real exchange rate and real interest rate.
Source: Modified from [12].

2. Literature review

2.1. Conceptual issues

The term foreign direct investment has received various conceptual definitions [13]. Views FDI to represent investment made by a country's residents in a foreign company over which foreign owners exercise effective control. FDI is also defined as an investment made by multinational corporations in oversea countries with the aim of having control over the assets and as well manages the production activities in those countries. This definition finds support in the view of [14] who noted that FDI takes place through the establishment of a business operation in in another country by way of forming a joint venture in the host economy. It also involves building a new wholly-owned affiliate or the acquisition of a local company. In another vein, Devereux and Yetman [15] observed that two types of FDI have been identified in theory, namely: horizontal (market-seeking) and vertical. While horizontal FDI refers to the establishment of identical plants in foreign locations in order to supply certain goods in a foreign country, the aim of vertical FDI is to search for the lowest possible cost of production overseas. Apere and Akarara [11] defined FDI as the investment behaviour in which the country investing channels capital for production and operation in the host country in order to own part of management rights. In the opinion of [12], FDI generally could be in the form of acquisition, joint ventures,

green-field investment and reinvested company earnings. Ragazzi [13] included other forms of FDI such as licensing, franchising and turnkey agreements.

In another vein, the relevance of interest rate to monetary policy setting has spurred interests in providing conceptual meaning to it. Keynes [14] earlier defined interest rates as the cost associated with borrowing capital over a specified period of time. Interest rate plays vital role as an indicator of future inflationary trend as well as any anticipated change in a country's purchasing power of money. In a similar vein, Devereux and Yetman [15] defined interest rates as the price which a borrower pays for using money or capital that he does not own. Normally, interest rates are predetermined by the interplay of demand and supply function of capital. Apart from this, interest rates in an economy are determined by the actions of the monetary authorities of a country. Cuthbertson [16] observed that interest rates operate in a similar way like other prices by acting as market clearing mechanism and the rationing of the amount of available credit. Kasemo [17] was of the opinion that interest rates are determined in the debt markets or credit markets just the same way the stock prices are determined. Interest rate could be nominal or real. Nominal interest rate is the actual price which borrowers pay to lenders without putting into consideration, other economic factors. However, real interest rate considers the impact of the price level or inflation which is attuned to reality and thus justifies its adoption in this present paper.

2.2. Theoretical issues

Some theoretical issues concerning the factors that determine capital inflows have been emphasized in literature. The Mundell-Flemming model which was jointly introduced by Robert Mundell and Marcus Fleming in the 1960s contended that the prevailing interest rate in an economy is influenced by the world interest rate. Thus, in any country where the domestic interest rate is higher than the world interest rate, such country has the opportunity to experience an increase in capital inflows into its domestic economy. Such inflows will persist till the country's interest rate equates the international rate. On the other hand, if domestic interest rate declines, such will lead to outflow of capital from the domestic economy which will persist until the domestic rate aligns with the international rate. From another perspective, the monopolistic advantage theory was developed by [18] as an extension of the work of [19]. The theory was based on the premise that firms which operate in foreign countries are faced with competition with host countries' firms that already have existing advantages with respect to language, consumer preferences, legal systems and culture. In order to penetrate the host country, these constraints must be dismantled through the acquisition of some form of market power to enable firms make profits. Lall [20] observed that the source of market power can only be through conditions of imperfect competition. Market power can be acquired through the possession of patent-protected products, economies of scale, superior technology, management skills, brand names and cheaper sources of finance.

Buckley and Casson [21] explained what happens when the external market condition facing the multinational corporations (MNCs) fails to yield efficient environment that can necessitate profit through the use of brand name, technological

know-how and production processes. Under this condition, the firm may wish to create internal market through investing in numerous countries and hence create the needed market to achieve its aims. Buckley and Casson [21] came up with a different notion of FDI which lays emphasis on inputs and technology at the intermediate level. Thus, in the discussion of the determinants of inflows, there was a shift of emphasis on international investment theory away from country-specific. If a firm engages in research and development and thus develops new technology, it could be difficult for the firm to engage in technological transfer to other firms that use unrelated technology because the transaction costs may be too expensive for them. In the face of this limitation, a firm may decide to internalize through the adoption of forward and backward integration. This could mean that a subsidiary's output can serve as production input of another or that other subsidiaries may use the technology developed by another subsidiary.

2.3. Review of empirical literature

Studies across different countries have examined how FDI inflows is linked to interest rate with varying results. In Zimbabwe, Anna et al. [22] indicated that interest rates had no significant impact on FDI inflows. However, a cross-country study involving five Association of South East Asian Nations (ASEAN-5) comprising Indonesia, Malaysia, Philippine, Singapore and Thailand by [23] revealed that interest rates exerted an adverse effect on FDI inflows in Thailand, Indonesia and Malaysia. In Sierra Leone, Faroh and Shen [24] showed that interest rate had no significant influence on FDI inflows. This contrasted with a finding in India by [25] which indicated that interest rate impacted FDI inflows significantly. Equally in Sierra Leone, Fornah and Yuehua [26] indicated that interest rate failed to exert a significant influence on the penetration of FDI and this corroborates the finding by [24]. In Pakistan, Ditta and Hassan [27] showed that both interest rate and exchange rate impacted positively and significantly on FDI inflows. However, findings by [28] showed that a negative and insignificant link exists between interest rate and FDI inflows.

A study in China by [29] found that real interest rate led to higher FDI inflows, while findings by [4] in Kenya revealed that interest rates had positive link with FDI inflows. In Ghana, Kombui and Kotey [30] indicated that interest rate Granger caused FDI inflows. In Nigeria, finding by [7] revealed that differences in interest rate exerted non-significant influence on the penetration of FDI. However, while [8] showed that interest rate impacted positively on FDI inflows in the short-run, the long-run result indicates that its impact is negative. Another study in Nigeria by [9] indicated that interest rate impacted negatively on FDI inflows even though the outcome is not significant

A study focusing on Iraq by [31] showed that FDI inflows was influenced positively by interest rate, while a study involving Brazil, China, Turkey and Poland by [32] revealed that a policy which reduced interest rate before and during COVID-19 led to rising FDI inflows, while a policy that raised it after the pandemic constrained FDI inflows. A study in sub-Sahara African countries by [12] showed that a fall in interest rate attracted FDI inflows in the short-run, but the fall resulted

in the decline of FDI inflows in the long-run. In Switzerland and Sweden, [33] found that negative interest rates did not have effect on the penetration of FDI in the both economies. In Bangladesh, Morshed and Hossain [34] did not find any causal relationship between FDI inflows and interest rate but a study in Nigeria by [35] indicated that in the short-run, domestic interest rate was impacted negatively by FDI inflows even though the impact was not significant. A study on emerging markets and developing economies by [36] indicated FDI inflows was adversely influenced by real interest rate.

3. Methodology

3.1. Data and sources

The present paper employed yearly data covering 1981–2022 to evaluate the nature of causal relationship that exists between FDI inflows and interest rate in Nigeria. For the sake of normalization and to ease interpretation, FDI inflows, real exchange rate, oil revenue and broad money supply are in log form. Included variables are shown in **Table 1** in addition to their sources and measurement.

Table 1. Variable sources and measurement.

Variables	Definition	Measurements	Source
RINTR	Real interest rate	Measured in percentage	WDI (2022)
FDII	Foreign direct investment inflows	Measured in current US Dollars	WDI (2022)
REXCHR	Real effective exchange rate	Exchange rate of naira to US Dollars measured in 2010 base year	WDI (2022)
CRPRV	Credit to the private sector	Measured as a percentage of GDP	WDI (2022)
OILR	Oil revenue	Measured in Billions of Naira	CBN Bulletin (2021)
CPI	Consumer price index	Measured using 2010 as the base year	WDI (2022)
M2	Broad money supply	Measured in current local currency unit	WDI (2022)

3.2. Model specification

In order to test for the causality between domestic interest rate and FDI inflows, this present paper used the vector error correction model (VECM) which is suitable when the series are stationary at first difference and are cointegrated. While causality in short-run is evaluated under the Wald test, causality in the long-run is evaluated by examining the sign and significance of the error correction model's coefficient in each equation. The VECM representation of a standard VAR is specified as follows:

$$\Delta\gamma_t = \omega + \sum_{i=1}^{n} \sigma_i \gamma_{t-1} + \pi ECM_{t-1} + \varepsilon_t \quad (1)$$

where,

Δ = differencing operator, $^{\Delta}\gamma_t = \gamma_t - \gamma_{t-1}$, $\gamma_t = (nx1)$ column vector of the endogenous variables, $\varphi = (nx1)$ vector of constant, $\sigma = (3x3)$ coefficient matrices, $\pi = (3x1)$ vector of coefficients for each of the error correction terms.

The VECM Granger is thus specified as follows:

$$\Delta RINTR_t = \psi_0 + \sum_{i-1}^{p} \psi_1 \Delta RINTR_{t-1} + \sum_{t=1}^{p} \psi_2 \Delta LFDII_{t-1} + \sum_{t=1}^{p} \psi_3 \Delta LREXCHR_{t-1} + \sum_{t=1}^{P} \psi_4 \Delta CRPRV_{t-1} + \sum_{t=1}^{p} \psi_5 \Delta LOILR_{t-1} + \sum_{t=1}^{p} \psi_6 \Delta CPI_{t-1} . + \sum_{t=1}^{p} \psi_7 \Delta LM2_{t-1} + \psi_8 ECT_t + \varepsilon_t \quad (2)$$

$$\Delta LFDII_t = \gamma_0 + \sum_{t=1}^{p} \gamma_1 \Delta LFDII_{t-1} + \sum_{i-1}^{p} \gamma_2 \Delta RINTR_{t-1} + \sum_{t=1}^{p} \gamma_3 \Delta LREXCHR_{t-1} + \sum_{t=1}^{P} \gamma_4 \Delta CRPRV_{t-1} + \sum_{t=1}^{p} \gamma_5 \Delta LOILR_{t-1} + \sum_{t=1}^{p} \gamma_6 \Delta CPI_{t-1} . + \sum_{t=1}^{p} \gamma_7 \Delta LM2_{t-1} + \gamma_8 ECT_t + \varepsilon_t \quad (3)$$

$$\Delta LREXCHR_t = \lambda_0 + \sum_{t=1}^{p} \lambda_1 \Delta LREXCHR_{t-1} + \sum_{t=1}^{p} \lambda_2 \Delta LFDII_{t-1} + \sum_{i-1}^{p} \lambda_3 \Delta RINTR_{t-1} + \sum_{t=1}^{P} \lambda_4 \Delta CRPRV_{t-1} + \sum_{t=1}^{p} \lambda_5 \Delta LOILR_{t-1} + \sum_{t=1}^{p} \lambda_6 \Delta CPI_{t-1} . + \sum_{t=1}^{p} \lambda_7 \Delta LM2_{t-1} + \lambda_8 ECT_t + \varepsilon_t \quad (4)$$

$$\Delta CRPRV_t = \pi_0 + \sum_{t=1}^{P} \pi_1 \Delta CRPRV_{t-1} + \sum_{t=1}^{p} \pi_2 \Delta LREXCHR_{t-1} + \sum_{t=1}^{p} \pi_3 \Delta LFDII_{t-1} + \sum_{i-1}^{p} \pi_4 \Delta RINTR_{t-1} + \sum_{t=1}^{p} \pi_5 \Delta LOILR_{t-1} + \sum_{t=1}^{p} \pi_6 \Delta CPI_{t-1} . + \sum_{t=1}^{p} \pi_7 \Delta LM2_{t-1} + \pi_8 ECT_t + \varepsilon_t \quad (5)$$

$$\Delta LOILR_t = \xi_0 + \sum_{t=1}^{p} \xi_1 \Delta LOILR_{t-1} + \sum_{t=1}^{P} \xi_2 \Delta\, CRPRV_{t-1} + \sum_{t=1}^{p} \xi_3 \Delta LREXCHR_{t-1} + \sum_{t=1}^{p} \xi_4 \Delta\, LFDII_{t-1} + \sum_{i-1}^{p} \xi_5\, \Delta RINTR_{t-1} + \sum_{t=1}^{p} \xi_6 \Delta CPI_{t-1}\,. + \sum_{t=1}^{p} \xi_7 \Delta LM2_{t-1} + \xi_8 ECT_t + \varepsilon_t \quad (6)$$

$$\Delta CPI_t = \delta_0 + \sum_{t=1}^{p} \delta_1 \Delta CPI_{t-1} + \sum_{t=1}^{p} \delta_2 \Delta LOILR_{t-1} + \sum_{t=1}^{P} \delta_3 \Delta\, CRPRV_{t-1} + \sum_{t=1}^{p} \delta_4\, \Delta LREXCHR_{t-1} + \sum_{t=1}^{p} \delta_5 \Delta\, LFDII_{t-1} + \sum_{i-1}^{p} \delta_6\, \Delta RINTR_{t-1} + \sum_{t=1}^{p} \eta_7 \Delta LM2_{t-1} + \delta_8 ECT_t + \varepsilon_t \quad (7)$$

$$\Delta LM2_t = \eta_0 + \sum_{t=1}^{p} \eta_1 \Delta LM2_{t-1} + \sum_{t=1}^{p} \eta_2 \Delta CPI_{t-1} + \sum_{t=1}^{p} \eta_3 \Delta LOILR_{t-1} + \sum_{t=1}^{P} \eta_4 \Delta\, CRPRV_{t-1} + \sum_{t=1}^{p} \eta_5\, \Delta LREXCHR_{t-1} + \sum_{t=1}^{p} \eta_6\, \Delta LFDII_{t-1} + \sum_{i-1}^{p} \pi_7\, \Delta RINTR_{t-1} + \pi_8 ECT_t + \varepsilon_t \quad (8)$$

where: *RINTR*= real interest rate, *LFDII* = log of foreign direct investment inflows, *LEXCHR* = log of real exchange rate, *CRPRV*= credit to the private sector, *LOILR*= log of oil revenue, *CPI* = consumer price index, *LM2* = log of broad money supply, Δ = first difference operator, *t* = trend value, *ECT* = error correction term, ε_t are the stochastic terms assumed not to be correlated with one another as well as being normally distributed with zero mean. The coefficients ψ_1 to ψ_7, γ_1 to γ_7, λ_1 to λ_7, π_1 to π_7, ξ_1 to ξ_7, δ_1 to δ_7 and η_1 to η_7 in equation 2 through equation 8 measure the short-run causality, while the coefficient of the ECT in each equation measures the long-run causality.

4. Results and discussions

Descriptive statistics is carried out to examine how the included variables behave. Results in **Table 2** show an evidence of proximity between the median and mean of every series. This reveals the symmetric nature of the series. A distribution is said to be symmetrical when the values of the variables appear at regular frequencies and usually the median, mean and mode all occur at the same point. The variable that has the highest mean (82.72) is the CPI. On the other hand, with the

mean value of 0.46, RINTR was revealed to have the lowest mean. Apart from the CPI whose standard deviation is high, other variables have relatively low standard deviation, implying that the deviations from their mean values are very small. The range of CPI was equally the highest among the variables which implies that it experienced the highest volatility compared to others within the period of study. Evidence reveals that the variable with the least range is RINTR, indicating that it exhibited the least volatility within the period. In terms of skewness, it is found that a positive skewness was found in the consumer price index and real exchange rate, while a negative skewness was found in other variables. With respect to Kurtosis, it is found that every variable is heavy-tailed as their values are positive.

Table 2. Descriptive statistics.

	RINTR	FDII	REXCHR	CRPRV	OILR	CPI	M2
Mean	0.46	8.94	2.08	30.61	2.59	82.72	11.72
Median	3.66	9.20	2.00	28.18	2.97	37.45	12.06
Maximum	18.18	9.94	2.72	46.30	3.94	421.07	13.64
Minimum	−65.85	0.00	1.69	0.00	0.00	0.48	0.00
Std. Dev.	14.08	1.49	0.25	9.85	1.19	105.56	2.18
Skewness	−2.75	−5.24	1.02	−0.37	−0.63	1.57	−3.70
Kurtosis	13.23	32.12	3.21	3.30	2.10	4.79	20.73
Jarque-Bera	236.32	1676.7	7.40	1.15	4.22	23.00	646.20
Probability	0.00	0.00	0.02	0.56	0.12	0.00	0.00
Sum	19.51	375.7	87.36	1285.7	109.01	3474.3	492.5
Sum Sq. Dev.	8133.1	91.56	2.68	3984.8	58.86	456898.7	196.4
Observations	42	42	42	42	42	42	42

In order to ascertain the degree of correlation that exists among the series, the correlation matrix test was conducted. Information in **Table 3** revealed the existence of a low positive correlation between RINTR and the rest of the series with the exception of REXCHR which has low and negative correlation. A strong and positive correlation was also found to exist between FDI inflows and M2 and between FDI inflows and CRPRV. However, the correlation between FDI inflows and CPI and REXCHR is negative and weak. It is found that while the correlation between REXCHR and other variables is negative and weak, a relatively strong correlation was found to exist between CRPRV and FDI inflows, M2 and OILR. In summary, the low correlation between RINTR and other variables is an indication of the existence of a low multicolinearity among them.

Table 3. Correlation matrix.

	RINTR	FDII	REXCHR	CRPRV	OILR	CPI	M2
RINTR	1	0.09	−0.19	0.40	0.37	0.25	0.23
FDII	0.09	1	−0.19	0.67	0.53	−0.33	0.93
REXCHR	−0.19	−0.19	1	−0.19	−0.44	−0.09	−0.21
CRPRV	0.40	0.67	−0.19	1	0.66	0.40	0.83

Table 3. (*Continued*).

	RINTR	FDII	REXCHR	CRPRV	OILR	CPI	M2
OILR	0.37	0.53	−0.44	0.66	1	0.13	0.68
CPI	0.25	−0.33	−0.09	0.40	0.13	1	−0.04
M2	0.23	0.93	−0.21	0.83	0.68	−0.04	1

Next the paper conducted a cointegration test to ascertain the order of integration of the series. A major pre-requisite in the time series analysis is that the series have to be stationary in order not to obtain spurious results. In this study, stationarity test was conducted through the frameworks of the Augmented Dickey Fuller (ADF) and the Phillip Perron (PP). Analyses are based on the null hypothesis which states that the series are not stationary (have unit root) which is evaluated at chosen level of significance. If the t-statistics is lower than the chosen level of significance, then there is every reason to accept the null, otherwise it is rejected. **Tables 4** and **5** below display the summary of results of the stationarity tests under the ADF and PP, respectively. In **Tables 4** and **5**, evidence shows that under both the ADF and PP, RINTR and CPI are stationary at level I (0). However, other series are stationary only after the first difference I (1). Thus, there is an admixture of order of integration of the variables which makes the ARDL appropriate to be used to examine the cointegrating relationship among them.

Table 4. ADF level and first difference results of stationarity.

Variable	ADF Level t-stat	ADF Level Critical value at 5%	ADF First Diff. t-stat	ADF First Diff. Critical value at 5%	Order of Integration
RINTR	−7.57	−2.93*	−10.22	−2.93*	I (0)
FDII	−1.55	−2.93	−7.14	−2.93*	I (1)
REXCHR	−2.15	−2.93	−4.29	−2.93*	I (1)
CRPRV	−1.39	−2.93	−5.23	−2.93*	I (1)
OILR	−1.66	−2.93	−6.11	−2.93*	I (1)
CPI	−3.55	−2.93*	−20.33	−2.93	I (0)
M2	−1.65	−2.93	−2.94	−2.93*	I (1)

Table 5. PP level and first difference results of stationarity.

Variable	PP Level t-stat	PP Level Critical value at 5%	PP First Diff. t-stat	PP First Diff. Critical value at 5%	Order of Integration
RINTR	−7.34	−2.93*	−25.21	−2.93*	I (0)
FDII	−1.54	−2.93	−7.14	−2.93*	I (1)
REXCHR	−2.04	−2.93	−4.29	−2.93*	I (1)
CRPRV	−1.60	−2.93	−4.24	−2.93*	I (1)
OILR	-1.67	−2.93	−6.18	−2.93*	I (1)
CPI	−3.87	−2.94*	−10.78	−2.93*	I (0)
M2	−1.96	−2.93	−3.18	−2.93*	I (1)

Next, the study went on to examine the cointegration among the series. The result of cointegration in **Table 6** indicates that the computed F-statistic is 6.70,

while the upper critical bounds I (1) at the 5% level is 3.61 which is lower than the computed F-statistic. The study thus concludes that the series are co-integrated at the chosen level of significance.

Table 6. ARDL bound tests result for model 2.

Test Statistic	**Value**	**K**
F-statistic	6.70	6
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

The Granger causality results in **Table 7** reveal that while FDI inflows Granger caused RINTR at the 10% level of significance, at the 5% level, RINTR also Granger caused FDI inflows. It thus indicates that a bi-directional link exists between the two variables. The study found that CRPRV Granger caused FDI inflows and M2 at the 10% level of significance without a feedback. It also Granger caused CPI at the 5% level of significance with no feedback. Thus, an un-directional relationship running from CRPRV to FDI inflows, M2 and CPI is revealed in the study. OILR was found to Granger cause RINTR and FDI inflows at the 10% level without a feedback. Findings equally indicate the existence of a one-way (uni-directional) causality that runs from OILR to RINTR and FDI inflows. However, at the 5% level, OILR was found to Granger cause both M2 and CRPRV without a feedback.

Table 7. Results of the causality between FDI and interest rate (Model 3).

VECM Granger Causality/Block Exogeneity Wald Tests							
Ind. Variable	Dependent Variable						
	D(RINTR)	D(LFDII)	D(LREXCHR)	D(CRPRV)	D(LOILR)	D(CPI)	D(LM2)
D(RINTR)	-	5.17(0.07) **	0.62(0.73)	3.07(0.21)	1.57(0.45)	0.63(0.72)	3.30(0.19)
D(LFDII)	5.70(0.05)*	-	1.13(0.56)	1.44(0.48)	4.23(0.12)	0.58(0.74)	0.03(0.98)
D(RLEXCHR)	1.78(0.41)	0.8(0.66)	-	1.21(0.54)	1.09(0.57)	0.46(0.79)	0.14(0.93)
D(CRPRV)	2.23(0.32)	9.22(0.009) **	1.78(0.4091)	-	2.78(0.24)	8.57(0.01) *	5.24(0.07) **
D(LOILR)	5.07(0.07) **	4.68(0.09) **		12.13(0.002) *	-	0.92(0.62)	19.15(0.00) *
D(CPI)	0.20(0.90)	1.48(0.47)	3.16(0.20)	0.33(0.84)	13.61(0.00) *	-	0.41(0.81)
D(LM2)	0.94(0.62)	1.61(0.44)	0.99(0.60)	0.72(0.69)	0.50(0.77)	4.58(0.101)	-

Note: Figures with asterisks * and ** indicate that the null hypothesis of an absence of causality is rejected at 5% and 10% level, respectively.

Table 8 shows the results of the long-run causality among the variables. Findings indicate that at the 10% level, other variables Granger caused RINTR. On the other hand, other variables Granger caused FDI inflows, M2 and CRPRV. By

implication, the long-run causality reveals a bi-directional causal relationship between RINTR and FDI inflows, thus confirming the short-run result.

Table 8. Results of long-run causality.

Variable	ECMt-1/*P*-value	Decision
ΔRINTR	−0.75/0.09**	Existence of causality
ΔLFDII	−0.03/0.01*	Existence of causality
ΔLEXCHR	0.00/0.004	No causality
ΔCRPRV	−0.09/0.06**	Existence of causality
ΔLOILR	0.01/0.01	No causality
ΔCPI	0.158/0.09	No causality
ΔLM2	−0.01/0.01*	Existence of causality

Note: Figures with asterisks * and ** indicate that the null hypothesis of an absence of causality is rejected at 5% and 10% level, respectively.

Discussion of findings

A bi-directional causal relationship is found to exit between FDI inflows and real interest rate in Nigeria. By implication as FDI inflows Granger caused RINTR, it also Granger caused FDI inflows. These results have thus corroborated both the theoretical and conceptual views raised in this study. Theoretically, the Mundell-Flemming model suggests that in any country where the domestic interest rate is high, such country has the tendency to attract capital inflows, implying that interest rate should influence FDI inflows. Also, conceptually FDI inflows has been said to raise money supply which could end up reducing real interest rate; implying that FDI inflows should cause real interest rate. In periods of rising capital inflows such as inflows occasioned by high FDI inflows, money supply is usually high; encouraging improved liquidity in the banking sector. Such situation has the tendency to result into high inflation as the increased liquidity gives banks the leverage to offer more loans to investors and other economic agents. Since inflation-targeting is a major monetary policy thrust of the monetary authorities, the Central Bank of Nigeria (CBN) usually intervenes to mitigate the inflationary impact of the inflows through, among others by raising the monetary policy rate (MPR). Such contractionary monetary policy measure often pushes domestic interest rate up because the monetary policy rate is the benchmark rate that influences other interest rates. Furthermore, exchange rate policy intervention of the monetary authorities during periods of rising FDI inflows such as buying of foreign currency often results into increase in high powered money and, hence improved liquidity in the banking sector. The reverse is the case if there is a fall in FDI inflows. Therefore, it is apposite to state that the transmission mechanism through which FDI inflows Granger cause real interest rate is through the monetary policy intervention of the CBN which seeks to reduce or increase the reserve position of the deposit money banks. In another vein, high interest rate in Nigeria is a phenomenon that has been of much concern to domestic investors. There have been calls by manufacturers for a reduction in interest rate to enable them access cheap funds, but such demands has not been able to be addressed. The reasons often given by the monetary authorities for the

continuous rise in interest is that so long as the economy keeps experiencing high inflation, it will be difficult to officially reduce interest rate. This much accounts for part of the reasons why high interest rate persists in the economy. The implication of high interest rate is that it offers foreign investors an opportunity to push more investments into the economy because with high interest rate, returns on investment is usually high and this is the major issue raised by the Mundell-Flemming hypothesis. It has been noted in several quarters that since interest rate in advanced economies is usually very low, foreign investors often seek opportunities in developing countries such as African countries where interest is relatively high. During the global financial meltdown that happened around 2008, the capital markets of several African countries including Nigeria experienced a glut in liquidity as foreign investors were attracted by the high interest rate which was a phenomenon then.

Findings in this present paper is partly supported by a study in Ghana by [30] which revealed that real interest rate Granger caused FDI inflows without a feedback. Also in Nigeria, Ezirim and Ezirim [8] revealed the existence of a one-way causal relationship that runs from real interest rate to FDI inflows. The reason for the divergent results between the present study and that of [8] could be because the two studies used different sample periods. While Ezirim and Ezirim [8] used dataset that spanned the period between 1986 and 2018, the dataset used in the present study ranged between 1981 and 2022. Also, while the present study used net inflows in current US Dollars to proxy FDI inflows, the proxy used by [8] is FDI ratio to GDP. Findings also revealed that causality runs from credit to the private sector to M2 without a feedback. This has thus revealed the sensitive nature of credit granted to the private sector in Nigeria regarding its impact on money supply. High private sector to the private sector raises money supply which stimulates domestic demand and which may give rise to price increases. It is against this backdrop that the CBN often intervenes through the implementation of contractionary monetary policy aimed at curtailing the growth in money supply. The oil sector is the main source of revenue in Nigeria such that when oil price rises, the CBN employs monetary policy instruments to reduce the monetary impact of the oil price rise. Finding in this present study has therefore confirmed the role of oil revenue in influencing real interest rate and money supply as evidence has shown that oil revenue Granger caused both variables without a feedback.

Table 9 displays the results of post-diagnostic tests. Findings prove that the VEC residual heteroskedasticity test result has a *p*-value of 0.38 that is greater than the 5% level. Thus, the study has every reason not to reject the null hypothesis that there is an absence of heteroskedasticity in the error terms. The result of the VEC residual serial correlation also indicates that with a *p*-value of 0.75 that is greater than the 5% level, there is every reason to accept the null hypothesis of no serial correlation in the variables. The normality result indicates that the Jarque-Bera test has a *p*-value of 0.37 which is greater than the 5% level of, indicating that the errors are normally distributed. The stability test in **Figure 3** indicates that some of the roots of the equation are not within unit circle which reveals that the model is not stable. The instability in the model could be attributed to many factors such as policy issues and other factors which impact on the variables as the study extended to the

periods of pre-structural adjustment programme (SAP), military regimes and civilian regimes as well as exogenous shocks arising from the global financial meltdown that occurred in 2009 and the COVID-19 pandemic.

Table 9. Results of post diagnostics.

Test	*P*-value	Null Hypothesis	Conclusion
VEC Residual Heteroskedasticity Tests	0.38	No Heteroskedasticity	Accept
VEC Residual Serial Correlation LM Tests	0.75 at lag 1	No Serial Correlation	Accept
VEC Residual Normality Tests: Jarque-Bera	0.37 at lag 1	Normally distributed	Accept

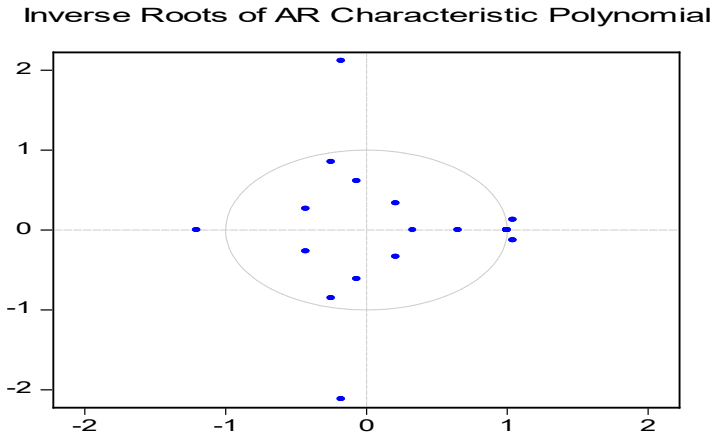

Figure 3. Test of stability.

5. Conclusion

This study was motivated by the divergent views; both theoretically and conceptually regarding the relationship that exists between FDI inflows and interest rate. While theoretically, interest rate is expected to impact on FDI inflows, some emerging opinions emphasize that FDI inflows should impact on interest rate through its impact on money supply. Findings so far have proven the existence of a one-way causal relationship between FDI inflows and real interest rate which supports both the theoretical and conceptual views. The outcome so far has confirmed that much as interest rate influences FDI inflows in Nigeria, a reverse causality running from FDI inflows to interest rate equally exists. This finding has some policy implications. First, while it is economically wise to raise domestic interest rate in order to shore up FDI, such has the tendency to raise money supply which could eventually lead to fall in interest rate. Fall in interest rate may retard the penetration of FDI but could rather encourage outflows of domestic investment that may affect the liquidity position of the economy. Second, if the rise in FDI inflows persists, the intervention of the monetary authorities to curtail its inflationary impact through increase in the policy rate may lead to further penetration of FDI inflows into the economy. This is because when the policy rate is increased, other domestic rates also rise and foreign investors may want to seize the opportunity to push more investments into the economy. The aftermath of this scenario is that another round of policy intervention may ensue which could put pressure on the monetary authorities. Third, if the continuous penetration of FDI leads to a fall in interest rate through

raising money supply, such may result into high inflation if there is no commitment on the part of the monetary authorities to intervene. However, fall in interest rate leads to lower cost of capital which helps to improve productivity in the economy. In all these scenarios, the monetary authorities are in a dilemma.

Consequently, the study recommends that other measures that enhance FDI inflows such as institutional reforms and upgrading of critical infrastructure has to be put in place instead of relying on the manipulation of the monetary policy instruments to attract FDI inflows as well as influencing them with the aim of handling the consequences of fluctuating FDI inflows. For future research, the paper suggests that a decomposition of the various types of capital inflows should be done and their individual impact on domestic interest rate should be evaluated. This is paramount as it will reveal which aspect of capital inflows has more influence on interest rate for the sake of policy simulation.

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