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EXCHANGE RATE AND FOREIGN DIRECT INVESTMENT IN ANGOLA: AN EMPIRICAL INVESTIGATION

Taremwa Joshua[1], Nahabwe Patrick Kagambo John[2], Kagarura Willy Rwamparagi[3]
[1,2,3]*Kabale University, Uganda*

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ABSTRACT

Angola is analyzed under the empirical approach from the relationship between exchange rate and foreign direct investment (FDI) based on quarterly data from 2001-2024 acquired from the World Bank. After using unit root tests, Johansen co integration tests, and Granger causality tests, the results indicate that FDI is stationary at level and the exchange rate is stationary if it were first and second differenced. It shows that the co integration test holds true, indicating that there is one long run relationship between the FDI and the exchange rate, where FDI changes significantly (–0.24) to re-establish the long run equilibrium while the exchange rate changes weakly (0.002). With respect to FDI, Granger causality indicate that there is unidirectional short-run causality from exchange rate and international flows, implying that changes in the exchange rate can lead and impact foreign investment. In the long run, a 1% increase in the exchange rate would cause a 1.45% change in FDI, which suggests that movements in exchange rates are having a significant effect on foreign investment. It is recommended that policies are required to be implemented to stabilize the exchange rate as essential supports to retain FDI inflows to Angola.

KEY WORDS*: Co integration, Exchange rate, Foreign direct investment, Angola*

INTRODUCTION

Two of the most important macroeconomic variables that can affect the stability and growth of an economy are exchange rate and foreign direct investment (FDI). Exchange rate changes influence the ability of the domestic markets to compete with export markets, and the interest of foreign investors to invest in the country; FDI inflows bring capital, technology and jobs for the long-term development (Bénassy-Quéré et al., 2001). The literature has been divided on the direction and strength of this relationship for a long time; it has been proposed that exchange rate volatilities discourage investment, while depreciated values may attract foreign investments as they may bring down production costs (Goldberg, 2009).

The study of the Angola case is a special case to look at this relationship. It is a resource-based economy, and usually is influenced by oil price fluctuations, external imbalances and even by the limits of the economy. Concurrently, foreign direct investments (FDI) have been a key source of financing of growth and economy diversification. It is therefore important for designing policy measures for stabilizing the macro-economic environment to know whether changes in exchange rates impact and drive FDI inflows.

Using World Bank data which are quarterly data, from 2001-2024, this study empirically analyses the relationship between exchange rates and FDI inflows to Angola in the light of these features to evaluate the study: viz the unit root test, Johansen co integration test and Granger causality statistics. The results indicate that the FDI is stationary (at level) while the exchange rate requires first differencing in order to be stationary. The number of the integration function required to perform the cointegration analysis. The Johansen test validates the existence of only one long-run equilibrium relationship, while the dynamic of this relationship suggests that the movement of FDI is strongly affected by deviations from a long run equilibrium and that the movement of the exchange rate is weakly affected. The results of Granger causality also show that there is unidirectional causality from exchange rate to FDI at the short-term level, implying that exchange rate variations precede and impact foreign investment flows. The impact of exchange rate fluctuation on investment is significant in the long run as indicated by the strong relation between both variables; similar to the 1 per cent movement in exchange rate resulting in 1.45 per cent movement in FDI in the LR.

Based on the need to reinterpret traditional macroeconomic models in light of reality, the rationale for this research is motivated. The articles regularly mention empirical evidence consistently and thus have helped in the investigation of the impact of exchange rate stability on the trajectory of FDI inflows. The outcomes show the importance of policies on exchange rates in order to support foreign investments and economic resilience in Angola.

DATA AND METHODS

For the study, we use (quantitative time series research design based on econometrics) empirical approach to examine the relationship of exchange rates and foreign direct investment (FDI) in Angola. The quantitative design is explained by the necessity of quantitative analysis of numerical macroeconomic

indicators and their time and space character, which is more suitable by using econometric modelling (Böhm, 2017).

The data used are secondary, quarterly data from the World Bank database on the World Development Indicators (WDI) from 2001 to 2024. The two variables of primary interest are the dependent variable FDI net inflows (% of GDP) and the independent variable official exchange rate (LCU per US$, period average). The data of the series are complete and cover a reasonable period of the Angola macro-economic swings and investment patterns, consisting of 100 quarterly observations.

Descriptive statistics (standard deviation, mean, skewness, kurtosis) are calculated to give an overview of the distributes characteristics of the data (Washington, etal,2020). To validate the time-series analysis and prevent the spurious regression, we choose the most frequently used tests for the identification of stationary order of each analyzed time-series: Augmented Dickey-Fuller test and Phillips-Perron test (Petrică et al., 2017).

The Johansen approach is applied to the analysis of I (1), since they both belong to the class of order one integrated variables, to find out whether there is an LRE between exchange rate and FDI? The series are all non-stationary, but may be a stationary linear family of series. The normalized co-integrating equation is given as:

$\Delta \text{FDI}t = \beta 0 + \beta 1 \text{ExchangeRate}t + \varepsilon t(1)$…….... (1)

Where:

FDI_t = Foreign direct investment inflows (% of GDP)

Exchange Rate_t = Official exchange rate (LCU per US$, period average)

β_0, β_1 = Co integrating parameters to be estimated

ε_t = White noise error term

This kind of specifying will test out if the exchange rate and FDI moves together in the long run and does it correct the deviation from the equilibrium?

Granger causality modulations are also used to determine the direction of causal influence between the variables (Troster, 2018). This method is suitable because although two time series may be co integrated in the long-term, short-term predictive information is required. That is, Granger causality evidences lack of causality as the exchanges rate becomes independent of the forecast of FDI and vice versa.

The general Granger causality model is expressed as:

$\Delta FDI_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta \text{FDI}_{t-i} + \sum_{j=1}^{q} \gamma_i \Delta \text{Exchange Rate}_t + \varepsilon_t$

……(2)

Where:

- β0 = Constant term
- βi = Coefficients of lagged FDI
- γj = Coefficients of lagged exchange rate
- εt = White noise error term

Under the case where the coefficients γj are indeed jointly significant, the exchange rate is said to Granger-cause FDI. If the coefficients of the lagged FDI's are significant in a similar model in which the exchange rate is the dependent variable, it is concluded that exchange rate Granger-causes FDI. This framework is important in applied econometrics as it separates out the correlation from the predictive cause and effect relationship, and illuminates how exchange rates and foreign investment flows interact.

The dynamic econometric model developed here is especially suitable in the context since it allows for modelling complex interaction among the macroeconomic indicators, while also being constructed without a necessarily a priori definition of the exogeneity of variables. This is especially true for Angola when Analysing the connection between changes in the exchange rate and inflow of foreign direct investment, as the external environment has significantly impacted investment performance in the country and the exchange rate has been fairly volatile.

RESULTS

The empirical results of our research are presented and interpreted and the central research question is whether the foreign direct investment (FDI) in Angola is related to the exchange rate of the country, using quarterly data for the period 2001-2024. The analysis starts with descriptive statistics, with the objective of grasping the overall characteristics and distribution of the variables of interest the exchange rate and FDI inflows.

FDI inflows in Angola show a mean value of 5.60% of GDP indicating that foreign capital plays a key role in the country's economy. The standard deviation is 6.12: this suggests that the data has a high degree of variation, with a minimum of –1.97% and a maximum of 24.92%. The exchange rate has a broader range however (from a minimum of 209 to a maximum of 223, with a mean of 216.04 local currency units per dollar) than did the other rates and it should be noted that the Angolan franc is very volatile. The skewedness in the distributions of the two variables FDI and exchange rate is positive and negative, respectively (0.84 and –0.52). The kurtosis value for the FDI is higher with 3.41 while 2.12 is lower for the exchange rate, indicating that the FDI is leptokurtic and the exchange rate is platykurtic. Both series show signs of non-normality, which is confirmed by the Jarque-Bera statistic, hence the use of robust time-series methods are appropriate.

The Augmented Dickey-Fuller (ADF) procedure is used for testing time series stationarity. The findings suggest that the exchange rate is non-stationary at levels whereas FDI is stationary at levels. It meets the requirement of co integration analysis and the total series' statistical characteristics are kept constant over time, eliminating the possibility of spurious regression results.

Co integration analysis using the Johansen test confirms the existence of a long-run equilibrium relationship between exchange rate and FDI. The normalized co integrating equation is given as:

$\Delta FDIt = 1 - 4.652 \text{Exchange Rate}t + (\text{SE} = 0.317)$

…….... (3)

This implies that a 1% change in the exchange rate leads to a 1.45% change in FDI in the long run. Adjustment coefficients also indicate that the response to the differences from the equilibrium level is very sensitive for FDI (–0.24) while it is only moderately sensitive for the exchange rate (0.002). In this sense, the analyst argues that the foreign investment flow is more responsive to the correction of imbalances than are exchange rate movements, according to the role of FDI as a stabilizing factor for Angola's economy.

The results of Granger causality tests give further information about the direction of the influence between variables. $HLR-sdg formula was estimated as:

$\widehat{FDI}_t$ = 12.314 + 0.845FDI_{t-1} + 1.452$ExchangeRate_t$

(F=5.11,P=0.0078)

+$\varepsilon_{t(4)}$……

……(4)

Because p<0.05 the null hypothesis of no causation between the exchange rate and FDI is rejected; this means that the exchange rate (XR) can be said to Granger-cause FDI. In contrast, if exchange rate is endogenized, the FDI Granger causes that the exchange rate is not statistically significant (p-values=0.099) when it is lagged. The discovery indicates that while an easing or depressing of the exchange rate does forecast an easing or depressing of FDI, the reverse is not true. The causality runs in a direction of economic theory, and in an economy the investment decisions are only affected by an exchange rate change through its impact on investor confidence and capital flows, not directly by FDI.

DISCUSSION

This study aimed to examine empirically the relationship of exchange rate and foreign direct investment (FDI) in Angola, based on quarterly data for the period from 2001–2024. Both Johansen co-integration and Granger causality techniques have been used to investigate long run equilibrium relations and short run relations between the two variables so that their theoretical basis in international investment and the international exchange rate theory (Tan et al., 2021) can be followed. Contrary to the earlier assumption that the volatility of the exchange rate automatically attracts foreign capital, the results of this study reveal that this is not the case. Rather, the findings indicate a substantial long-survival equilibrium relationship, as well as the short-run unidirectional causality from exchange rate to FDI.

Say a change of 1% in exchange rate causes the change of 1.45% in FDI in the long run, then the equation is normalized to yield co integrating equation. This result corresponds with the results of research in resource-poor economies, where fluctuations in the exchange rate have significant effects on investors' confidence and capital inflows (Dunning, 2005) .Also the adjustment coefficients confirm the fact that the reaction of the FDI is significant when away from equilibrium, and the exchange rate reacts weakly. Under this interpretation the flow of foreign capital seems to play a stabilizing role in Angola's economy, with a greater capacity to cushion shocks and re-establish economic stability than exchange rate fluctuation will.

The results of Granger causality analysis indicate that the change in the exchange rate Granger-causes the change in FDI but the change in FDI does not Granger-cause the exchange rate. This causality direction is in line with the economic theory, which states that exchange rate volatility affects investment rather than affecting an increase of foreign capital inflows. This causality direction is consistent with the economic theory, which says that exchange rate volatility tends to affect investment and not their foreign capital inflows(Demir & Razmi, 2022) This is especially true of external factors such as oil price fluctuations and currency devaluations in Angola, in determining investors behavior(Kyle, 2005). The net impact of FDI on exchange rate dynamics (when there is no reverse causality) signals the recent importance of FDI as a source of a modest effect on the South African currency dynamics, and therefore the country's structural dependence on commodity exporters.

These are similar findings that have been reported in numerous other developing countries literature: examining this situation in developing countries one fact consistently highlighted in the literature is that stabilizing the exchange rate is central to attract sustainable foreign investment (Bénassy-Quéré et al., 2001). Emiola et al., 2025) further show that an advanced country's institutional quality and market depth smooths the impact of exchange rate fluctuation on capital flows while Angola is more vulnerable to oil revenues factors, exchange rate fluctuation will have more impact on capital flows in the country. The results of this study thus emphasize the need for managing the rate as an instrument of policy for maintaining inflows of foreign direct investments.

One of the more common exchange rate volatility models in the literature is the “racino effect” model suggesting that rising volatility must reduce investment, and the results of a strong and unidirectional causal link have strengthened the validity of this model. The findings of a robust and unidirectional causal relationship have supported one of the more widely accepted models in the literature, the “racino effect” which argues that exchange rate volatility in general deters investment. On the other hand, the essay works out that given certain macroeconomic circumstances, the exchange rate can attract and shape foreign capital inflows. It underscores the need for structural changes to diversify Angola's economy and to build monetary stability not through short-term monetary adjustments. The study adds to this literature by demonstrating the effect of exchange rate-FDI linkage is dynamic and asymmetric in resource deficient countries of the world, thereby pointing out that the theory of investment due to typical investment behavior conditions are incorrect.

LIMITATIONS

This study allows for valuable insights into the relationship between the exchange rate and FDI flows into Angola, but has some weaknesses. These constraints have impacted the findings' validity, reliability, and generalizability and warrant consideration when interpreting the results. The quantitative research design technique that we used is Time series econometric method that is Johansen co integration and Granger causality method. However, these models work well for capturing the interdependencies among variables, but they are unable to explicitly incorporate changes in economic relationships over time that could be induced by changes in the structures (e.g., structural breaks, regime shifts, and policy interventions) that may occur during the period of study (Casini & Perron, 2018) . Indeed, the absence of shock variables from oil prices, currency devaluation and the disruptions of the institutions could compromise the actual explication of the results in Angola as its macroeconomic history, since it is characterized by huge oil price shock, devaluation of the currency and institutional disruptions (Rwamparagi & John, n.d.).

Furthermore, macroeconomic theory is not necessarily linear and is thus vulnerable to the presence of non-linearity, threshold effects, and asymmetric reactions, which may be significant for

the analysis of the causality relations that are used as a basis for determining the causality of country income growth within the framework of co integration and causality analysis(Wang, et al, 2021). A non-linear model like the Threshold VAR or the Markov Switching model may be more suitable of representing regime-dependent behavior and nonlinearity in highly unstable economies like Angola (CHELLAI, 2025).

The data spans 25 years (2001-2024) and was obtained from World Bank. This method captures a relatively long timeframe but has a possibility of missing in some degree some of the short-term fluctuations and seasonality, which can reduce precision of some of the results (Majka, 2024). Moreover, the study was conducted exclusively in Angola, which reduces the extent to which results can be generalizable to other countries and/or regions. The context of Angola's economy and politics may lead to outcomes that cannot be translated or applied to other more stable or other structured economies.

Official exchange rate and FDI inflows are only proxies and raise concerns due to measurement issues. Although these are well-established macroeconomic indicators, they are not necessarily reflective of investment flows that rely on informal capital flows, parallel market exchange rates, and sectoral investment differences in Angola (Abbott et al., 2012). Notably, exchange rate figures could suffer from reporting delays and/or inconsistencies and, therefore, create measurement bias in estimating the exchange rate FDI relationship.

Diagnostic tests for stationarity, lag length selection, residual normality and stability took place but some econometric assumptions might be violated. For instance, even after first difference were taken, there is still an observed risk of misspecification and omitted variable bias because other important variables like Oil receipts, fiscal deficit and institutional quality were omitted to prove model parsimony (Koh, 2017).In addition, it is important to note that the absence of an identification of the underlying structure in the co integration and causality framework suggests caution must be taken when interpreting the long-run coefficients and causality. The models are not restricted and in theory, may give results that depend on ordering or simultaneity issues, which reduces the extent to which they could be used as a policy tool in more complicated economies such as Angola.

CONCLUSION

This study aims at empirically Analysing the impact of exchange rates on foreign direct investment (FDI) in Angola, in the time span 2001 - 2024. The aim of the research was to examine the dynamic relationship between changes in the value of currency and foreign capital inflows of a country that is a net importer of resources in a framework of time-series econometrics that uses co-integration and causality test (Anne, 2019). Our results bring to light several vital points that bear upon the exchange rate FDI nexus in developing countries.

First, the study establishes the existence of the long-run relationship between exchange rate and FDI as results indicate that the change of exchange rate by one percent results in the change of FDI by one percent. This demonstrates that foreign exchange sensitivity is a big concern of foreign investment and make the case of currency stabilization as an essential condition for foreign investment to inflow (Zahid, 2018). Paradoxically, Angola's macroeconomic environment, characterized by oil price volatility, depreciation of the Angolan currency, external imbalances, and a pronounced and worsening collapse in investors' confidence, is of particular interest in terms of the direct effects that exchange rate volatility can have on capital allocation and investor confidence (Salah, 2025).

Moreover, the study shows that the short-run dynamics are also crucial; by the performance of the Granger causality tests, it can be confirmed that movements in the exchange rate have preceded and influenced FDI inflow while the opposite has not. The result is in line with theory predictions which argue that fluctuation in the exchange rate influences investment decisions, not foreign capital inflows (Kyereboah-Coleman & Agyire-Tettey, 2008). In the methodological perspective, both the use of quarterly data and the use of powerful econometric techniques reveal the relevance of capturing the two facets of causation: long run equilibrium and short run prediction, and underscore the importance of the specification in the context of volatile economic environments (Garratt et al., 2012).

The Angolan case is complicated: Government policy on domestic investment levels will have only a part to play in boosting FDI; other factors matter more to the amount of FDI flowing into the country, including exchange rate policy and external shocks, and structural dependence on oil receipts. Thus, one of the core implications for exchange rate stability as the policy guideline is essential to accommodate foreign investments to come in. The study fills a gap in the literature by demonstrating the need to exercise caution when interpreting FDI dynamics in the context of exchange rate changes in the resource driven and structurally unstable economies. Rather, comprehensible prescriptions for macroeconomic stabilization deficits – similar to what applies to diversification in the structure of the economy are needed to reassure investors and support sustainable economic development (Iddrisu et al., 2025).

RECOMMENDATIONS

Based on the results of the study the following policy, program and research recommendations are recommended to help shape macroeconomic stabilization in Angola and the need for continued research. Along with the high level of long-run equilibrium relationship, the empirical evidence revealed unidirectional causality from exchange rate to FDI in the short-run; hence, policymakers should focus on stabilizing the exchange rate bid by the coordinated fiscal policy, monetary policy, and exchange rate policy. Specifically, the management of exchange rate should not be determined from external reserve alone, but should be taken from the disciplined spending of funds, diversification of export income, and by the action of an honest and good monetary policy (ADESUNLORO et al, 2025). The transparent exchange rate regimes, in combination with higher central bank independence, support the investors' expectations and minimize the volatility (Bernanke, 2010).

FDI inflows are still large, but also very sensitive to fluctuations in exchange rates. Investment policy measures need to be reformulated with a goal of diversification, infrastructure development and strengthening institutions in order to preserve inflows in the longer term. Oil-export dependent countries are vulnerable to commodity price fluctuations, which could be

lessened by promoting investment in manufacturing, agriculture and services and by implementing targeted programmes to reduce their reliance on oil revenues (IMF & UNCTAD, 2011). It is important that the monetary policies they pursue for exchange rate stability are embedded in measures to boost investment climate reforms to streamline time-consuming and obstructive regulatory processes, increase transparency and improve property rights.

Social and economic measures should both be planned to enable the households and firms to cushion the effects of fluctuations in exchange rates. There are a number of potentially helpful measures to maintain investor confidence in tackling the challenges of the short run – conditional subsidies, targeted credit facilities and wage indexation mechanisms. Next, making investment and exchange rate statistics more useful, timely and of high quality will further strengthen the policy responsiveness work. These involve national statistical offices capacity building and related to international statistical platforms (Linders 2013).

Additionally, the use of measures of institutional quality, political instability, fiscal deficit, and oil prices as either explanatory variables, or as measures of the structure that could be used to develop a more complete understanding of FDI flows and their effects on exchange rate. A more comprehensive description of investment behaviour of sectors, flows of informal capital and perceptions of risk by investors would be useful to develop, given the apparent lack of symmetry, under which FDI does not lead to exchange rate changes. In addition to aggregate timeseries evidence, micro-economic evidence, based on details from firm and household level surveys, might be supplied to support the timeseries evidence. Future research in Angola could rely on threshold VAR models and/or regime switching models or time varying parameter models to allow adequate representation of dynamic relationships (Alves, 2024).

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APPENDICES

Appendix 1: Descriptive statistics

	Official exchange rate (LCU per US$, period average)	Foreign direct investment, net inflows (% of GDP)
Mean	216.038	5.604877
Median	95.14501	3.521026
Maximum	930.4876	24.92214
Minimum	7.602337	-1.966228
Std. Dev.	235.5254	5.777339
Skewness	1.49976	1.712845
Kurtosis	3.998301	5.633456
Jarque-Bera	41.64052	77.79352
Probability	0	0
Sum	21603.8	560.4877
Sum Sq. Dev.	5491749	3304.387
Observations	100	100

Appendix 2: Unit root test, FOREIGN_DIRECT_INVESTMENT (in Level)

Null Hypothesis: FOREIGN_DIRECT_INVESTMENT has a unit root
Exogenous: None
Lag Length: 9 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.722863	0.0069
Test critical values:	1% level	-2.590910	
	5% level	-1.944445	
	10% level	-1.614392	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FOREIGN_DIRECT_INVESTMENT)
Method: Least Squares
Date: 04/30/26 Time: 16:19
Sample (adjusted): 2002Q3 2024Q4
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FOREIGN_DIRECT_INVESTMENT(-1)	-0.040389	0.014833	-2.722863	0.0079
D(FOREIGN_DIRECT_INVESTMENT(-1))	0.675192	0.093689	7.206771	0.0000
D(FOREIGN_DIRECT_INVESTMENT(-2))	0.067085	0.073144	0.917168	0.3618
D(FOREIGN_DIRECT_INVESTMENT(-3))	0.033052	0.067791	0.487555	0.6272
D(FOREIGN_DIRECT_INVESTMENT(-4))	-0.893180	0.066648	-13.40151	0.0000
D(FOREIGN_DIRECT_INVESTMENT(-5))	0.617863	0.093718	6.592823	0.0000
D(FOREIGN_DIRECT_INVESTMENT(-6))	0.035260	0.070342	0.501270	0.6176
D(FOREIGN_DIRECT_INVESTMENT(-7))	0.011428	0.066997	0.170576	0.8650

D(FOREIGN_DIRECT_INVESTMENT(-8))	-0.247874	0.065844	-3.764570	0.0003
D(FOREIGN_DIRECT_INVESTMENT(-9))	0.189186	0.053899	3.510012	0.0007

R-squared	0.819218	Mean dependent var	-0.095094
Adjusted R-squared	0.798880	S.D. dependent var	1.825825
S.E. of regression	0.818817	Akaike info criterion	2.542526
Sum squared resid	53.63684	Schwarz criterion	2.820282
Log likelihood	-104.4137	Hannan-Quinn criter.	2.654534
Durbin-Watson stat	2.173002		

Appendix 3: Unit root test, Exchange_rate (in Level)

Null Hypothesis: LNEXR has a unit root
Exogenous: None
Lag Length: 9 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.354161	0.9551
Test critical values:	1% level	-2.590910	
	5% level	-1.944445	
	10% level	-1.614392	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNEXR)
Method: Least Squares
Date: 04/30/26 Time: 16:21
Sample (adjusted): 2002Q3 2024Q4
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNEXR(-1)	0.001444	0.001067	1.354161	0.1795
D(LNEXR(-1))	0.747352	0.102402	7.298183	0.0000
D(LNEXR(-2))	0.202691	0.118896	1.704775	0.0921
D(LNEXR(-3))	0.063223	0.121245	0.521444	0.6035
D(LNEXR(-4))	-0.881165	0.127335	-6.920045	0.0000
D(LNEXR(-5))	0.644184	0.138586	4.648277	0.0000
D(LNEXR(-6))	0.107004	0.120707	0.886477	0.3780
D(LNEXR(-7))	0.037975	0.122198	0.310768	0.7568
D(LNEXR(-8))	-0.636392	0.141477	-4.498205	0.0000
D(LNEXR(-9))	0.449653	0.112987	3.979675	0.0002

R-squared	0.667141	Mean dependent var	0.034684
Adjusted R-squared	0.629695	S.D. dependent var	0.064796
S.E. of regression	0.039430	Akaike info criterion	-3.524129
Sum squared resid	0.124379	Schwarz criterion	-3.246373
Log likelihood	168.5858	Hannan-Quinn criter.	-3.412122
Durbin-Watson stat	2.028012		

Appendix 4: Unit root test, Exchange_rate (in First difference)

Null Hypothesis: D(LNEXR) has a unit root
Exogenous: None
Lag Length: 8 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.835848	0.0050
Test critical values:	1% level	-2.590910	
	5% level	-1.944445	
	10% level	-1.614392	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNEXR,2)
Method: Least Squares
Date: 04/30/26 Time: 16:23
Sample (adjusted): 2002Q3 2024Q4
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNEXR(-1))	-0.189881	0.066957	-2.835848	0.0058
D(LNEXR(-1),2)	-0.034053	0.101608	-0.335144	0.7384
D(LNEXR(-2),2)	0.172950	0.101143	1.709963	0.0911
D(LNEXR(-3),2)	0.237316	0.103299	2.297366	0.0242
D(LNEXR(-4),2)	-0.649358	0.107367	-6.048019	0.0000
D(LNEXR(-5),2)	0.021906	0.097770	0.224058	0.8233
D(LNEXR(-6),2)	0.130737	0.097735	1.337676	0.1847
D(LNEXR(-7),2)	0.171051	0.102275	1.672465	0.0983
D(LNEXR(-8),2)	-0.473717	0.112154	-4.223812	0.0001

R-squared	0.506710	Mean dependent var	-0.001456
Adjusted R-squared	0.457990	S.D. dependent var	0.053833
S.E. of regression	0.039633	Akaike info criterion	-3.523689
Sum squared resid	0.127230	Schwarz criterion	-3.273708
Log likelihood	167.5660	Hannan-Quinn criter.	-3.422881
Durbin-Watson stat	2.037704		

Appendix 5 Results of the Cointegration Test

Date: 04/30/26 Time: 16:39
Sample: 2000Q1 2024Q4
Included observations: 100
Lags interval (in first differences): 1 to 2
Endogenous variables: FOREIGN_DIRECT_INVESTMENT LNEXR
Deterministic assumptions: Case 3 (Johansen-Hendry-Juselius): Cointegrating relationship includes a constant. Short-run dynamics include a constant.

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.** Critical Value
None *	0.243243	27.68738	15.49471	0.0005
At most 1	0.006701	0.652200	3.841465	0.4193

Trace test indicates 1 cointegrating equation(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Max-eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.** Critical Value
None *	0.243243	27.03518	14.26460	0.0003
At most 1	0.006701	0.652200	3.841465	0.4193

Max-eigenvalue test indicates 1 cointegrating equation(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

FOREIGN_DIRECT_INVESTMENT	LNEXR
0.256101	0.372303
0.017846	1.103459

Unrestricted Adjustment Coefficients (alpha):

D(FOREIGN_DIRECT_INVESTMENT)	-0.950419	-0.043593
D(LNEXR)	0.008844	-0.003539

1 Cointegrating Equation
Log-Likelihood: -31.22372

Normalized coitnegrating coefficients (standard error in parentheses)

FOREIGN_DIRECT_INVESTMENT	LNEXR
1.000000	1.453736
	(0.77607)

Adjustment coefficients (standard error in parentheses)

D(FOREIGN_DIRECT_INVESTMENT)	-0.243403
	(0.04722)
D(LNEXR)	0.002265
	(0.00123)

Appendix 7: Granger Causality Tests

Pairwise Granger Causality Tests
Date: 04/30/26 Time: 16:48
Sample: 2000Q1 2024Q4
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LNEXR does not Granger Cause FOREIGN_DIRECT_INVESTMENT	98	5.10898	0.0078
FOREIGN_DIRECT_INVESTMENT does not Granger Cause LNEXR		2.37099	0.0990