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FOREIGN DIRECT INVESTMENT (FDI) AND ITS MACROECONOMIC DETERMINANTS IN EMERGING ECONOMIES: A PANEL DATA ANALYSIS OF INDIA, NIGERIA, AND BRAZIL (1991-2024)

ABSTRACT

This study examines the macroeconomic determinants of Foreign Direct Investment (FDI) inflows in three major emerging economies: India, Nigeria, and Brazil over the period 1991-2024. Data were accessed from the World Bank database. Panel data analysis was employed to meet the objective. The analysis uses Pooled Ordinary Least Squares (OLS), Least Squares Dummy Variable (LSDV), Within Fixed Effects (FE), Random Effects (RE), the First Differences (FD) estimator, and the Between Estimator (BE). Pre-estimation diagnostics were also used, including Im-Pesaran-Shin (IPS) panel unit root tests, Pedroni panel cointegration tests, and Variance Inflation Factor (VIF) analysis. Also, the Post-estimation diagnostics encompass the Breusch–Pagan Lagrange Multiplier (BP-LM) test, the Modified Wald test for group-wise heteroscedasticity, the Wooldridge test for first-order autocorrelation, the Pesaran Cross-sectional Dependence (CD) test, and the Hausman specification test. According to the Hausman test, the Fixed Effects (FE/Within) estimator is the preferred specification at $P<0.01$ level. Findings of the Fixed Effects reveal that trade liberalization, human capital development, and exchange rate positively affect FDI, while real GDP per capita and GFCF negatively impact FDI in the study countries. The study suggests important policy implications for attracting and sustaining foreign direct investment in emerging economies.

Keywords: Foreign Direct Investment, Emerging Economies, Panel Data, Fixed Effects

INTRODUCTION

Foreign Direct Investment (FDI) has emerged as one of the most significant means of capital transfer, technological diffusion, and economic integration in the modern global economy. Over the past three decades, the landscape of global FDI has undergone profound transformations, shifting from a concentration in advanced industrialized economies toward a more pluralistic distribution that increasingly encompasses emerging market economies. Among the most dynamic recipients of this FDI are India, Nigeria, and Brazil, which are large and populous nations whose economic history represents the diverse face of the emerging world development.

The theoretical case for FDI as an engine of economic development is rooted in several well-established propositions. FDI is widely regarded as a vehicle for capital accumulation that supplements domestic savings, augments productive capacity, and stimulates gross domestic product (GDP) growth (UNCTAD, 2023). Beyond its direct capital contribution, multinational enterprises (MNEs) that undertake FDI are recognized as channels of proprietary technology, managerial expertise, and global supply-chain integration. These are spillover benefits that are particularly valuable in economies where indigenous innovation capacity remains limited (Dunning, 2000; Blomstrom & Kokko, 1998). Furthermore, FDI is associated with employment generation, export diversification, and improvements in total factor productivity, which contribute to the structural transformation necessary for sustained development.

Despite the theoretical consensus on FDI's positive economic contribution, the empirical literature on what actually determines FDI flows, particularly to emerging economies, is considerably more contested. Market size, measured principally by GDP and GDP per capita, consistently emerges as one of the most robust pull factors across multiple studies and regional contexts (Jahan, 2020; Faruq et al., 2023; Saini & Singhania, 2018). Trade openness has also been identified as a consistent attractor of FDI, indicating a hospitable investment environment and integration into global value chains (Mottaleb & Kalirajan, 2010; Islam et al., 2024). However, beyond these conventional economic determinants, a growing body of scholarship underscores the importance of institutional quality, encompassing governance effectiveness, the rule of law, political stability, control of corruption, and regulatory quality (Sabir et al., 2019; Aziz, 2022; Patel et al., 2024).

The three economies examined in this study represent a unique position in the global FDI literature. India, following its landmark liberalization reforms of 1991, progressively dismantled its restrictive Foreign Exchange Regulation Act (FERA) framework and opened key sectors to foreign participation, triggering a sustained, if uneven, increase in FDI inflows that has made it one of the world's top recipient nations in recent years (Mallick & Tanwar, 2025). Brazil, the largest economy in Latin America, has historically attracted market-seeking FDI into its vast consumer market, yet remains constrained by an elevated tax burden, volatile macroeconomic conditions, and complex regulatory frameworks (Kayani & Al-Ammary, 2021). Nigeria, Africa's most populous nation and its largest economy by nominal GDP, offers resource-seeking FDI opportunities centered on its vast hydrocarbon reserves, yet simultaneously confronts formidable institutional barriers, including systemic corruption, political instability, and infrastructural deficits that have historically dampened investor confidence (Osuma et al., 2024; Asiedu, 2006).

The choice of these three nations as the comparative unit of analysis in a panel data framework is analytically motivated by several considerations. First, the three countries collectively represent significant shares of their respective regional economies, namely South Asia, Sub-Saharan Africa, and Latin America and thus offer insights that may generalize to broader regional development contexts. Second, despite sharing the broad classification of 'emerging economy,' they exhibit considerable heterogeneity across dimensions of institutional quality, resource endowment, market structure, and policy environment, heterogeneity that is analytically valuable for isolating the relative salience of different FDI determinants. Third, the period from 1991 to 2024 encompasses multiple cycles of global economic expansion and contraction, including the Asian financial crisis of 1997–1998, the global financial crisis of 2007–2009, commodity price shocks, and the COVID-19 pandemic, providing a rich temporal laboratory for examining the resilience and sensitivity of FDI determinants under varying macroeconomic conditions.

The study employs balanced panel data techniques encompassing Pooled Ordinary Least Squares (OLS), Fixed Effects (FE), Random Effects (RE), the First Differences (FD) estimator, and the Between Estimator (BE) estimations to investigate the economic, institutional, and structural determinants of FDI inflows in India, Nigeria, and Brazil over the period 1991 to 2024. The data source is the World Bank's World Development Indicators (WDI). The explanatory variables include Real GDP per Capita, Human Capital Index, Trade Openness, Gross Fixed Capital Formation, and Exchange Rate.

REVIEW OF LITERATURE

Theoretical Foundations

The theoretical relationship between FDI and economic growth is grounded in multiple strands of economic theory. Neoclassical growth models, exemplified by Solow (1956) and Swan (1956), treat technological progress as exogenous and predict that capital inflows such as FDI increase the capital stock, raise output per worker, and accelerate convergence to steady-state income levels. However, because capital exhibits diminishing returns in the neoclassical framework, FDI's growth effects are necessarily transitory.

Endogenous growth theory, pioneered by Romer (1986, 1990) and Lucas (1988), provides a more compelling mechanism for sustained FDI-led growth. In these models, FDI generates persistent growth through knowledge spillovers, learning-by-doing externalities, and human capital accumulation. FDI can diffuse new technologies and managerial best practices to domestic firms through backward and forward linkages (Javorcik, 2004), worker mobility, and demonstration effects (Blomstrom & Kokko, 1998). These channels imply that the absorptive capacity of the host economy, particularly its level of human capital, is critical in translating FDI inflows into lasting productivity gains (Borensztein et al., 1998).

The other theory is the two-gap model (Chenery & Strout, 1966), which provides an additional rationale for FDI in developing economies. Countries facing a savings-investment gap and a foreign exchange gap can use FDI to simultaneously fill both deficits, supplement domestic investment, and provide foreign exchange for imported capital goods. This framework is particularly relevant for Nigeria and Brazil, which have historically faced balance of payments constraints and inadequate domestic savings rates.

Dunning's (1977, 1988) Eclectic Paradigm (OLI framework) also offers a microeconomic foundation for understanding FDI location decisions: firms invest abroad when they possess Ownership advantages (firm-specific assets), face Location advantages in the host country (factor costs, market size, institutions), and find Internalization preferable to licensing or exporting. This framework implies that FDI's growth impact will depend critically on the host country's institutional environment, infrastructure, and policy regime.

Empirical Review of FDI Determinants in Emerging Economies

Market size proxied by GDP, GDP per capita, or population is the most consistently identified FDI determinant across all FDI studies. Reviewing 112 empirical studies on FDI from 2000–2018, Islam and Beloucif (2024) find market size as the single most determining factor for FDI. Jahan (2020) confirms a significant positive effect of GDP on FDI across 24 emerging countries in studied from 1992 to 2016. This finding is reinforced by Faruq (2023) for 24 Asian emerging economies (2002–2018) and by Saini and Singhania (2018) that GDP per capita positively impacts FDI. The positive impact of market size on FDI is equally supported by Okere et al. (2022), who confirm the significance of economic growth dynamics for Nigeria, Brazil, and Vietnam.

Trade openness, or exports plus imports as a share of GDP, is the second determinant, according to Islam and Beloucif (2024). Jahan (2020) and Asiedu (2024) respectively confirm the positive impact of trade openness in emerging and Sub-Saharan African economies. Afolabi et al. (2023) find significantly positive effects for Nigeria's oil and gas FDI (1990–2021), while Rithi et al. (2025) confirm its positive role in India's bilateral FDI flows (2000–2023). Khan and Nawaz (2010) also show that export volume is the most powerful determinant of FDI in Pakistan.

Macroeconomic stability, captured by inflation and exchange rate dynamics, is essential for long-term investment in general and FDI in particular. Faruq (2023) finds that inflation negatively affects FDI across Asian emerging economies. The exchange rate operates through multiple channels. For example, Garg and

Dua (2014) highlight depreciation as a positive FDI driver in some emerging markets, and Hedau and Mishra (2025) confirm the exchange rate's positive significance in India.

The other factor which could affect FDI is human capital. Human capital ranks second in Nigeria per Yohanna (2013), and globally fourth per Islam and Beloucif (2024). Natural resource endowments are also confirmed as significant (Jahan, 2020; Asiedu, 2002; Afolabi et al., 2023; Kimiagari et al., 2023). Financial market development rounds out the economic determinants, confirmed by Jahan (2020) for 24 emerging countries and by Islam et al. (2024) for Arab economies.

DATA AND METHODS

Data Sources and Variable Definitions

The dataset is a panel covering three emerging economy countries: Brazil, India, Nigeria — over the period 1991 to 2024 (34 time periods per country), yielding 102 total observations. All data are sourced from the World Bank World Development Indicators (WDI) and the International Monetary Fund (IMF) International Financial Statistics (IFS). All continuous variables are transformed into natural logarithms before estimation. This log-log specification yields coefficient estimates directly interpretable as elasticities, the percentage change in FDI associated with a one % change in each explanatory variable. Log transformation also reduces the influence of extreme values, compresses the scale of right-skewed distributions, and linearizes multiplicative relationships. The complete variable definitions are listed in Table 1.

Variable	Original Name	Log Transform	Expected Sign
ln(FDI)	Foreign Direct Investment	ln(FDI)	-
ln(RGDPC)	Real GDP per Capita	ln(RGDPC)	+
ln(HC)	Human Capital Index	ln(HC)	+
ln(TO)	Trade Openness	ln(TO)	+
ln(GFCF)	Gross Fixed Capital Formation	ln(GFCF)	+
ln(EXR)	Exchange Rate	ln(EXR)	-

Econometric Approach

Model Specification

The baseline empirical model in log-log form is:

$$\ln FDI_{it} = \alpha + \beta_1 \ln RGDPC_{it} + \beta_2 \ln HC_{it} + \beta_3 \ln TO_{it} + \beta_4 \ln GFCF_{it} + \beta_5 \ln EXR_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

Where: *lnFDIit* is the natural log of net FDI inflows (% of GDP);

lnRGDPCit is the natural log of real GDP per capita country *i* at time*t*;

lnHCit is the natural log of human capital measure by secondary gross enrollment rate;

lnTOit is the natural log of trade openness (% of GDP);

lnGFCFit is the natural log of gross fixed capital formation (% of GDP);

lnEXRit is the natural log of the real effective exchange rate index;

μi represents country-specific fixed effects capturing time-invariant heterogeneity;

εit is the idiosyncratic error term.

$\beta 1$ through $\beta 5$ are elasticities due to log–log specification

i denotes country (i = India, Nigeria, Brazil), t denotes year (t= 1991, …, 2024).

Pooled OLS

Pooled OLS ignores panel structure by stacking all $N \times T$ observations and regressing lnFDI on the regressors with a single intercept. While computationally straightforward, Pooled OLS is inconsistent in the presence of unobserved heterogeneity ($\mu_i \neq 0$) and is included primarily as a benchmark. Its residuals are used to construct the Breusch–Pagan LM test for the existence of random effects.

Least Squares Dummy Variable (LSDV)

LSDV augments the Pooled OLS specification with $(n-1) = 2$ binary country dummy variables, with India as the omitted reference category. LSDV is numerically equivalent to the Within Fixed Effects estimator and produces identical slope coefficients; it has the advantage of directly reporting the magnitude of country-specific intercept shifts, facilitating cross-country comparisons. The dummy coefficients capture all time-invariant country-specific heterogeneity.

Fixed Effects (Within Estimator)

The Within estimator eliminates unobserved country-specific effects by demeaning each variable with respect to its country mean, i.e., transforming variables as $Yit = Yit - Yit$. This removes all time-invariant variation, including any omitted country-level variables rendering consistent estimates even when μi is correlated with regressors. The cost is loss of information on time-invariant regressors and reduced degrees of freedom ($N - k - n$). The F-test for joint significance of country fixed effects tests $H0$: all μi are equal.

Random Effects (GLS Estimator)

If country effects are uncorrelated with regressors $(E\mu i|Xit=0)$, the RE GLS estimator is more efficient than FE. The Swamy–Arora approach (implemented here) decomposes the total variance into within-group ($\delta\varepsilon 2$)and between-group ($\delta\mu 2$) components, computing the GLS weight $\theta = 1 - \delta\varepsilon 2 \delta\varepsilon 2 + T\delta\mu 2$. The estimated theta is $\theta = 0.000$, indicating the degree of partial demeaning applied. The RE estimator uses a weighted combination of within- and between-country variation.

First Differences Estimator

The First Differences (FD) estimator transforms the model by first-differencing across consecutive time periods:

$$\Delta \ln FDI_{it} = \Delta\beta_1 \ln RGDPC_{it} + \Delta\beta_2 \ln HC_{it} + \Delta\beta_3 \ln TO_{it} + \Delta\beta_4 \ln GFCF_{it} + \Delta\beta_5 \ln EXR_{it} + \Delta\varepsilon_{it}$$

This eliminates the individual effect μ_i and is equivalent to FE when $T = 2$. For $T > 2$, FD and FE differ in efficiency depending on the serial correlation structure of εit. FD is preferred when errors follow a random walk, while FE is preferred when errors are i.i.d.

Between Estimator

The Between estimator operates exclusively on cross-sectional variation, regressing country time-means on each other. With only 3 observations (one per country), the BE has very limited degrees of freedom but is included to isolate long-run cross-country differences from time-series dynamics captured by the Within estimator.

Model Selection: Hausman Specification Test

The Hausman test evaluates whether the difference in coefficients between FE and RE is systematic:

$$H = (b_{FE} - b_{RE})' [Var(b_{FE}) - Var(b_{RE})]^{-1} (b_{FE} - b_{RE}) \sim \chi^2(k) \quad (3)$$

Under *H0* (no correlation between effects and regressors), RE is consistent and efficient; FE is consistent but inefficient. Rejection of *H0* implies RE is inconsistent and FE is preferred.

Panel Unit Root Tests

The non-stationarity problem in panel data must be properly addressed so that it does not lead to spurious regression results. The two common panel unit root tests are employed. One, the Im-Pesaran-Shin test, which allows for heterogeneous autoregressive coefficients across cross-sections and accommodates individual unit root processes (Im et al., 2003). Two, the Fisher-ADF test, which combines individual ADF p-values into a chi-square statistic. Both tests are run with individual intercept and trend in levels and intercept only in first differences (Maddala & Wu, 1999). The null hypothesis for both tests is that all panels contain a unit root, implying non-stationarity. The optimal lag selection uses the Schwarz Information Criterion (SIC) up to a maximum of 4 lags.

Panel Cointegration Tests

We apply the panel cointegration test to examine whether a long-run equilibrium relationship exists between the dependent variables and the explanatory variables, provided all variables are found to be integrated of order one I(1). We use two complementary cointegration tests: (i) the Pedroni test, which proposes seven test statistics (four panel statistics and three group statistics) based on the null hypothesis of no cointegration, and accommodates heterogeneous cointegrating vectors and individual effects (Pedroni, 1999, 2004); and (ii) the Kao test, which imposes homogeneous cointegrating vectors but provides additional corroborating evidence under the null of no cointegration (Kao, 1999). Rejection of the null in these tests supports the existence of a long-run cointegrating relationship, validating the use of cointegration-based estimators.

RESULTS AND DISCUSSION

FDI inflows to the countries

Figure 1 plots log FDI inflows for the three countries over the sample period (1991-2024). India and Brazil show a broadly rising trend in FDI/GDP through the 2000s liberalization period, while Nigeria's series is more volatile and periodically inclines toward the near-zero offset floor.

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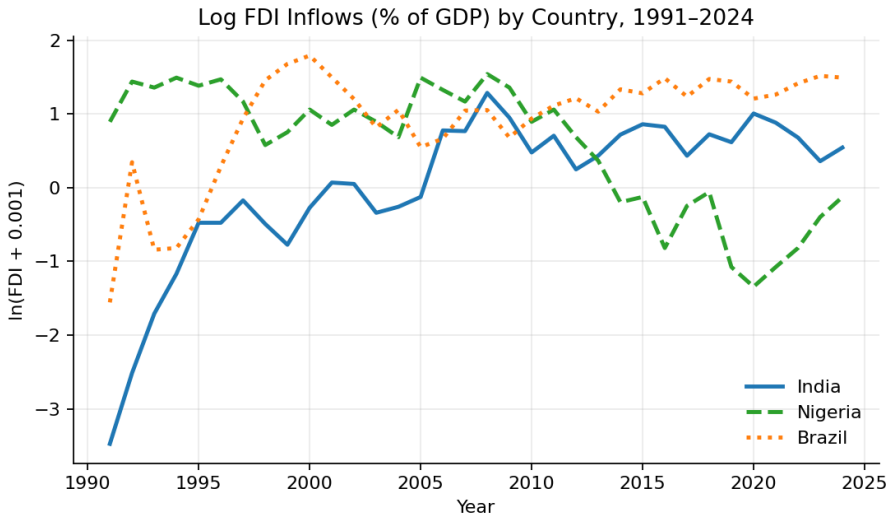

Figure 1. Log FDI Inflows (% of GDP) by Country

Figure 1. Log FDI Inflows (% of GDP) by Country, 1991–2024

Descriptive statistics

Table 2 presents the descriptive statistics for the panel observations across India, Nigeria, and Brazil from 1991 to 2024. The dependent variable ln(FDI) has a mean of 0.495 with the widest dispersion among all variables, showing a range from -3.507 to 1.790 and exhibiting notable negative skewness of -1.416, indicating that the FDI distribution is left-tailed.

Of the explanatory variables, Real GDP per capita growth (ln(RGDPC)) averages 7.446 with a std. dev. of 1.101 and positive skewness. Human capital (ln(HC)) and trade openness (ln(TO)) are comparatively stable across observations with std. dev. of 0.398 and 0.340 respectively, with near-zero skewness for trade openness of 0.027, suggesting a roughly symmetric distribution, while human capital is slightly left-skewed of -0.198, consistent with gradual but uneven educational improvements across the panel. Gross fixed capital formation (ln(GFCF)) similarly shows low variability with std. dev. of 0.299 and skewness of -0.022, indicating relatively steady domestic investment rates across the sample period, whereas the exchange rate (ln(EXR)) is the least dispersed variable of 0.103 but carries a moderate negative skew of -0.631, reflecting periodic but asymmetric currency appreciations within the panel. Overall, the descriptive statistics confirm that the log transformation has substantially reduced skewness in most variables, supporting the suitability of the log-log panel regression framework adopted in this study.

Variable	Mean	Std. Dev.	Min	Max	Skewness
ln(FDI)	0.495	0.959	-3.507	1.790	-1.416
ln(RGDPC)	7.446	1.101	5.916	9.062	0.238
ln(HC)	3.891	0.398	3.114	4.545	-0.198
ln(TO)	3.403	0.340	2.765	4.033	0.027
ln(GFCF)	3.025	0.299	2.387	3.587	-0.022
ln(EXR)	4.541	0.103	4.221	4.770	-0.631
Note: Statistics computed on	Note: Statistics computed on	Note: Statistics computed on	Note: Statistics computed on	Note: Statistics computed on	Note: Statistics computed on

Variable	Mean	Std. Dev.	Min	Max	Skewness
log-transformed variables. N = 102 observations across 3 countries and 34 time periods.	log-transformed variables. N = 102 observations across 3 countries and 34 time periods.	log-transformed variables. N = 102 observations across 3 countries and 34 time periods.	log-transformed variables. N = 102 observations across 3 countries and 34 time periods.	log-transformed variables. N = 102 observations across 3 countries and 34 time periods.	log-transformed variables. N = 102 observations across 3 countries and 34 time periods.

Correlation Matrix

Table 3 presents the Pearson correlation coefficients among the log-transformed variables. Foreign direct investment (lnFDI) is positively correlated with real GDP per capita (0.327), human capital (0.222), and trade openness (0.388). It has weak negative correlations with GFCF (-0.124) and the exchange rate (-0.013). Real GDP per capita shows a moderate positive association with human capital (0.474) and a moderate negative relationship with trade openness (-0.527). Human capital is moderately positively related to GFCF (0.576). Overall, the correlation coefficients are below the accepted threshold of 0.80, suggesting no serious multicollinearity concerns. The Variance Inflation Factor (VIF) test also confirms this finding (Table 6).

	ln(FDI)	ln(RGDPC)	ln(HC)	ln(TO)	ln(GFCF)	ln(EXR)
ln(FDI)	1.000	0.327	0.222	0.388	-0.124	-0.013
ln(RGDPC)	0.327	1.000	0.474	-0.527	0.262	-0.190
ln(HC)	0.222	0.474	1.000	-0.461	0.576	-0.343
ln(TO)	0.388	-0.527	-0.461	1.000	-0.159	0.004
ln(GFCF)	-0.124	0.262	0.576	-0.159	1.000	-0.008
ln(EXR)	-0.013	-0.190	-0.343	0.004	-0.008	1.000
Note: Values are Pearson correlation coefficients. High correlations among regressors may indicate multicollinearity, formally tested via VIF.	Note: Values are Pearson correlation coefficients. High correlations among regressors may indicate multicollinearity, formally tested via VIF.	Note: Values are Pearson correlation coefficients. High correlations among regressors may indicate multicollinearity, formally tested via VIF.	Note: Values are Pearson correlation coefficients. High correlations among regressors may indicate multicollinearity, formally tested via VIF.	Note: Values are Pearson correlation coefficients. High correlations among regressors may indicate multicollinearity, formally tested via VIF.	Note: Values are Pearson correlation coefficients. High correlations among regressors may indicate multicollinearity, formally tested via VIF.	Note: Values are Pearson correlation coefficients. High correlations among regressors may indicate multicollinearity, formally tested via VIF.

Pre-estimation diagnostics

Panel Unit Root Test: Im–Pesaran–Shin (IPS)

Before estimation, it is necessary to determine the integration order of all panel series to avoid spurious regression. The Im–Pesaran–Shin (2003) test allows for heterogeneous unit root processes across panels by computing country-specific ADF statistics and combining them into a standardized W-statistic with a standard normal distribution under H_0 (all panels contain a unit root). The IPS test results indicate that most variables are non-stationary in levels, with unit roots failing to be rejected at conventional significance

levels for lnRGDPC, lnHC, lnTO, lnGFCF, and lnEXR. This suggests the variables are I(1) processes, warranting a cointegration analysis before proceeding to panel estimation. The results are reported in Table 4.

Variable	t-bar	W-stat	p-value
ln(FDI)	-2.168	-1.172	0.121
ln(RGDPC)	-1.033	1.366	0.914
ln(HC)	-0.124	3.399	0.999
ln(TO)	-1.937	-0.655	0.256
ln(GFCF)	-2.038	-0.881	0.189
ln(EXR)	-1.728	-0.188	0.426
Note: H₀: All panels contain a unit root. ADF regressions include an intercept with 1 lag. Critical values based on IPS (2003) tabulated moments for T = 34.	Note: H₀: All panels contain a unit root. ADF regressions include an intercept with 1 lag. Critical values based on IPS (2003) tabulated moments for T = 34.	Note: H₀: All panels contain a unit root. ADF regressions include an intercept with 1 lag. Critical values based on IPS (2003) tabulated moments for T = 34.	Note: H₀: All panels contain a unit root. ADF regressions include an intercept with 1 lag. Critical values based on IPS (2003) tabulated moments for T = 34.

Panel Cointegration Test: Pedroni Test

Since the IPS results indicate most series are I(1), a panel cointegration test is essential to determine whether a long-run equilibrium relationship exists among the variables. The Pedroni (1999, 2004) test allows heterogeneous cointegrating vectors and tests *H0* : no cointegration. The Pedroni test rejects the null hypothesis of no cointegration at P<0.01 level of significance, confirming the existence of a long-run cointegrating relationship among ln(FDI) and its determinants across the panel. This validates the use of levels-based panel estimators for long-run inference.

Statistic	Value	p-value
Panel t-bar	-2.811	----
Standardized Z-statistic	-2.609	0.005
Note: H₀: No cointegration across all panels. Individual ADF regressions with intercept and 1 lag.	Note: H₀: No cointegration across all panels. Individual ADF regressions with intercept and 1 lag.	Note: H₀: No cointegration across all panels. Individual ADF regressions with intercept and 1 lag.

Variance Inflation Factor (VIF) for Multicollinearity

Table 6 presents the Variance Inflation Factor (VIF) results used to assess multicollinearity among the explanatory variables. The VIF values range from 1.405 to 5.017, indicating generally acceptable levels of multicollinearity. Specifically, ln(RGDPC), ln(HC), ln(TO), and ln(EXR) have VIF values below the commonly accepted threshold of 5, suggesting no serious multicollinearity concerns. Although ln(GFCF) records a VIF of 5.017, indicating moderate multicollinearity, it remains well below the critical threshold of 10. Overall, the results suggest that multicollinearity is not severe enough to compromise the reliability of the regression estimates. The results are consistent with what was reported in Table 3.

Variable	VIF	Interpretation
ln(RGDPC)	2.141	No multicollinearity

Variable	VIF	Interpretation
ln(HC)	4.858	No multicollinearity
ln(TO)	1.405	No multicollinearity
ln(GFCF)	5.017	Moderate multicollinearity
ln(EXR)	2.645	No multicollinearity
Source: Authors' calculation, 2026	Source: Authors' calculation, 2026	Source: Authors' calculation, 2026

Estimation Results

The panel data estimation results reveal a consistent and compelling story about the determinants of FDI inflows across the sample countries (Table 7). Across all six estimators, the variable trade openness emerges as the single most robust determinant of FDI, being positive and statistically significant at $p<0.01$ level. The coefficients, ranging from 1.04 to 2.88, establish trade integration as the dominant channel through which countries attract FDI. The exchange rate also exerts a positive and significant influence in most estimators, suggesting that currency depreciation lowers the cost of investment and enhances host country attractiveness to foreign investors.

Under Pooled OLS and Random Effects, which capture both cross-sectional and time-series variation, GFCF is negative and significant, possibly indicating a crowding-out relationship between domestic and foreign investment. This negative effect disappears once country fixed effects are introduced, indicating it is largely a structural cross-country phenomenon rather than a within-country dynamic. Both the LSDV and Within Fixed Effect specifications offer particularly informative insights by isolating within-country variation over time and controlling for unobserved country-specific characteristics. Under these specifications, human capital becomes positive and statistically significant, probably suggesting that domestic improvements in education and workforce quality meaningfully attract FDI when country-level structural differences are held constant, a relationship obscured in the pooled specifications. Notably, real GDP per capita turns negative and marginally significant under fixed effects, which may reflect the efficiency-seeking nature of FDI in the sample, where rising incomes correspond to higher production costs that deter cost-sensitive investors. The First Differences estimator, while with a lower R^2 of 0.09, validates the importance of trade openness in driving short-run changes in FDI, with human capital entering marginally. Overall, the findings across multiple estimators show that trade openness, human capital, and exchange rate are the main determinants of FDI, which could provide a credible empirical basis for policy recommendations centered on trade liberalization, human capital development, and exchange rate management as factors for attracting foreign direct investment.

As a conclusion, the Fixed Effects (FE/Within) estimator is the preferred estimator based on the Hausman test (Table 9). The following interpretation is based on these results of FE (within). Keeping other variables constant, a 1% increase in real GDP per capita is associated with a 1.088% decrease in FDI inflows at $p<0.10$. This effect is consistent with market size theory, where larger, wealthier markets attract greater FDI by offering expanded consumer demand and returns on investment. Human capital exhibits a positive and statistically significant ($p<0.05$) effect on FDI at $p<0.05$, ceteris paribus. This aligns with the proposition that skilled labour endowments attract quality FDI, particularly in technology-intensive and services sectors. Trade openness has a positive elasticity of 2.885 with respect to FDI and is highly significant at $p<0.01$. Greater openness reduces barriers to trade and investment, signalling an export-platform orientation favorable to foreign investors. Moreover, the exchange rate coefficient is positive and

statistically significant at $p< 0.05$; the implication is that an appreciation is associated with higher FDI, consistent with wealth effects and lower investment costs in the host country.

Coming to the Country Fixed Effects, taking India as a reference, holding the economic controls fixed, Brazil's average lnFDI is about 2.72 log points higher than India's. Brazil has systematically attracted more FDI relative to GDP than India across this sample, for reasons not captured by the other regressors (e.g. deeper capital markets, commodity-sector FDI, privatization waves). Where as, once the controls are accounted for, Nigeria's average FDI/GDP is not statistically distinguishable from India's.

Variable	Pooled OLS	LSDV (FE)	Within (FE)	Random Effects	First Diff.	Between Est.
ln(RGDPC)	0.416 (0.292)	-1.088* (0.644)	-1.088* (0.644)	0.416 (0.292)	-2.619 (1.729)	0.413*** (N/A)
ln(HC)	1.081 (1.012)	2.824** (1.376)	2.824** (1.376)	1.081 (1.012)	17.349* (10.129)	-0.313*** (0.000)
ln(TO)	2.214*** (0.215)	2.885*** (0.253)	2.885*** (0.253)	2.214*** (0.215)	1.038*** (0.392)	0.2027*** (N/A)
ln(GFCF)	-1.223** (0.546)	-0.537 (0.694)	-0.537 (0.694)	-1.223** (0.546)	0.1951 (1.012)	-0.799*** (0.000)
ln(EXR)	2.090** (0.972)	2.189** (0.965)	2.189** (0.965)	2.090** (0.972)	1.421 (1.113)	0.077*** (N/A)
DNigeria	----	0.221 (0.584)	0.221 (0.584)	----	----	----
DBrazil	----	2.716 ***(2.954)	2.716 ***(2.954)	----	----	----
Constant	-20.134*** (4.894)	-18.790*** (5.185)	----	-20.134*** (4.894)	-0.213 (0.196)	0.017*** (0.000)
Country FEs / Dummies	No	Yes	Yes	No	N/A	No
R^2	0.604	0.679	0.626	0.604	0.089	1.000
Adj. R^2	0.584	0.655	0.598	0.584	0.039	N/A (N=3)
Observations	102	102	102	102	99	3
Note: *, , and * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses	Note: *, , and * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses	Note: *, , and * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses	Note: *, , and * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses	Note: *, , and * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses	Note: *, , and * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses	Note: *, , and * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses

Post-estimation Diagnostic Tests

Following estimation, a battery of specification and diagnostic tests is conducted to assess the validity of the regression assumptions and the appropriateness of the chosen estimator (Table 8). Results are consolidated in Table 9. The Breusch–Pagan LM test examines whether the variance of country-specific effects $\delta\mu 2=0$ i.e., the Pooled OLS is adequate. The LM statistic rejects the null hypothesis at p<0.01 level

of confirming the presence of significant unobserved country-level heterogeneity. Panel estimators (FE or RE) are therefore preferred over Pooled OLS.

The Modified Wald test evaluates *H0:δi2=δ2* for all *i*(homoscedastic errors). The test statistic is fails to reject *H0*, indicating the absence of groupwise heteroscedasticity in the panel. The Wooldridge (2002) test for first-order serial correlation in the idiosyncratic errors tests H_0: $\rho = 0$ (no autocorrelation). The estimated mean AR(1) coefficient $\bar{\rho} = 0.561$, and the F-statistic 44.235 rejects H_0 at $p<0.05$ level, indicating significant positive serial correlation in the panel residuals. This violates the classical *i.i.d*. assumption and suggests the use of Driscoll–Kraay or cluster-robust standard errors for inference. The average Durbin–Watson statistic across countries is 0.824.

The Pesaran (2004) CD test examines whether the error terms are correlated across countries: H_0: no cross-sectional dependence. The CD statistic of 2.383 rejects H_0 at $p<0.05$ level of significance, indicating significant cross-sectional dependence in the panel. This is expected given that the countries: India, Nigeria, and Brazil are integrated into global capital markets and may respond to common shocks (e.g., the 2008 Global Financial Crisis, COVID-19 pandemic). This finding strengthens the rationale for using the FE estimator, which partially accounts for common time effects.

Table 8 further shows the Hausman test result is H = 22.211, distributed $\chi^2(5)$, with p-value = 0.0005. The null hypothesis (RE is consistent) is rejected at the p<0.01 level. The systematic difference between FE and RE coefficients confirms that country-specific effects are correlated with the regressors (endogenous effects). Accordingly, the Fixed Effects (Within) estimator is the preferred, consistent specification for this panel. All subsequent interpretation focuses on the Fixed Effects (FE/Within) estimates as indicated in Table 7.

Test	Statistic	p-value	Conclusion
Breusch–Pagan LM (RE vs Pooled)	7.232	0.007	RE preferred (RE effects exist)
Modified Wald (Groupwise Heterosc.)	2.393	0.495	Homoscedastic
Wooldridge AR(1) (Autocorrelation)	44.239	0.022	Serial correlation present
Pesaran CD (Cross-Sect. Dependence)	2.383	0.017	Cross-sect. dependence
Hausman Test (FE vs RE)	22.211	0.001	FE preferred
Pedroni Panel Cointegration (Z-stat)	-2.609	0.005	Cointegrated

CONCLUSION AND POLICY IMPLICATIONS

This study employs a panel data sourced from the World Bank database to investigate the macroeconomic determinants of FDI across India, Nigeria, and Brazil over the period 1991-2024. The analysis incorporates the full sequence of panel econometric best practices: log-linearization for elasticity interpretation, construction of country dummies for LSDV estimation, systematic pre-estimation diagnostics (IPS unit root tests, Pedroni cointegration, VIF), estimation of all six standard panel models (Pooled OLS, LSDV, Within FE, RE, FD, BE), and comprehensive post-estimation testing (BP-LM, Modified Wald, Wooldridge, Pesaran CD, Hausman).

Converting all variables to natural logarithms and estimating lnFDI as a function of RGDPC, human capital, trade openness, investment, and the exchange rate shows that trade openness and the real exchange rate are the most reliable correlates of FDI inflows across India, Nigeria, and Brazil over 1991-2024. Adding country dummy variables (India as reference) and re-estimating via LSDV substantially improves model

fit and is statistically preferred over pooled OLS and the other estimates. Trade openness, Real exchange rate appreciation, and human capital (lnHC) positively and significantly affect FDI in the countries, whereas RGDP and GFCF do the opposite. Moreover, Brazil systematically outperforms India but not Nigeria.

Policy recommendations flowing from the results include: (i) investment in human capital formation to attract technology-intensive FDI; (ii) deepening trade openness through tariff reduction and regional trade agreements; (iii) maintaining macroeconomic stability and exchange rate management to reduce currency risk; and (iv) increasing domestic investment in infrastructure to complement foreign capital inflows. Country-specific institutional reforms, particularly in Nigeria are necessary to bridge the FDI performance gap relative to comparable emerging economies.

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