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THE ROLE OF ECONOMIC INDICATORS IN FDI INFLOWS: AN EMPIRICAL INSIGHTS FROM PANEL DATA ANALYSIS

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Abstract

The study examined the role of key economic indicators in influencing Foreign Direct Investment (FDI) inflows, with a particular focus on the BRICS economies—Brazil, Russia, India, China, and South Africa. Using panel data analysis, the study assessed both short-run and long-run relationships between FDI inflows and macroeconomic determinants, including GDP, exchange rate stability, energy consumption, natural capital, and human capital. The analysis employed advanced econometric techniques such as cross-sectional dependence tests, unit root tests, panel cointegration tests, and the Pooled Mean Group (PMG) estimation to ensure robust and reliable results. The findings of the study have revealed that economic growth and natural capital have a positive long-run impact on FDI inflows, in contrast exchange rate depreciation and increased energy consumption significantly deter foreign investment. Short-run results indicated that exchange rate movements are the most influential determinant of the economic growth, underscoring the importance of currency stability in attracting investors. Additionally, the significant error correction mechanism which confirmed that the presence of a long-run equilibrium relationship, suggesting that deviations from FDI equilibrium are gradually corrected every time. Found that there is a critical role of stable macroeconomic policies and efficient resource utilization in fostering a favorable investment climate. Policymakers are encouraged to implement strategies that enhance economic stability, improve energy efficiency, and leverage natural capital to attract sustainable FDI.

Keywords: Foreign Direct Investment (FDI), panel data analysis, macroeconomic stability, exchange rate volatility, BRICS economies.

Introduction

Foreign direct investment (FDI) has been pivotal in the economic development of BRICS nations—Brazil, Russia, India, China, and South Africa—since the early 2000s. Collectively, these countries experienced more than fourfold increase in annual FDI inflows, rising from $ 84 billion in 2001 to $355 billion in 2021, thereby doubling their share of global FDI inflows from 11 per cent to 22 per cent during this period **(UNCTAD, 2023).** China has been the largest recipient among the BRICS, with FDI inflows amounting to $180.2 billion, followed by Brazil and India, receiving $ 91.5 billion and $ 49.9 billion, respectively **(Sethi et al., 2023).** However, since 2011, the growth in FDI inflows to the BRICS has plateaued,

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contrasting with the robust expansion observed in the preceding decade **(UNCTAD, 2023).** This stagnation raises concerns about the sustainability of foreign investment-driven growth in these emerging economies.

Review of Literature

Foreign direct investment (FDI) continues to be a key driver of economic growth, facilitating capital inflows, technology transfer, and productivity enhancements **(Borensztein et al., 1998; UNCTAD, 2023).** Recent studies emphasized that macroeconomic stability, including GDP growth, exchange rate stability, and inflation control, remains crucial for attracting FDI **(Kumar & Pradhan, 2022).** Exchange rate volatility can deter investment, while a stable currency environment encourages long-term commitments **(Froot & Stein, 1991; Iamsiraroj & Ulubaşoğlu, 2015).** Moreover, energy availability, particularly renewable energy, has gained prominence as a determinant of greenfield investments **(Sadorsky, 2010; Shahbaz et al., 2018).** Natural and human capital also play a significant role, with higher education levels and skilled labor enhancing investment attractiveness **(Noorbakhsh et al., 2001; Asiedu, 2020).** Recent advancements in panel data methodologies, including cross-sectional dependence tests **(Pesaran, 2007)** and dynamic panel techniques like PMG estimation **(Pesaran, Shin, & Smith, 1999),** have improved the robustness of empirical analyses, offering deeper insights into the short- and long-run drivers of FDI inflows **(Adams & Opoku, 2023).**

Objectives of the Study

1. To examine the role of key macroeconomic indicators in influencing foreign direct investment (FDI) inflows using panel data analysis.
2. To assess the short-run and long-run relationships between economic indicators and FDI inflows

Methodology

Research Design

The study has adopted an empirical quantitative approach to investigate the role of key economic indicators in influencing foreign direct investment (FDI) inflows. The analysis is based on panel data, which allows for the exploration of both cross-sectional and time-series dimensions. This approach is particularly suited to examining the short-run and long-run relationships between economic indicators and FDI inflows across BRICS countries. By integrating both temporal and cross-sectional variations, the study ensures a comprehensive understanding of the dynamic interactions among the selected variables.

Data Sources

To facilitate this empirical investigation, the study utilized annual panel data from BRICS countries over a specified period of time. Data for these variables were sourced from reliable databases, such as the UNCTAD, which ensures the robustness and credibility of the dataset and enhancing the validity of the subsequent econometric analysis.

Panel Data Estimation Techniques

Given the panel structure of the dataset, comparing multiple countries observed over several years- this study adopts appropriate econometric techniques that account for both cross-sectional and time-series dimensions. The empirical analysis begins with the test for cross-sectional dependences to assess whether the residuals are correlated across countries, which is a common feature in macro panel data. Following this, panel unit root tests are employed to determine the stationarity properties of the variables. Finally, cointegration tests are conducted to explored the existence of long run equilibrium relationships among the key economic indicators. These procedures ensure the robustness of the coefficient estimators and provided a solid foundation for applying the Pooled Mean Group (PMG) estimator to analyze both short-run dynamics and long-run effects.

Cross-Sectional Dependence Test

Pesaran's Cross-Sectional Dependence (CD) test was conducted to account for potential cross-sectional dependence among panel units. The null hypothesis (H_0) assumed no cross-sectional dependence, while the alternative hypothesis (H_1) indicated its presence. Detecting cross-sectional dependence is crucial, as ignoring it may lead to biased and inconsistent estimates. To further ensure the robustness of the analysis, Pesaran's Cross-Sectional Dependence (CD) test was employed to detect potential correlations among panel units. The CD test statistic is calculated as:

$$\sqrt{\frac{2}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}$$

Where $\hat{\rho}_{ij}$ represents the pairwise correlation coefficients of residuals across panel units. A significant CD statistic implies cross-sectional dependence, necessitating the use of second-generation panel data techniques for more reliable estimation.

Panel Unit Root Tests

Following the detection of cross-sectional dependence in most variables, second-generation unit root tests were employed to assess stationarity. Specifically, Pesaran's Cross-Sectionally Augmented Dickey-Fuller (CADF) and CIPS tests were applied to both level and first-difference series. These tests helped determine the order of integration for each variable, ensuring appropriate model specification in subsequent analyses. It is particularly useful, as it accounts for cross-sectional averages in its specification:

$$\Delta y_{it} = \propto_i + \beta_i t + \gamma_i y_{it-1} + \delta_i \bar{y}_{t-1} + \sum_{j=1}^{p} \emptyset_{ij}\Delta y_{it-j} + \epsilon_{it}$$

In this equation, $\bar{y}_{t-1}$ represents the cross-sectional averages of lagged levels. The null hypothesis of non-stationarity was tested against the alternative of stationarity after controlling for cross-sectional dependence.

Panel Cointegration Tests

The Pedroni (1999, 2004) and Kao (1999) panel cointegration tests were applied to examine long-run relationships among the variables. These tests accounted for cross-sectional heterogeneity and confirmed whether the variables shared a common stochastic trend. Establishing cointegration is essential for validating long-run equilibrium relationships in panel data settings.

Upon confirming the stationarity properties, the study employed Pedroni's panel cointegration test to assess long-run relationships among variables. This approach involves estimating the residuals from the hypothesized cointegrating equation and testing whether they exhibit stationarity. The residual-based test is expressed as:

$$\hat{\mu}_{it} = \rho_i \hat{\mu}_{it-1} + \varepsilon_{it}$$

The null hypothesis of no cointegration is rejected if $\rho_i < 1$, indicating the presence of a common stochastic trend among variables.

Panel ARDL Model

Finally, the study adopted the Panel ARDL model using the Pooled Mean Group (PMG) estimator to capture short-run dynamics and long-run equilibrium relationships. As previously outlined, the model specification ensured that short-run coefficients varied across countries while maintaining homogeneous long-run coefficients. This approach provided nuanced insights into how economic indicators influence FDI inflows across different temporal horizons.

Given the mixed order of integration, I (0) and I (1), and evidence of cointegration, the Pooled Mean Group (PMG) estimator of the Panel ARDL model was employed. This approach allowed for estimating both short-run and long-run relationships while accounting for cross-sectional dependence. The Panel ARDL model was specified as follows:

$$\Delta \mathrm{FDI}_{it} = \alpha_i + \sum_{j=1}^{p} \beta_{ij} \Delta \mathrm{X}_{it-j} + \phi_i \left(FDI_{it-1} - \theta_i X_{it-1} \right) + \epsilon_{it}$$

Where:

- Δ represents first differences,
- X_{it} denotes the independent variables,
- ϕ_i is the error correction term (ECT), indicating the speed of adjustment towards long-run equilibrium.

The PMG estimator's advantage lies in its flexibility, allowing short-run coefficients to vary across countries while constraining long-run coefficients to be homogeneous. This balance ensures more realistic and interpretable results.

Results and Discussion

Table 1: Results of Pesaran's Cross-Sectional Dependence (CD) Test

Variable	CD-Test	P-value	Mean ρ	Mean	Cross-Sectional Dependence?
Net FDI Inflows	-1.879	0.060	-0.13	0.3	No ($p > 0.05$)
GDP (lngdp)	13.253	0.000	0.89	0.89	Yes ($p < 0.05$)
Exchange Rate (lnexr)	2.262	0.024	0.15	0.33	Yes ($p < 0.05$)
Energy Consumption (lnener)	11.126	0.000	0.75	0.75	Yes ($p < 0.05$)
Gross Fixed Capital (lngfc)	12.667	0.000	0.85	0.85	Yes ($p < 0.05$)
Natural Capital (lnnaturalcapital)	3.201	0.001	0.22	0.68	Yes ($p < 0.05$)
Human Capital (lnhumancapital)	13.715	0.000	0.92	0.92	Yes ($p < 0.05$)

Source: Computed

(H_0): No cross-sectional dependence (CSD) in the panel data.

(H_1): Presence of cross-sectional dependence among panel units.

As shown in table 1, the results of Pesaran's Cross-Sectional Dependence (CD) test indicated varying degrees of cross-sectional dependence among the variables. Net FDI Inflows had a CD test statistic of -1.879 with a p-value of 0.060, suggesting weak evidence against the null hypothesis of cross-sectional independence. The mean correlation (ρ) was -0.13, while the variable's mean was 0.3. In contrast, GDP (lngdp) exhibited strong cross-sectional dependence, with a CD test statistic of 13.253, a p-value of 0.000, and a mean correlation of 0.89. Similarly, the Exchange Rate (lnexr) showed significant dependence, as indicated by a CD test statistic of 2.262 (p-value = 0.024), a mean correlation of 0.15, and a mean of 0.33. Energy Consumption (lnener) also demonstrated strong cross-sectional dependence, with a CD test statistic of 11.126 (p-value = 0.000) and a mean correlation of 0.75. Likewise, Gross Fixed Capital (lngfc) had a CD test statistic of 12.667 (p-value = 0.000) and a mean correlation of 0.85, confirming substantial dependence across cross-sections. Natural Capital (lnnaturalcapital) showed significant cross-sectional dependence, with a CD test statistic of 3.201 (p-value = 0.001), a mean correlation of 0.22, and a mean of 0.68. Lastly, Human Capital (lnhumancapital) exhibited the highest level of dependence, as reflected by a CD test statistic of 13.715 (p-value = 0.000) and a mean correlation of 0.92.

Overall, it was concluded that most variables displayed significant cross-sectional dependence, except for Net FDI Inflows, null hypothesis rejected and alternative hypothesis accepted. Thus, there is weaker evidence of dependence among the panel unit and required second generation unit root test.

Unit root test

Since most variables exhibited cross-sectional dependence, the second-generation unit root tests were more suitable. Tests such as Pesaran's CADF (CIPS) test or Cross-Sectionally Augmented IPS (CIPS) test **(Pesaran, 2007)**[6] were preferred because they accounted for cross-sectional dependence. However, for Net FDI Inflows, which showed no significant dependence, both first-generation tests like Levin-Lin-Chu (LLC) test (Levin, Lin, & Chu, 2002)[7] and second-generation tests remained applicable.

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[6] Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics, 22*(2), 265-312.

[7] Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit root tests in panel data: asymptotic and finite-sample properties. *Journal of Econometrics, 108*(1), 1-24.

Table 2: Results of Pesaran's Panel Unit Root Test (CIPS) at Level

Variable	CIPS Statistic	10% Critical Value	5% Critical Value	1% Critical Value	Stationary? (p < Critical Value)
Net FDI Inflows	-2.24	-2.21	-2.33	-2.57	Stationary at 10%
GDP (lngdp)	-2.076	-2.21	-2.33	-2.57	Non-stationary
Exchange Rate (lnexr)	-1.905	-2.21	-2.33	-2.57	Non-stationary
Energy Consumption (lnener)	-1.693	-2.21	-2.33	-2.57	Non-stationary
Gross Fixed Capital (lngfc)	-1.875	-2.21	-2.33	-2.57	Non-stationary
Natural Capital (lnnaturalcapital)	-1.824	-2.21	-2.33	-2.57	Non-stationary
Human Capital (lnhumancapital)	-1.575	-2.21	-2.33	-2.57	Non-stationary

Source: Computed

As presented in table 2, the results of Pesaran's Panel Unit Root Test (CIPS) at level indicated that Net FDI Inflows was the only variable that exhibited stationarity at the 10 per cent significance level, with a CIPS statistic of -2.24, which was lower than the 10 per cent critical value of -2.21. However, it remained non-stationary at the 5 per cent and 1 per cent levels. In contrast, GDP (lngdp), Exchange Rate (lnexr), Energy Consumption (lnener), Gross Fixed Capital (lngfc), Natural Capital (lnnaturalcapital), and Human Capital (lnhumancapital) were all non-stationary at level, as their CIPS statistics were higher than the critical values at all significance levels. These findings suggested that most of the variables contained unit roots and required further differencing to achieve stationarity

Table 3: Results of Pesaran's Panel Unit Root Test (CIPS) at First Difference

Variable	CIPS Statistic	N, T	1% Critical Value	5% Critical Value	10% Critical Value	Stationary? (H_0: Non-Stationary)
D.NETFDIINFLOWS	-5.464*	(5, 21)	-2.57	-2.33	-2.21	Yes (Stationary)
D.LNGDP	-3.675*	(5, 21)	-2.57	-2.33	-2.21	Yes (Stationary)
D.LNEXR	-3.914*	(5, 21)	-2.57	-2.33	-2.21	Yes (Stationary)
D.LNENER	-4.779*	(5, 21)	-2.57	-2.33	-2.21	Yes (Stationary)
D.LNGFC	-2.884	(5, 21)	-2.57	-2.33	-2.21	Yes (Stationary)

D.LNNATURALCAPITAL	-4.839*	(5, 21)	-2.57	-2.33	-2.21	Yes (Stationary)
D.LNHUMAN CAPITAL	-4.437*	(5, 21)	-2.57	-2.33	-2.21	Yes (Stationary)

Source: Computed

As illustrated in the table 3, the results of Pesaran's Panel Unit Root Test (CIPS) at first difference indicated that most variables became stationary after differencing. Net FDI Inflows (D.netfdiinflows), GDP (D.lngdp), Exchange Rate (D.lnexr), Energy Consumption (D.lnener), Natural Capital (D.lnnaturalcapital), and Human Capital (D.lnhumancapital) had CIPS statistics lower than the 1 per cent critical value (-2.57), confirming their stationarity at the 1 per cent significance level.

Additionally, Gross Fixed Capital (D.lngfc) was found to be stationary, as its CIPS statistic (-2.884) was below the 5 per cent critical value (-2.33). These findings suggested that after first differencing, all tested variables no longer contained unit roots, indicating that they were integrated of order I (1).

Panel Cointegration

Given that Pesaran's Panel Unit Root Test (CIPS) confirmed that the variables were integrated of order I (1), it was necessary to apply panel cointegration tests to determine whether a long-run association existed **(Pesaran, 2007)[8].** The **Pedroni (1999[9], 2004)[10]and Kao (1999)[11]** tests were chosen because they are widely used for panel data settings, accounting for heterogeneity across cross-sections while testing for cointegration. Since the majority of the test statistics rejected the null hypothesis, it confirmed that the variables moved together over time **(Pedroni, 2004; Kao, 1999)**

Table 4: Panel Cointegration Test Results

Test	Statistic	Value	p-value	Conclusion
Pedroni Test	Modified Phillips-Perron t	1.1046	0.1347	No cointegration (Fail to reject H0H_0H0)
	Phillips-Perron t	-5.4075	0.000	Cointegration exists (Reject H0H_0H0)
	Augmented Dickey-Fuller t	-5.6718	0.000	Cointegration exists (Reject H0H_0H0)

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[8] **Pesaran, M. H. (2007)**. A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics, 22*(2), 265–312.

[9] **Pedroni, P. (1999)**. Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and Statistics, 61*(S1), 653–670.

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[11] **Kao, C. (1999)**. Spurious regression and residual-based tests for cointegration in panel data. *Journal of Econometrics, 90*(1), 1–44.

Kao Test	Modified Dickey-Fuller t	-2.2765	0.0114	Cointegration exists (Reject H0H_0H0)
	Dickey-Fuller t	-2.4139	0.0079	Cointegration exists (Reject H0H_0H0)
	Augmented Dickey-Fuller t	-1.5359	0.0623	Weak evidence of cointegration
	Unadjusted Modified DF t	-4.7994	0.000	Strong cointegration evidence
	Unadjusted Dickey-Fuller t	-3.298	0.0005	Cointegration exists (Reject H0H_0H0)

Source: Computed

As depicted in the table 4, the results of the Pedroni and Kao panel cointegration tests provided insights into the long-run relationship among the variables. The Pedroni test yielded mixed findings, with the Modified Phillips-Perron t-statistic (p = 0.1347) failing to reject the null hypothesis of no cointegration. In contrast, the Phillips-Perron t-statistic (-5.4075, p = 0.000) and Augmented Dickey-Fuller (ADF) t-statistic (-5.6718, p = 0.000) strongly rejected the null, indicating the presence of cointegration. Similarly, the Kao test results showed strong evidence of cointegration, as the Modified Dickey-Fuller (p = 0.0114), Dickey-Fuller (p = 0.0079), and Unadjusted DF statistics (p < 0.001) rejected the null hypothesis. However, the Augmented Dickey-Fuller t-statistic (p = 0.0623) only provided weak evidence. Despite minor inconsistencies, the findings suggested that the variables were cointegrated, implying a long-run equilibrium relationship.

With cointegration established, the next step involved estimating both the long-run and short-run dynamics using a Panel ARDL (PMG or MG) approach, which is particularly suited for mixed integration orders and provided robust estimates of both equilibrium relationships and short-term adjustment.

The suitable test to apply next would be a panel cointegration test to examine the long-run relationship between the variables. Given the presence of cross-sectional dependence in previous results, **Westerlund's (2007)[12]** panel cointegration test would be appropriate as it allows for cross-sectional dependence and provides robust results. Alternatively, if cross-sectional dependence is weak, **Pedroni's (1999) or Kao's (1999) cointegration tests** could also be considered.

Pooled Mean Group (PMG) Estimation Result: Long-run (LR) effects

Once cointegration is established, an appropriate estimation method would be the Panel ARDL (PMG) approach since it accommodated a mix of I (0) and I (1) variables and allows for long-run equilibrium relationships among them.

[12] Westerlund, J. (2007). Testing for error correction in panel data. *Oxford Bulletin of Economics and Statistics, 69*(6), 709–748.

Table 5: Long-Run (LR) Effects

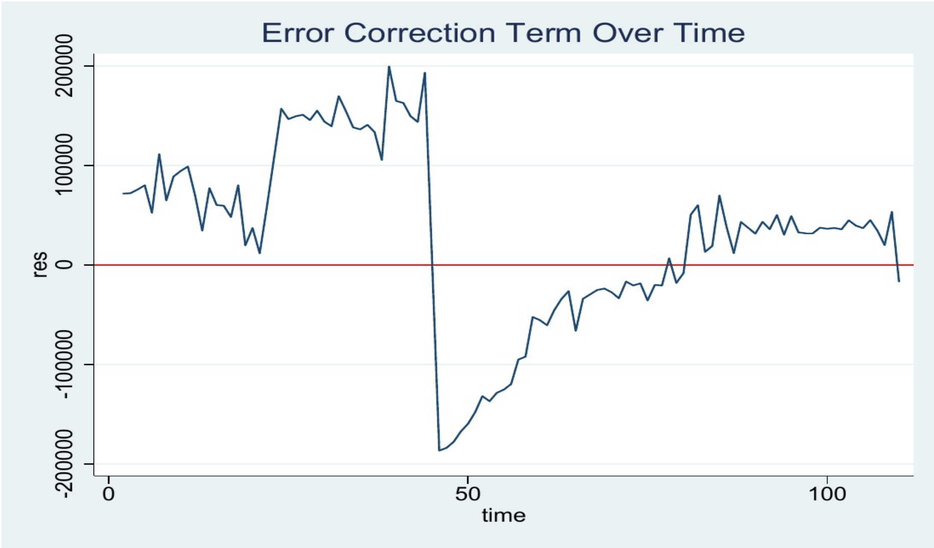
Variable	Coefficient	Std. Error	z-value	p-value	Interpretation
lngdp (Economic growth)	25,679.64	15,180.32	1.69	0.091	Weakly significant positive effect on FDI inflows.
lnexr (Exchange rate)	-56,589.53	24,771.18	-2.28	0.022	Significant negative impact on FDI inflows.
lnener (Energy consumption)	-295,670.60	80,508.33	-3.67	0.000	Strong negative impact on FDI inflows.
lngfc (Gross fixed capital)	1,123.29	16,961.40	0.07	0.947	No significant effect on FDI inflows.
lnnaturalcapital (Natural capital)	293,456.10	74,891.72	3.92	0.000	Strong positive impact on FDI inflows.
lnhumancapital (Human capital)	20,001.48	51,459.03	0.39	0.698	No significant impact on FDI inflows.
Error Correction Term (ECT)	-0.6005	0.2965	-2.03	0.043	Significant error correction, meaning short-run deviations correct towards LR equilibrium.

Source: Computed

As presented in the table 5, the long-run estimation results revealed that economic growth (*lngdp*) had a weakly significant positive effect on FDI inflows, with a coefficient of 25,679.64 and a p-value of 0.091, suggested that higher economic growth was associated with an increase in FDI inflows, albeit with limited statistical significance. In contrast, the exchange rate (*lnexr*) significantly negatively impacted FDI inflows, as indicated by a coefficient of -56,589.53 and a p-value of 0.022, implying that currency depreciation discouraged foreign investment. Similarly, energy consumption (*lnener*) had a strong negative effect on FDI inflows, with a coefficient of -295,670.60 and a highly significant p-value of 0.000, suggested that higher energy consumption was linked to a decline in FDI inflows.

Meanwhile, gross fixed capital formation (*lngfc*) did not significantly impact FDI inflows, as evidenced by a coefficient of 1,123.29 and a p-value of 0.947, indicating that variations in gross fixed capital did not meaningfully influence foreign investment. In contrast, natural capital (*lnnaturalcapital*) had a substantial positive impact on FDI inflows, with a coefficient of 293,456.10 and a p-value of 0.000, suggested that greater availability of natural resources attracted more foreign investment. However, human capital (*lnhumancapital*) did not exhibit a significant impact on FDI inflows, as indicated by a coefficient of 20,001.48 and a p-value of 0.698, implying that improvements in human capital did not significantly influence FDI inflows in the long run.

Finally, the error correction term (ECT) was statistically significant, with a coefficient of -0.6005 and a p-value of 0.043, confirming a stable long-run equilibrium relationship. This result indicated that any short-term deviations in FDI inflows from their long-run equilibrium were gradually corrected over time. Specifically, approximately 60 per cent of the disequilibrium from the previous period was adjusted in the current period, signifying a moderate convergence speed toward equilibrium. The negative sign of the ECT validated the expected correction mechanism, ensuring that temporary shocks to FDI inflows did not persist but moved toward their long-run equilibrium path. The finding underscored the dynamic nature of FDI inflows, where long-run adjustments systematically counterbalance short-run fluctuations.



Graph 1

As shown in the graph 1, the Error Correction Term (ECT) measured how fast deviations from the long-run equilibrium were corrected. When the ECT was negative and significant, it confirmed that FDI inflows returned to equilibrium aftershocks. However, if the ECT was close to zero or positive, it indicated a lack of adjustment in the long run. The graph likely displayed ECT values over time, representing how fast the correction occurred. If the values moved toward zero over time, it suggested that the adjustment process was stable. Conversely, if the values fluctuated significantly or remained above zero, it indicated instability in the long-run relationship.

Pooled Mean Group (PMG) Estimation Result: Short-run (SR) effects

Table 6: Short-run (SR) effects

Variable	Coefficient	Std. Error	z-value	p-value	Interpretation
Δlngdp	-37,936.34	61,338.36	-0.62	0.536	Insignificant short-run effect.
Δlnexr	60,009.13	26,983.43	2.22	0.026	Significant positive short-run effect.
Δlnener	124,635.30	382,409.20	0.33	0.744	No significant short-run effect.

Δlngfc	-54,327.40	44,507.45	-1.22	0.222	No significant short-run effect.
Δlnnaturalcapital	-99,174.21	111,323.00	-0.89	0.373	No significant short-run effect.
Δlnhumancapital	75,790.54	119,277.10	0.64	0.525	No significant short-run effect.
Constant	38,476.46	9,443.47	4.07	0.000	Significant positive impact.

Source: Computed

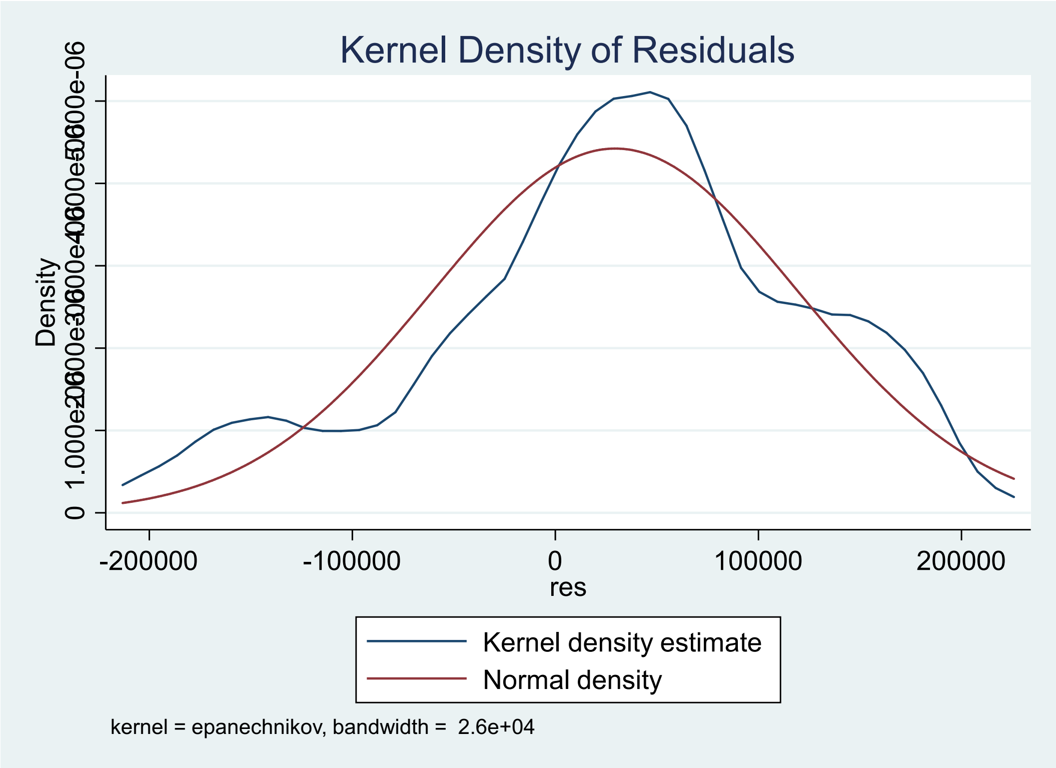
As presented in Table 6, the short-run effects estimated through the Pooled Mean Group (PMG) approach provided mixed results regarding the impact of various economic indicators on the dependent variable. The coefficient for GDP (Δlngdp) was negative (-37,936.34) and statistically insignificant (p=0.536), indicating that short-run fluctuations in GDP did not have a meaningful effect. Conversely, the exchange rate (Δlnexr) exhibited a significant positive short-run impact, with a coefficient of 60,009.13 and a p-value of 0.026, suggesting that an appreciation in the exchange rate contributed to an increase in the dependent variable in the short run.

Other variables, including energy consumption (Δlnener), gross fixed capital formation (Δlngfc), natural capital (Δlnnaturalcapital), and human capital (Δlnhumancapital), did not demonstrate statistically significant short-run effects, as indicated by their high p-values (ranging from 0.222 to 0.744). This implied that short-term changes in these factors did not substantially influence the dependent variable. However, the constant term was found to be statistically significant (p=0.000), with a positive coefficient of 38,476.46, indicating the presence of other underlying factors contributing positively in the short run.

It was concluded that results indicated that in the short run, exchange rate movements were the only statistically significant determinant among the examined variables. At the same time, other macroeconomic indicators did not exhibit immediate and measurable effects. These findings underscored the sensitivity of the dependent variable to exchange rate fluctuations in the short term while highlighting the potential lagged effects of other economic determinants.

As seen in the Graph 2, the residual distribution from the PMG estimation appeared to follow a bell-shaped curve, suggesting that the residuals were approximately normally distributed. The density plot indicated that the residuals were centered around zero, implying that the model did not systematically overpredict or underpredict the dependent variable. The spread of residuals ranged between -200,000 and +200,000, reflecting the variation in the errors. The distribution seemed symmetrical, with no visible skewness or extreme outliers, which indicated that the model's errors were well-behaved.

Graph 2



Conclusion

The study investigated the role of economic indicators in influencing Foreign Direct Investment (FDI) inflows using panel data analysis. The results provided empirical insights into the short-run and long-run relationships between FDI and key macroeconomic determinants, including GDP, exchange rate stability, energy consumption, natural capital, and human capital.

Pesaran's Cross-Sectional Dependence (CD) test revealed significant cross-sectional dependence among most variables, except for net FDI inflows, which exhibited weak evidence of dependence. This justified using second-generation panel data techniques to account for interdependencies among cross-sectional units. Furthermore, the results of panel unit root tests indicated that most variables were non-stationary at level but became stationary after first differencing, confirming their integration of order I (1). The panel cointegration tests provided strong evidence of a long-run equilibrium relationship among the variables, suggesting that these macroeconomic factors move together over time.

The long-run estimation results from the Pooled Mean Group (PMG) model highlighted that economic growth and natural capital positively influenced FDI inflows. At the same time, exchange rate depreciation and increased energy consumption had a significant negative impact. This suggests that higher GDP and abundant natural resources attract foreign investment, whereas exchange rate instability and high energy consumption deter it. Gross fixed capital formation and human capital did not significantly impact FDI in the long run, indicating that these factors may not be the primary drivers of investment decisions among the BRICS. The significant and negative error correction term (ECT) further confirmed the existence of a stable long-run equilibrium, demonstrating that short-run deviations in FDI inflows were gradually corrected over time.

In the short run, exchange rate fluctuations were the only statistically significant determinant of FDI inflows, reinforcing the importance of currency stability in attracting foreign investors. Economic indicators, including GDP growth, energy consumption, gross fixed capital, natural capital, and human capital, did not show measurable short-run effects, suggesting potential lagged responses to investment decisions.

The study concluded the crucial role of stable macroeconomic policies and efficient resource management in fostering a favorable investment environment. Policymakers should focus on maintaining exchange rate stability, enhancing economic growth, and leveraging natural resources sustainably to attract long-term FDI. Future research could explore sectoral FDI trends and incorporate additional institutional factors to understand investment dynamics in emerging economies better.

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