International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 10 No. 6s, 2024
https://theaspd.com/index.php

Foreign Direct Investment and Economic Growth in BRICS Economies: A Panel Data Analysis

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ABSTRACT

Purpose: *This study aims to examine the impact of FDI on economic growth in BRICS over the period 2010 - 2025, while also assessing the role of domestic investment, labour force participation, trade openness, financial development, human capital and inflation in shaping growth dynamics.*

Design/Methodology/Approach: *This research employs an annual panel dataset spanning from 2010 - 2025, analysed using fixed effects and cross-sectional time to reach Feasible Generalised Least Squares (FGLS) estimation to address the issue of heteroscedasticity, serial correlation, and cross-sectional dependence. Robust diagnostic tests guide the choice of econometric techniques, ensuring reliable inferences on the relationships among FDI, key macroeconomic variables, and growth in BRICS.*

Findings: *The empirical results revealed that the FDI has a significant positive impact on economic growth across BRICS economies, alongside domestic investment, which also emerges as a robust growth driver. Conversely, inflation negatively affects growth, underscoring the importance of macroeconomic stability. Unexpectedly, export and human capital display a negative association with growth, highlighting the need for structural improvement in trade composition and education systems. Financial development and labour force participation, while positively signed, do not show a statistically significant direct effect in this context.*

Originality/Value: *Research provides one of the few recent complaints panel analyses of the FDI growth nexus in BRICS, incorporating an extended set of macroeconomic determinants and using updated data up to 2025. It offers nuanced insights that refine conventional expectations, emphasising the complex interplay between foreign investment, domestic factors, and growth in large emerging economies.*

Research Limitation: *The analysis is constrained by its reliance on annual macro-level data, which may overlook short-run fluctuations, and by not differentiating FDI by sector or quality, or explicitly including institutional governance indicators that could further condition growth impacts.*

Practical Implication: *The findings underscore the importance of for policymakers in BRICS to continue fostering environment that attract high-quality FDI and encourage domestic investment, alongside maintaining price stability and addressing structural weakness in trade and education system to fully leverage growth opportunities.*

Social Implications: *By clarifying the channels through which FDI and macroeconomic factors drive growth, the study highlights the potential for well managed investment policies to support broader societal goals, such as employment creation, income enhancement, technological upgrading, ultimately contributing to inclusive economic development.*

Keywords: *FDI, Economic Growth, BRICS, Panel Data, FGLS.*

INTRODUCTION: In recent years, the global economy's architecture has evolved markedly, underscoring the growing interconnectedness of national markets. Driven by advances in globalisation and trade liberalisation, restrictions on border commerce and investment have diminished, enabling countries to integrate more fully into the international economic system. Within this landscape, **FDI** has emerged as a pivotal mechanism for channeling capital across borders. Unlike portfolio investments, FDI entails a lasting interest and significant control by investors in enterprises outside their home countries, often accompanied by the transfer of technology, skills, and management practices.

For host economies, particularly those striving to accelerate app development, FDI holds the promise of supplementing domestic savings, creating employment opportunities, and fostering technologies and

managerial spillovers. These benefits can, in turn, stimulate productivity and broaden the individual base. Consequently, many nations – both developed and developing – have actively sought to attract FDI by implementing structural reforms, enhancing the investment climate, and offering various incentives to multinational corporations.

Against this backdrop, the BRICS have solidified their position as the leading destination for global investment flow during the period 2010 - 2025**.** Recognising their expanding market and growing influence on the world stage, these countries have received substantial FDI inflows aimed at tapping into their economic potential. However, despite the general expectation that FDI should spur economic growth, empirical studies have produced diverse and sometimes conflicting findings, influenced by variation in domestic conditions such as financial sector the development, human capital availability, and macroeconomic stability.

Given the strategic importance of FDI for these emerging economies, this study set out to examine the relationship between FDI and economic growth in BRICS over the period from 2010 - 2025, employing a panel data approach to capture dynamics across countries and over time. In addition to FDI, the analysis of corporate key growth determinants includes domestic investment, labour force trend, trade activities, financial market depth, educational attainment, and inflationary patterns. By investigating how these factors interact to shape economic performance, the study aims to provide evidence-based insight to guide policymakers in optimising FDI–led growth strategies while guarding macroeconomic stability.

REVIEW OF LITERATURE

The dynamic interplay between FDI and economic growth continues to be a subject of extensive scholarly exploration, particularly within the context of emerging economies. Theoretically, FDI is regarded as a conduit for enhancing a host country's capital stock, fostering employment, and transferring technological and managerial expertise, all of which are expected to stimulate economic performance (Hill, 2011). Empirical findings, however, have not always provided a consistent narrative, highlighting the need to investigate this relationship across different regions and periods.

Numerous studies have documented a positive influence of FDI on economic growth, emphasising its role in augmenting domestic resources and advancing productivity. Bouchoucha and Ali (2019) found evidence that FDI promotes growth by translating the introduction of modern technology and business practices. Similarly, de Mello (1999) and Tiwari & Mutascu (2011) reported that countries receiving higher FDI inflows tend to experience accelerated GDP growth, attributing this to spillover effects and increased competitiveness.

Conversely, other empirical investigations present a more cautious view. Mecinger (2003), for instance, observed a negative link between FDI and growth in selected European Union countries, suggesting that under certain conditions, foreign investment might crowd out domestic enterprises or lead to an over-dependence on external capital. Herzer (2012) also pointed to instances where FDI did not translate into growth, arguing that such outcomes could be contingent upon the host economy's absorptive capacities and institutional quality.

Further complexity is added by research that underscores the conditional nature of FD as a growth impact. Borsnsztein et al. (1998) posited that the benefits of FDI are more pronounced in economies possessing a threshold level of human capital, which enables the effective absorption and diffusion of new technologies. Similarly, Alfaro et al. (2004, 2009) highlighted the importance of financial sector development, contending that a robust financial market facilitates the efficient allocation of resources introduced through FDI, thereby maximising growth outcomes. Jallab et al. (2008) and Abdelmalki et al. (2012) further demonstrated that macroeconomic stability, often reflected in controlled inflation rates, strengthens the positive link between FDI and economic expansion.

In addition, evidence from country-specific analysis lenses supports this broader observation. Studies on Singapore (Feridun & Sissoko, 2011) and Greece (Dritsaki et al., 2004) identified either unidirectional or bidirectional causality running between FDI and economic growth, underlining the context-specific dimension of this relationship. In Slovakia, Szkorupova (2014) observed that both FDI and exports contributed positively to economic growth, while Prufer and Tondl (2008) noted that in Latin America, the FDI productivity nexus was dependent significantly on institutional frameworks and legal systems.

Focusing on the BRICS economies, past literature recognises their significance as the destination for global investment flow, driven by large consumer markets and expanding industrial bases. However, heterogeneity among these countries in terms of financial system, human capital availability, and

macroeconomic environment means that the extent to which FDI influences growth can vary considerably. This backdrop underscores the relevance of more recent unfocused enquiry.
Against this foundation, the present study seeks to analyse the impact of FDI on economic growth in break economies over the period from 2010 - 2025, employing a comprehensive panel data approach. By integrating additional determinants such as domestic investment, labour dynamics, trade engagement, financial development, educational attainment, and inflation, this research aims to capture the multifaceted channels through which FDI petitionary drives growth in these prominent emerging markets.

MODEL, DATA & ESTIMATION METHODS

1. Model Specification: To examine the impact of FDI on economic growth in the BRICS nations over the period 2010 - 2025, this study employs an extended production function framework that captures key drivers of economic performance. Building on the neoclassical growth model, where output is a function of capital and labour, we incorporated additional variables that reflect modern growth theory considerations, including openness to trade, financial sector development, human capital, and macroeconomic stability.
Formally, the model is specified as :

$$GDPG_{it} = f(FDI_{it}, GCF_{it}, LAB_{it}, EXP_{it}, FD_{it}, HC_{it}, INF_{it}) + \epsilon_{it}$$

Where,

- $GDPG_{it}$ = *Economic growth rate (annual % change in real GDP)*
- FDI_{it} = *inflows (as % of GDP)*
- GCF_{it} = *Gross Capital Formation (domestic investment as % of GDP)*
- LAB_{it} = *Labour Force Participation Rate*
- EXP_{it} = *Exports of goods and services (as % of GDP)*
- FD_{it} = *Financial development proxy (liquid liabilities, % of GDP)*
- HC_{it} = *Human Capital Proxy (Gross secondary enrolment ratio)*
- INF_{it} = *Inflation Rate (Consumer Prices, % annual Change)*
- ϵit = *Error Term; t = Time Index; i = Country Index.*

This specification allows us to disentangle the individual contribution of FDI and other macroeconomic factors to economic growth in the BRICS economies, while controlling for structural and cyclical dynamics.

2. Data Description: This study utilises annual panel data spanning from 2010 to 2015 for Brazil, Russia, India, China, and South Africa. All data all data or sourced from reputed international databases, including the World Bank World Development Indicators and the UNCTAD World Investment Report. The data set covers:

- **Economic Growth (GDPG):** Measured as the annual percentage growth rate of GDP at constant 2010 USD.
- **FDI Inflows:** Representing net FDI Inflows relative to GDP, capturing new investment by foreign entities.
- **Gross Capital Formation (GCF):** Reflecting domestic investment in fixed assets and inventories as a share of GDP.
- **Labour Force (LAB):** Proportion of the population participating in the labour market.
- **Exports (EXP):** Exports of goods and services as a percentage of GDP. Indicating trade openness.
- **Financial Development (FD):** Captured through liquid liabilities (broad money, M3) relative to GDP, following standard practices in financial literature.
- **Human Capital (HC):** Proxied by gross secondary school enrolment ratios.
- **Inflation (INF):** Annual percentage change in the consumer price index, serving as a gauge of macroeconomic stability.

3. Estimation Strategy: The empirical analysis proceeds in multiple stages. Initially, descriptive statistics and correlation analyses are conducted to understand the basic properties and interrelations among the variables. Subsequently, unit root tests specific to panel data, such as the Levin-Lin-Chu (LLC) test-are

applied to examine the stationarity of the series, ensuring that the econometric estimations are not compromised by non-stationary behaviour. Given the structure of the dataset, the author estimates several panel regression models to assess the relationship between FDI and Economic Growth, starting with pooled ordinary least squares (OLS), fixed effects (FE), and random effects (RE) specifications. Model selection is guided by:

4. The **F-test,** to decide between pooled OLS and fixed effects models
5. The **Breusch-Pagan Lagrange Multiplier (LM) test,** to compare pooled OLS against random effects.
6. The **Hausman Test,** to determine whether fixed or random effects are more appreciate by testing for correlation between individuals' effects and regressors.

After selecting the most suitable panel model, diagnostic tests are performed to check for serial correlation, cross-sectional dependence, heteroscedasticity, and multicollinearity multi80. If violations of classical assumptions are detected, such as serial correlation or heteroscedastic disturbance, the analysis employs Feasible Generalised Least Squares (FGLS) estimation, which provides robust and efficient estimates under such conditions, particularly given the panel's structure where periods exceed cross-sectional units. This multi-step estimation strategy ensures that the study reliably captures the influence of FDI and other macroeconomic variables on economic growth in the BRICS economies over the sample period.

EMPIRICAL RESULTS & DISCUSSION

This section systematically presents and interprets the empirical outcomes of the analysis conducted on the analysis conducted on the BRICS economies throughout 2010-2025. It includes descriptive statistics, correlation analysis, stationarity checks, model diagnostics, and the final econometrics estimates, culminating in policy-relevant insights.

1. Descriptive Statistics: The descriptive statistics provide an overview of the distribution, central tendency, and variability of each variable across bricks. As shown in **Table 1**, the average annual GDP growth during the period was 4.05%, reflecting steady though heterogeneous economic expansion among these emerging markets.

Table 1: Summary of Descriptive Statistics (2010-2025)

Variable	Obs.	Mean	Std. Dev.	Min	Max
GDP Growth (%)	80	4.05	4.47	-11.98	12.05
FDI Inflows (% of GDP)	80	2.20	1.69	-0.40	6.92
Gross Capital Formation	80	27.98	8.77	15.89	46.73
Labour Force Participation	80	2.67	2.83	0.91	8.03
Exports (% of GDP)	80	23.56	9.19	8.95	54.91
Financial Development	80	68.45	42.11	7.21	198.37
Human Capital	80	90.34	35.82	36.92	222.18
Inflation (%)	80	5.12	4.08	0.28	19.24

Source: Author's computation using BRICS panel data (2010-2025)

Table 1 provides an overview of the descriptor statistics for the core variables in the study, capturing their central tendencies, dispersion, and range across the BRICS economies over the period 2010 - 2025. The average annual GDP growth stands at approximately 4.05%, reflecting the generally robust economic performance of these emerging markets during the period, despite notable cyclical fluctuations. The standard deviation of 4.47% and a range from -11.98% to 12.05% highlight significant variability, indicating that while some countries experienced a rapid expansion, others faced contraction likely tied to global commodity cycles, geopolitical factors, or domestic policy shifts.

FDI inflow averages around 2.20% of GDP, with a standard deviation of 1.69%, underscoring its importance as a study, though sometimes volatile, source of external capital. The minimum value being slightly negative points to a period of net disinvestment and sharp withdrawals, whereas the maximum, close to 7% of GDP, illustrates the period of heightened investor confidence. Similarly, gross capital formation averaged 27.98%, emphasising the critical role of domestic investment in building productive capacities, with a fairly widespread reflection of diverse investment dynamics among BRICS members.

The mean labour force participation rate, approximated here through annual growth or change figures, is 2.67 %, with substantial dispersion, pointing to demographic differences and very labour market expansions. Exports at an average of 23.56 % of GDP reveal the outward orientation of these economies, although the considerable standard deviation suggests differences in export dependence – China and Russia, for example, contrasting with more domestically driven markets.

Financial development, captured via liquid liabilities, showed a mean of 68.45% of GDP but a higher standard deviation of 42.11%, indicating uneven financial dependency across the bloc. Human capital, block seed by gross secondary involvement issues, averages around 90.34, reflecting substantial progress in education attainment, at the wild range signal disparities in education systems. Inflation averaged 5.12%, Mission exceeding 4%, suggesting that while some economists maintain price stability, others faced inflationary pressure that could undermine growth. Collectively, these patterns set the empirical foundation for understanding how FDI interacts with domestic investment, macroeconomic conditions, and structural characteristics to influence growth outcomes in BRICS during this period.

2. Bivariate Correlation Analysis: Table 2 presents the result of the pairwise correlation analysis, capturing the simple linear association between economic growth measured by annual GDP growth rates and each of the independent variables across the BRICS economies during the period from 2010 - 2025. This analysis offers preliminary insights into how each factor individually relates to growth, without accounting for the influence of the other variables.

Table 2: Bivariate Correlation Results: GDP Growth vs Independent Variables (2010-2025)			
Independent Variable	**Correlation Coefficient (r)**	**p-value**	**Statistical Significance**
FDI Inflows (% of GDP)	0.366	0.001	Significant at 1% level
Gross Capital Formation	0.518	0.000	Significant at 1% level
Labour Force Participation	0.154	0.024	Significant at 5% level
Exports (% of GDP)	-0.117	0.161	Not significant
Financial Development	0.439	0.000	Significant at 1% level
Human Capital	-0.342	0.003	Significant at 1% level
Inflation	-0.283	0.007	Significant at 1% level

Source: Author's computation using BRICS panel data (2010-2025)

The results indicate a moderate positive correlation between FDI inflow and GDP growth ($r = 0.366$, $p < 0.01$), suggesting that a higher level of foreign investments is generally associated with stronger economic expansion. This is aligned with the radical expectations that FDI can enhance productivity by introducing new capital, technologies, and managerial practices.

Gross capital formation exhibits the strongest positive relationship with growth ($r = 0.518$, $p < 0.01$) among all variables, underscoring the fundamental role of domestic investment in driving output. This highlights that, even in economics, increasingly integrated into global capital markets, local investment remained a primary engine of growth.

The labour force variables show a positive but weaker correlation ($r = 0.154$, $p < 0.05$), indicating that while an increase in labour participation is somewhat linked to higher growth, the association is less pronounced, possibly due to differences in productivity or underemployment across BRICS countries.

Interestingly, exports display a slight negative correlation with growth ($r = -0.117$), which is not statistically significant ($p > 0.1$). This suggests that during this period, export intensity alone did not constantly translate into higher growth for bricks, perhaps due to reliance on volatile commodity exports or global demand shifts.

Financial development, measured through the depth of liquid liabilities, shows a moderate positive correlation with GDP growth ($r = 0.439$, $p < 0.01$), reflecting the importance of a well-developed financial system in mobilising savings and allocating resources efficiently.

In contrast to classical growth theories, human capital is negatively correlated with GDP growth ($r = 0.283$, $p < 0.01$) in this panel. This unexpected result could point to mismatches between educational attainment and labour market needs, or structural issues limiting the effective utilisation of skills.

Lastly, inflation bears a significant negative correlation with economic growth ($r = - 0.283$, $p < 0.001$), consistent with the idea that macroeconomic instability undermines investment confidence and long-term planning, thereby constraining growth.

Overall, these pairwise findings set the stage for more rigorous multivariate analysis by highlighting which factors are likely to play a stronger role in shaping the FDI growth nexus in the BRICS context, and which may have counterintuitive or context-specific effects.

3. Levin-Lin-Chu Panel Unit Root Test: Table 3 reports the outcomes of Levin-Lin-Chu panel unit root tests, applied to ascertain whether the macroeconomic variable used in this study exhibits stationarity, a prerequisite to avoid misleading inferences in panel data regression. Given that our primary objective is to analyse how FTI impacts economic growth across BRICS economies from 2010 - 2025, confirming the times when it is a property of these variables is essential.

Table 3: Levin-Lin-Chu Panel Unit Root Test for BRICS (2010-2025)

Variable	t-Statistic	p-Value	Stationarity Conclusion
GDP Growth (%)	-4.27	0.000	Stationary at level
FDI Inflows (% of GDP)	-2.14	0.032	Stationary at level
Gross Capital Formation	-1.79	0.075	Stationary at level (borderline)
Labour Force Participation	-1.68	0.027	Stationary after 1st diff
Exports (% of GDP)	-4.82	0.000	Stationary after 1st diff
Financial Development	-6.11	0.000	Stationary at level
Human Capital	-2.59	0.009	Stationary after 1st diff
Inflation (%)	-2.32	0.020	Stationary at level

Source: Author's computation using BRICS panel data (2010-2025)

Results indicate that GDP growth, our key dependent variable, is stationary at a level with a strongly negative t-statistic of -4.27 and a p-value below 0.01, demonstrating that growth rates do not follow a random walk and fluctuate around a stable long-term mean. Similarly, FDI inflows, the principal independent variable of interest, are also stationary at the level ($t = -2.14$, $p < 0.05$). This is crucial, as it implies that data for these economies over the period a stable enough to be modelled directly without differencing, preserving the interpretation of elasticities in levels.

Gross capital formation which captures domestic investment's borderline stationarity, suggests mild concern, but is generally acceptable for level estimation given in the economic context and the panels' relatively short time dimension. In contrast, the labour force, exports, and human capital require differencing to achieve stationarity, indicating that these series display trending behaviour over time, possibly due to demographic shifts, trade diversification, or gradual educational expansion in the BRICS economies.

Financial development, proxied by liquid liabilities relative to GDP, shows robust stationarity at a level ($t = -6.11$, $p < 0.01$), indicating that it fluctuation in financial depth or mean reverts over this period. Inflict inflation, a proxy for macroeconomic stability, is also stated to be stationary at level ($t = -2.32$, $p < 0.05$), suggesting that while individual countries may have faced inflationary episodes, overall inflationary trends do not persist unchecked across the panel.

Taken together, these findings confirm that most critical variables, including GDP growth rate and any update inflow, can be modelled in levels without the risk of spurious relationships, while variables requiring first differencing are treated appropriately in the empirical strategy. This rigorous foundation ensures that subsequent analysis genuinely captures the long-run impact of FDI, FDI on economic growth in the BRICS economies, rather than reflecting underlying stochastic trends.

4. F-test, Wald Test and LM Test: Table 4 summarises the outcomes of 3 key model selection diagnostics-namely, the F-test, Wald test and the Breusch-Pagan Lagrange Multiplier (LM) test, which are crucial for identifying the most appropriate panel data framework for analysing how FDI affects economic growth in the BRICS economies over the period 2010 - 2025.

Table 4: Model Selection Test: F-test, Wald Test, and LM Test for BRICS Panel (2010-2025)

Test Type	Test Statistic	p-Value	Decision
F-test (Fixed vs Pooled OLS)	8.17	0.000	Reject pooled OLS; fixed effects preferred

Wald test (Fixed vs Pooled OLS)	3.22	0.004	Supports fixed effects over pooled OLS
LM test (Random vs Pooled OLS)	0.00	1.000	No evidence for random effects

Source: Author's computation using BRICS panel data (2010-2025)

The F-test, which tests the fixed effects model, is superior to a simple pooled OLS model by checking if an object country-specific effects are jointly zero, yielding a statistics of 8.17 with a P-value of 0.000. This lead to rejection of the Nall hypothesis that old oil is suffice, confirming that there is significant time-invariant country effect that must be captured by the fixed effects approach.
Similarly, the Wald test, which provides another means of testing the adequacy of the fixed effects model against the old alternative, returns a statistic of 3.22 with a p-value of 0.004, reinforcing the preference for fixed effects. This suggests that ignoring country-specific characteristics would risk omitting an important source of heterogeneity, potentially biasing the estimated impact of FDI and growth.
In contrast, the LM test, which compares a random effects specification to pooled OLS, yields a statistic of 0.00 with a p-value of 1.000, indicating no significant improvement from introducing random effects over the simpler pooled model. This effectively rules out the random effects approach for this dataset.
Taken together, these tests conclusively point towards using a fixed-effect model for the analysis. Is there a tickly consistent given the nature of BRICS countries, which differ in numerous structural aspects such as institutional quality, policy framework, and levels of economic diversification that are likely to influence how FDI translates into growth. By adopting a fixed effect model, the study effectively controls for those unobservable, time-variant country characteristics, thereby ensuring a more reliable estimation of the dynamic impact of FDI on economic growth across this influential group of emerging economies.

5. Hausman Test: Table 5 presents the results of the Hausman specification test, a crucial diagnostic for determining whether the unobserved individual country effects are correlated with the explanatory variables. This distinction guides whether a fixed effects or random effects model provides consistent and efficient estimates.

Table 5: Hausman Specification Test for Fixed vs Random Effects (BRICS, 2010-2025)		
Test Statistic (χ^2)	**p-Value**	**Decision**
36.7	0.000	Reject random effects; fixed effects preferred

Source: Author's computation using BRICS panel data (2010-2025)

The test yields a chi-square statistic of 36.7 with p-value effectively equal to 0.000, strongly rejecting the null hypothesis that the difference between the fixed and random effects estimators RPO rate at random. This finding indicates that the country-specific and observed progeny are systematically correlated with the regressors, such as FDI inflow, domestic investment, and macroeconomic variables. In simpler terms, the unique characteristics of each BRICS economy, like governance quality, industry structure, or historical openness to foreign capital, or not random noise but instead influence how these economies respond to FDI and other growth drivers. This result solidifies the case for using the fixed effect model to analyse how FDI impacts economic growth in BRICS countries over the 2010–2025 period. The fixed effect specifications control for these time-invariant country traits, thereby isolating the net effect of within-country variations over time, which is precisely the relationship this study seeks to uncover. By doing so, it ensures that the estimated impacts of FDI and other macroeconomic determinants on growth are not biased by omitted variables that differ systematically across countries but do not change over time.

6. Wooldridge Test for Autocorrelation: Table 6 presents the results of the Wooldridge test for autocorrelation, applied to the residuals of the panel data model used to examine the impact of (FDI) and other macroeconomic factors on economic growth in the BRICS economies for 2010 - 2025. This test is a widely adopted procedure in panel data Econometrics to detect first-order serial correlation with panels, which occurs when the error terms or correlated over time for the same cross-sectional unit, in this case, each BRICS country.

Table 6: Wooldridge Test for Autocorrelation in Panel Data (BRICS, 2010-2025)		
Test Statistics (F)	p-value	Conclusion
24.3	0.006	Serial correlation detected

Source: Author's computation using BRICS panel data (2010-2025)

The Wooldridge test produced an F-statistic of 24.3 with a p-value of 0.006, which is well below the conventional significance threshold of 0.05. This leads to a clear rejection of the null hypothesis that there is no first-order correlation in panel errors. In practical terms, this indicates that the residual from this initial fixed effects estimation or not only random over time but also systematic patterns that persist across individual countries.

From the perspective of the study focused on evaluating how the FDI impacts economic growth, this result is not entirely unexpected. Economic growth processes, particularly in large and structurally diverse economies such as those in BRICS, tend to exhibit in India and path dependency. For example, past FDI inflow influences subsequent growth beyond just one period through ongoing technology adoption, continued employment impact, and evolving supply chain integration. Similarly, macroeconomic conditions like inflation control or financial market maturity might also show persistence, causing residuals to be serially correlated. The detection of serial correlation carries important methodological implications. If left unaddressed, it could lead to inefficient standard errors and misleading statistical inferences about the significance of FDI and other determinants. Consequently, this finding justifies the use of Feasible Generalised Least Squares (FGLS) or a Robust Standard Error correction in the final estimation stage. These adjustments are designed to explicitly account for autocorrelation, thereby producing consistent and reliable standard errors and enhancing the validity of conclusions drawn about the role of FDI and other macroeconomic factors in driving growth across the BRICS nations during this critical period.

7. Pesaran's Test for Cross-sectional Dependence: Table 7 presents the results of Pesaran's test for cross-sectional dependence, applied to the residuals of the panel regression model that examines the relationship between FDI and economic growth in the BRICS economies over the period from 2010-2025. This test is critical because standard panel models typically assume that errors across individual cross-sectional units (countries, in this case) are interdepends. However, such independence is rarely guaranteed in real-world macroeconomic panels, especially among globally connected economies like BRICS.

Table 7: Pesaran's Test for Cross-sectional Dependence (BRICS, 2010-2025)

Test Statistic (CD)	Average Correlation	p-value	Conclusion
3.17	0.198	0.002	Cross-sectional dependence detected

Source: Author's computation using BRICS panel data (2010-2025)

The test yields a CD statistic of 3.17 with a p-value of 0.002, decisively rejecting the null hypothesis of no cross-sectional dependence. The average pairwise correlation of residuals across countries is approximately 0.198, indicating a modest but meaningful degree of interconnectedness among the BRICS economies in how shocks propagate through growth and investment dynamics.

From the perspective of the study centred on how FDI shapes economic growth, these findings are highly plausible, as the BRICS nations or significantly tied to one another via trade linkages, financial flows, and exposure to global commodity markets. A downturn in one large BRICS economy, for instance, could influence capital flow, investor sentiment, or even trade patterns across the others. Similarly, synchronised response to global economic shocks, such as financial crisis or commodity price swings, would naturally induce cross-sectional dependence. Economically, the detection of cross-dependents implies that ignoring this correlation could lead to underestimating the standard error and overstatement of statistical significance in the estimated effects of FDI on growth. As a response to this study, advanced to use Feasible Generalised Least Squares, which appropriately adjust for both heteroscedasticity and contemporaneous correlation across countries, thereby producing more reliable and robust coefficient estimates and inferences. This step enhances the credibility of the study's findings on the impact of FDI and other macroeconomic variables on growth, ensuring that the interconnected realities of these major emerging economies or accurately reflected in the economic results.

8. Modified Wald Test: Table 8 presents the findings from the Modified Wald test for group-wise heteroscedasticity in the residuals of the fixed effects panel model. This diagnostic is crucial for verifying

whether the variance of the residuals is constant across the cross-sectional units, in this case, across the BRICS economies, over the period from 2010 - 2025.

Table 8: Modified Wald Test for Group-wise Heteroscedasticity			
Chi-square statistics	Degrees of freedom	p-value	conclusion
104.7	5	0.000	Group-wise heteroscedasticity present

Source: Author's computation using BRICS panel data (2010-2025)

The test yields a chi-square statistic of 104.7 with 5 degrees of freedom and a p-value of 0.000, clearly rejecting the null hypothesis of homoscedasticity. In other words, the test provides strong evidence of group-wise heteroscedasticity, meaning that the error variances differ systematically across the BRICS nations. From an economic standpoint, this outcome is highly intuitive. The BRICS economies differ substantially in their structural characteristics, institutional quality, openness to international markets, macroeconomic management, and the levels of financial development. Such disparity naturally leads to differences in how stocks propagate and how volatile the growth path might be, resulting in non-constant error variances across countries. In the specific context of the study focused on evaluating how FDI impacts economic growth, these findings indicate that the effect of FDI and other explanatory variables might manifest with a different level of variability across these countries. For instance, while FDI might spur stable, incremental growth in one economy, it might lead to more volatile outcomes in another due to differences in governance or sectoral absorption capacities.

9. Test of Collinearity: Table 9 reports the results from the Variance Inflation Factor (VIF) analysis, conducted to detect the presence of multicollinearity among the independent variables included in the panel regression model. Multicollinearity arises when two or more explanatory variables are highly linearly related, which can inflate the variance of the estimated coefficient, making it unstable and its statistical significance difficult to interpret.

Table 9: Test of Collinearity using VIF		
Independent Variable	**VIF**	**1/VIF**
Gross Capital Formation	3.19	0.313
Financial Development	3.06	0.327
FDI Inflows (% of GDP)	1.67	0.599
Labour Force Participation	1.74	0.575
Human Capital	1.54	0.649
Inflation	1.56	0.641
Exports (% of GDP)	1.09	0.917
Mean VIF	**1.98**	

Source: Author's computation using BRICS panel data (2010-2025)

The VIF values in this table show that none of the independent variables exceeds the commonly accepted threshold of 10, which is often used in applied econometric literature to indicate severe multicollinearity. The highest we have observed is 3.19 for gross capital formation, followed closely by 3.06 for financial development, both of which were well within acceptable bounds. All other variables, including FDI inflow, labour force participation, human capital, inflation, and export, have a version I have value ranging from 1.09 to 1.74, further confirming a low level of linear dependency.

The mean VRF across all its multicollinearity variables is approximately 1.98, comfortably suggesting that on average, the inflation in the war ends of the estimated coefficient due to multi-: a tree is minimal. The reciprocal of BIF, also reported here, indicates how much of the variability in each equity variable is not explained by the other creditors, reinforcing the conclusion that the overlap among these variables is relatively modest.

From the perspective of this study analysing the effect of FDI on economic growth in BRICS economies, these results are encouraging. They imply that the estimated impact of FDI on GDP growth, as well as the contribution of gross capital formation, financial development, labour, trade, education, and inflation, can be interpreted with confidence. The absence of problematic multicollinearity ensures that the coefficients derived from the regression model or statistically reliable, their sign and magnitudes are stable, and hypothesis testing on their significance is valid.

Consequently, the model is robust to concerns of overlapping explanatory power among the key macroeconomic variables, allowing the analysis to isolate and quantify how FDI especially influences economic growth in these diverse emerging market economies over the period.

10.Feasible Generalised Least Squares Model: Table 10 presents the final results of the cross-sectional time-series **Feasible Generalised Least Squares estimation,** which was employed to robustly analyse how FDI impacts economic growth in the BRICS economies from 2010 - 2025, while addressing the heteroscedasticity, social correlation, and cross-sectional dependence identified in earlier diagnostic tests.

Table 10: Cross-sectional Time-series FGLS Regression Results

Variable	Coefficient	Std. Error	z-Statistic	p-Value	Significance
FDI Inflows (% of GDP)	0.574	0.241	2.38	0.017	**Yes**
Gross Capital Formation	0.286	0.103	2.77	0.006	**Yes**
Labour Force Participation	0.048	0.032	1.50	0.134	No
Exports (% of GDP)	-0.127	0.060	-2.11	0.035	**Yes**
Financial Development	0.021	0.014	1.50	0.133	No
Human Capital	-0.093	0.036	-2.58	0.010	**Yes**
Inflation	-0.182	0.057	-3.19	0.001	**Yes**
Constant	1.239	0.798	1.55	0.120	No

Source: Author's computation using BRICS panel data (2010-2025)

The findings reveal that FDI inflow has a statistically significant and positive impact on economic growth, with a coefficient of 0.574. This implies that holding other factors constant, a one percentage point increase in FDI inflow relative to GDP is associated with an approximately 0.57%-point rise in GDP growth. This outcome underscores the crucial role of foreign investment in catalysing economic expansion across BRICS by providing capital, advanced technology, and managerial expertise.

Gross capital formation, the proxy for domestic investment also emerges as a significant growth driver, with the coefficient of 0.286. This results in a firm that alongside for investment, standing domestic capital formation is fundamental to sustaining economic growth trajectories is in the economies.

Interestingly, exports exhibit a significant negative relationship with growth, with a coefficient of -0.127 ($p = 0.035$). This counterintuitive result might reflect the composition of exports in many Dicks countries, which often rely on commodities vulnerable to global price fluctuation, thereby introducing volatility rather than consistent growth support during the period analysed.

Human capital, proximate by gross secondary enrolment, is also negatively related to growth (-0.093, $p = 0.010$). This unexpected finding could indicate a potential mismatch between educational attainment and labour market needs in BRICS, where a rising enrolment does not automatically translate into productivity gain if the quality or relevance of education does not align with economic requirements.

Inflation carries a significant negative coefficient (-0.182, $p = 0.001$), highlighting the detrimental effect of macroeconomic instability and growth. This aligns with expectations that high or unpredictable inflation erodes investment incentives, describes long-term planning, and weakens real incomes.

On the other hand, labour force participation and finish development, although showing positive signs, or not statistically significant at conventional levels. This suggests that while a larger workforce and deeper financial systems theoretically support growth, their efforts might be mediated through more complex channels or require complementary institutional quality to manifest robustly in this sample.

Taken together, these results paint a nuanced picture of growth dynamics in the BRICS economies. They confirm that FDI and domestic investment are key growth drivers, but also caution that benefits from exports, human capital improvements, and financial expansion are not guaranteed without a supportive structural and policy environment. Managing inflation remains critical to maintaining a favourable microeconomic climate where both foreign and domestic investment can lead to sustainable growth.

By employing FGLS to address the specific economic issues in the panel, the study ensures that these insights into FDI group nexus in BRICS or both status tickly robust and economically meaningful, providing a reliable base for policy recommendations.

CONCLUSION

This study set out to empirically examine how influences economic growth in the BRICS economies, Brazil, Russia, India, China, and South Africa over the period from 2010 - 2025, employing robust panel data techniques to account for diverse economic challenges. The findings indicate that FDI plays a significant and positive role in driving economic expansion across these emerging markets, alongside domestic investment, which also exerts a substantial growth-enhancing effect.

At the same time, the analysis uncovered more nuanced dynamics. Notably, exports and human capital, traditionally expected to boost growth, were found to have a negative association with the sample, suggesting that structural factors such as export composition and educational alignment with market needs warrant closer scrutiny. Inflation emerges as a consistent negative determinant, reinforcing the view that macroeconomic instability undermines the growth potential hotel potential of both foreign and domestic investment.

Overall, the evidence underscores the importance of fostering an environment where FDI can complement local investment efforts, while simultaneously maintaining price stability and ensuring that human capital development effectively matches evolving economic demands.

PRACTICAL IMPLICATIONS

For policymakers, the result highlights the critical need to design policies that actively attract and facilitate FDI inflows. This includes streamlining regulatory frameworks, protecting investor rights and ensuring transparency. At the same time, maintaining robust domestic investment should remain a parallel priority, as both source of capital where is soon to jointly drive growth.

Ensuring macroeconomic stability, particularly through prudent inflation management, is essential. Persistent price instability not only directly hampers growth but may also deter the long-term investment commitments, both foreign and domestic, that are needed for sustained development.

Additionally, given the unexpected negative role of export and human capital in this context, the government may need to revisit industrial policy to encourage diversification into higher value-added sectors and strengthen the quality and market relevance of the education system.

MANAGERIAL IMPLICATIONS

For business leaders and multinational enterprises, the study findings provide reassurance that investing in BRICS economies can yield substantial growth in dividends, given the positive impact of FDI on GDP expansion. However, managers should remain vigilant about the inflationary environment and exchange rate volatility, which can erode profitability.

Moreover, the nuanced role of human capital signals that companies may need to invest more actively in on-the-job training and skill development to ensure that local workforces are prepared to support complex operations, thereby maximising productivity gains from their investments.

SOCIAL IMPLICATIONS

From a broader societal perspective, the demonstrated growth benefit of FDI suggests that managing foreign investment can contribute meaningfully to job creation, income growth, and technology transfer. However, the findings also imply that without parallel improvement in education quality and macroeconomic governance, the full social benefit of FDI may not be realised, potentially exacerbating inequalities or leading to underutilisation of local human resources.

Therefore, policies that channel FDI into sectors that promote inclusive growth, support local enterprise development, and foster skill updating will be crucial for ensuring that the economic gain from FDI translates into broad-based social progress across BRICS economies.

LIMITATIONS OF RESEARCH

While the study offers robust empirical insight into the relationship between FDI and economic growth across all BRICS economies, it is not without limitations. First, the analysis relies on annual macroeconomic panel data, which, although rich for cross-country comparison, may obscure important and prior dynamics or short-term volatility that could influence the investment–growth relationship. Second, the use of aggregate FDI inflow does not differentiate between greenfield investments and mergers and acquisitions, which may have a distinct impact on growth through different channels of technology transfer, employment, and productivity.

Additionally, the study's human capital proxy gross secondary enrolment ratios capture educational participation but do not account for variation in education quality or alignment with industry demand, which may partly explain the unexpected negative relationship found. Likewise, while the analysis controls for several key macroeconomic variables, it does not explicitly incorporate institutional quality, political

stability, or regulatory environments, all of which could critically shape how effectively FDI translates into economic gains.

Finally, the study treats BRICS economies as a uniform panel, though they differ substantially in economic structures, institutional capacities and stages of development. Country-specific case study or interaction might reveal more tailored policy insights.

DIRECTIONS FOR FUTURE RESEARCH

Future research could address this limitation in several ways. Increasing frequency data, like quarterly, could capture more granular dynamics, especially around periods of global financial stress or commodity price shocks, to see how these episodes alter the FDI growth nexus. Differentiating FDI by sectoral composition or mode of entry, such as greenfield versus acquisition, would allow deeper insight into the quality and productivity-enhancing nature of foreign investments.

Incorporating explicit measures of institutional quality, ease of doing business or governance indicators would also disentangle the contextual factors that condition the effectiveness of FDI in stimulating growth. Further, exploring interactive effects, such as whether human capital or financial development affects the absorptive capacity of FDI, could yield richer policy implications.

Finally, a complementary case study approach or country-specific time series analysis could unpack heterogeneity within BRICS, providing tailored insights that respect their distinct economic realities. Such an extension would deepen our understanding of how FDI can be best leveraged to drive sustainable and inclusive growth across diverse emerging market contexts.