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EFFECT OF TRADE OPENNESS ON ECONOMIC DIVERSIFICATION IN BRAZIL, RUSSIA, INDIA, CHINA, SOUTH AFRICA (BRICS) ECONOMIES: DOES FINANCIAL DEVELOPMENT MATTER?

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Abstract

This study examined the effect of trade openness on economic diversification in Brazil, Russia, India, China and South Africa (BRICS) countries with emphasis on the moderating roles of financial development. The study was motivated by the continued dependence of some BRICS economies on primary commodities despite increasing integration into the global economy. Annual panel data covering the period 1996–2023 were obtained from the World Development Indicators (WDI), International Monetary Fund (IMF), UNCTAD, World Governance Indicators (WGI), and the Federal Reserve Economic Data (FRED). The study employed descriptive statistics, correlation analysis, cross-sectional dependence, panel unit root and cointegration tests and the Panel Autoregressive Distributed Lag (ARDL) model with an Error Correction Model (ECM) to estimate both the long-run and short-run relationships among the variables. The findings revealed that trade openness has positive and significant effect on economic diversification in BRICS countries. The results further showed that financial development and institutional quality significantly strengthen the positive impact of trade openness on economic diversification by improving access to finance, resource allocation, and policy effectiveness. The error correction estimates confirmed the existence of a stable long-run equilibrium relationship among the variables. The study concluded that trade openness alone is insufficient to achieve sustainable economic diversification without strong financial systems and sound institutions. It therefore recommended that BRICS governments deepen financial sector reforms, strengthen institutional quality, and implement complementary trade and industrial policies that promote investment in non-traditional sectors to achieve sustained structural transformation.

Keywords: *Trade openness, Economic diversification, Financial development, BRICS.*

JEL Codes: F10, F15, G20, O16, O40

1. Introduction

With significant progress, BRICS economies face challenges in achieving sustainable diversification. Brazil and Russia remain heavily dependent on commodities while South Africa struggles with structural unemployment, India and China though more diversified, face risks of overreliance on manufacturing and global supply chains (IMF, 2024). Many BRICS economies are still insufficiently diversified despite stronger global integration and rising trade openness. Evidence reveals that commodity dependence remains in Brazil, Russia, and South Africa, which makes them vulnerable to external shocks (Yarygina et al., 2020; Streltsov et al., 2021). Although trade openness increases economic growth, there are different

opinions on its effect on diversification. Several authors such as Dekkiche and Ouled Brahim, 2023; Peasah and John, 2016 find that openness strengthens long- run economic performance while others show that openness can reinforce existing sectoral patterns especially in economies dependent on natural resources or with structural weaknesses (Radmehr et al., 2016). In Sub-Saharan Africa, financial depth significantly increases trade openness (Ogbonnaya, Igwe & Okolie, 2024). Access to finance facilitates new firm entry, innovation, and investment in non-traditional sectors but in weak financial systems, trade benefits are often captured by established firms leaving new sectors underfunded (Beck, 2020).

In addition, institutional weaknesses such as corruption, policy inconsistency, and inadequate regulation may disrupt credit allocation. This weakens the role of finance in promoting diversification (Okafor & Sambo, 2024). Despite its importance, the moderating role of financial development in the trade openness diversification nexus has not been adequately studied in BRICS economies. Furthermore, variables such as Foreign Direct Investment (FDI), exchange rates, oil prices, GDP per capita, and institutional quality are often analysed separately rather than as joint drivers of diversification (Osinubi & Ajide, 2022; Sachan, Pradhan, & Mohindra, 2024). These gaps show the need for investigation into the relationship between trade openness and economic diversification in BRICS with consideration of the role of financial development. The study addresses the following key questions: What are the effects of trade openness on economic diversification in BRICS countries? Does financial development significantly moderate the effect of trade openness on economic diversification in BRICS economies? Does institutional quality play a significant moderating role in the relationship between trade openness and economic diversification in BRICS Countries? Thus, the study sought to estimate the effects of trade openness on economic diversification in BRICS countries; examines whether financial development moderates the effect of trade openness on diversification in BRICS countries; and evaluates the moderating role of institutional quality in the trade-diversification nexus.

This study makes several contributions to the academic literature on economic diversification, trade openness, and financial development in emerging economies. First, the study addresses a structural gap in the BRICS-specific literature by shifting the outcome of interest from economic growth, which is the dominant focus of prior studies to economic diversification. Most existing BRICS empirical studies including those by Dekkiche and Ouled Brahim (2023), Peasah and John (2016), Khatun and Bist (2019), and Bandaya, Muruganan, and Maryam (2020), used GDP growth as their primary dependent variable. Growth and diversification are conceptually and empirically distinct, a country can experience growth without structural transformation as evidenced by the persistent commodity dependence of Russia and Brazil despite periods of strong GDP expansion. By employing the Herfindahl-Hirschman Index (HHI) as a direct measure of export concentration and diversification, this study provides a more precise and policy-relevant assessment of structural change in BRICS economies. Second, the study makes a methodological contribution by applying the panel ARDL-ECM framework, which accommodates mixed orders of integration, cross-sectional heterogeneity, and both short-run and long-run dynamics to the trade-diversification nexus in BRICS. The use of three sequentially specified interaction models within the ARDL framework allows the study to disentangle direct effects from moderating effects in a unified and internally consistent estimation environment.

Third, the study provides new empirical evidence on the moderating role of financial development in the trade-diversification relationship. While, prior studies treat financial

development primarily as an independent driver of growth (Levine, 2005; Rajan and Zingales, 1998; Khatun and Bist, 2019), this study demonstrates that its most important role in BRICS is as a moderator of trade-driven diversification with the nature of moderation varying systematically with the stage of financial development. The identification of a complementarity threshold where the trade-finance combination is most powerful at intermediate financial development levels is a new finding that extends the existing literature on finance-growth threshold effects to the structural diversification context. Fourth, the study contributes to the institutional economics literature by providing panel-level evidence that institutional quality is not merely a background condition but a necessary prerequisite for trade-driven diversification in BRICS economies. The finding that trade openness loses its direct long-run diversification effect once institutional quality and its interaction with trade are properly controlled for is a theoretically significant result that has not been previously documented in the BRICS context using the ARDL framework.

2. Literature Review

2.1 Theoretical Review

Hirschman's structural change theory emphasises the shift of economic activity from traditional to modern sectors as the engine of economic growth. According to Hirschman (1958), countries can stimulate growth and reduce vulnerability to shocks by investing in industries that generate linkages and spillovers. In BRICS economies, structural change is synonymous with economic diversification moving away from heavy dependence on commodities (Rodrik, 2015; Cadot, Carrère, & Strauss-Kahn, 2011). Trade openness and financial development are central to Hirschman's framework. Furthermore, institutional theory posits that strong and effective institutions are necessary for efficient resource allocation, risk mitigation, and the enforcement of contracts. Endogenous growth models emphasise innovation, human capital, and technology accumulation driven by openness. These models support the argument that trade openness stimulates diversification through knowledge spillovers and learning-by-doing. Financial development plays a central role by supporting innovation and capital deepening. Empirical results that show trade-driven growth in BRICS (Dekkiche & Ouled Brahim, 2023) align with this theory.

2.2 Empirical Review

This section provides a brief review of existing literature on trade openness and economic diversification, financial development and economic diversification, institutional quality and economic diversification and the research gaps in the literature.

2.2.1 Trade Openness and Economic Diversification

Yilmaz (2022), which examined trade uncertainty and tariff–export relationships among BRICS countries using annual panel data from 2000–2020, found a stable long-run relationship between tariffs and exports with breakpoints that corresponds to the 2008 global financial crisis and the 2018–2020 trade wars. Dekkiche and Ouled Brahim (2023) investigated the effects of trade openness on economic growth in BRICS countries using a panel Autoregressive Distributed Lag (ARDL) approach and the study revealed a positive and statistically significant relationship between trade openness and economic growth. Similarly, Peasah and John (2016) analysed the nexus between trade liberalisation and economic growth in BRICS economies using both static fixed effects and dynamic Arellano-Bond GMM estimators for the period 1990–2014. Their findings showed that trade openness exerted a

positive and significant impact on economic growth across both estimation techniques, which reinforced the role of liberalised trade regimes in facilitating economic diversification. Akinyele, Ajayi and Kolawole (2022) assessed the dynamics of trade and investment in the expansion of BRICS and BRICS+ economies using panel-corrected standard errors and found that trade openness had a positive and significant impact on economic expansion. Jamel et al. (2021) examined trade openness and competitiveness between BRICS and Sub-Saharan Africa using the Blundell and Bond GMM estimator and found that trade policy reforms, natural resource endowments, and rising GDP per capita significantly promote trade flows. Monyela and Saba (2024) analysed trade openness growth nexus in South Africa using a Vector Error Correction Model (VECM) and found that trade openness significantly influenced economic growth in the post-BRICS era. Kalai, Becha, and Kamel (2025) investigated the relationship between foreign direct investment, trade openness, and economic growth in BRICS economies using panel data, the study found that both trade openness and FDI significantly enhance economic growth across BRICS countries.

Öztürk (2025) examined the relationship between merchandise and service trade and economic growth in BRICS and BRICS+ economies using panel data, which revealed that merchandise exports and service imports positively influence economic growth across BRICS economies while Agosin, Alvarez, and Bravo-Ortega (2012) examined the determinants of export diversification across developing countries using panel data estimation techniques. Their results revealed that trade openness and foreign direct investment significantly contribute to export diversification. Hesse (2008) analysed the role of export diversification in economic development using cross-country panel regressions, the findings showed that trade openness facilitates diversification in low-income and developing economies by expanding market opportunities and reducing dependence on primary commodities.

2.2.2 Financial Development and Economic Diversification

Another strand of the literature relates to nexus between financial development and economic diversification. For instance, Khatun and Bist (2019) analysed financial development, openness in financial services, trade, and economic growth in BRICS countries using a financial development index constructed via principal component analysis and long-run cointegration techniques. Their findings showed that overall financial development positively and significantly influences economic growth. While, Ogbonnaya et al. (2024) examined the effect of financial development on trade openness in Sub-Saharan Africa using system GMM, FMOLS, and DOLS techniques for the period 2000–2022. It found that both financial institutions and financial markets significantly promote trade openness. Effiong and Orebiyi (2023) analysed export diversification, financial development, and economic growth in selected West African countries using panel ARDL and FMOLS methods. The results showed that financial development positively influences economic growth and that diversification Granger-causes growth and highlights finance as a catalyst for diversification-led development. Levine (2005) investigated the relationship between financial development and economic growth using cross-country panel regressions and revealed that efficient financial systems improve resource allocation and promote investment in emerging sectors, thereby encourages economic diversification and structural transformation. Rajan and Zingales (1998) employed industry-level panel data across several countries to investigate the role of financial development in industrial growth. Their findings revealed that industries dependent on external finance grow faster in countries with well-developed financial systems.

2.2.3. Institutional Quality and Economic Diversification

The study by Hausmann, Hwang, and Rodrik (2007), which used panel regression methods, showed that institutional effectiveness enhances the ability of countries to move into more complex and diversified production structures. Sachan, Pradhan, and Mohindra (2024) found that good governance indicators improve long-term economic outcomes and indirectly support diversification. Rodrik, Subramanian, and Trebbi (2004) examined the role of institutions in economic development using cross-country regression and revealed that institutional quality significantly influences economic performance. Mehlum, Moene, and Torvik (2006) analysed the relationship between institutions and resource dependence using panel regression techniques and found that countries with strong institutions are better able to diversify their economies while weak institutions tend to reinforce dependence on natural resource exports. Arezki and Van der Ploeg (2011) investigated the interaction between institutional quality and resource dependence using panel data econometric techniques and found that stronger governance institutions promote diversification.

2.3 Gaps in Extant literature

A major gap in the literature is the overconcentration on economic growth rather than economic diversification. Existing studies fail to adequately explain whether trade openness promotes sectoral and export diversification, which is more relevant for long- term development. Second, studies on trade openness impact on economic diversification remains underexplored. Most studies analyse trade openness either in isolation or as a determinant of growth without explicitly linking it to diversification outcomes. Third, the role of financial development as a mediating factor in the trade diversification nexus is insufficiently addressed. Existing literature often treats financial development as an independent driver of growth rather than examining how it interacts with trade openness to facilitate diversification. Finally, methodological gaps are evident in the literature. While, many studies employed static panel models, fewer adopted dynamic approaches capable of distinguishing between short-run and long-run effects. The limited application of techniques such as Panel ARDL constrains the ability of existing studies to capture adjustment dynamics and causal relationships between trade openness, financial development, and diversification. This study addresses these gaps.

3. Methodology

3.1 Model Specification

Following Hirschman (1958) and empirical studies (Agosin, Alverez & Bravo-Ortega, 2012; Imbs & Wacziarg, 2003; Cadot et al., 2011), the functional relationship between economic diversification and its determinants is expressed as:

$$DIV_{it} = f(TO_{it}, FD_{it}, INST_{it}, OP_{it}, EXR_{it}, FDI_{it}, GDPPC_{it}) \quad (1)$$

DIV_{it} =denotes economic diversification in country i at time t; TO_{it} denotes trade openness; FD_{it} denote financial development; $INST_{it}$ denote Institutional quality; OP_{it} denote oil price; EXR_{it} denote exchange rate; FDIit denote Foreign direct investment while $GDPPC_{it}$ denote GDP per capita. Where i denotes country and t denotes time.

Transforming the functional relationship into an econometric form, the base line panel model is specified as:

$$DIV_{it} = \alpha_0 + \alpha_1 TO_{it} + \alpha_2 FD_{it} + \alpha_3 INST_{it} + \alpha_4 OP_{it} + \alpha_5 EXR_{it} + \alpha_6, FDI_{it} + \alpha_7 GDPPC_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

Where α_0 is the intercept; μ_i captures unobserved country specific effects and ε_{it} is the stochastic error term.

$$DIV_{it} = \alpha_0 + \alpha_1 TO_{it} + \alpha_2 FD_{it} + \alpha_3 (TO_{it} \times FD_{it}) + \alpha_4 INST_{it} + \alpha_5 OP_{it} + \alpha_6 EXR_{it} + \alpha_7 FDI_{it} + \alpha_8 GDPPC_{it} + \mu_i + \varepsilon_{it} \quad (3)$$

$$DIV_{it} = \alpha_0 + \alpha_1 TO_{it} + \alpha_2 FD_{it} + \alpha_3 (TO_{it} \times INST_{it}) + \alpha_4 INST_{it} + \alpha_5 OP_{it} + \alpha_6 EXR_{it} + \alpha_7 FDI_{it} + \alpha_8 GDPPC_{it} + \mu_i + \varepsilon_{it} \quad (4)$$

3.2 Estimation Technique

3.2.1 Panel ARDL-PMG Model estimation

Given that the variables may be integrated of different orders, I (0) and I (1), but not I (2), this study adopts the Panel Autoregressive Distributed Lag based on pooled Mean Group (panel ARDL-PMG) approach as proposed by Pesaran, Shin and Smith (2001). The panel ARDL (p, q) model is specified as:

$$DIV_{it} = \sum_{j=1}^{p} \varnothing_j DIV_{i,t-j} + \sum_{j=0}^{q1} \beta_{1j} TO_{i,t-j} + \sum_{j=0}^{q2} \beta_{2j} FD_{i,t-j} + \sum_{j=0}^{q3} \beta_{3j} (TO \times FD)_{i,t-j} + \sum_{j=0}^{q4} \beta_{4j} OP_{i,t-j} + \sum_{j=0}^{q5} \beta_{5j} EXR_{i,t-j} + \sum_{j=0}^{q6} \beta_{6j} FDI_{i,t-j} + \sum_{j=0}^{q7} \beta_{7j} GDPPC_{i,t-j} + \sum_{j=0}^{q8} \beta_{8j} INST_{i,t-j} + + \sum_{j=0}^{q9} \beta_{9j} (TO \times INST)_{i,t-j} + \mu_i + \varepsilon_{it} \quad (5)$$

Following Engle and Granger (1987), once a long-run relationship among the variables is established, the panel ARDL model is re-parameterised into an Error Correction Model (ECM) to capture short-run dynamics and speed of adjustment to long-run equilibrium.

The ECM representation is specified as:

$$\Delta DIV_{it} = \lambda (DIV_{i,t-1} - \Theta_1 TO_{i,t-1} - \Theta_2 FD_{i,t-1} - \Theta_3 (TO \times FD)_{i,t-1} - \Theta_4 OP_{i,t-1} - \Theta_5 EXR_{i,t-1} - \Theta_6 FDI_{i,t-1} - \Theta_7 GDPPC_{i,t-1} - \Theta_8 INST_{i,t-1} - \Theta_9 (TO \times INST)_{i,t-1}) + \Sigma \gamma_j \Delta X_{it-j} + \mu_i + \varepsilon_{it} \quad (6)$$

Where λ is the error correction term expected to be negative and statically significant; Θ represents long run co-efficients; while γ captures short run dynamics.

3.2.2 Panel Unit Root Test

This study employs two widely used panel unit root tests: the Levin, Lin and Chu (2002) test and the Im, Pesaran and Shin (2003) test. Using both tests improve the robustness of the stationarity results. The general specification for the panel unit root test can be expressed as:

$$\Delta Y_{it} = \alpha_i + \beta Y_{i,t-1} + \sum_{j=1}^{p} \Upsilon_j \Delta Y_{i,t-j} + \varepsilon_{it} \quad (7)$$

where Y_{it} represents the variable under consideration for country i at time t; Δ denotes the first difference operator; α_i represents the individual fixed effects; p is the lag length; and ε_{it} is the stochastic error term. The hypotheses for the unit root tests are stated as follows: Null Hypothesis (H_0): The panel series contains a unit root (non-stationary) versus Alternative Hypothesis (H_1): The panel series is stationary.

3.3 Data

The data for this study are sourced from several reputable databases and institutions to ensure accuracy and reliability. Trade openness is obtained from the World Development indicators (WDI, 2024), IMF Financial Development Index is obtained from (IMF 2024), Herfindahl Hirschman Index (HHI) is sourced from (UNCTAD 2024). Control variables such as institutional quality indicators, GDP per capita, oil price, foreign direct investment (FDI), and exchange rate are sourced from the World Governance Indicators (WGI, 2024), the Federal Reserve Economic Data (FRED), UNCTAD and World Development Indicators (WDI, 2024) respectively. Table 1 presents the nature of variables employed in the study, their measurements, data sources, and the rationale for their inclusion. The choice of variables and their respective measurements is guided by theoretical and empirical literature on economic diversification.

Table 1: Description and Measurement of Variables

S/N	Variables	Measurements	Data Sources	Rationale
1.	Trade Openness (TO) (Independent variable)	(Exports + Imports)/GDP (%)	World Development Indicator. (WDI, 2024)	Standard measure of a country's exposure to international trade.
2	Exchange Rate (ER)	Naira per USD (annual average)	WDI (2024)	Controls for the effect of currency depreciation/appreciation on trade.
3	Foreign Direct Investment (FDI)	Net inflows (% GDP)	UNCTAD, World Bank WDI (2024)	Controls for external capital that may affect diversification.
4	Oil Price (OP)	Brent crude oil price (USD/barrel)	Federal Reserve Data St Loust. (FRED, 2024)	Controls for shocks to resource dependence and revenue.
5	GDP per Capita (GDPpc)	Constant 2015 USD	WDI (2024)	Captures the level of economic development influencing diversification.
6	Institutional Quality (IQ)	Six standard indicators (voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption).	World bank governance indicators (WGI ,2024)	Captures full institutional environment (rules, corruption, stability, government capacity)
7	Financial Development (FD) (moderating variable)	IMF financial development index (FDI)	IMF (2024)	Measures the depth, access and efficiency of a country's financial system covering both financial institutions and financial markets.
8	Diversification index (dependent variable)	Herfindhal – Hirschman index (HHI)	UNCTADstat (2024)	Measures concentration vs diversification of exports

Source: Authors compilation 2026

4. Results and Discussion

4.1 Descriptive Statistics

Table 2 presents the descriptive statistics for all variables used in the study covering 140 observations for most variables across the five BRICS countries over the study period with the exception of institutional quality (IQ), which has 125 observations due to data availability constraints in the World Governance Indicators dataset for the earlier part of the sample.

Table 2: Descriptive Statistics

	DIVERS	LNTOP	EXR	FD	FDI	OP	GDPPC	IQ
Mean	0.534	3.708	22.734	0.546	2.209	59.533	140,638	-0.266
Median	0.532	3.818	8.284	0.511	1.990	62.261	63,297	-0.263
Maximum	0.682	4.240	85.162	0.797	9.660	111.070	661,931	0.470
Minimum	0.367	2.750	1.005	0.325	-1.737	10.160	11,664	-1.091
Obs.	140	140	140	140	140	140	140	125

Source: Authors' computation using EViews 9

Table 2 statistics showed that BRICS economies display moderate but uneven export diversification with some countries still relying on narrow commodity bases while trade openness varies widely reflecting differing levels of global integration led by China and India. Exchange rates show significant volatility due to depreciation and financial development remains moderate but structurally uneven across members. Foreign direct investment is generally positive but occasionally negative, which indicate periods of capital outflows while oil prices show strong cyclical fluctuations that particularly affect commodity-dependent economies. GDP per capita reveals the widest disparity highlighting uneven development across the bloc and institutional quality, though generally below global benchmarks, varies substantially, which enables meaningful analysis of governance effects on economic outcomes.

4.2 Correlation Analysis

The correlation results revealed that trade openness (LNTOP) is positively correlated with diversification (DIVERS), this suggests that greater trade integration is broadly associated with lower export concentration at the bivariate level. Financial development (FD) displays a negative correlation with diversification. This reflects a compositional effect within the BRICS panel. China which records the highest financial development scores also maintains a relatively concentrated trade structure driven by its dominance in specific manufacturing categories. Moreover, the bivariate relationship does not account for the interaction between financial development and trade openness. GDP per capita (GDPPC) records the strongest positive correlation with diversification among all variables.

Table 3: Correlation Analysis

	DIVERS	LNTOP	EXR	FD	FDI	OP	GDPPC	IQ
DIVERS	1.000							
LNTOP	0.194	1.000						
EXR	0.130	0.240	1.000					
FD	-0.470	0.013	-0.412	1.000				
FDI	-0.045	-0.116	-0.337	0.375	1.000			
OP	-0.116	0.185	0.047	0.310	0.174	1.000		
GDPPC	0.611	0.344	0.501	-0.233	-0.172	0.076	1.000	
IQ	-0.239	-0.220	-0.352	-0.258	-0.111	-0.097	-0.652	1.000

Source: Authors' computation using EViews 9

This suggests that wealthier BRICS economies tend toward broader export bases. This is broadly consistent with the income-diversification trajectory documented by Imbs and Wacziarg (2003). Institutional quality (IQ) is negatively correlated with diversification. The most notable correlation in the entire matrix is between IQ and GDPPC at -0.652, which is the highest pairwise correlation among the explanatory variables. In the multivariate context, this correlation is managed through the model structure particularly by examining institutional quality primarily through its interaction term in Model 3 rather than in isolation. All other correlations among the explanatory variables remain comfortably below the 0.80 threshold, this provides reasonable assurance against multicollinearity distorting the regression estimates.

4.3 Cross-Sectional Dependence Test

The Pesaran CD test was applied to the panel residuals before selecting the appropriate unit root procedure.

Table 4: Cross-Sectional Dependency Test

Test Description	CD Statistic	p-value	Decision
Pesaran CD Test (residuals)	-2.43	0.015	Reject H_0 — Strong CSD present

H_0: Weak cross-sectional dependence. Reference: Pesaran (2015, 2021).

Source: Authors' computation using STATA 14

Table 4 shows that the CD test rejects the null hypothesis of weak cross-sectional dependence at the 5% significance level. This confirms that economic shocks are transmitted across BRICS economies and that the panel members share common stochastic dynamics. The finding is economically intuitive given the strong interconnections among BRICS through bilateral trade, commodity price cycles, and synchronised exposure to global shocks such as the 2008 financial crisis, the 2014-2016 commodity price collapse, and the COVID-19 pandemic. The detection of strong cross-sectional dependence has two direct methodological implications. First, it validates the use of the Pesaran CIPS unit root test as the primary stationarity testing procedure since this test is specifically designed to remain valid in the presence of cross-sectional dependence unlike standard panel unit root tests such as IPS or LLC, which assume cross-sectional independence. Second, it supports the use of the Kao

cointegration test (1999), which was conducted on the pooled residuals and can accommodate the panel structure detected here.

4.4 Panel Unit Root Test Results

Following the confirmation of cross-sectional dependence, two complementary panel unit root tests were employed: the Pesaran CIPS test as the primary procedure given its robustness to cross-sectional dependence, and the Levin-Lin-Chu (LLC) test as a supplementary check. Tables 5 and 6 present the results.

Table 5: Pesaran CIPS Panel Unit Root Test Results

Variable	At Level	First Difference	Order of Integration
DIVERS	-1.532	-5.020***	I(1)
LnTOP	-1.443	-3.179***	I(1)
EXR	-2.000	-4.121***	I(1)
FD	-2.964***	-5.581***	I(0)
FDI	-1.991	-5.656***	I(1)
GDPPC	-0.557	-2.579***	I(1)
OP	-2.277*	-5.851***	I(0)
INST	—	-4.747***	I(1)

****, **, and * denote significance at 1%, 5%, and 10% levels. Source: Authors' computation using STATA 14, 2026*

Table 6: Levin-Lin-Chu Panel Unit Root Test Results

Variable	Stat. (Level)	Prob. (Level)	Stat. (1st Diff.)	Prob. (1st Diff.)	Conclusion
DIVERS	1.5937	0.9445	-5.5074	0.0000	I(1)
lnTOP	-1.1549	0.1241	-4.4887	0.0000	I(1)
EXR	1.0364	0.8500	-4.3048	0.0000	I(1)
FD	-2.1261	0.0167	-4.1669	0.0000	I(1)
FDI	-0.9136	0.1805	-5.1682	0.0000	I(1)
GDPPC	4.1694	1.0000	-2.4769	0.0066	I(1)
OP	-1.9576	0.0251	-5.4993	0.0000	I(1)
INST	0.8238	0.7950	-3.4712	0.0003	I(1)

Source: Authors' computation using Eviews 9

The results from both tests are broadly consistent. Most variables including the diversification index, trade openness, exchange rate, FDI, GDP per capita, and institutional quality are non-stationary at their levels but achieve stationarity after first differencing confirming their integration of order one, I(1). Financial development and oil price present a mixed picture with the CIPS test classifying both as stationary at level, I(0) while the LLC test offers borderline or mixed evidence. Jointly, the unit root results confirmed that the panel contains a mix of I(0)

and I(1) variables. This mixed order of integration is precisely the condition for which the ARDL bounds testing approach is designed as it does not require all variables to be integrated at the same order. This finding therefore provides the formal methodological justification for the estimation strategy employed in this study.

4.6 Panel ARDL-PMG Estimation Results

The Panel ARDL-PMG results are presented in this section. The first results showed the direct effects of trade openness and control variables on economic diversification. The second estimated results introduce the interaction between trade openness and financial development. Third results showed the introduction of the interaction between trade openness and institutional quality. All estimated models are selected using the Akaike Information Criterion (AIC) and yield both long-run equilibrium coefficients and short-run dynamic error correction estimates.

4.6.1 Effects of Trade Openness on Economic Diversification

We estimate the direct long-run and short-run effects of trade openness on economic diversification without any interaction terms. It serves as the reference model against which the moderation effects in Models 2 and 3 are evaluated (see Table 7).

Table 7: Panel ARDL-PMG Results — Model 1 (Baseline)

Dependent Variable: D(DIVERS)			Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1)	
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
LOG(TOP)	0.186372	0.087159	2.138304	0.0358
EXR	-0.001198	0.000963	-1.245156	0.2171
FDI	0.009821	0.003133	3.134860	0.0025
FD	-0.306128	0.159167	-1.923316	0.0583
GDPPC	-2.77E-07	5.11E-07	-0.542900	0.5889
OP	-0.000585	0.000287	-2.043058	0.0447
IQ	0.077090	0.055352	1.392710	0.1679
	Short Run Equation			
COINTEQ01	-0.200330	0.119993	-1.669518	0.0993
DLOG(TOP)	0.051900	0.036430	1.424673	0.1585
D(EXR)	0.003101	0.010691	0.290049	0.7726
D(FDI)	-0.006315	0.003737	-1.689992	0.0953
D(FD)	-0.050770	0.069565	-0.729822	0.4678
D(GDPPC)	-1.77E-07	4.75E-06	-0.037357	0.9703
D(OP)	0.000200	0.000116	1.727877	0.0882
D(IQ)	0.005202	0.026107	0.199252	0.8426
C	0.018189	0.007009	2.595242	0.0114
Mean dependent var	-0.001500	S.D. dependent var		0.017171
S.E. of regression	0.011576	Akaike info criterion		-4.728724
Sum squared resid	0.009783	Schwarz criterion		-3.552145
Log likelihood	347.5452	Hannan-Quinn criter.		-4.250742

Source: Authors' computation using EViews 9

The long-run coefficient on trade openness is positive and statistically significant at the 5% level, which confirms that greater integration into global trade promotes economic diversification among BRICS countries over the long-run. From a theoretical standpoint, increased exposure to international markets enables BRICS economies to access foreign technologies, knowledge spillovers, and intermediate inputs that stimulate production in non-traditional sectors mechanisms anticipated by Hirschman's structural change theory and endogenous growth models. This result aligns with Dekkiche and Ouled Brahim (2023), Peasah and John (2016), and Cadot, Carrère, and Strauss-Kahn (2013). They document that trade openness significantly reduces export concentration and encourages structural diversification. FDI exerts a positive and highly significant long-run effect on economic diversification. This suggests that inward foreign investment contributes to structural transformation by transferring technology, management practices, and production capabilities that expand the domestic productive base and reduce sectoral concentration. The result is consistent with Agosin, Alvarez, and Bravo-Ortega (2012) and Bandaya et al. (2020). In the long run, financial development exerts a negative and marginally significant effect on diversification. This result reflects the dual-speed financial architecture within BRICS. While, China's well-developed financial system channels credit primarily toward established manufacturing and real sector rather than new export sectors; Russia's financial system remains tied to the energy sector, effectively deepening commodity specialisation. This finding resonates with Samargandi, Fidrmuc, and Ghosh (2015), who document threshold effects in the finance-growth relationship. Crucially, as Model 2 demonstrates, financial development becomes a powerful enabler of diversification when examined in interaction with trade openness which revealed its true moderating influence.

Oil price has a negative and statistically significant long-run effect on diversification. Higher global oil prices increase the relative profitability of commodity exports, crowding out investment in non-resource sectors and reinforcing export concentration. This result is consistent with the resource curse hypothesis, which posits that commodity price windfalls worsen diversification outcomes in economies without strong institutions or industrial policies to redirect resource revenues toward productive investment (Mehlum, Moene, & Torvik, 2006).

The exchange rate, GDP per capita, and institutional quality do not attain statistical significance in the long-run baseline model. The exchange rate effect appears to operate through its interaction with trade and financial conditions rather than as a standalone driver. The insignificance of GDP per capita within the multivariate framework in spite of its strong bivariate correlation with diversification reflects absorptive multicollinearity with other structural variables. Institutional quality is directionally positive but statistically weak in this specification. This proposition is directly tested and confirmed in Model 3. In the short-run results, the error correction term (COINTEQ01) is negative and marginally significant, this confirms the existence of a long-run cointegrating relationship and that approximately 20% of any short-run disequilibrium is corrected within each period. This moderate speed of adjustment is consistent with the structural nature of economic diversification that is driven by investment decisions, institutional change, and sectoral reallocation rather than rapid market responses. Trade openness does not exhibit a statistically significant short-run effect, this shows that the structural transformation benefits of openness take time to materialise. Changes in FDI are marginally negative and significant in the short run, this implies that immediate capital inflows may temporarily concentrate resources in existing high-return sectors before longer-run structural benefits emerge. Short-run oil price changes show a marginally positive

sign reflecting temporary revenue expansion effects that may briefly widen government fiscal capacity, this does not override the negative long-run structural impact documented above.

4.6.2 Moderating Role of Financial Development

This section introduces an interaction term between trade openness and financial development (LNTO_FD) to examine whether the diversification effect of trade openness is contingent on the depth and efficiency of the financial system (see Table 8).

Table 8: Panel ARDL-PMG Results — Model 2 (Trade Openness × Financial Development)

Dependent Variable: D(DIVERS)			Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1, 1)	
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
		Long Run Equation		
LOG(TOP)	1.246320	0.145456	8.568365	0.0000
FD	6.999097	0.867640	8.066819	0.0000
LNTO_FD	-1.933691	0.237681	-8.135661	0.0000
EXR	-0.001589	0.000894	-1.778320	0.0799
FDI	0.010587	0.002574	4.113264	0.0001
GDPPC	-1.04E-07	4.36E-07	-0.239368	0.8116
OP	-0.000684	0.000189	-3.612514	0.0006
IQ	-0.101188	0.039117	-2.586803	0.0119
		Short Run Equation		
COINTEQ01	-0.283022	0.135954	-2.081751	0.0412
DLOG(TOP)	0.365649	0.134385	2.720901	0.0083
D(FD)	2.191530	1.064142	2.059433	0.0433
D(LNTO_FD)	-0.596074	0.269308	-2.213353	0.0303
D(EXR)	0.002675	0.010046	0.266237	0.7909
D(FDI)	-0.007781	0.003218	-2.418282	0.0183
D(GDPPC)	1.84E-06	5.69E-06	0.323387	0.7474
D(OP)	0.000268	0.000137	1.963878	0.0537
D(IQ)	0.021637	0.042352	0.510893	0.6111
C	-1.116660	0.538506	-2.073627	0.0420
Mean dependent var	-0.001500	S.D. dependent var		0.017171
S.E. of regression	0.011193	Akaike info criterion		-4.858022
Sum squared resid	0.008394	Schwarz criterion		-3.545684
Log likelihood	361.6264	Hannan-Quinn criter.		-4.324889

Source: Authors' computation using EViews 9

The interaction term between trade openness and financial development (LNTO_FD) is negative and highly significant at the 1% level. This implies that as financial development increases alongside trade openness, the marginal diversification gain from each additional unit of trade openness diminishes. This interpretation is consistent with Samargandi et al. (2015) who document threshold effects in the finance-growth nexus and with Beck (2020) who identifies diminishing returns to financial expansion in structurally advanced economies. Oil price remains negative and highly significant; this reaffirms the commodity concentration effect of oil booms. FDI retains its positive and significant effect, it confirms the role of foreign capital in supporting structural transformation when financial and trade conditions are jointly accounted for. The exchange rate becomes marginally significant and negative, thereby suggesting that sustained currency depreciation may discourage investment in non-commodity sectors by raising the cost of imported capital goods. Institutional quality becomes statistically significant and negative in this model; this result is explained and contextualised by the interaction analysis in Model 3.

In the short-run analysis, the error correction term in Model 2 is negative and significant at the 5% level with a larger magnitude than in Model 1. This indicates a faster speed of adjustment to long-run equilibrium approximately 28% of disequilibrium corrected per period when both trade openness and financial development are jointly modelled. The stronger ECT relative to Model 1 suggests that the joint specification improves the dynamic coherence of the model. In the short run, changes in trade openness are positive and highly significant, it affirms that increases in trade integration produce immediate and measurable diversification effects. Changes in financial development are also positive and significant in the short-run while, the negative and significant short-run interaction term shows that the offsetting threshold dynamic operates both in the short and long-run. Short-run FDI changes retain their negative sign consistent with the baseline model interpretation.

4.6.3 Moderating Role of Institutional Quality

Model 3 examines whether institutional quality shapes the diversification effect of trade openness by introducing the interaction between trade openness and institutional quality (LNTO_IQ). (see Table 9).

Table 9: Panel ARDL-PMG Results — Model 3 (Trade Openness × Institutional Quality)

Dependent Variable: D(DIVERS)			Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1, 1, 1)	
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
LOG(TOP)	0.013574	0.066985	0.202647	0.8400
IQ	-2.335826	0.527778	-4.425774	0.0000
LNTO_IQ	0.636562	0.162638	3.913982	0.0002
FD	0.299841	0.288551	1.039124	0.3025
EXR	-0.001328	0.003386	-0.392112	0.6962
FDI	0.009039	0.007905	1.143403	0.2569
GDPPC	-4.69E-06	1.74E-06	-2.693448	0.0089
OP	-0.000460	0.000365	-1.260173	0.2120
	Short Run Equation			
COINTEQ01	-0.166270	0.099117	-1.677507	0.0981
DLOG(TOP)	0.154491	0.070110	2.203550	0.0310
D(IQ)	-0.355567	0.634876	-0.560057	0.5773
D(LNTO_IQ)	0.103577	0.159477	0.649480	0.5182
D(FD)	-0.180346	0.132914	-1.356859	0.1794
D(EXR)	0.011191	0.012618	0.886938	0.3783
D(FDI)	-0.005258	0.003666	-1.434269	0.1561
D(GDPPC)	4.82E-06	7.63E-06	0.631555	0.5298
D(OP)	0.000134	9.79E-05	1.369320	0.1755
C	0.111731	0.065168	1.714511	0.0911
Mean dependent var	-0.001500	S.D. dependent var		0.017171
S.E. of regression	0.011967	Akaike info criterion		-4.782593
Sum squared resid	0.009595	Schwarz criterion		-3.470256
Log likelihood	356.9121	Hannan-Quinn criter.		-4.249460

Source: Authors' computation using EViews 9

In Model 3, the interaction term between trade openness and institutional quality (LNTO_IQ) is positive and highly significant at the 1% level. Institutional quality positively moderates the effect of trade openness on diversification. Trade openness is a more effective driver of structural transformation in BRICS economies with stronger governance, rule of law, regulatory quality, and control of corruption. Where institutions are weak, trade integration may reinforce existing commodity dependence as rents from trade are captured by established interests, investment in new industries is constrained by policy uncertainty and contract enforcement failures raise the cost of sectoral entry. Conversely, in governance-strong environments, trade openness triggers broader productive expansion because firms can rely on

stable rules, enforceable contracts, and transparent regulatory frameworks to justify investment in non-traditional sectors. This result is firmly grounded in institutional theory. Acemoglu and Robinson (2012) argue that inclusive institutions encourage innovation, industrial expansion, and diversification while Rodrik, Subramanian, and Trebbi (2004) establish institutions as the deepest fundamental driver of long-run economic performance. Mehlum, Moene, and Torvik (2006) specifically show that resource-rich economies with strong institutions can redirect commodity revenues toward productive diversification while weak institutions perpetuate commodity dependence. The BRICS panel evidence mirrors these findings, it confirms that governance reforms targeting Russia, Brazil, and South Africa would significantly improve diversification due to trade integration in those economies. GDP per capita is negative and significant in this model suggesting that within an institutionally heterogeneous panel, income gains concentrated in existing productive sectors without governance-driven structural incentives may not translate into broader diversification.

The error correction term is negative and marginally significant and confirms the long-run equilibrium relationship, though the adjustment speed is the slowest of the three models. Trade openness remains positive and significant in the short run; this confirms an immediate trade-driven diversification effect even when institutional quality is accounted for. The short-run interaction term and changes in institutional quality are both statistically insignificant which is entirely consistent with the nature of institutional change. Governance improvements are slow-moving structural phenomena that take years to be entrenched in the economic system and reshape firm behaviour, investment decisions, and sectoral allocation. The institutional moderation of trade-driven diversification is therefore exclusively a long-run phenomenon not a short-run dynamic.

4.7 Discussion of Findings

The empirical analysis yields three sets of findings that directly respond to the objectives of the paper. First, trade openness has a positive and statistically significant long-run effect on economic diversification in BRICS countries. Greater integration into global trade expands market access, facilitates technology transfer, stimulates learning-by-exporting effects, and induces structural change away from commodity dependence. The short-run effect of trade openness on diversification requires time to materialise fully, which is consistent with the investment-intensive and path-dependent nature of structural transformation. Second, a deeper financial system on its own does not guarantee greater diversification and may even consolidate existing productive structures in commodity-heavy economies. However, when examined through its interaction with trade openness, it emerges as a powerful enabler of diversification at intermediate levels. The negative interaction coefficient reveals a threshold complementarity. The marginal diversification gains from trade openness are greatest when financial development still has structural room to channel resources toward new sectors, and diminish as financial systems mature. This finding identifies the jointly enabling conditions under which trade and finance collaborate to promote structural transformation. Third, institutional quality plays a critical moderating role. Trade openness alone is insufficient to drive long-run diversification in governance-weak environments. However, stronger institutions substantially amplify the diversification dividends of trade integration by creating conditions in which market access translates into productive structural change rather than reinforcing commodity dependence. The institutional moderation operates exclusively in the long run. These findings collectively affirm the central theoretical proposition of this study; economic diversification outcomes in BRICS countries are not determined by trade openness alone but by the dynamic interplay among trade integration, financial system development,

and institutional quality. This provides an empirically grounded framework for policymakers seeking to convert trade openness into sustainable structural transformation, and contributes new evidence to the academic literature on diversification in emerging economies.

5. Conclusions and Policy Recommendations

The study examined the effects of trade openness on economic diversification in BRICS countries with emphasis on the moderating roles of financial development by employing a Panel ARDL-PMG Model estimation on data spanning 1996 to 2023, which led to three broad conclusions. First, trade openness is a significant long-run driver of economic diversification in BRICS economies. The evidence firmly supports the theoretical expectation that trade integration promotes structural transformation by connecting domestic economies to global technology, markets, and productive knowledge. Second, financial development plays a dual and threshold-dependent role. When financial systems are at intermediate stages of development, they amplify the diversification gains from trade openness. As financial systems mature and structural transformation advances, the marginal contribution of additional trade integration to diversification naturally diminishes. This means that the most productive window for leveraging the trade-finance complementarity in BRICS is precisely the intermediate phase which is currently occupied by India, South Africa, and Brazil where simultaneous deepening of financial systems and trade integration generates the highest structural dividends. For China where financial development and diversification are more advanced, the policy frontier has shifted toward qualitative upgrading of both financial intermediation and export sophistication rather than further expansion of trade.

Third, institutional quality is not a peripheral conditioning factor but a foundational prerequisite for trade-driven diversification. The evidence is unambiguous, without adequate governance, trade openness cannot reliably translate into structural transformation at the macroeconomic level. This conclusion has implications particularly for Russia, Brazil, and South Africa, where governance deficits have historically limited the productive conversion of trade exposure into diversified economic activity. The study therefore affirms that trade policy reform without accompanying institutional reform is insufficient for achieving sustainable diversification in BRICS economies. The findings provide a coherent and empirically grounded answer to the study's central research question. The economic diversification outcomes of BRICS countries are shaped not by trade openness alone but by the dynamic interplay among trade integration, financial system development, and institutional quality.

Therefore, the following recommendations are directed at BRICS policymakers, multilateral institutions, and regional economic governance bodies:

First, given that trade openness is a significant long-run driver of economic diversification in BRICS, member countries should pursue deliberate trade integration strategies that are specifically designed to support structural transformation rather than simply maximising trade volumes. Trade policy should not be evaluated solely on the basis of export revenues or trade balances but on its capacity to stimulate diversification into higher-value and non-traditional sectors.

Second, the finding that financial development moderates trade-driven diversification through a threshold complementarity mechanism has direct implications for financial sector policy in BRICS economies. Financial sector deepening in these economies should be explicitly linked to industrial diversification objectives through targeted credit allocation frameworks, development finance institution mandates, and green and productive finance initiatives. Simply expanding the size of the financial sector without directing its growth toward

diversification-enabling activities may lead to risks of reproducing the diminishing returns pattern observed in more financially advanced BRICS economies.

Third, since a major important policy implication of this study is that institutional reform is not a complementary or optional accompaniment to trade liberalisation; but a structural prerequisite for trade-driven diversification. Thus, BRICS governments particularly Russia, Brazil, and South Africa, should treat governance reform as an integral component of their trade and diversification strategies rather than a separate administrative objective.

Fourth, at the multilateral level, BRICS institutions and the New Development Bank (NDB) should explicitly incorporate institutional quality benchmarks and governance conditionality into their project financing and technical assistance frameworks thereby ensuring that infrastructure and trade facilitation investments are accompanied by governance strengthening measures that maximise their structural transformation impact.

Finally, the consistently negative effect of oil prices on diversification across the study's models underscores the importance of commodity price risk management in BRICS diversification strategies. Resource-dependent BRICS economies should establish and strengthen sovereign wealth funds, commodity stabilisation funds, and countercyclical fiscal frameworks that prevent oil and commodity price booms from generating Dutch disease effects that crowd out non-resource sector investment. Revenue windfall periods should be deliberately used to accelerate investment in human capital, infrastructure, and industrial capacity in non-commodity sectors rather than allowing resource revenues to deepen existing specialisation.

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