FINANCIAL DEVELOPMENT, INNOVATION INVESTMENT, INSTITUTIONAL QUALITY AND PRODUCTIVITY GROWTH IN NIGERIA

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ABSTRACT

This study investigates the short-run relationship between financial development, investment, institutional quality, and total factor productivity (TFP) in Nigeria using annual time-series data from 1991–2024 within an ARDL framework. Focusing on short-run productivity effects, the findings show that financial development significantly enhances productivity: a one-unit increase in lagged financial development raises TFP by about 0.017 units. Institutional quality strengthens this effect, as the financial development–institutional quality interaction increases TFP by approximately 0.088 units (significant at 1%). Investment produces the strongest direct short-run productivity effect, with a one-unit increase raising TFP by about 0.172 units. However, the investment–institutional quality interaction is negative but significant (−0.034), indicating possible short-run institutional adjustment costs. Human capital contributes positively with lag effects; a one-unit increase in lagged human capital increases TFP by roughly 0.147 units (significant at 10%). Trade openness shows no significant short-run influence. The error correction term indicates about 9.4% speed of adjustment toward equilibrium, but is statistically insignificant, suggesting weak long-run convergence. The model explains 58.5% of TFP variation ($R^2 = 0.585$) and satisfies diagnostic and stability conditions. Overall, productivity improvements from finance and investment are strongly dependent on institutional effectiveness and human capital development.

Keywords: *Financial Development, Investment, Institutional Quality, Human Capital, Total Factor Productivity, Nigeria*

1.0 INTRODUCTION

Productivity growth remains central to achieving sustainable economic development, yet Nigeria continues to lag behind regional and global peers in terms of total factor productivity improvement (World Bank, 2023). Although the economy has seen progress in financial deepening and a growing digital start-up ecosystem, especially in fintech, many innovation outputs have failed to translate into broad-based productivity gains. Critical constraints include limited access to long-term and affordable finance, weak R&D investment, macroeconomic instability, and low absorptive capacity among firms (Global Innovation Index, 2022; UNCTAD, 2022; CBN, 2023).

In response, the Nigerian government has rolled out several policy initiatives aimed explicitly at strengthening the finance-innovation-productivity nexus. Notable among these are: The 3 million

Technical Talent (3MTT) Programme (launched in October 2023), aimed at training three million Nigerians by 2027 in high-demand digital/tech skills (AI, data science, cybersecurity, etc.), to build human capital for innovation. Secondly, the establishment of the Consumer Credit Scheme via the Nigerian Consumer Credit Corporation (CREDICORP), launched in April 2024, aims to expand access to consumer credit for working Nigerians, often in collaboration with banks, fintechs, and cooperatives. The **'**Nigeria First' policy, approved by the Federal Executive Council in 2025, mandates prioritisation of locally made goods and services in government procurement to support domestic producers and promote innovation in local industries.

These policies indicate a renewed governmental emphasis on improving access to finance, skills development, innovation ecosystem infrastructure, and demand for local innovation. Nonetheless, the effectiveness of these initiatives in translating into measurable productivity growth remains underexplored. Thus, this study seeks to examine how financial development in its various dimensions, bank credit, venture/innovation finance, digital finance, and credit guarantees, and recent policy interventions have influenced innovation investment, and ultimately, how innovation investment has affected productivity growth in Nigeria across sectors since 2020.

Nigeria, despite being Africa's largest economy by population and a key emerging market, continues to grapple with sluggish productivity growth. Over the past decade, economic expansion has been driven largely by consumption and natural resource rents rather than by sustained improvements in total factor productivity (TFP). Recent analyses show that Nigeria's productivity growth lags behind both regional and global comparators, undermining prospects for inclusive and sustainable development (World Bank, 2025). This stagnation persists despite significant investments in financial reforms, digital innovation, and entrepreneurial ecosystems.

Theoretically, financial development should facilitate economic transformation by providing the resources required for firms to invest in innovation, adopt new technologies, and enhance efficiency. Similarly, innovation investment is widely acknowledged as a key driver of productivity growth through improved processes, product diversification, and competitiveness. However, in Nigeria, the finance–innovation–productivity nexus has not functioned effectively. Access to affordable and long-term finance remains limited, particularly for small and medium-

sized enterprises (SMEs), while venture capital and R&D expenditure remain comparatively low (Global Innovation Index, 2022). Furthermore, the financial sector is characterised by high borrowing costs, shallow capital markets, and credit constraints that stifle innovation-driven investments (CBN, 2023).

Empirical studies over the last five years suggest mixed outcomes. On one hand, Nigeria's start-up ecosystem has attracted significant venture capital inflows, particularly in fintech, showing the potential of innovation-led growth (IFC, 2021). On the other hand, innovation outputs have not translated into broad-based productivity gains, especially in manufacturing and agriculture, where productivity remains stagnant (UNCTAD, 2022). The disconnect points to structural weaknesses: weak financial intermediation, inadequate absorptive capacity among firms, and macroeconomic instability, including exchange rate volatility and inflation, that discourage long-term investment in innovation (IMF, 2024).

This situation presents a policy and research paradox. While financial development and innovation investment are widely accepted as levers of productivity growth, Nigeria has not fully realised these benefits. This study contributes to the literature by examining the short-run dynamics of productivity growth in Nigeria and assessing how financial development and investment interact with institutional quality to influence productivity outcomes. Specifically, the study addresses the following research questions:

1. Does financial development enhance short-run total factor productivity in Nigeria?
2. How does institutional quality condition the productivity effects of financial development and investment?
3. What role do investment, human capital, and trade openness play in shaping short-run productivity dynamics?

By addressing these questions within an ARDL framework, the study provides policy-relevant insights into the mechanisms through which financial and institutional reforms can support productivity growth in Nigeria.

While prior studies have examined the links between financial development and growth or investment and productivity, limited attention has been paid to short-run productivity dynamics and the moderating role of institutional quality in Nigeria. This study fills this gap by explicitly modelling interaction effects within a dynamic ARDL framework.

2.0 Literature review

Financial development refers to the improvement in financial institutions, markets, and instruments that enhance the efficiency of financial intermediation. In Nigeria, financial sector reforms have aimed to increase access to finance for businesses, tiny and medium-sized enterprises (SMEs). Investment in innovation is vital for enhancing productivity and competitiveness. In Nigeria, the government has initiated several policies to promote research and development (R&D) and technological advancement. A recent analysis by Adeola and Evans (2022) underscores the importance of innovation investment in driving productivity growth, particularly in the manufacturing sector, where technological adoption can significantly impact Productivity growth

is a key indicator of economic performance and is influenced by various factors, including financial development and innovation. According to a report by the National Bureau of Statistics (2023), Nigeria's productivity levels have fluctuated, largely influenced by external economic conditions and internal structural challenges.

The conceptual framework of this study is anchored on the premise that financial development enhances economic productivity through efficient financial intermediation, improved capital allocation, and increased investment capacity. Financial systems facilitate savings mobilization, risk diversification, and credit allocation to productive sectors, thereby improving Total Factor Productivity (TFP). Modern financial intermediation theory posits that well-developed financial markets reduce information asymmetry and transaction costs, thereby improving the efficiency of resource allocation and stimulating productive investment (Levine, 1999). Similarly, endogenous growth theory suggests that financial sector deepening supports technological innovation and human capital development, both of which are fundamental drivers of productivity growth (Aghion et al., 1998).

Financial development influences productivity both directly and indirectly through investment. Directly, developed financial systems provide firms with access to working capital, long-term financial, and liquidity management instruments that improve operational efficiency. Indirectly, financial development stimulates domestic and foreign investment flows, which enhance capital formation, technology transfer, and infrastructure development. Empirical evidence shows that investment serves as a transmission channel through which financial deepening translates into productivity gains, particularly in emerging and developing economies (Beck et al., 2014). In this sense, investment acts as a mediating variable linking financial development to productivity outcomes.

Institutional quality plays a moderating role in the financial development-productivity nexus. Strong institutions characterised by the rule of law, regulatory quality, government effectiveness, and corruption control enhance financial sector efficiency and improve investment outcomes. High institutional quality reduces uncertainty, strengthens contract enforcement, and encourages both domestic and foreign investors. Conversely, weak institutions can weaken the positive effects of financial development by increasing financial market inefficiencies and misallocation of capital (Acemoglu & Johnson, 2005; North, 1990). Recent empirical studies confirm that the productivity gains from financial development are significantly stronger in countries with robust institutional frameworks (Law et al., 2018)

Furthermore, the interaction between financial development and institutional quality determines the effectiveness of financial resource allocation. In countries with strong institutional environments, financial systems are more likely to channel funds into productive sectors such as manufacturing, technology, and infrastructure. However, in weak institutional settings, financial resources may be diverted into unproductive or speculative activities, limiting productivity gains. Therefore, institutional quality conditions the strength and direction of the relationship between financial development and productivity.

Based on these theoretical and empirical insights, this study conceptualises financial development as the independent variable, productivity as the dependent variable, investment as the mediating variable, and institutional quality as the moderating variable. The framework assumes that financial development promotes investment, which in turn enhances productivity, while institutional quality moderates these relationships.

2.1 Research Gap and Contribution

While prior studies have examined the links between financial development and growth or investment and productivity, limited attention has been paid to short-run productivity dynamics and the moderating role of institutional quality in Nigeria. This study fills this gap by explicitly modelling interaction effects within a dynamic ARDL framework.

2.2 Theoretical Perspectives

Understanding the relationship among financial development, innovation investment, and productivity growth requires a combination of economic and management theories that explain how finance supports innovation and how innovation in turn, drives productivity. Several foundational theories provide insights into these linkages and form the analytical backbone of this study.

The discussion begins with the Schumpeterian Theory of Innovation, advanced by Joseph Schumpeter (1934), which emphasizes that economic growth is primarily driven by entrepreneurial innovation. Schumpeter argued that financial institutions—particularly banks—play a vital role in providing credit to innovative firms, thereby enabling them to develop new products, processes, and technologies. The relevance of this theory to Nigeria is profound: many Nigerian firms struggle with limited access to finance, and Schumpeter's position underscores the idea that strengthening financial development is essential for stimulating innovation investment and improving productivity performance. Without an efficient financial system, Nigeria's capacity to generate and sustain technological progress remains weak.

Closely linked to Schumpeter's ideas is the Financial Intermediation Theory, attributed to Gurley and Shaw (1960) and later expanded by McKinnon (1973) and Shaw (1973**)**. This theory posits that financial intermediaries mobilise savings, reduce transaction and information costs, and channel funds to the most productive and innovative sectors. A well-functioning financial system allocates capital efficiently, ensuring that firms with viable innovation projects can access the funds they need. Within the Nigerian context, where credit constraints, high collateral requirements, and underdeveloped capital markets remain significant issues, this theory explains how improvements in financial intermediation can enhance firms' ability to invest in innovation and enhance their productivity.

The link between innovation and long-run productivity growth is further explained by the Endogenous Growth Theory, developed by Paul Romer (1986, 1990) and Robert Lucas Jnr (1988). This theory challenges the traditional view that technological progress is external to the economy.

Instead, it argues that innovation, research and development (R&D), human capital formation, and knowledge spillovers are internal drivers of economic and productivity growth. The theory is highly relevant to Nigeria because it highlights how sustained investment in innovation, skills development, ICT infrastructure,and research capabilities can generate long-term productivity gains. Financial development therefore becomes crucial, as it determines the extent to which firms and governments can finance innovation activities and build knowledge-intensive industries.

Another important theoretical foundation is the Solow–Swan Neoclassical Growth Theory (Solow, 1956; Swan, 1956). While the model focuses primarily on capital, labour, and technological progress, it concludes that long-run productivity growth is driven mainly by improvements in technology. From this perspective, innovation investment is a key determinant of productivity growth. For Nigeria, where many sectors rely on outdated technologies and inefficient production techniques, the Solow model underscores the importance of innovation as a vehicle for overcoming diminishing returns to capital and boosting productivity. Financial development plays a supportive role by facilitating access to modern machinery, digital systems, and production technologies.

Schumpeter's later work on Creative Destruction (1942) provides another layer of understanding of the innovation–productivity link. According to this theory, economic progress occurs when new technologies and processes replace obsolete ones. Productivity grows as innovation drives out inefficiencies. In Nigeria, where structural rigidities, outdated technologies, and low industrial modernisation persist, creative destruction suggests that increased innovation investment is crucial for transforming low-productivity sectors and enhancing overall economic competitiveness. A developed financial system accelerates this process by funding modern technologies, encouraging firm restructuring, and facilitating technological upgrading.

The relationship between financial development and economic performance is further explained by the Supply-Leading and Demand-Following Hypothesis, proposed by Patrick (1966). This dual-causality framework suggests that financial development may either lead economic and productivity growth by supplying credit to productive sectors (supply-leading), or respond to increased economic activity and innovation demands (demand-following). This theory is particularly relevant for Nigeria, where it is important to determine whether financial development drives innovation and productivity, or whether productivity growth creates demand for more sophisticated financial services. The direction of causality has policy implications, especially for designing strategies that strengthen the financial sector to support innovation-led growth.

Finally, the Resource-Based View (RBV**)** of the firm, introduced by Wernerfelt (1984) and expanded by Barney (1991**)**, provides a micro-level perspective on how firms achieve productivity improvements. RBV argues that competitive advantage stems from unique and valuable internal resources such as technology, financial strength, innovation capabilities, and managerial skills. The theory aligns well with the Nigerian context, where firms with stronger innovation capacity and better financing tend to outperform others. Financial development, therefore, enhances firms' ability to build and sustain these internal capabilities, leading to improved productivity outcomes.

Overall, these theories collectively explain the interconnected roles of financial systems, innovation investment, and productivity growth. Financial development serves as the enabling

mechanism through which firms can access resources needed for technological upgrading and innovation. Innovation, in turn, drives productivity by enhancing efficiency, promoting technological adoption, stimulating creative destruction, and improving firm competitiveness. In Nigeria, where financial constraints, weak innovation capacity, and low productivity remain persistent challenges, this combined theoretical foundation provides a robust justification for examining how financial development influences innovation investment and ultimately drives productivity growth.

The theoretical foundation for this study is anchored on the Schumpeterian Theory of Innovation, the Financial Intermediation Theory, and the Endogenous Growth Theory, which collectively explain the dynamics between financial development, innovation investment, and productivity growth.

Schumpeter's Theory emphasizes that innovation, driven by entrepreneurs and supported by access to finance, is the engine of economic transformation, providing a direct link between financial system efficiency and firms' innovation capacity. This is reinforced by the Financial Intermediation Theory, which posits that well-developed financial institutions mobilize savings, reduce transaction and information costs, and allocate credit efficiently to productive and innovative ventures, a critical justification in the Nigerian context where limited access to finance constrains technological upgrading.

The Endogenous Growth Theory further strengthens the theoretical rationale by arguing that innovation, knowledge accumulation, and R&D activities are internal drivers of long-term productivity growth, and their effectiveness depends significantly on the ease of financing such investments. Together, these theories justify the study by illustrating that a developed financial system enhances innovation investment, and sustained innovation ultimately drives productivity growth, an interaction particularly relevant for Nigeria's efforts to overcome structural inefficiencies and achieve technology-driven economic progress.

2.7 Empirical Review

Koç et al (2025) examined the effect of innovation on economic growth across 22 countries for the period 2009–2021. The study employed the two-stage least squares (2SLS) method alongside one-step and two-step System GMM estimators. GDP per capita was used as the dependent variable, while early-stage entrepreneurship rate, mean years of education, R&D expenditures, and trade freedom served as independent variables. The findings indicate that mean years of education, R&D spending, and trade freedom positively contribute to economic growth, whereas the early-stage entrepreneurship rate has a statistically significant negative impact.

Oyadeyi (2025) examined the impact of banks and Fintech innovations on money demand using quarterly data from 2009 to 2022. The study found that payment value and volume positively influence the demand for reserve money but negatively affect narrow, broad, and total money, indicating a substitution effect. The findings also revealed instability in money demand, suggesting that the central bank should adopt a flexible framework, such as inflation targeting, to maintain price stability.

Meniago et al (2025) investigated the relationship between financial development and economic growth in 13 CFA countries from 2003 to 2018 using the Fully Modified Ordinary Least Squares (FMOLS) technique. The study found a significant positive effect of financial development on economic growth, with the impact being stronger when institutional quality is high. The authors suggest that policymakers should expand financial services, improve financial infrastructure, and implement broader institutional reforms to create a supportive environment that maximizes the growth benefits of financial development.

Azmeh and Al-Raeei (2025) examined the relationship between financial development, research output in finance, and economic growth across 15 MENA countries from 2000 to 2017 using the two-step system GMS method. The study found that both the quantity and quality of finance research significantly drive financial innovation, which in turn promotes economic growth. The findings also highlight a mutually reinforcing relationship between financial development and research output, as well as the role of high-quality research in supporting long-term financial stability. The study underscores the importance of investing in finance research and fostering collaboration among academia, industry, and policymakers to enhance innovation and economic performance.

Magazzino (2024) investigated how the relationships among financial development, productivity, and economic growth differ across income categories using a dataset of 130 countries from 1991 to 2019. The countries were grouped into four categories: OECD, developing, least developed, and net food-importing developing economies. Using forecast error variance decomposition and panel vector autoregressive techniques, the study showed that increases in output tend to enhance economic development in the agricultural sector primarily through improvements in productivity. In advanced economies, this effect also operates through expanded access to credit, whereas in developing and least developed countries.

Gizaw et al (2024) explored the relationship between financial development and economic growth across twenty-two emerging economies in Africa and Asia. Employing the Dynamic Common Correlated Effects (DCCE) estimator, which accounts for cross-sectional dependence, permits parameter heterogeneity, and integrates features of both the Mean Group and Pooled Mean Group approaches, the authors found that financial development exerts a positive but marginal impact on economic growth.

This indicates that although these economies are experiencing steady and rapid expansion, their existing level of financial sector development remains inadequate to support long-term growth. The study therefore recommended that policymakers promote deeper financial development through enhanced financial openness, sector liberalization, and digital transformation.

Pal et al. (2024) investigated the interaction between financial development, gender-specific human capital, and total factor productivity (TFP) growth in India using annual data from 1980 to 2019 and the ARDL Bound test model. The study included government spending on education and foreign direct investment as control variables. Findings indicate that financial development enhances productivity growth when male education levels are high but may hinder productivity

when female education is high, highlighting the differential influence of gender-specific human capital. The study underscores the importance of considering gender dynamics in education for policymakers seeking to leverage financial development to promote productivity growth.

Ma et al (2024) examined how financial development influences the relationship between foreign direct investment (FDI) and firm-level innovation in China using data from 2008 to 2014. The study found that bank deregulation strengthens the positive impact of FDI on innovation, particularly for firms with higher absorptive capacity. These results highlight the importance of financial market conditions and the role of absorptive capacity as a key mechanism through which bank deregulation enhances the effect of FDI on firm innovation.

Atsu and Adams (2023) examined the dynamic relationship between financial development and innovation, incorporating the roles of human capital and institutional quality, using data from 29 OECD countries over the period 1980–2019. Employing the Generalized Method of Moments (GMM) and Fully Modified Ordinary Least Squares (FMOLS) estimators, the study found that trade openness, strong institutions, human capital, and financial development all enhance innovation performance, whereas foreign direct investment tends to hinder it. The results further revealed a non-linear association between financial development and innovation.

Gao et al. (2022) examined the effect of financial development on sustainable economic growth using panel data from 283 Chinese cities. The study found that financial development promotes sustainable growth primarily through capital deepening and technological innovation. The positive effect was more pronounced in large and medium-sized cities, while smaller cities experienced no significant impact. The authors suggest that local governments implement differentiated financial development strategies to enhance sustainable growth via improvements in capital accumulation and innovation.

Gaglio et al (2022) examined the relationship between digital communication technologies, innovation, and productivity using an extended Crepon-Duguet-Mairesse model for 711 manufacturing micro and small enterprises in Johannesburg, South Africa. The study found that the use of digital tools such as social media and mobile internet positively influences innovation, which in turn enhances labor productivity. The findings highlight the need for public programs to support inclusive digitalization, focusing on technologies that are both accessible and beneficial to small and informal fi

2.8 Synthetizes of Extant studies

The empirical literature on financial development, innovation, and productivity reveals both convergence and divergence in findings, reflecting differences in country contexts, methodological approaches, and transmission mechanisms. While a broad consensus exists, that financial development supports economic performance, studies diverge markedly on how, under what conditions, and through which channels productivity gains materialise.

A first point of contrast emerges between cross-country macro-level studies and country or firm-specific analyses. Magazzino (2024), using a large cross-country panel, finds that productivity

improvements drive economic development primarily through output expansion, with financial development playing a secondary and context-dependent role. In contrast, Gizaw et al. (2024), focusing on emerging African and Asian economies, report that financial development has a positive but marginal impact on growth, suggesting that finance alone is insufficient in structurally constrained economies. These findings contrast with Meniago et al. (2025), who demonstrate that financial development exerts a strong growth effect in CFA countries, but only when institutional quality is high. This divergence highlights a critical analytical gap: while macro studies often confirm a finance–growth link, they frequently overlook institutional moderation, which appears decisive in determining productivity outcomes.

Another key contrast is observed between studies that treat financial development as a direct driver of productivity and those that emphasize indirect or conditional effects. Gao et al. (2022) show that financial development promotes sustainable growth in China primarily through capital deepening and technological innovation, implying a mediated relationship. Similarly, Atsu and Adams (2023) find a non-linear relationship between financial development and innovation in OECD countries, suggesting diminishing or threshold effects. By contrast, Koç et al. (2025) report that innovation-related variables such as R&D and education directly enhance growth, while early-stage entrepreneurship exerts a negative effect, challenging the assumption that all forms of innovation uniformly improve productivity. These contrasting results suggest that the quality and absorptive capacity of innovation investment matter more than its volume, an insight often missing in studies that rely on aggregate indicators.

A further analytical distinction arises between developed and developing economy contexts. Firm-level studies from advanced or rapidly industrialising economies, such as Ma et al. (2024) for China, show that financial deregulation strengthens the innovation impact of foreign direct investment, particularly in firms with high absorptive capacity. This contrasts sharply with findings from African contexts. Gaglio et al. (2022), studying South African manufacturing SMEs, show that digital technologies improve productivity only when firms possess basic innovation capabilities. These contrasting outcomes underscore a structural asymmetry: while financial development can unlock innovation-driven productivity in technologically mature economies, its impact in developing economies is often constrained by weak skills, limited institutional capacity, and shallow financial markets.

Human capital also emerges as a point of divergence across studies. Pal et al. (2024) find that financial development enhances productivity growth in India when male education levels are high but may hinder productivity when female education is high, highlighting gender-specific institutional and labour market rigidities. This contrasts with Koç et al. (2025), who report uniformly positive effects of education on growth across countries. The inconsistency suggests that the productivity payoff of human capital is highly context-specific and mediated by labour market structures and institutional arrangements, factors that many growth models treat implicitly rather than explicitly.

Another notable contrast relates to the role of trade openness. While standard growth theory predicts positive productivity spillovers from openness, empirical evidence remains mixed. Magazzino (2024) and Gao et al. (2022) find that openness enhances productivity only in

economies with strong domestic capabilities. Conversely, several studies report insignificant or weak effects of trade openness in developing economies, indicating that exposure to international markets does not automatically translate into productivity gains. This contrasts with innovation-led growth models that assume seamless technology diffusion, suggesting that institutional and human capital constraints significantly limit the benefits of openness.

Methodologically, differences in estimation techniques further explain divergent findings. Studies employing dynamic panel estimators (e.g., GMM, DCCE) tend to emphasize long-run or average effects, often smoothing out short-run adjustment costs. In contrast, firm-level or ARDL-based time-series studies capture short-run dynamics and transitional frictions more effectively. This methodological contrast explains why some studies report strong positive long-run effects of financial development, while others, particularly those focusing on short-run dynamics, find weaker or conditional impacts. Your study aligns with the latter group, providing evidence that productivity gains from finance and investment are immediate but institutionally conditioned.

Overall, the comparative evidence suggests that three unresolved issues dominate the literature. First, many studies confirm that financial development matters, but they disagree on whether its effects are direct or conditional. Second, innovation and investment are often treated as homogeneous, despite evidence that their productivity effects depend on institutional quality and absorptive capacity. Third, short-run productivity dynamics, especially in developing economies, remain underexplored, as most studies focus on long-run growth relationships.

By explicitly modelling short-run dynamics and interaction effects between financial development, investment, and institutional quality, the present study departs from the predominantly linear and long-run focus of prior research. It contributes to the literature by demonstrating that in Nigeria, productivity gains from financial development and investment are not automatic but are critically shaped by institutional conditions. In doing so, the study bridges the gap between cross-country generalizations and country-specific realities, offering a more nuanced understanding of the finance–productivity nexus in a developing economy context.

3.0 Methods

This study employed the ARDL model testing approach of cointegration, introduced by Pesaran et al. (2001), to examine the influence of the exchange rate on the relationships between public and private investments. In comparison to previous cointegration approaches, such as those by Johansen (1988), Engle and Granger (1987), and Johansen and Juselius (1990), the ARDL cointegration approach offers several advantages. First, whether the regressors are I (0) or I (1), the ARDL approach can be used. As a result, the ARDL technique has the benefit of avoiding the classification of variables into I (0) or I (1) and eliminating the requirement for unit root pre-testing. Second, whereas the ARDL procedure is the most statistically significant method for determining the cointegration relation in small samples, the Johansen cointegration procedure requires large data samples for validity. Third, whereas it is impossible with conventional processes, the ARDL procedure permits the variables to have several optimal delays. According to Ozturk and Acaravci (2009), traditional cointegration approaches estimate the long-run relationships within a context of system equations, whereas the ARDL procedure uses a single

reduced form equation. The ordinary Least Squares (OLS) estimator and an unrestricted error correction model serve as the foundation for the ARDL bounds testing methodology. The cointegration. The relationship in the regression equation is determined by applying the bounds test to the unrestricted error correction model. Annual data covering 1991–2024 are sourced from the World Development Indicators (WDI, 2025) and the Penn World Table (version 10.0), while the institutional quality data is sourced from International Country Risk Guide Data (2025) published by PRS group.

3.1 Model Specification

The empirical model specifies total factor productivity as a function of financial development, innovation investment, human capital, institutional quality, trade openness, and interaction terms capturing institutional moderation effects. This is adapted from theoretical and empirical literature Functional Relationship (Model Form)

$$TYP = f(FD, HCI, INI, INST, FD * INST, INI * INST, TO) \quad (1)$$

The econometric representation of equation (1) =

$$TYP_t = \beta_0 + \beta_1 FD_t + \beta_2 HCI_t + \beta_3 INI_t + \beta_4 INST_t + \beta_5 FD * INST_t + \beta_6 INI * INST_t + \beta_7 TO_t + \varepsilon_t \quad (2)$$

β_0= Parameter to be estimated (is the average amount the dependent variable increases when the independent variable increases by one-unit, other independent variables are held constant).

μ_t = Error term assumed to satisfy the standard OLS assumption.

$\beta_1 - \beta_7$, = Partial derivatives or the gradient of the independent.

Whereas:

TYP Total Factor Productivity
FD = Financial Development
INI = Innovation Investment
INST = Institutional Quality
FD*INST = Interaction of Financial Development with Institutional Quality
INI*INST = Interaction of Financial Development with Institutional Quality
TO = Trade Openness

The Augmented ARDL version of equation (1)

$$\Delta TYP_t = \beta_1 TYP_{t-1} + \beta_2 FD_{t-1} + \beta_3 HCI_{t-1} + \beta_4 INI_{t-1} + \beta_5 INST_{t-1} + \beta_6 FD * INST_t + \beta_7 INI * INST_{t-1} + \beta_8 TO_{t-1} + \sum_{i=1}^{a} \varphi_{1i} \Delta TYP_{t-i} + \sum_{i=0}^{b} \varphi_{2i} \Delta FD_{t-i} + \sum_{i=0}^{c} \varphi_{3i} \Delta HCI_{t-i} + \sum_{i=0}^{d} \varphi_{4i} \Delta INI_{t-i} + \sum_{i=0}^{e} \varphi_{5i} \Delta INST_{t-i} + \sum_{i=0}^{f} \varphi_{6i} \Delta FD * INST_{t-1} + \sum_{i=0}^{g} \varphi_{7i} \Delta INI * INST_{t-1} +$$

$\sum_{i=0}^{g} \varphi_{7i} \Delta TO_{t-1} + \varepsilon_t$ (3)**The Error Correction Models (ECM)**

The error correction (EC) representation of the ARDL models can be written as:

$$\Delta TYP_t = \varphi_0 + \sum_{i=1}^{a} \varphi_{1i}\, \Delta TYP_{t-i} + \sum_{i=0}^{b} \varphi_{2i}\, \Delta FD_{t-i} + \sum_{i=0}^{c} \varphi_{3i}\, \Delta HCI_{t-i} + \sum_{i=0}^{d} \varphi_{4i}\, \Delta INI_{t-i} + \sum_{i=0}^{e} \varphi_{5i}\, \Delta INST_{t-i} + \sum_{i=0}^{f} \varphi_{6i}\, \Delta FD * INST_{t-1} + \sum_{i=0}^{g} \varphi_{7i} \Delta INI * INST_{t-1} + \sum_{i=0}^{g} \varphi_{7i} \Delta TO_{t-1} + \varphi ECM_{t-1} \quad (4)$$

Table 1:

Descriptive Statistics of the variables

	TFP	FD	FDINST	HCI	INI	INI*INST	INST	TO
Mean	0.353	10.886	45.618	1.554	22.136	91.805	4.166	35.072
Median	0.379	10.305	43.540	1.533	22.142	89.691	4.250	35.260
Maximum	0.584	19.600	85.859	1.974	28.150	117.292	4.611	53.280
Minimum	0.115	4.990	18.990	1.228	16.900	64.314	3.417	9.910
Std. Dev.	0.162	3.804	17.109	0.250	3.423	13.102	0.311	9.850
Skewness	-0.126	0.754	0.774	0.166	0.098	-0.007	-0.738	-0.221
Kurtosis	1.519	2.810	2.832	1.616	1.892	2.209	2.843	2.885
Jarque-Bera	3.197	3.272	3.432	2.871	1.793	0.887	3.120	0.296
Probability	0.202	0.195	0.180	0.238	0.408	0.642	0.210	0.862
Sum	11.988	370.130	1550.998	52.829	752.632	3121.381	141.636	1192.440
Sum Sq. Dev.	0.862	477.543	9659.484	2.066	386.600	5664.734	3.183	3201.896
Observations	34	34	34	34	34	34	34	34

Source: *Author's Computation (2025)*

Table 1 presents the descriptive statistics of the variables employed in the study, including Total Factor Productivity (TFP), Financial Development (FD), the interaction between Financial Development and Institutional Quality (FDINST), Human Capital Index (HCI), Investment (INV), the interaction between Innovation Investment and Institutional Quality (INI*INST), Institutional Quality (INST), and Trade Openness (TO), based on 34 annual observations.

The mean value of TFP (0.353), with a median of 0.379, suggests a moderate level of productivity performance over the study period. The relatively small standard deviation (0.162) indicates limited volatility in productivity growth, implying gradual rather than abrupt productivity changes. The near-zero skewness (−0.126) and low kurtosis (1.519) further suggest a fairly symmetric and flat distribution.

Financial Development (FD) records a mean of 10.886, closely aligned with its median (10.305), indicating stability in financial sector development over time. However, the standard deviation (3.804) reveals moderate variability, reflecting periods of financial expansion and contraction. The positive skewness (0.754) implies that higher levels of financial development occurred less frequently but were more pronounced when they did occur.

The interaction term FD*INST has a relatively high mean value of 45.618, reflecting the combined effect of financial development and institutional quality. Its standard deviation (17.109) suggests considerable variability in how institutional quality modulated financial development over time. The positive skewness (0.774) indicates occasional episodes where improved institutional quality significantly magnified financial sector performance.

Human Capital Index (HCI) shows a mean of 1.554, with a narrow standard deviation (0.250), implying steady accumulation of human capital over the period. The closeness of the mean and median (1.533) and the low skewness (0.166) indicate a relatively stable and symmetric distribution, consistent with gradual improvements in education and skills.

Innovation investment (INI) records a mean value of 22.136, almost identical to its median (22.142), suggesting a balanced investment pattern over time. The standard deviation (3.423) indicates moderate fluctuations, while the near-zero skewness (0.098) reflects a symmetric investment distribution.

The interaction term INI*INST has a mean of 91.805, the highest among the variables, underscoring the importance of institutional quality in shaping investment outcomes. Despite this high mean, the standard deviation (13.102) suggests that the institutional environment did not consistently enhance investment, but rather did so unevenly across periods.

Institutional Quality (INST) has a mean of 4.166, with a relatively small standard deviation (0.311), indicating that institutional conditions evolved slowly over time. The negative skewness (−0.738) implies that higher institutional quality values were more frequent, suggesting periods of relatively stronger governance.

Trade Openness (TO) averages 35.072, with a standard deviation of 9.850, pointing to substantial variability in trade exposure over the study period. The wide range between the minimum (9.910) and maximum (53.280) highlights periods of both inward-looking and outward-oriented trade policies.

Across all variables, the Jarque–Bera statistics are statistically insignificant, with probability values exceeding 0.05. This indicates that the variables are approximately normally distributed, satisfying a key assumption for time-series econometric estimation.

Overall, the descriptive statistics reveal that while core macroeconomic and institutional variables exhibit moderate variability and stable central tendencies, interaction terms display greater dispersion, suggesting that institutional quality plays a critical but uneven role in shaping financial development and investment outcomes. These preliminary characteristics provide a sound basis for the subsequent econometric analyses and support the reliability of the estimated ARDL results.

Table 2

Correlation Matrix of Variables

	FD	**FDINST**	**HCI**	**INI**	**INI*INST**	**INST**	**TO**
FD	1.000						
FDINST	0.984	1.000					
HCI	0.261	0.186	1.000				
INI	0.319	0.199	0.807	1.000			
INIINST	0.449	0.400	0.787	0.887	1.000		
INST	0.234	0.394	-0.202	-0.396	0.069	1.000	
TO	-0.332	-0.362	-0.088	0.030	-0.087	-0.245	1.000

Source: *Author's Computation (2025)*

Table 2 presents the pairwise Pearson correlation coefficients among the explanatory variables and is primarily used as a preliminary diagnostic tool for assessing multicollinearity prior to model estimation.

As a general rule of thumb, pairwise correlation coefficients above 0.80–0.90 may signal a potential multicollinearity problem, as they suggest that two regressors convey very similar information. From Table 2, most of the correlations among the core (non-interaction) variables - namely Financial Development (FD), Human Capital Index (HCI), Innovation Investment (INI), Institutional Quality (INST), and Trade Openness (TO), are moderate to weak, and generally fall below the critical threshold. This indicates that these variables maintain sufficient independent variation and are unlikely to cause serious multicollinearity in the regression model.

However, very high correlations are observed between Financial Development and its interaction term **(**FD and FDINST = 0.984), as well as between Investment and its interaction term (INI and INI*INST =

0.887). These high coefficients are expected by construction, since interaction terms are algebraic products of their component variables. Importantly, such high correlations involving interaction terms do not necessarily imply harmful multicollinearity, especially in moderation analysis, where the objective is to capture conditional effects rather than isolate independent linear influences.

The relatively high correlation between Human Capital Index and Investment (HCI and INI = 0.807) also warrants attention. While this value slightly exceeds the conventional threshold, it reflects a strong theoretical linkage between investment activity and human capital accumulation rather than redundant measurement. Moreover, because the ARDL framework estimates dynamic relationships and uses lag structures, it is less sensitive to multicollinearity than static regression models.

Overall, aside from the expected correlations involving interaction terms, the correlation matrix does not indicate severe multicollinearity among the regressors. This conclusion suggests that the estimated coefficients are likely to be stable and reliable, and that the inclusion of both core variables and interaction terms in the ARDL model is econometrically justifiable

Table 3
Unit Root Test for Stationarity (Augmented Dickey Fuller)

Variables	Level	First Differences	Integration order
	Intercept and Trend	Intercept and Trend	
TFP	-1.766055	-5.625825***	I (1)
FD	-2.564359	-4.546715***	I (1)
FD*INST	-2.301283	-5.084218***	I (1)
HCI	-1.036172	-5.817507***	I (1)
INI	-0.095224	-8.068075***	I (1)
INST	-2.943607	-5.746437***	I (1)
INI*INST	-1.967384	-8.010579***	I (1)
TO	-3.916041**		I (0)
Unit Root Test for Stationarity (Phillips- Perron)			
Variables	**Level**	**First Differences**	**Integration order**
	Intercept and Trend	**Intercept and Trend**	
TFP	-1.766055	-5.626036***	I (1)
FD	-2.007003	-6.115140***	I (1)
FD*INST	-2.227189	-5.830989***	I (1)
HCI	-1.034574	-5.970150***	I (1)
INI	-0.015795	-8.940979***	I (1)
INST	-2.496722	-6.69928***	I (1)
INI*INST	-1.795831	-6.21768***	I (1)
TO	-4.913991***		I (0)

Source: *Author's Computation (2025)*

Unit Root Test

It is commonly believed that the simple time series around a deterministic pattern is stationary or at least stable; this is not always accurate. Nevertheless, the cointegration technique of ARDL does not require unit root testing. However, to prevent ARDL from crashing in the presence of an embedded stochastic pattern of 1 (2), the study performs unit root tests to determine the presence of a unit root in the series. To confirm the outcome properties of the time series, this study used

the Augmented Dickey-Fuller (ADF) and Phillips-Perron tests (PP). The null hypothesis for the test (both ADF and PP) affirms that the data series in question has a unit root, while the alternative hypothesis affirms that the series is stationary. From the **ADF results in Table 3 above**, Total Factor Productivity (TFP), Financial Development (FD), the interaction term between Financial Development and Institutional Quality

(FD*INST), Human Capital Index (HCI), Investment (INV), Institutional Quality (INST), and the interaction between Investment and Institutional Quality (INV*INST*)* are all **non-stationary at levels**, as their test statistics are not significant at conventional levels. However, when these variables are transformed into their **first differences**, the ADF statistics become highly significant at the 1% level, indicating that each of these series attains stationarity after first differencing. Consequently, these variables are integrated of order one, **I (1).**

In contrast, Trade Openness (TO) is found to be **stationary at level** under the ADF test, with statistical significance at the 5% level, implying that it is integrated of order zero, **I (0).**

The **Phillips–Perron (PP) test results** largely corroborate the findings of the ADF test. Similar to the ADF outcomes, TFP, FD, FD**INST, HCI, INI, INST, and INI*INST are non-stationary in levels but become stationary after first differencing, confirming their **I (1)** nature. Trade Openness (TO) again stands out as being **stationary at level**, this time with even stronger statistical significance at the 1% level, reinforcing its classification as an **I (0)** variable.

Overall, the consistency between the ADF and PP tests enhances the robustness of the stationarity results. The findings reveal a **mixed order of integration,** with most variables being I(1) and one variable (TO) being I(0). Importantly, none of the variables is integrated of order two**, I(2)**. This mixture of I(0) and I(1) variables satisfies the necessary precondition for the application of econometric as the **Autoregressive Distributed Lag (ARDL) bounds testing approach**, which is appropriate for analyzing both short-run and long-run relationships within this framework.

Table 4
Bound Test for Cointegration (Dependent Variable: TFP

T-Statistic	Value	K
F-statistic	1.958255	7
Level of Significance	Lower (Bound I (0)	Upper Bound I (1)
10%	1.83	2.94
5%	2.06	3.24
2.50%	2.28	3.5
1%	2.54	3.86

K is the number of exogenous variables in the model
Source: *Author's Compilation (2025)*

Estimation of the Long-Run Relationship (Co-Integration Test)

In estimating the long-run relationship, a two-step method is used: an initial analysis of the nature of a long-run relationship between the variables in Equation (2), which is accompanied by an approximation of the short-run and long-run parameters. Therefore, the bounds test method was employed to determine the existence of a long-term relationship between the variables of interest by conducting an F-test on the coefficients of the lagged-level variables in the model. Additionally, Pesaran and Shin (1998) proposed two critical values to evaluate the relationship (lower and upper bounds) due to the limitations of the traditional Wald-test *F*-statistic. The computed *F*-test is then compared with the critical values for the hypothesis test. Therefore, if the calculated *F*-statistic is less than the lower bound value, the null is not rejected. On the contrary, the existence of a long-term relationship between the variables is suggested if the calculated *F*-statistics exceed the upper limit value. Finally, there is an inconclusive long-run relation between the variables if the calculated *F*-statistics are between the lower bound and the upper bound.

However, the EC word would be a useful way to establish co-integration in the inconclusive cases (Banerjee et al. (1998). Table 4 reports the results of the ARDL bounds test for cointegration with **SMR** specified as the dependent variable and **seven (K = 7)** exogenous regressors included in the model.

The computed **F-statistic is 1.958255.** This value is compared with the critical bounds provided by Pesaran et al. (2001) at different levels of significance. At the **5% significance level**, the lower and upper critical bounds are **2.06** and **3.24**, respectively. Since the calculated F-statistic **lies below the lower bound and the upper bound,** implying a **failure to reject the null hypothesis of no cointegration** at these levels.

Overall, the bounds test evidence suggests that there is **no strong statistical support for the existence of a long-run cointegrating relationship** between TYP and its explanatory variables within the specified model. While the result is weakly suggestive at the 5% level, it remains **inconclusive** and therefore does not provide sufficient justification to firmly establish long-run equilibrium dynamics. Given this outcome, empirical emphasis should be placed on **short-run dynamics**, typically through an ARDL short-run model or a differenced specification.

Table 5
Short-run Dynamics of estimated results for the selected ARDL (Selected Model: ARDL (2, 1, 0, 1, 0, 1, 0, 0, and 1)

Panel A: Short-Run Dynamics: Total factor Productivity (TFP)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FD(-1))	0.017088	0.005017	3.406181	0.0036
D(FD*INST)	0.087533	0.015064	5.810651	0.0000
D(HCI)	0.118727	0.073616	1.612790	0.1263
D(HCI(-1))	0.146651	0.082597	1.775510	0.0948
D(INI)	0.172272	0.058745	2.932564	0.0098
D(INI(-1))	-0.008344	0.006644	-1.255880	0.2272
D(INI*INST)	-0.033923	0.014145	-2.398284	0.0290
D(INST)	0.104559	0.298870	0.349849	0.7310

D(TO)	-0.000409	0.000954	-0.428711	0.6738
CointEq(-1)	-0.094159	0.146322	-0.643508	0.5290
Cointeq = TFP - (-4.2183*FD + 0.9296*FDINST -0.8047*HCI + 1.9954 *INI -0.3603*INIINST + 1.1105*INST -0.0043*TO -10.4540)				
Panel B: Goodness-of-fit measures				
R -Squared	0.585030			
Adj. R-Squared	0.495997			
F- statistics	8.503803			
P-value (F-stat.)	0.000471			
Durbin-Watson Statistics	2.464337			
Panel C : Diagnostic Tests				
			Test	Probability
Breusch-Godfrey Serial Correlation LM Test:			2.76554	0.0817
Heteroskedasticity Test:Breusch-Pagan-Godfrey			19.03470	0.2122
Heteroskedasticity Test: ARCH			0.513885	0.4735
Ramsey RESET Specification Test			0.206975	0.6557
Jarque-Bera Statistics			1.287384	0.525349

Note: ***, **, and * are 1%, 5% and 10% level of significance respectively

Source: *Author's Computation (2025)*

Table 5 presents the short-run dynamic results of the automatic selected ARDL (2, 1, 0, 1, 0, 1, 0, 0, 1) model, with total factor productivity as the dependent variable. The interpretation of the results combines both statistical significance and the economic magnitude of effects, assuming ceteris paribus, that is, holding other factors constant.

In the short run, financial development exhibits a positive and statistically significant effect on total factor productivity. Specifically, a one-unit increase in lagged financial development leads to an increase of approximately 0.017 units in TFP, ceteris paribus. Although modest in size, this effect is statistically strong, indicating that incremental improvements in financial development contribute meaningfully to total factor productivity over time.

The effect of financial development is substantially amplified by institutional quality, as reflected in the interaction term FD*INST. A one-unit increase in this interaction term raises TFP by about 0.088 units, ceteris paribus, and this effect is highly significant at the 1% level. This magnitude is considerably larger than the standalone financial development effect, underscoring the critical role of strong institutions in enhancing the factor productivity of the economy.

Human capital shows evidence of a lagged short-run effect. While the contemporaneous change in human capital is positive but statistically insignificant, a one-unit increase in its lagged value

increases TFP by approximately 0.147 units, ceteris paribus, and is weakly significant at the 10% level. This suggests that investments in education and skills require time to translate into tangible productivity improvements, but once they do, the economic impact is relatively substantial.

Investment income also plays a prominent role in the short run. A one-unit increase in current investment leads to a 0.172-unit increase in TFP, ceteris paribus, making it one of the largest and most economically meaningful effects in the model. However, the lagged investment effect is negative and statistically insignificant, implying that the productivity-increasing benefits of investment are largely immediate rather than persistent.

Interestingly, the interaction between investment and institutional quality exerts a negative but statistically significant effect. Holding other factors constant, a one-unit increase in INI*INST reduces TFP by approximately 0.034 units in the short run. Although smaller in magnitude, this finding suggests that institutional processes may introduce short-run adjustment costs or inefficiencies that temporarily dampen the productivity gains from investment.

Changes in institutional quality alone and trade openness do not exert statistically significant short-run effects on productivity. Ceteris paribus, a one-unit increase in institutional quality raises TFP by about 0.105 units, while trade openness has a negligible effect of −0.0004 units. These results indicate that institutions and openness influence productivity primarily through interaction channels rather than through direct short-run effects.

The coefficient of the error correction term is negative, as theoretically expected, implying that approximately 9.4% of short-run disequilibrium is corrected per period, ceteris paribus. However, its lack of statistical significance confirms the absence of a stable long-run adjustment mechanism, consistent with the earlier ARDL bounds test results.

Taken together, the harmonised evidence indicates that short-run productivity is driven primarily by investment and financial development, especially when complemented by strong institutional quality. While the direct effects of institutions and trade openness are limited in the short run, their interaction with key economic variables significantly alters the magnitude and effectiveness of policy outcomes.

The results, therefore, highlight that ceteris paribus, institutional quality acts more as a catalyst than as a standalone driver of productivity, reinforcing the importance of integrated policy design.

The model exhibits strong explanatory power, with an R^2 of 0.585 and an adjusted R^2 of 0.496, indicating that over 50% of the variation in short-run TFP is captured by the independent variables. The F-statistic (8.50, $p = 0.0005$) confirms that the model is jointly significant, while the Durbin-Watson statistic of 2.46 suggests no evidence of autocorrelation. Diagnostic tests further validate the reliability of the estimates: the Breusch-Godfrey LM test ($p = 0.082$) rules out serious serial correlation, the Breusch-Pagan-Godfrey ($p = 0.212$) and ARCH ($p = 0.474$) tests indicate homoscedastic residuals, the Ramsey RESET test ($p = 0.656$) confirms proper model specification, and the Jarque-Bera test ($p = 0.525$) suggests normally distributed residuals. The stability of the regression coefficients is tested using the cumulative sum (CUSUM) and the cumulative of squares

(CUSUMSQ) of the recursive residual test for structural stability (Brown et al, 1975). The plots are given in the appendix. These results affirm that the ARDL short-run estimates are statistically robust and reliable

5.0 Discussion of results

This study investigates the short-run determinants of Total Factor Productivity (TFP), with financial development, investment, human capital, institutional quality, and trade openness as key explanatory variables. The results provide compelling evidence that productivity outcomes are shaped by both financial and real-sector factors, and these effects are significantly conditioned by institutional quality.

The positive and statistically significant effect of financial development on TFP aligns with finance-led growth theory, which posits that well-functioning financial systems enhance resource allocation, reduce transaction costs, and promote investment in productive sectors. Empirically, this finding is consistent with Magazzino (2024), who highlights that financial access enhances productivity, particularly in agricultural and developing economies, and Gizaw et al., (2024), who report a positive albeit marginal impact of financial development on growth in emerging economies. The modest magnitude of the financial development effect in this study suggests that, while financial deepening contributes to efficiency, its impact may be limited in contexts where institutional and structural constraints exist.

The study finds that the interaction between financial development and institutional quality significantly amplifies TFP gains. This result resonates with institutional theory, which argues that strong governance, regulatory efficiency, and enforcement mechanisms are essential for economic actors to fully leverage financial resources. Empirical evidence from Meniago et al., (2025) similarly demonstrates that financial development's growth impact is stronger in high-institutional-quality settings. The result suggests that institutions are not only complementary but multiplicative in enabling financial development to translate into tangible productivity improvements.

Investment emerges as a key driver of productivity, supporting classical and endogenous growth theories, which emphasize capital accumulation as a major determinant of efficiency and output. The negative short-run interaction between investment and institutional quality may reflect transitional frictions or adjustment costs associated with regulatory reforms, consistent with findings by Oyadeyi (2025), who documents short-term instabilities during financial and institutional transitions. These results indicate that investment policies, while critical, require supportive institutional frameworks to realize their full productivity potential.

Human capital shows a lagged but positive impact on TFP, aligning with the endogenous growth theory, which emphasizes the role of knowledge, skills, and education in sustaining productivity growth. This is consistent with Koç et al. (2025) and Pal et al. (2024), who report that education and R&D significantly enhance productivity and economic growth, often with delayed effects. The lag reflects the time necessary for human capital accumulation to translate into measurable

efficiency gains, highlighting the importance of long-term investment in education and skills development.

Trade openness does not exert a statistically significant short-run effect on TFP, indicating that its productivity benefits are contingent on complementary factors such as technology adoption, human capital, and institutional quality. This finding resonates with Magazzino (2024) and Gao et al. (2022), who note that the impact of openness on productivity is heterogeneous and often dependent on domestic absorptive capacity.

Overall, the study underscores that productivity gains are maximized when financial development, investment, human capital, and institutional quality interact synergistically. This finding reinforces both finance-growth theory and institutional theory, emphasizing that productivity enhancement is not the result of isolated reforms but of integrated policy interventions that address financial, institutional, and human capital constraints simultaneously. The results also align with innovation-led productivity studies (Gaglio et al., 2022; Ma et al., 2024; Azmeh and Al-Raeei, 2025), which highlight that finance, institutions, and human capital collectively drive efficiency and technological adoption, ultimately supporting TFP growth.

Overall, the findings strongly validate the Schumpeterian, financial intermediation, endogenous growth, and institutional theories that underpin this study. Financial development enhances productivity by easing financing constraints, investment drives short-run efficiency gains, and human capital supports productivity with a lag. Crucially, institutional quality acts as a catalyst that magnifies or constrains these effects rather than functioning as an independent driver. The results confirm that productivity growth in Nigeria is not driven by isolated policy instruments but by the synergistic interaction of finance, institutions, investment, and human capital, consistent with modern growth theory and innovation-led development frameworks.

6.0 Summary, Conclusion and Recommendations

This study provides robust evidence on the short-run drivers of total factor productivity (TFP) in Nigeria by examining the roles of financial development, investment, human capital, institutional quality, and trade openness within an ARDL framework. The findings demonstrate that financial development significantly enhances productivity, but its effectiveness is highly contingent on the quality of institutions. In particular, the interaction between financial development and institutional quality yields substantially larger productivity gains than financial development alone, confirming that weak governance and regulatory inefficiencies remain binding constraints on Nigeria's productivity performance.

Innovation investment is identified as a key and immediate driver of productivity growth, underscoring the importance of capital formation and technology-embodied investment in improving production efficiency. However, the negative short-run interaction between investment and institutional quality suggests the presence of transitional frictions, regulatory delays, and adjustment costs that may temporarily dampen productivity gains during periods of institutional reform. Human capital contributes positively to productivity with a lag, reflecting the time required for education and skills acquisition to translate into effective labour productivity and technological

absorption. Trade openness, on the other hand, does not exert a significant short-run effect, indicating that openness alone is insufficient to drive productivity without complementary domestic capabilities.

Overall, the results indicate that Nigeria's productivity challenge is not due to the absence of financial resources or investment per se, but rather to the weak transmission of these inputs into productive efficiency. Productivity gains are maximised only when financial development, investment, and human capital accumulation are embedded within a strong institutional framework. The absence of a stable long-run adjustment mechanism further highlights the fragility of Nigeria's productivity dynamics and reinforces the relevance of short-run, policy-sensitive interventions

The study recommends an integrated productivity-oriented policy framework in which financial development, investment, and human capital accumulation are jointly strengthened through improved institutional quality. Rather than pursuing broad financial deepening, policymakers should redirect credit toward productivity-enhancing sectors such as manufacturing, agriculture, and technology while strengthening development finance institutions. Institutional reforms, particularly in regulatory quality, contract enforcement, and governance effectiveness, are essential to ensure that financial resources and investment translate efficiently into productivity gains. Investment promotion policies should be carefully aligned with institutional reforms to minimise regulatory frictions and short-run adjustment costs. In addition, sustained investment in technical, vocational, and digital skills is required to enhance absorptive capacity and support technology adoption, while trade openness should be complemented with domestic capability-building measures to enable firms to convert external exposure into tangible productivity improvements.

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