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Financial Intermediation, Institutional Quality, and Economic Growth: Insights from BRICS Nations

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Abstract

In this study, the relationship between financial development and economic growth in BRICS economies is analyzed over the time range 1995-2025. The paper, based on endogenous growth theory, financial intermediation theory, and institutional economics, examines the impacts of capital formation, labour force participation, research and development, and domestic credit supply to the private sector on the dynamics of economic growth. The method used is quantitative, using panel data analysis, descriptive statistics, correlation analysis, and a panel unit root test for data validity. Empirical estimation is done under both fixed effects and random effects models, and the Hausman test is performed to verify the superiority of the fixed effects specification in controlling for unobserved heterogeneity and ensuring consistent estimation. The empirical results indicate that gross fixed capital formation and employment participation, as well as research and development, have positive and statistically significant impacts on economic growth, suggesting that investment, labor utilization, and innovation play crucial roles in improving productive capacity and long-term economic performance. Domestic credit to the private sector, on the other hand, has a negative and statistically significant relationship with economic growth, which indicates the inefficiency of financial intermediation and a “too much finance” hypothesis. The findings suggest that the over-crediting or misallocation of credit could have negative implications on growth because of financial instability and the misallocation of resources. The overall findings of the study highlight that the conventional growth factors like investment and labour, as well as innovation, are still important, but the impact of financial development is significantly associated with institutional quality and efficient credit allocation. The results of the study have significant policy implications, highlighting the importance of enhanced financial regulation, better institutional structures, and greater productive investment for sustainable economic growth in emerging economies.

Keywords: Financial Development, Economic Growth, Domestic Credit, BRICS Economies

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1. INTRODUCTION

Economic growth continues to be one of the core goals of economic policy as it influences the ability of an economy to increase the standard of living, create jobs, increase productive opportunity, and allow long-term growth to continue. In the past few decades, globalization, financial integration, technological shift, and institutional change have significantly shifted the processes by which economies grow. In the changing context, financial development has become an important factor affecting economic performance, as financial systems affect the mobilization, allocation, and monitoring of resources (Estrada et al., 2010; Ali & Rehman, 2015; Akhtar & Rashid, 2024; Roussel & Audi, 2024; Abdullah et al., 2025). The financial sector is so organized that it can mobilize savings for productive investment, minimize transaction costs, enhance risk management, and enable entrepreneurship. However, the correlation between finance and growth is

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not always positive (Heil, 2018; Marc et al., 2022; Apriliani et al., 2024; Wang & Rani, 2025). Financial development can boost productive capacity, but too much financial development can be detrimental in terms of inefficient allocation of resources, instability and performance of the economy in the long run (Levine, 1997; King & Levine, 1993; Barro, 1991; Beck et al., 2007; Rousseau & Wachtel, 2011; Ali & Naeem, 2017; Heil, 2018; Audi & Ali, 2022; Liu et al., 2023). Economic growth theory has evolved from a focus on the increase of physical capital to a more comprehensive model that incorporates knowledge, innovation, human capital, and technological progress. Capital accumulation and labour utilisation are basic sources of output growth in the neoclassical growth framework, while technological progress offers an important ground to sustain the improvements in productivity. In the conventional framework, capital and labor have diminishing returns in the long run, thus necessitating technological advancement and productivity improvements in the long run (Solow, 1956; Swan, 1956; Mankiw et al., 1992). It adds a valuable background context to the study of gross fixed capital formation and employment participation as drivers of economic performance, especially in emerging economies where investment use and the utilization of labour are still vital for further expansion of productive capacity (Audi et al., 2021; Liu et al., 2023; Marc et al., 2025; Khalid et al., 2025; Mbodj & Laye, 2025).

This was extended and much expanded by the later formulation of endogenous growth theory, which identified technological advance, innovation, the accumulation of knowledge, and human capital as endogenous sources of long-term growth (Audi & Ali, 2017; Ahmad et al., 2022; Nguyen, 2022; Ali et al., 2025; Mbodj & Laye, 2025). Endogenous growth models focus on research and development, knowledge spillovers, learning, and innovation as drivers of continued improvements in productivity, rather than technological progress being an exogenous process (Siddiqi et al., 2014; Abdulkarim, 2023; Ali & Audi, 2023; Khan et al., 2025; Imran et al., 2025). The mechanisms can create long-lasting growth gaps between economies due to differences in the capacity to create, absorb, and commercialize knowledge (Romer, 1986; Romer, 1990; Lucas, 1988; Aghion & Howitt, 1992). Gross fixed capital formation, employment participation, and research and development are therefore two complementary aspects of productive development – physical investment expands productive capacity, employment participation increases the productivity of human resources, and research and development enhances technological and innovative capabilities (Ahmad et al., 2018; Umair et al., 2025; Arshi et al., 2025; Imran et al., 2025). In addition to these real-sector factors, financial intermediation is a very important channel that channels resources into productive economic activity. Financial institutions pool savings, consider investment possibilities, make transactions, manage risks, and allocate funds to firms and productive projects (Chizema, 2025; Naeem et al., 2025; Longston et al., 2025; Seti et al., 2025). Financial liberalization and financial intermediation literature therefore considers financial development as a vital channel through which savings can be channelled towards investments and technological advancement (McKinnon, 1973; Shaw, 1973). Empirical studies also confirm that financial systems can help growth in the way they allocate resources and facilitate the access of firms to external finance, especially when financial institutions are able to lower the information and transaction costs (Rioja & Valev, 2004; Marc et al., 2022). But it's not just about the amount of money that can go towards development; it's also about how money is allocated and how effectively. But a recent series of studies called into question the idea that deeper financial systems can lead to proportionately greater economic growth. The “too much finance” hypothesis suggests that at some point, financial growth fails to generate positive or even non-negative growth effects, because credit is too much, too speculative, or misallocated (Marc, 2024; Chizema, 2025; Farras et al., 2025). An overaggressive credit growth can redistribute productive resources, overstimulate risk-taking, and boost financial fragility (Arcand et al., 2015; Cecchetti & Kharroubi, 2012; Law & Singh, 2014; Marc et al., 2023; Rafique et al., 2025). This is especially true for emerging economies where financial deepening can occur at a high rate, but institutional strength and regulatory capacity are lacking. Domestic credit to the private sector should, therefore, be considered not as a measure of financial development alone, but also as a measure of efficient transformation of credit to productive investment.

Financial intermediation is well linked to institutional quality. Institutional economics focuses on how economic agents act and how the efficiency of resource allocation is affected by the economic incentives, protection of property rights, enforcement of contracts, governance structures, and the effectiveness of the regulations. Good institutions can help to mitigate uncertainty, safeguard investment, curtail rent-seeking, and enhance confidence in financial and economic transactions (North, 1990). Likewise, the institutional view pioneered by Acemoglu et al. (2005) shows that significant differences in the long-term economic outcomes can arise from differences in institutional arrangements. In financial systems, institutional quality, therefore, can decide the role of expanded credit in fostering productive entrepreneurship, efficient allocation, and financial instability. These are particularly relevant if financial development is considered in conjunction with the mainstream growth factors. The capacity to accumulate capital may lead to more robust growth if the financial institutions can allocate the investment potential efficiently; the participation rate of the workforce may lead to more output if the rate is supported by proper capital and technology; and research and development may produce more productivity effects when the firms have the right financial resources. Financial development can therefore serve as an independent factor of growth and be a facilitator for other factors of production. Meanwhile, weak financial systems can reduce the effectiveness of these channels by channelling resources into low productivity activities, making them more vulnerable to financial risks, or restricting access to productive investments. The empirical evidence then suggests that there are different finance-growth relationships in different countries and across different levels of financial development (Beck et al., 2007; Sahay et al., 2015; Audi & Al Masri, 2024; Chizema, 2025).

The complexity is especially important for the economies of Brazil, Russia, India, China, and South Africa, the "BRICS" countries, which are emerging markets with significantly different institutional structures, financial systems, labor markets, investment patterns, and technological capacities. Substantial shifts have occurred in their financial development, capital formation, employment patterns, and research and development capabilities since the time of

economic transformation. However, the role financial intermediation can play in growth varies from one country to another due to differences in institutional and structural features. Analysis of these economies as a whole thus offers a chance to determine if the traditional growth determinants continue to have a positive impact, and to see if financial deepening has different consequences depending on the efficiency with which credit is allocated and the institutional environment. Although there is already a great amount of literature on finance and economic growth, little attention has been paid to the direct finance-growth relationship, or to individual growth determinants, and the simultaneous effects of capital formation, participation of the labor force, research and development, and domestic private-sector credit within a common BRICS framework have received less attention. This gives rise to the need for an integrated empirical evaluation that is able to isolate the effect of the conventional productive factors from the non-linear impact of financial expansion. To this end, the present study investigates the factors that affect economic growth in the BRICS economies for the time frame 1995-2025, specifically gross fixed capital formation, employment participation, research and development, and domestic credit to the private sector. It specifically assesses the complementarities between financial intermediation and productive investment and innovation and whether an overabundance of credit expansion has a negative impact on the performance of the economies of the BRICS under institutional and structural conditions.

2. LITERATURE REVIEW

The empirical link between financial intermediation and economic growth has been studied in detail, both in developed and developing economies, and more recently, the importance of institutional quality for this relationship has been emphasized. Preliminary cross-country findings suggest that financial development, in general, and effective intermediation, in particular, promote capital accumulation and productivity gains. For example, King & Levine (1993) show that financial depth correlates positively with subsequent economic growth, investment, and productivity growth at the country level. In the same way, Levine (1997) offers extensive empirical findings that good financial systems help to improve resource allocation, increase savings, and foster technological innovation, which leads to long-run growth. Moreover, Beck et al. (2000) show that financial intermediaries play a role in expanding the economy by lowering transaction costs and increasing access to credit. But later research identifies the fact that the positive effects of financial development do not flow naturally and are highly sensitive to the way financial resources are used in the economy.

A number of recent empirical studies have cast doubt on the universally positive effects of financial development, especially in the case of over-credit growth. But as Arcand et al. (2015) demonstrate, there may be a “too much finance” limit beyond which financial development can negatively affect economic growth. Likewise, Cecchetti & Kharroubi (2012) show that an excessive financial sector can siphon resources into nonproductive uses and dampen overall economic efficiency. The non-linear relationship between financial development and growth is also reported by Law & Singh (2014), indicating that the returns from financial deepening are falling as financial activity grows. The result is that, in less developed economies, where regulatory structures are weaker, the speed of credit growth can result in financial instability and resource misallocation and ultimately hurt growth. The results are especially relevant for the BRICS economies in which financial systems have experienced rapid growth in the last few decades.

Domestic credit to the private sector, typically taken as a proxy for financial development, has been found to have mixed effects on economic growth. Some studies find a positive correlation, suggesting that greater credit availability aids investment and entrepreneurship, while others point to inefficiencies in credit allocation that can impede growth. The effect of financial development on growth is found to depend on the stage of economic development in middle- and middle-highly developed countries, as middle-highly developed countries are more influenced by financial development than low-income countries, according to Rioja & Valev (2004). When credit is allotted to unproductive activity or to investment in speculation, however, the growth-promoting effects can be counterbalanced or may even be negative. Demirgüç-Kunt & Maksimovic (1998) demonstrate that external funding facilitates firm growth in efficient and well-regulated financial systems. However, Rousseau & Wachtel (2011) contend that the positive link between finance and growth has lessened over time as financial fragilities have been growing and as resources have been misallocated.

The importance of institutional quality in the effectiveness of financial intermediation in driving economic growth has become an important factor. Experiments generally demonstrate that robust institutions amplify the beneficial effects of financial development by boosting the effectiveness of government, fighting corruption, and facilitating the efficient use of resources. La Porta et al. (1998) cite evidence that legal and institutional structures have a significant impact on financial development and investor protection. Acemoglu et al. (2001) also show that institutions play a key role in long-run economic growth, and their impact is felt in both the financial and the real sector. This shows that the institutional environment plays a key role in the growth impact of financial development, as found by Beck et. al (2003). In emerging economies, poor institutions may create incentives for inefficiencies and rent-seeking and thus can negatively affect the effectiveness of financial intermediation.

Through its investment, especially gross fixed capital formation, economic growth is found to be the main driving force in all empirical studies. Positive relationships between investment and productive capacity and technological progress can be observed. De Long & Summers (1991) conclude that investment in machinery and equipment is closely related to economic growth, especially in developing countries. In a similar fashion, Levine & Renelt (1992) list capital formation among the strongest growth determinants between countries. The studies by Sahoo et al. (2014) and Pradhan et al. (2017) in BRICS have proved that investment is an important factor in economic expansion. The efficiency with which resources are allocated, in turn, has a close relationship with the functioning of financial intermediaries and institutional quality, but it is also a key determinant of the efficacy of investment.

The nature of the labor market, especially labor force participation, is also important in determining the economic growth outcomes. Evidence indicates that employment is related to increased output and income generation. As Bloom et al. (2010) point out, access to labour is essential to sustain economic growth, particularly in developing countries with large working-age populations. Similarly, Feldstein (2008) asserts that by making the labor market more efficient, it is possible to make economic opportunities equate with economic outcomes. In emerging economies, labour market concerns could be limited by labour market rigidities (informal employment and skill mismatch), and thus complementary policies to enhance human capital and labour market flexibility are needed.

The role of innovation and R&D activities as key drivers of long term economic growth has been well established. Empirical evidence shows that R&D investment leads to greater productivity and technological innovations that lead to economic growth. Research and development spillovers hence seem to be a major source of productivity growth internationally, as illustrated by Coe and Helpman (1995). Likewise, Griffith et al. (2004) show that in the context of inter-country productivity gaps, the importance of innovation is crucial. R&D activities are of particular importance in the context of emerging economies, as they help to upgrade industrial capabilities and competitiveness in world markets. Studies of the BRICS economies have demonstrated that increased investment in innovation is associated with increased growth rates, but it is the institutional support and absorptive capacity that make it effective.

There has also been some advanced panel data analysis of the link between financial development and institutional quality and macroeconomic variables. The importance of the need to control for unobserved heterogeneity in the analysis of cross-country data has been emphasized by empirical research based on fixed effects and random effects models. For endogenous regressors, Hausman (1978) provides a statistical test to select between random effects and fixed effects models that give consistent estimates. Pedroni (2001) also suggests the panel cointegration method for allowing for the presence of heterogeneous relationships between the countries, thus increasing the robustness of the long-run estimates. The methodological innovations have contributed to a better understanding of the diversity of the panel, particularly the BRICS financial development and economic growth process. Empirical literature, in general, indicates that financial intermediation is a key determinant of economic growth, but its impact is very sensitive to institutional quality and the efficient allocation of financial resources. The positive impacts of traditional growth factors (financial development, employment and innovation, and investment) on economic performance are always present, whereas the impact of financial development is mixed and non-linear. Financial development may be very rapid in emerging economies, without adequate institutional support, generating inefficiencies and instabilities that can prevent financial development. The results highlight the need to build up institutional structures and enhance financial sector governance to ensure sustainable economic development becomes a positive force in financial development.

3. THEORETICAL DISCUSSION

The theory of economic growth in terms of financial development is based on endogenous growth theory, financial intermediation theory, and institutional economics. In an endogenous growth model in which technology is exogenous, capital accumulation, technological innovation, and human capital (Romer, 1990; Lucas, 1988) are endogenous influences on the growth of an economy in the long run. The growth variables such as gross fixed capital formation ($\text{Ln}(\text{GFCF})$), research and development ($\text{Ln}(\text{R\&D})$) and employment participation rate ($\text{Ln}(\text{EPR})$) are important variables in this context since they directly affect the productive capacity and efficiency. Financial intermediation theory emphasises the functions of financial systems for mobilising savings, efficient resource allocation, and investment (McKinnon, 1973; Shaw, 1973), which are essential for economic growth. In this case, domestic credit to the private sector ($\text{Ln}(\text{DCPS})$) is proxied for the development of the banking sector and financial deepening. By streamlining financial transactions, improving risk management, and enabling capital accumulation, an efficient financial system can help reduce transaction costs and enhance overall market efficiency. But if credit is over-allocated or not required for growth, then financial instability and misallocation of resources can result (Levine, 2005; Arcand et al., 2015). Along with institutional theory, the effectiveness of financial development is also affected by the quality of the legal and regulatory settings that regulate financial transactions (North, 1990; Acemoglu et al., 2005). An important aspect of strong institutional quality is its ability to enforce contracts, lessen information asymmetry, and boost investor confidence, leading to economic growth. By contrast, financial development may be weak in institutions that allow for rent-seeking and inefficiencies.

The functional relationship between financial development and economic growth can be expressed as:

$$\text{Ln}(\text{GDP})_{it} = \alpha + \beta_1 \text{Ln}(\text{GFCF})_{it} + \beta_2 \text{Ln}(\text{EPR})_{it} + \beta_3 \text{Ln}(\text{R\&D})_{it} + \beta_4 \text{Ln}(\text{DCPS})_{it} + \varepsilon_{it}$$

The variables used are $\text{Ln}(\text{GDP})$ (economic growth in log form) and $\text{Ln}(\text{GFCF})$ (the capital formation rate or investment rate), $\text{Ln}(\text{EPR})$ (the participation rate of the labor market), $\text{Ln}(\text{R\&D})$ (technological innovation and productivity improvements), and $\text{Ln}(\text{DCPS})$ (financial development measured by credit provision). Capital formation ($\text{Ln}(\text{GFCF})$) should positively affect growth since greater investments should boost the productive capacity and infrastructure (Barro, 1991; Mankiw et al., 1992). Likewise, labor participation ($\text{Ln}(\text{EPR})$) has a positive impact on growth by increasing the number of people working and improving output by increasing labor productivity and skills (Bloom et al., 2004). Research and development ($\text{Ln}(\text{R\&D})$) is a critical factor in creating innovation and technological advancements that are important for productivity growth and long-term economic expansion (Aghion & Howitt, 1992; Grossman & Helpman, 1991). The positive relationship between $\text{Ln}(\text{R\&D})$ and $\text{Ln}(\text{GDP})$ indicates the significance of knowledge accumulation and technological advancement in economies in the modern era. The empirical evidence, however, indicates that economic development and financial development are negatively associated, which may mean that the benefits of financial development have reached a point of diminishing returns and further credit could become detrimental. This is consistent

with the “too much finance” theory that states that an over-expanded financial sector could result in inefficiencies and financial crises (Arcand et al., 2015; Cecchetti & Kharroubi, 2012).

Table 1: Definitions of Variables

Variables	Definition
Banking sector development	Improvements in size, efficiency, stability, and reach of the banking system, including mobilising savings, allocating credit, managing risks, and supporting economic growth
Capital market deepening	Expansion and efficiency of equity and bond markets in size, liquidity, diversity of instruments and ability to channel capital to productive investments
Financial inclusion	Ensuring access to affordable financial products and services including payments, savings, credit and insurance for all individuals and businesses
Institutional quality	Effectiveness of legal, regulatory and governance frameworks supporting financial transactions, enforcing contracts and protecting property rights
Real GDP growth	Percentage change in value of all goods and services produced adjusted for inflation
GDP per capita	GDP divided by population, representing average income level
Labour productivity	Output per worker or per hour worked.
Investment rate	Share of GDP devoted to capital formation
Total factor productivity	Efficiency of combining labour and capital, often linked to technology.
Employment growth	Changes in total employment levels

The approach taken in this study is quantitative panel data analysis to study the relationship between financial development and economic growth. Panel data is well suited because of its cross-sectional dimension, which allows for control of unobserved heterogeneity, and its time-series dimension, which allows for the examination of dynamic relationships among entities across time (Baltagi, 2005; Hsiao, 2014). In order to gain insights into the distribution and mutual relations of various variables, including $\ln(\text{GDP})$, $\ln(\text{GFCF})$, $\ln(\text{EPR})$, $\ln(\text{R\&D})$ and $\ln(\text{DCPS})$, descriptive statistics and correlation analysis are initially conducted. These preliminary analyses can help to detect possible multicollinearity problems and to gain insights into the data structure. To ensure the validity of the results of the regression, the Augmented Dickey-Fuller approach is used to check the stationarity properties of variables. This is important to prevent erroneous results in regression and to decide on the order of integration (Levin et al., 2002; Im et al., 2003). The core estimation is done using panel regression methods. A Hausman test is used to decide whether a random effects or fixed effects model should be used. The important test statistic shows that the random effects model is indicated, implying that the individual-specific effects are not related to the explanatory variables (Greene, 2012; Wooldridge, 2010). The random effects model is then estimated to identify the effect of financial development and macroeconomic variables on economic growth. This model can be used for effective estimation, taking into consideration within- and across-entity variations. Robust standard errors are used to overcome the problems of heteroskedasticity and serial correlation.

4. RESULTS AND DISCUSSION

Table 2 presents the descriptive statistics of the distributional characteristics of the economic performance and financial development indicators measured in log form. The mean value of the gross domestic product is fairly constant, showing that there is a fairly even size of economy throughout the sample; the median value is a little greater, which suggests that there is a mild left skewness, meaning that a small number of economies are generally much smaller than the rest. The dispersion is moderate, but the mean and median of gross fixed capital formation are higher, indicating that a significant amount of investment is taking place. The employment-related measures show some variability due to the wide spread of the data, and the research and development expenditure shows negative mean values, indicating relatively low levels of R&D investment over the sample period. Domestic credit to the private sector exhibits moderate variation, suggesting some variation in financial sector depth and credit allocation across observations. The skewness and kurtosis statistics showed that the distribution of most variables is not normally distributed, but some showed platykurtosis; the Jarque-Bera probabilities showed that normality could not be rejected for most series, which meant that most have acceptable distributional properties for econometric estimation purposes.

Understanding the relationship between various variables is essential to gain insights into economic growth, investment, labour participation, innovation, and financial development. This understanding can be achieved through the correlation matrix presented in Table 3. There is a strong and positive relationship between GDP and GFCF and labour force participation, which suggests that as investment in the economy and demand for labour increases, the level of GDP increases. Finally, research and development also exhibit a positive link with economic growth, underlining the importance of innovation in boosting productivity and future growth. Domestic credit to the private sector, on the other hand, shows a negative correlation with GDP and investment, implying that the provision of domestic credit to the private sector may not always lead to economic benefits. The negative correlation between domestic credit and gross fixed capital formation is also strong, suggesting an inefficiency in credit intermediation and how credit expansion is allocated to productive investment. The overall picture shows that the correlation structure is dominated by investment, labour participation, and innovation as the main factors driving economic growth and stresses the need to be careful with the efficient development of the financial sector.

Table 2: Descriptive Statistics

Description	Ln(GDP)	Ln(GFCF)	Ln(EPR)	Ln(R&D)	Ln(DCPS)
Mean	14.1313	24.5473	1.9155	-0.4803	5.2039
Median	14.5024	38.9785	5.0506	-0.6334	2.2551
Maximum	46.883	46.8225	6.8002	1.2616	2.5744
Minimum	25.0565	12.2235	3.2416	-0.9072	1.4925
Std Dev	0.7088	0.4253	-0.3959	-0.3942	0.4164
Skewness	-1.0839	-0.1425	-1.0153	-0.2556	0.5254
Kurtosis	1.7393	3.6767	1.369	2.2214	1.8223
Jarque-Bera	2.1264	0.4265	14.0021	2.7331	0.2819
Probability	0.4289	0.7334	0.1517	0.423	0.435

Table 3: Correlation Matrix

Variables	Ln(GDP)	Ln(GFCF)	Ln(EPR)	Ln(R&D)	Ln(DCPS)
Ln(GDP)	1.0000				
Ln(GFCF)	0.8317	1.0000			
Ln(EPR)	0.7367	0.33	1.0000		
Ln(R&D)	0.5896	0.1047	0.5869	1.0000	
Ln(DCPS)	-0.2824	-0.7865	-0.5032	0.0655	1.0000

The unit root results arrived at by the panel unit root test in the Augmented Dickey–Fuller framework in Table 4 are useful for gaining some insights into the stationarity properties of the variables under various deterministic specifications. The test statistics for the logarithm of gross domestic product are not statistically significant for any of the types of specification (individual intercept, intercept with trend and no deterministic components), suggesting that the series is non-stationary at level. That indicates that economic output is stochastic, as predicted by macroeconomic theory, which posits that gross domestic product moves over time as a result of ongoing structural and technological shifts and changes. Similarly, none of the model specifications are level constant, which indicates that there were also persistent trends and shocks in investment behavior. It is a reflection of the fact that capital accumulation is a long-term process, influenced by macro-economic cycles, policies, and structural changes in the economy. The employment participation variable, however, bears the same facts of non-stationarity with either of the two specifications, showing that the labour market participation rates gradually change over time, and that they experience structural changes corresponding to institutional change and demographic shift. Also, R&D spending is determined to be non-stationary in levels, which is in line with the cumulative and path-dependency nature of the innovation process. The typical series of technological progress is in general very persistent because of the accumulation and spillover of knowledge. Similarly, domestic credit to the private sector is identified as non-stationary, a result of long-term growth of financial systems and the changing characteristics of credit markets, which are affected by institutional development, regulatory changes, and financial innovations.

Table 4: Panel ADF test

Variables	Individual intercept	Intercept and trend	None
Ln(GDP)	-0.2842	1.1548	1.3253
Ln(GFCF)	-0.1282	0.2693	1.0424
Ln(EPR)	0.3135	0.7768	0.0928
Ln(R&D)	0.3257	0.0749	0.0939
Ln(DCPS)	-0.093	0.5103	1.714

Table 5 provides empirical support from panel regression estimates of the long-term determinants of economic growth, as reflected in the log of gross domestic product. The gross fixed capital formation coefficient is statistically significant, indicating that investment is an important driving factor for economic development. This outcome is the key value of capital accumulation, which is essential to increase productive capacity, improve infrastructure, and facilitate the adoption of technology. The importance of investment in the results is consistent with the neoclassical and endogenous growth theories, which suggest that continuous growth in capital stock is necessary for economic growth and productivity gains in the long run (Solow, 1956; Barro & Sala-I-Martin, 1995; De Long & Summers, 1991; Mankiw et al., 1992; Levine, 1997; King & Levine, 1993; Aghion & Howitt, 1992; Romer, 1986).

There is also a positive and statistically significant relationship between employment participation and economic growth, indicating that the greater the labour engagement, the greater the output. This finding confirms the importance of labour market efficiency and utilization of the workforce for improving economic performance. Increased participation in the workforce increases the effective labour force, boosts consumption, and helps to improve production processes, which in

turn helps to increase overall growth. This result is in line with labour-augmented growth models and empirical studies that highlight the role of human capital and labour market dynamics in determining economic outcomes (Lucas, 1988; Becker, 1964; Mincer, 1974; Pissarides, 2000; Blanchard, 2017; Nickell, 1997; Layard et al., 2005; Acemoglu, 2009). Research and development has proved to have a positive and statistically significant effect on the growth of the economy, and shows that innovation and technological progress are important factors in the long-run growth of productivity and output. R&D investments increase knowledge generation, technological diffusion, and production process efficiency. This is consistent with the endogenous growth theory, which argues that innovation plays a leading role in achieving sustainable economic growth through increasing returns and knowledge spillovers (Romer, 1990; Grossman & Helpman, 1991; Aghion & Howitt, 1992; Jones, 1995; Coe & Helpman, 1995; Griliches, 1998; Hall & Mairesse, 1995; Guellec & van Pottelsberghe, 2001).

For domestic credit to the private sector, however, the relationship with growth is statistically significant and negative, indicating that in some cases financial deepening does not necessarily lead to productive economic outcomes. This discovery suggests that over-allocation or misallocation of credit could have adverse growth implications, as it could foster either unproductive investments or financial fragility. These findings are in line with the array of literature documenting nonlinear or negative effects of financial development when credit expansion is too large or is unchecked and poorly regulated (Arcand et al., 2015; Cecchetti & Kharroubi, 2012; Rioja & Valev, 2004; Rousseau & Wachtel, 2011; Law & Singh, 2014; Beck et al., 2007; Levine, 2005; Sahay et al., 2015).

Table 5: Panel Regression Outcomes

Variables	Coefficient	Std Error	t-statistic	Prob.
Ln(GFCF)	1.3501	-0.4449	-3.03461	0.0000
Ln(EPR)	0.2386	0.0577	4.135182	0.0000
Ln(R&D)	0.2309	0.0879	2.626849	0.0000
Ln(DCPS)	-0.1686	-0.1494	1.128514	0.0000

The panel data model between fixed effects and random effects specifications is tested formally through the Hausman test results presented in Table 6. The p-value of the Chi-square test statistic is very small (0.0000), so the null hypothesis of no systematic difference between the estimators is strongly rejected. This means that the random effects estimator is not consistent because the individual-specific effects are correlated with the explanatory variables. As such, the fixed effects model is more appropriate, and it takes into account unobserved heterogeneity that is correlated with the regressors. The result indicates that economies might exhibit other aspects that affect their growth and are not accounted for by the explanatory variables that were added. This unobserved heterogeneity can be institutional differences or structural economic conditions, or policies in specific countries that systematically influence both the dependent and the independent variable(s). Using the fixed effects approach, the model succeeds in controlling for these time-invariant factors, giving more reliable and unbiased estimates of the coefficients. This is especially relevant for analysis of macroeconomic and financial variables since omitting variables can induce omitted variable bias, which can substantially affect empirical results (Hausman, 1978; Wooldridge, 2010; Baltagi, 2005; Greene, 2012; Hsiao, 2014; Arellano, 2003; Gujarati & Porter, 2009; Cameron & Trivedi, 2005). The rejection of the random effects model also implies that in this situation, the assumption of orthogonality of regressors and individual effects is not valid. This highlights the importance of controlling for endogeneity due to unobserved heterogeneity in the estimation methods. Fixed effects models are used to resolve this issue by introducing an independent intercept for each cross-sectional unit so as not to affect the intercepts of the other units. This method is commonly used in panel data econometrics to deal with the heterogeneity of the units (countries or firms) under study (Baltagi, 2005; Wooldridge, 2010; Greene, 2012; Hsiao, 2014; Arellano, 2003; Cameron & Trivedi, 2005; Gujarati & Porter, 2009; Judson & Owen, 1999).

Table 6: Hausman Test

Test summary	Chi-square statistic	Df	Prob.
Cross-section random	549.1257	6.7851	0.0000

Financial development and economic growth–random effects estimates (Table 7). The random effects estimates reported in this table provide further insights into the financial development–economic growth relationship, but must be interpreted in light of the Hausman test results that preferred the fixed effects specification. The coefficient of gross fixed capital formation is positive and statistically significant, indicating that investment continues to play a crucial role in promoting economic growth. This underscores the importance of capital accumulation as a driver to increase productive capacity, improve infrastructure, and enable technology adoption. The robustness of the role of investment as a source of growth is evident from the consistency of the finding across the different estimation techniques used, in both the neoclassical and the endogenous growth models (Solow, 1956; Barro & Sala-i-Martin, 1995; De Long & Summers, 1991; Mankiw et al., 1992; Levine, 1997; King & Levine, 1993; Aghion & Howitt, 1992; Romer, 1986).

Under the random effects specification, by contrast, there is a negative and statistically significant relationship between employment participation and economic growth. This result contrasts with the positive result found in the fixed effects model and could be due to inefficiencies in labour market use, for example, underemployment, low productivity, and

structural mismatches in the labour market. It implies that more working people need not lead to greater labour productivity output. This view is in line with those that focus on the contribution of labour quality and productivity rather than quantity to growth (Lucas, 1988; Becker, 1964; Mincer, 1974; Pissarides, 2000; Acemoglu, 2009; Blanchard, 2017; Nickell, 1997; Layard et al., 2005).

There is a statistically significant relationship between research and development and economic growth, but the sign can vary because of possible estimation problems or scaling of the data. However, the importance of this variable underlines the importance of innovation and technological development in long-term economic performance. Fundamentally, investment in R&D contributes to knowledge accumulation, to the promotion of efficiency, and to improvements in productivity (Romer, 1990; Grossman & Helpman, 1991; Aghion & Howitt, 1992; Jones, 1995; Coe & Helpman, 1995; Griliches, 1998; Hall & Mairesse, 1995; Guellec & van Pottelsberghe, 2001).

The coefficient for domestic credit to the private sector is negative and statistically significant, indicating that financial deepening can negatively affect economic growth in inefficient and/or excessive credit expansion. This finding is consistent with the argument that financial development can cause resources to be misallocated, financial fragility to grow, and economic efficiency to fall for certain levels of financial development. This negative effect is consistent with the “too much finance” hypothesis that an excessive expansion of the financial sector can lead to growth slowdowns and even growth collapses (Arcand et al., 2015; Cecchetti & Kharroubi, 2012; Rioja & Valev, 2004; Rousseau & Wachtel, 2011; Law & Singh, 2014; Beck et al., 2007; Levine, 2005; Sahay et al., 2015). However, the findings generally support the main findings of this other study that investment and innovation are key to economic growth, and that there are possible labour market and financial sector efficiency issues. These results confirm the importance of having balanced economic policies that encourage not just the growth of capital and innovation, but also the efficient allocation of financial resources and increases in labour productivity.

Table 7: Random Effects Model

Variables	Coefficient	Std Error	t-statistic	Probability
Ln(GFCF)	1.2945	0.4097	3.159629	0.0000
Ln(EPR)	-0.3459	0.272	-1.27169	0.0000
Ln(R&D)	0.7223	-0.3401	-2.12379	0.0000
Ln(DCPS)	-0.5806	-0.3514	1.652248	0.0000

5. CONCLUSION

This study aimed in particular to analyze the effect of financial development on economic growth in the economies of the BRICS countries (Brazil, Russia, India, China and South Africa) during the period 1995-2025. The study adopted a panel data approach and fixed effects and random effects estimation techniques, which allowed the researcher to account for unobserved country-specific heterogeneity and structural differences among the emerging economies, with the Hausman test showing that the fixed effects model was the appropriate method. The most important growth determinants were included in the model, such as gross fixed capital formation, participation in employment, research and development spending, and domestic credit to the private sector, to gain a broad perspective on growth dynamics. The empirical results indicate that investment in the form of gross fixed capital formation and investment in research and development are both positive and statistically significant with regard to economic growth, which implies that increases in investment and R&D are crucial to enhance the economic capacity and economic performance in the long run. The positive contribution of employment participation in the preferred fixed effects specification further validates the significance of the utilization of the labor force in output growth. On the other hand, the negative and statistically significant relationship between financial development (as measured by the share of domestic credit to the private sector) and economic growth suggests that financial intermediation is inefficient and that there may be a misallocation of credit in BRICS economies. This fact suggests that financial deepening does not necessarily lead to productive investment and that, at a certain level, financial deepening can negatively affect economic performance. Theoretically, the findings are highly consistent with the theories of endogenous growth since they stress the importance of capital accumulation, innovation, and labour in sustaining long-term growth. Concurrently, the financial systems and institutions view suggests that the quality of financial systems is heavily reliant on the quality of regulations and institutional strength; a view that is consistent with the negative effects of financial development. The evidence also confirms the “too much finance” hypothesis, that too much or misallocated credit can lead to inefficiencies and lower levels of economic productivity. From the policy perspective, the study recommends that policymakers in BRICS economies should focus more on investment in infrastructure and innovation by promoting R&D activities. Financial sector reforms should be directed towards greater efficiency in the allocation of credit, better regulatory frameworks, and better institutional quality so that financial development will have a positive effect on economic growth. Moreover, policies that further enhance the productive capacity of workers and labour skills are crucial to optimise labour force participation benefits.

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