

Impact of Financial Inclusion on Banking Sector in BRICS: Evidence from the Indirect Role of Credit Risk

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ABSTRACT

Purpose— Financial inclusion refers to a phenomenon related to ease of use, affordable having accessibility wide spread of financial services. Research focuses on exploring the degree/level to which increasing access to financial services tends to contribute towards improving banking efficiency through operationalization and financial stability to improvements. Research further measures the role-played credit risk in shaping the relationship between financial inclusion and banking efficiency, due to increased credit lending activities.

Study Design/methodology/approach—This research adopted panel fixed effect, mediating analysis through two-stage path modeling, sensitivity analysis through fixed effect regression, and two-step system GMM to evaluate and provide a new understanding of the association between banking efficiency, financial inclusion, and credit risk using BRICS countries as a sample, covering a dataset of 24 years on an annual basis. Mediation analysis enables us to examine causal relationships by focusing on the indirect approach through which the independent variable tends to impact the outcome variable. Lastly, GMM estimation is used to get more reliable and robust results by addressing problems of endogeneity, heteroscedasticity, and autocorrelation.

Findings—Results of the research confirm that financial inclusion has a significant positive impact on bank efficiency, with a β coefficient of 0.085 having a p-value of 0.0009, but this impact depends on the macroeconomic environment and the riskiness of the banking system. To be more specific, an increase in financial inclusion will have a positive effect on the banking sector's profitability, whereas the credit risk tends to negatively affect the relationship between financial inclusion and banking efficiency.

Practical Implications— This research presents several policy and practical implications for banks, financial regulatory bodies, government agencies, and development organizations. They confirm the point that financial inclusion is not to be aimed at as some generic and symbolic objective, but as a well-timed intervention informed by risk assessment and economically contextualized. The direct and the mediated effects of inclusion on the efficiency of banking are empirically observed, but their size and stability are subject to the macroeconomic and institutional context.

Originality/Value— The study derives several new insights that position it apart from other current research in financial inclusion and banking efficiency. For a start, it offers a holistic approach to understanding the impact of financial inclusion on banking efficiency since this relationship is studied in an area characterized by unique socio-economic and institutional challenges, specifically the BRICS region.

Keywords: Financial Inclusion, Banking efficiency, Credit risk, Panel data

JEL Classification Codes: G20, G29, G32, G53

1 | INTRODUCTION

The role of financial inclusion is attaining global attention as it not only plays a major role in expanding the horizon of financial services for the unprivileged community, but also helps in improving financial institutions' stability through improved operational efficiency. For the same reason, countries in Asia, America, and Europe are focusing more on the adaptation of financial inclusion to reduce poverty by improving economic growth, stability, and financial institutions' profitability. Previous studies show that an increase in bank accounts, credit loans, Mobile & digital banking, and payments improves customer confidence, enhancing financial stability by increasing deposits and banks' outreach ([Kharabsheh & Gharaibeh, 2023](#)).

Recent years have seen a significant amount of study on the connection between financial inclusion, financial stability, and economic growth ([Antwi et al., 2024](#); [Oanh, 2023](#)). Smooth economic progress is dependent on the concept of financial inclusion, which refers to the use, availability, and usefulness of financial services by not only individuals as well as entities, especially in the developing or emerging markets ([Ediagbonya & Tioluwani, 2023](#)). As the world has become a global village, any new technological innovation in any part of the world effects the global world as a whole. Similarly, over the global landscape, financial inclusion has gained much significance because of its ability to act as a driving tool to minimize poverty and enhance economic growth ([Mhlanga, 2024](#)). However, today's world is a world of technological happenings and economic development. To achieve the set targets, adaptation of financial inclusion in our financial system is very important; by doing so, countries can achieve prosperity and stability ([Gomber et al., 2018](#)). Financial inclusion refers to the adaptation of a financial environment in which one has easy access to financial services, regardless of their status in society. Financial inclusion can reduce the financial services gap between people living in the same society. Like financial inclusion bank also play a vital role in the development of the economic structure of the country. In order to achieve the success of financial inclusion, the banking sector must come forward for the development of a dynamic economic and financial system by ensuring optimal distribution of available scarce resources ([Mhlanga, 2024](#)).

Financial inclusion is a process through which all segments of society can avail the benefits of the financial services, especially those underprivileged, who are new to the system and were illiterate about the functioning of the system ([Mishra et al., 2024](#)). This includes credit, insurance, and other financial instruments in addition to standard banking services. Knowing how financial inclusion affects different economic indicators is crucial as countries work to promote inclusive economic growth. In fact, financial inclusion could be defined as having simple and cheap access to rudimentary banking services ([Maity & Sahu, 2017](#)). However, a sizable section of the global population lacks access to such fundamental financial services, particularly in impoverished developing countries. A substantial proportion of the general masses' involvement in the proper financial system is essential for improved economic growth ([Emara & El Said, 2021](#)). It is a fact that the banking sector has a critical role in society's development and growth ([Sharma & Choubey, 2022](#)). This industry is crucial in providing common people with a formal financial stage ([Park & Kim, 2020](#)). Banks possess the ability to encourage individuals to save and engage in a variety of other actions that add to financial inclusion ([Ediagbonya & Tioluwani, 2023](#)).

Financial stability contributes to mediating the role between the FI and BE. To illustrate, the initial effects can be felt when banks lend money to unbanked people, and this can be a positive gain when it comes to outreach as well as inclusivity. Nonetheless, in case these clients do not demonstrate sufficient financial literacy or the ability to make repayments, this outcome may imply a high default rate, thus impacting the bank's efficiency. Therefore, credit risk can be seen as a mediator that makes FI estimates translate into measured efficiency.

Although the positive perspective of the role of financial inclusion in terms of economic growth and social development is well-known, its impact on the banking efficiency of the relevant process is less assertive, especially when it comes to emerging economies. The relation between biological factors and credit risk, with mediating factors like credit risk, complicates this.

The literature is strong in individual countries of India, Kenya, or developed economies ([Okoli & Tewari, 2020](#); [Vo et al., 2021](#)). Comparative studies across the emerging economies are not common; other countries lack representation in FI-BE research. On the one hand, BRICS countries have achieved much in FI; on the other hand, comparative studies considering their experiences in collaboration have been little done.

Nevertheless, the potential effects of FI on banking efficiency have received relatively little research focus. While banks act as key conduits in the implementation of financial inclusion policies, little empirical insight is available regarding the effect of FI on banking efficiency. Other research gaps need to be considered. First, there are very few studies exploring how the financial stability risks associated with the FI-banking efficiency association could be integrated into the analysis. Prior research on the subject tends to focus on the direct links between FI, financial development, and economic growth while disregarding how FI could affect banking efficiency through indirect mechanisms. Specifically, there has been very little research on the role of credit risk. There are also issues relating to geographical and methodology biases that need addressing within the literature. Past research studies mainly cover single-country settings such as India, Kenya, or advanced countries ([Okoli & Tewari, 2020](#); [Vo et al., 2021](#)), with a lack of comparative studies for BRICS, even though they have been growing quickly regarding digitization and financial inclusion activities. Moreover, past literature has focused mainly on classical econometrics methods using small datasets, with little attention paid to the issue of endogeneity and dynamics. The gap in the study, therefore, is in the direction of understanding how financial inclusion influences banking efficiency and what role is played by credit risk as a mediating variable.

In the developing countries, not much research is done, even though there has been a rapid expansion in financial inclusion in the last two decades. Another aspect of the literature gap is the inconsistency in the findings with respect to the relationship between financial inclusion and banking efficiency. One aspect highlights the importance of financial inclusion in improving operational and financial efficiency of the banking sector, while the second one highlights adverse elements like an increase in operational cost, technological risks faced in the earlier phase of financial inclusion adaptation. Lastly, there is a gap with regard to the usage of data sets and econometric models; previous studies have focused on simple regression and correlation analysis based on short data sets ([Diaz, 2025](#)).

Overall, financial inclusion tends to contribute to increased stability and efficiency in banks ([Han et al., 2025](#)). In situations where there are lax policies on regulation or too much government intervention, however, banks tend to indulge in risky behavior ([Ofoeda et al., 2024](#)). This illustrates that there is contextual dependence in the relationship between FI and BE; however, existing literature does not incorporate the phenomenon using a mediation-moderation approach. More research should be done on the heterogeneity of the FI-BE linkage, especially the conditionalities of business cycle and financial policy environments ([Saha & Dutta, 2022](#)).

The relevance of this study is especially high in a developing economy. The BRICS group (Brazil, Russia, India, China, and South Africa) has been at the forefront of implementing FI strategies globally, where technology and regulation have been utilized to increase access to finance. In line with the United Nations Sustainable Development Goals (SDGs), in particular SDG 8 (Decent Work and Economic Growth) and SDG 10 (Reduced Inequalities), FI has global policy relevance. In international development projects, the World Bank, IMF, and UNDP have had a long history of encouraging FI as a poverty reduction strategy to increase gender equity and financial resilience. Although the macroeconomics of FI are well known, its consequences, in terms of the efficiency and sustainability of banking institutions' competition, have not been fully examined.

Although financial inclusion is widely recognized as a positive aspect of economic development, its effects on banking efficiency remain an underemphasized domain in the extant literature. Most studies are concerned with the macroeconomic impact of financial inclusion, including a reduction in poverty levels and economic mobility, but few have explored its impact on banks' operational efficiencies ([Okoli & Tewari, 2020](#)).

Available studies claim that in the initial phase of expansion of the financial inclusion banking sector may be a reduction in operational and financial efficiency due to the increase in operational and technological advancement costs, especially in Asian countries, but this downward trend is temporary ([Le et al., 2019](#)).

Furthermore, although the nexus between financial inclusion and economic growth has been extensively analyzed, not much scholarly work has been directed at the moderating and mediating mechanisms that influence the nexus, such as financial credit risk and broader economic conditions of financial inclusion ([Frost, 2020](#)). For example, although financial inclusion leads to increased access to credit, it also exposes banks to considerable risks in terms of credit risk, which may reduce banking efficiency ([Feghali et al., 2021](#)).

1.1 | Research Objectives

The overarching aim of this study is to investigate the impact of financial inclusion on banking efficiency in emerging economies, with particular reference to BRICS countries. The main objective is to investigate the direct impact of financial inclusion on banking efficiency, followed by the financial inclusion impact on the credit risk of the banking sector. Likewise, the impact of credit risk on banking efficiency will be analyzed to conclude whether banking efficiency weakens/drops with an increase in the credit risk. Lastly, to conclude regarding the direct and indirect impact of financial inclusion on banking efficiency, we seek to test the mediating role of credit risk in the relationship between financial inclusion and banking efficiency ([Iatzaz Ul Hassan et al., 2025](#); [Shukar & Sufian, 2025](#); [Zhao et al., 2024](#)).

1.2 | Research Questions

Current research tends to answer the following questions based on the objectives: firstly, to explore the impact of financial inclusion on the banking efficiency in BRICS countries, secondly, to investigate the impact of financial inclusion on credit risk of banking sector, followed by impact of credit risk on banking efficiency, which will enable us to conclude on whether credit risk of banking sector enhances and weakens the banking efficiency. In the end, the credit risk's mediating role is evaluated to judge the direct and indirect impact of financial inclusion on banking efficiency.

2 | LITERATURE REVIEW

2.1 | Theoretical Framework

. The following theoretical frameworks provide an overall foundation to explore such relationships, and the discussion has been extended to especially address all the relevant study variables.

2.1.1. Information Economics Theory

Information Economics Theory focuses on the distribution of information and its implications for economic decisions, especially how a reduction in information asymmetry can lead to more efficient economic outcomes ([Stiglitz, 2017](#)).

The role of information economic theory is very important as it provides a clear picture of financial markets' actions and behaviors under asymmetric information. The banking sector faces problems because it lacks concrete information regarding customer credit history, historical loan patterns, monitoring and evaluation cost, and credit rating, and lastly, its own system inefficiencies. Financial inclusion, especially by adopting financial innovation like digital banking and money transfer, tries to fill the information gap, providing reliable and consistent customer data, which includes digital footprints, credit rating, and historical transactional data. All this information helps banks to be in a better position for risk assessment, minimize costs, and better allocation of credits, ultimately improving banking efficiency ([Ha et al., 2025](#); [Zheng, Rahman, et al., 2026](#)).

2.1.2. Resource-Based View Theory

Resource-Based View (RBV) theory concentrates on the important resources that can be exploited by companies to achieve competitiveness ([Barney, 1991](#)).

RBV theory main focus is achieving competitive advances by efficient and effective use of scarce resources like human resources, digital infrastructure, data analysis, et., of the institution and being sustained over a longer period. ([Barney, 1991](#); [Wang et al., 2025](#)) highlighted that adaptation of financial inclusion is a key tactical resource that ensures improvement in banking efficiency, timely service, and minimization of cost.

RBV links financial inclusion with banking efficiency via scarce resources, continuous innovation, and optimization. Having digital financial services as a strategic resource enables better management of risk assessments, especially in developing economies. Recent studies by [Ha et al. \(2025\)](#) and [Shukar and Sufian \(2025\)](#) highlighted the significant role of digitally enabled financial inclusion in strengthening the banking sector by converting in-house capabilities into competitive advantages.

Lastly, RBV provides a solid theoretical foundation for studying the relationship between financial inclusion and banking efficiency. RBV advocates that financial inclusion is not only a matter of theory or policy outcome but also a result of how effectively banks utilize their scarce internal resources to achieve a competitive advantage in the financial market.

2.1.3. Institutional Theory

Institutional theory supports the idea that the success or failure of financial inclusion is dependent on the external factors like governance, laws and regulations, market structure, and financial infrastructure.

According to [Monye \(2021\)](#), financial inclusion enhances the institutional framework since it is likely to influence people previously not using financial services to adopt such practices, and this way leads to better operations and efficiency in banking. [Claessens \(2006\)](#) suggests that if the institutional framework is stable, then banks can easily decide on strategic options and have improved banking efficiency.

As per [Mbarek \(2025\)](#), strong institutions rely on the acceptance and implementation of financial inclusion through fintech, enabling a reduction in procedural uncertainties, protecting the consumer. [Wu and Kikuchi \(2025\)](#) highlighted that institutional competence increases the success rate of financial inclusion on banking efficiency, through consistent operations at reduced cost and minimizing risks.

In this theatrical framework, financial inclusion is an independent variable which enhance overreach of financial services at low cost and easily accessible. Banking efficiency is a dependent variable representing banking sector resource utilization for cost reduction and profit maximization. Credit risk acts as a mediating variable, as consistent and correct timely information reduces the risk of default.

2.2 | Literature Matrix

Table 1

Literature Matrix

Author(s), Year	Country/Context	Methodology	Key Findings	Gap/Link
(Čihák et al., 2012)	Global	Findex survey	FI lowers exclusion, increases access.	Bank efficiency not studied → H1 gap.
(Burgess & Pande, 2005)	India	Policy panel	Branch expansion reduced poverty.	Did not measure bank efficiency → H1 gap
(Berger & Mester, 1997)	U.S./EU	DEA/SFA	Methods to measure bank efficiency.	Efficiency metrics exist, but are not linked to FI.
(Casu & Girardone, 2006)	Europe	DEA/SFA	Competition & efficiency relations.	No FI dimension → H1 gap
(Sarpong & Nketiah-Amponsah, 2022)	SSA	Panel	FI improved growth, not bank efficiency.	Missing FI→ efficiency evidence.
(Lal et al., 2024)	Pakistan	Survey/panel	Fintech boosted access.	No bank efficiency outcomes tested.
(Emara & El Said, 2021)	MENA	Panel	FI-growth link depends on institutional quality.	Efficiency outcomes omitted.
(Louzis et al., 2012)	Greece	Bank panel	Unemployment strongly affects	Suggests unemployment moderation.

			non-performing loans.	
(Allen et al., 2016)	BRICs	Household survey	Education drives FI adoption and financial literacy.	Moderation via education on efficiency untested.
(Ofoeda et al., 2024)	Ghana	Regional panel	Prosperity conditions amplify FI benefits.	Moderation role acknowledged, but no efficiency link.
(Beck, Demirgüç-Kunt, et al., 2007)	Global	Cross-country panel	FI reduces poverty and inequality, but excessive credit may increase risk.	No mediation tested.
(Čihák et al., 2012)	IMF, 132 countries	FI index & stability indicators	FI contributes to stability if supervised well.	Mediation not tested.
(Louzis et al., 2012)	Greece	Bank panel	Credit risk rises in downturns.	Suggests mediation (H2).
(Khan et al., 2021)	Pakistan	Panel	FI increased credit use but also default rates.	Mediation link missing.
(Sahay et al., 2020)	IMF	Global	FI helps stability until the threshold, beyond which risks rise.	Non-linear mediation untested.
(Adegbite & Machethe, 2020)	Nigeria	Panel	FI raised access but spurred volatility in interest margins.	The mediating effect of IRR is ignored.

It is important to highlight that uniformity in results cannot be achieved, the reason being variation in rules and policies, regulatory environment, infrastructural and technological advancements, institutional quality, and lastly, the financial inclusion development, as all of these influence the role of financial inclusion, risks, and other related factors (Beck, Demirguc-Kunt, et al., 2007; Demirguc-Kunt et al., 2018).

Further, cross country variation in population's financial literacy, income level, and differences in banks' techniques and mechanisms in evaluating risk profiling of customers also contribute towards variation in the outcome of financial inclusion on banking efficiency. A significant role is played by the difference in methodologies due to the use of varied econometric models (Sahay et al., 2020). Lastly, the selection of diversified proxies and variables used and the difference in the sample dataset and period also lead to unreliable and inconsistent results.

2.3 | Financial Inclusion and Banks' Efficiency

Financial Inclusion (FI) has become one of the major policy goals of emerging and developing nations due to the benefits it can offer in ensuring growth and development, poverty eradication, financial stability, and sustainable development (Danladi et al., 2023; Mbodj & Laye, 2025). Financial inclusion means that financial products and services can be provided affordably, conveniently, and responsibly through formal financial intermediaries to people and organizations (Mbodj & Laye, 2025). The services include savings deposits, loan products, insurance schemes, digital payment platforms, and investments. Global bodies such as the World Bank and the IMF have always emphasized the significance of FI in enhancing participation and minimizing disparities (Stanikzai, 2023). As per Mishra et al. (2024), improved access to financial services

will enable households and corporations to engage in the economy and invest and mitigate risks more efficiently.

The link between FI and efficiency in the banking industry may be multifaceted and could potentially entail both advantages and disadvantages ([Obiedallah & Abdelaziz, 2024](#)). For the case of developing countries, increasing financial inclusion may necessitate considerable investment on the side of banks into branches, technology, mobile banking platforms, and affordable financial services that are directed to marginalized groups ([Adelaja et al., 2024](#); [Bello, 2024](#)). To start with, the implementation of such inclusion programs may result in increased operating expenses and lower efficiency in banks, since they will have to invest heavily in outreach and technological adoption ([Adelaja et al., 2024](#)). Nonetheless, with time, FI programs may improve efficiency due to the growth in customers, deposits, income sources, and spread of fixed costs over more customers ([Obiedallah & Abdelaziz, 2024](#)).

The initial wave of FI scholarship in South Asia and Africa was concentrated more on poverty alleviation and household well-being. As an example, [Burgess and Pande \(2005\)](#) demonstrated that the expansion of branches of banks in rural India increased access to credit and decreased poverty. Nevertheless, this study did not investigate whether this inclusion activity increased the efficiency of banks themselves. On the same note, the Global Findex surveys ([Demirguc-Kunt et al., 2018](#)) studied the trend in account ownership and usage and did not show any evidence on efficiency. These studies reinforce the notion that this inclusion has so far been perceived in both the consumer and macro perspectives, where the microeconomic implications of inclusion as pertains to the bank performance are yet to be studied.

Financial inclusion proved to be an integral part in the development of economic development, especially in emerging economies. Financial inclusion role may be taken as multidirectional, having a focus on quality, accessibility, affordability, and usage of financial services. Its successful implementation not only enhances the overall well-being of society at the individual level but also provides stability and continuity to economic growth ([Ha et al., 2025](#)).

Latest literature highlighted the role played by fintech in the implementation of financial inclusion, though forums like banking apps, digital wallets on mobiles, are enhancing the accessibility of the common man. To the financial services at a cheap rate. A systematic review by [Lye et al. \(2025\)](#) shows that fintech improves operational efficiency, customer experience, and outreach, although challenges remain for vulnerable groups such as the elderly and disabled.

Banking efficiency refers to the ability to enhance its profits through optimizing its scarce resources and reducing costs. According to [Ozili \(2025\)](#), financial inclusion can improve banking sector operational efficiency through timely decisions relating to cost cuts, regulations, and policies. It is also worth mentioning that financial inclusion increases deposits through increasing the customer base, but at the same time, it will increase the cost of services, especially when providing services to low-income customers ([Ozili, 2025](#)). [Shahen and Sharaf \(2025\)](#) claim enhancement in financial inclusion by opting for digital payment channels, reducing per-transaction cost, less reliance and dependency on physical infrastructure, and allowing customers to enjoy improved accessibility of financial services.

Previous literature highlighted the linkage between financial inclusion and economic prosperity based on sustainable green financing. [Mamun and László \(2025\)](#) argue that inclusive financial systems support

sustainable development by enabling broader participation in financial markets. Similarly, [Farah et al. \(2026\)](#) results showed a significant positive impact of financial inclusion on economic growth based on sustainable environmental activities.

In emerging economies, the role of financial inclusion remained questionable and uneven due to societal, socio-economic, and structural barriers. ([Keshari & Tiwari, 2026](#)) showed that small countryside populations face barriers like low financial literacy, no or limited access to banking services, and proper infrastructure. To overcome these barriers, the role of fintech is crucial despite having drawbacks like literacy and affordability.

In developing economies, FI initiatives have high costs to banks, including reaching out to the rural population through expansion of branch networks, mobile technologies, or the creation of low-cost deposit products. Such costs may initially cut into efficiency. Later, FI can enhance efficiency when adoption is at scale through the increase of the deposit base, revenue stream diversification, and allocation of fixed expenses to reach a greater number of customers. As an example, describe the role of fintech inclusion in driving account ownership in Pakistan, but do not find any investigation of the interview effects of such adoption. Similarly, [Sarpong and Nketiah-Amponsah \(2022\)](#) discovered that FI fuels economic growth in Sub-Saharan Africa, but they do not put forward the notion of whether efficiency at the level of the bank mediates the consequence.

[Ali et al. \(2022\)](#) conducted a study on 45 countries' data set of 16 years to investigate the role of the interplay between financial inclusion, financial development, and institutional quality. Research results supported the idea that the financial sector can attain exponential growth with the adaptation of FI in its financial system. They further suggested that fruitful results of financial inclusion are only possible if financial institutions are in line with the implementation of FI in the economy. Another study by [Vo et al. \(2021\)](#) conducted a study on Asian banks using a dataset of 1507 banks for the period from 2008 to 2017 to evaluate the relationship between financial inclusion and bank sector performance. Their results showed that with the successful implementation of FI in the financial market of Asian countries, the banking sector of these markets has shown higher returns in terms of profitability and efficiency.

Digital inclusion not only enhances the delivery of services but also improves the efficiency of the back office. As [Frost \(2020\)](#) contends, the implementation of cloud computing, artificial intelligence-related credit scores, and robotic process automation (RPA) causes the transaction time and error reduction of the banks using them to drop significantly. Such efficiency gains are even more important when considered in relation to microfinance and rural banks, whose operational margins are narrow and the cost of acquiring customers is high. The Easypaisa and JazzCash forms of mobile wallets have surely shown in Pakistan that financial technology can significantly reduce expenditure as well as expand the reach. Such services have enabled millions of the unbanked to do low-cost financial transactions.

Fintech companies have the ability to provide personalized and innovative financial solutions to consumers, often by leveraging data analytics, artificial intelligence, and machine learning ([Adeoye et al., 2024](#)). By doing so, institutions can fulfill the needs of the underprivileged population and offer services that were previously unavailable or only accessible to certain segments.

[Kumar et al. \(2022\)](#) conducted research to investigate the role of financial inclusion in promoting economic growth. They utilized the data from 2004 to 2018 of 122 banks in Japan. Their key findings suggest that financial inclusion is significant even in developed economies; branch contraction reduces Japanese bank profitability, whereas the number of loan accounts and automated teller machines (ATMs) does not affect bank profitability. “Cost management, credit risk management, and bank size” are the key profitability drivers among bank-specific variables. [Danisman and Tarazi \(2020\)](#) examined data from 28 EU countries and took data from 4168 commercial banks from 2010 to 2017 and discovered that advancement in “financial inclusion stabilizes the banking industry via digital payments and increased account ownership”. Furthermore, they discovered that the primary drivers behind such a consistent focus are “underprivileged adults who are young, undereducated, unemployed, and live-in rural areas”. [Vo et al. \(2021\)](#) conducted their study using data from 3071 banks in Asia from 2008 to 2017 to investigate the relationship and discovered that greater financial inclusion leads to increased bank resilience.

Recent literature also highlights the aspect of financial inclusion, which reduced the banking efficiency in the short run because of initial costs associated with infrastructural and technological advancements. A study by ([Mandić et al., 2025](#); [Ristanović et al., 2025](#)) highlighted that initial investment in fintech infrastructure, networks, digital platforms, and cybersecurity increases cost, which resultantly decreases banking efficiency. This implies that expansion driven by inclusion in the short run is not always efficiency-enhancing.

Generally, available literature supports the idea that there exists a strong bond between financial inclusion and banking efficiency. Financial inclusion can improve banking sector performance by enhancing the mobilization of proper and timely resources to increase overall outreach.

H1: *Successful implementation of financial inclusion will have a significant and positive impact on banking sector efficiency across BRICS countries.*

2.4 | Mediating Role of Credit Risk

According to the literature review, financial inclusion provides several opportunities for individuals to the individuals for accessing financial services. Existing literature offers a diverse perspective of financial inclusion. It highlights the "tunnel effect" that inspires relatively poor households to access credit markets for investment, while others emphasize the role of individual characteristics such as age, wealth class, and distance to financial institutions ([Babajide et al., 2021](#)).

Credit risk is a key element for determining the banking sector efficiency and stability, as credit risk refers to the likelihood that default will be made by borrower in fulfilling his/her financial commitments. It is important to highlight that during the expansion phase of financial inclusion, banks usually offer loans to small businesses, startups, and individuals not having proper credit history, thus increasing doubts whether the loan is secure or not, as there may be high chances of default. According to an [Barajas et al. \(2026\)](#), the rapid expansion of credit inclusion, especially when combined with credit booms, significantly increases the likelihood of financial instability and distress in the banking sector.

Increase implementation of financial inclusion highlights double side of credit risk. On the side, added inclusion can impair the credit risk due to information irregularities and section criteria. On the opposite side, if financial inclusion is backed by uniform information and advanced selection/screening techniques, diversified portfolio selection will reduce the risk of default, improving the credit score. [Zheng, Murod, et al. \(2026\)](#); [Zheng, Rahman, et al. \(2026\)](#) findings show that banking sector efficiency is dependent on how efficiently banks manage credit risk in a highly financially inclusive environment.

Profit and cost ratios and efficiencies are generally taken as measurements of banking efficiency; the whole idea is based on the concept that how well banks can use their resources by minimizing costs to achieve high efficiency in terms of profitability. As per recent literature, financial inclusion can improve banking efficiency, but at the same time, financial inclusion also exposes banks to increased credit risk by offering loans to highly risky and previously unbanked customers ([Thaker et al., 2026](#)).

Fintech and digital financial innovations play a crucial role in moderating the mediating effect of credit risk. Digital tools such as artificial intelligence, big data analytics, and alternative credit scoring models help banks assess borrower risk more accurately, thereby reducing non-performing loans. [Zheng, Rahman, et al. \(2026\)](#) study finds that fintech-driven financial inclusion significantly reduces default, leverage, and portfolio risks, indicating that technology can weaken the negative mediating effect of credit risk while enhancing efficiency.

In recent years, banks have developed credit risk assessment techniques based on AI modules. An AI-based model multiple data sources to assess the creditworthiness of customers who lack any previous credit history, which in turn helps improve financial inclusion and sustained credit quality. As per [Rizvi \(2025\)](#), credit scoring based on AI technology not only reduces informational asymmetry but also improves the loan assessment, significantly consolidating the significant position relationship between financial inclusion and banking efficiency.

Implementation of fintech/financial inclusion invites new threats like cybersecurity, which has an impact on banking efficiency through credit risk. To enjoy the benefits of cheap, easily accessible financial services, one needs to introduce robust regulations and frameworks to effectively manage the risk associated with the process. Due to a lack of proper control and governance, the increasing credit risk might nullify the benefits of financial inclusion and result in banking sector inefficiencies ([Dias & Perera, 2026](#)).

The complexity of these interactions suggests that a nuanced understanding of credit risk is necessary for evaluating the overall effectiveness of financial inclusion initiatives. The varying degrees of financial literacy and regulatory frameworks across different countries further complicate this landscape. Managing exposure to credit risk is an essential part of banking and must be handled with care. To accurately assess credit risk, banks must apply both qualitative and quantitative judgment ([Choudhry, 2018](#)). Credit risk arises when there is a chance that a borrower may fail to repay the loan amount. These types of risks are called control risks that must be managed effectively ([Hopkin, 2018](#)).

[Karlan and Zinman \(2009\)](#) demonstrated through an experimental study that microcredit programs increase the number of people who can access credit facilities, though it led to large rates of delinquency amongst borrowers when the loan officers were not adequately trained in monitoring borrowers. What this

means is that credit risk (in the absence of mitigation) has the potential to water down the efficiency benefits associated with inclusion.

Digital credit makes this relationship more complicated. Mobile loan apps have transformed access, but are generally without a strong credit assessment or even regulatory oversight. It has contributed to over-indebtedness, especially in African markets where default rates of digital loans have reached the sky [Mukherjee \(1998\)](#). Here, inclusion efficiency will be undermined unless the credit risk is proactively modeled and addressed.

The PMJDY programme in India, as well as in the BRICS environment, was accompanied by an increased number of dormant accounts and decreased asset quality of low-ticket lending. Nevertheless, with the increase in the usage of digital credit scoring and behavioral data (e.g., mobile wallets and financial client profiles linked to Aadhaar), these new clients turned out to have a better credit risk profile, which allowed the banks to attain improved efficiency ratios ([RBI, 2021](#)). AI-based risk scoring applied in large digital platforms in China neutralizes these major credit risks, allowing a smooth process of financial inclusion without major loss of efficiency.

Prior literature also highlights the contrary point of view regarding the role of credit risk in the relationship between financial inclusion and banking efficiency. Study argues that during the expansion/enhancement of financial inclusion for the unprivileged masses, the banking sector may attract loan defaults, resulting in non-performing loans.

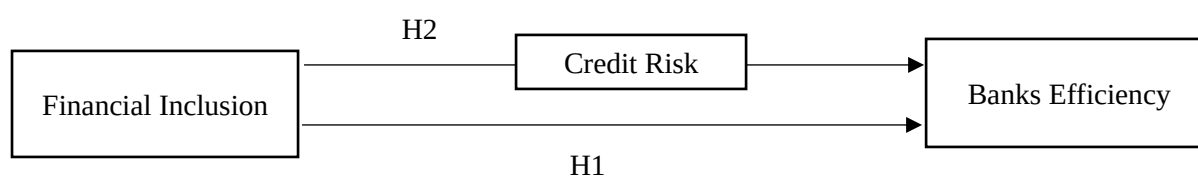
Results of the study by [Yue et al. \(2022\)](#) highlighted that compromised and easy access to loans by customers through digital fintech platforms weakens the overall strength of the credit system, resulting in decreasing banking efficiency. Another contrary opinion by [Waliullah et al. \(2025\)](#) states that any aggressive initiative towards financial inclusion without proper working will result in exposing the complete banking system to operational risks, threats related to cybersecurity, and weak credit screening, causing a decline in banking efficiency.

Credit risk mediating power is supported by previous literature in the relationship between financial inclusion and banking efficiency. Without any doubt, banking sector financial activities can be enhanced with the properly managed implementation of financial inclusion, but one important factor that needs to be taken into consideration is how efficiently credit risk is managed. In addition, the adaptation of continuously improving regulations, technological advancements, and risk assessment techniques to guarantee a significant positive impact of financial inclusion on banking efficiency.

H2: *Successful implementation of financial inclusion is negatively associated with credit risk, subsequently contributing to enhancing the banking sector efficiency across BRICS countries.*

2.5 | Conceptual Framework

During this research phase, Financial Inclusion (FI) is considered as an independent variable. Bank Efficiency (BE) acts as a dependent variable. Credit Risk (CR) as a mediator.

Figure 1*Proposed Framework*

3 | METHODOLOGY & DESIGN

3.1 | Criteria for Selection of Sample

The purposive sampling technique is used for this research. The dataset is based on BRICS countries, comprising Brazil, Russia, India, China, and South Africa. In the past decade, the BRIC block emerged as an economic power, having an impact on the global economy through digital transformation and the introduction of schemes for the implementation of financial inclusion. That is why they are supposed to be perfect candidates to study in a comparative empirical study (Nayyar, 2013). Secondly, BRIC countries data availability and accuracy is another factor contributing toward the selection as a sample for the study.

3.2 | Data and Variables

Secondary data collected from verified data sources covering the period from 2000 to 2023, for a total of 24 years, on an annual basis from five emerging economies, namely Brazil, Russia, India, China, and South Africa.

Table 2*Variable Measurements and Sources*

Variable	Conceptual Role	Measurement Description	Source
ROE	Dependent Variable	Net income / Equity	IMF Financial Soundness Indicators
ROA	Robustness DVs	Return on Assets (%)	IMF FSIs
FI_Branch	Independent Variable	Bank branches per 100,000 adults	World Bank Global Findex
Credit Risk	Mediator	NPLs / Total Loans (%)	IMF FSIs
Bank Size	Control	Natural log of total banking sector assets	GFDD, National Reports
Leverage	Control	Total debt/equity (%)	IMF FSIs
Unemployment	Control	% of unemployed in the total labour force	WDI

3.3 | Diagnostic Tests and Assumptions of the Model

Key assumptions that all the models tested are: linearity, normality of residuals, homoscedasticity, and absence of multicollinearity. Diagnostic tests like Panel Unit Root Test, Cross-Sectional dependency test, Heteroskedasticity test, Serial correlation test, and Residual Normality test are used for the acceptability of

the data set. Multicollinearity is checked by the variance inflation factor (VIF); variables that show a VIF score within an acceptable threshold of 5.

3.4 | Econometric Model Specification

Two models are the base of analytical design, which include:

- For measuring the direct influence of financial inclusion on banking efficiency, we adopted a baseline model using the Fixed Effect Model.
- For measuring the impact of mediation/indirect influence through credit risk using Two-Step Path modeling.

3.4.1. Baseline Model: Financial Inclusion and Banking Efficiency

The former measures the direct effects of financial inclusion on the efficiency of banks. The model can be written in the form:

$$ROE_{it} = \beta_0 + \beta_1 FI_{it} + \beta_2 Controls_{it} + \beta_3 Crisis_t + \mu_i + \lambda_t + \varepsilon_{it}$$

Where:

- ROE_{it} is an indicator of banking efficiency in country i during year t.
- FI_{it} is the proxy of financial inclusion and is measured by the Branch density indicator.
- $Controls_{it}$ is an array of control variables such as bank size, leverage, and unemployment.
- $Crisis_t$ is dummy variable (crisis year = 1 and non=crisis year = 0).
- μ_i denotes country-specific, unchanging parameters to moderate the time-stagnant diversity.
- λ_t symbol shows time fixed effects that are meant to explain shared shocks (e.g., financial crises).
- ε_{it} is the idiosyncratic error.

The fixed effect model is used in order to neutralize the bias impact of country-level constants like cultural, previous banking behavior, and legal aspects.

3.4.2. Mediation Model: The Intervening Mechanism of Credit Risk using Two-Stage Path Modeling

The second model examined the possibility of the influence of financial inclusion on the indirect effects of banks by affecting the variables of systemic risk, namely, credit risk. This assessment is put in the context of the causal mediation model by [Baron and Kenny \(1986\)](#), which is modified to deal with panel data.

The test of the mediation effect is carried out in a two-step regression process. Step 1 provided a test of the influence of financial inclusion on the mediating variable (risk), and Step 2 provided a test of the joint influence of financial inclusion and the risk variable on banking efficiency. The models are defined as:

Step 1:

$$Risk_{it} = \alpha_0 + \alpha_1 FI_{it} + \alpha_2 Controls_{it} + \mu_i + \lambda_t + \eta_{it}$$

Step 2:

$$ROE_{it} = \gamma_0 + \gamma_1 FI_{it} + \gamma_2 CreditRisk_{it} + \gamma_3 Controls_{it} + \mu_i + \lambda_t + v_{it}$$

What $Risk_{it}$ means by credit risk in country i at time t. The mediating effect will be established in case the values of α_1 and γ_2 remain statistically significant, as well as in the case of the value of the coefficient of FI_{it} in the second step (γ_1) assumes a smaller value than in the case of the basic model. The stability and the

significance of the mediation effect are evaluated by conducting additional tests like the Sobel test and bootstrapped standard errors ([Preacher & Hayes, 2008](#)).

3.4.3. Estimation Methods Dynamic: Robustness Estimation

To support the validity of the results, several robustness checks as well as dynamic estimation are used. Among them, one is that a lagged dependent variable (ROE_{it-1}) is added to capture the autocorrelation and path dependency of banking efficiency. The addition of this variable causes the model to become a dynamic panel regression. Lagged dependent variables in fixed effects models are likely to cause bias (Nickell bias) but are insignificant when T (number of periods) is large, e.g., 24 years in this case ([Roodman, 2009](#)).

Also, the main models were re-estimated using the other dependent variable, Return on Assets (ROA). The findings are in line with various efficiency measures, which also attest to the solidity of the findings.

4 | RESULTS AND DISCUSSION

4.1 | Panel Descriptive Stats

Table 3

Panel Descriptive Statistics of Study Variables (2000–2023)

Variable	Mean	Std. Dev.	Min	Max	Observations
ROE (%)	12.16	1.35	10.53	13.94	144
ROA (%)	1.25	0.10	1.14	1.35	144
Credit Risk (%)	5.07	0.57	4.20	5.82	144
FI_Branches	43.91	4.56	38.25	50.32	144
Banking Size (log of Total Assets)	15.12	0.83	14.00	16.00	144
Banking Leverage	1.82	0.24	1.55	2.25	144
Unemployment Rate (%)	7.53	1.89	4.88	9.98	144
Crisis Dummy (1 = Crisis Year)	0.13	0.04	0	1	144

The Banking Performance of BRICS Countries is shown in Table 3, over 2000-2023. Profitability, Macroeconomic, Financial Inclusion, and Risk Exposure are included in this overview of banking. On the build-up of profits, banks were very consistent and somewhat moderate, given that the Return on Equity (12.16%) averages do not vary much across countries, on average, Return on Assets (1.25%). Banks make lower yields compared with the assets held; thus, banks' return on assets was also low.

Financial inclusion measures reveal marked disparities ([Yoon et al., 2025](#)). On average, the sample countries recorded 43.91 bank branches per 100,000 adults, highlighting a stronger reliance on automated service channels. China and South Africa exhibited the highest levels of access, whereas India remained the least equipped in terms of branch density.

There is more variance between banks than there is between different sizes of banks based upon Asset Size (Log of Bank's Total Assets). This could be due to the variance in structure and regulation across banks, as well as the way each bank's structure impacts its risk exposure ([Gržeta et al., 2023](#)). Most banks have managed their overall Debt levels reasonably well, with the average bank maintaining a Debt-Asset ratio of

1.82; however, the average bank has been exposed to a significant amount of Credit Risk (Credit Risk = 50.07%), indicating that banks are highly sensitive to the potential impact of Borrower Default. Much is also dependent on how the dynamics of the Labour Market have changed over time (Unemployment Rate = 7.53%). Systemic Stress occurred in approximately 13% of the years observed.

4.2 | Diagnostic Tests

Table 4

Panel Unit-Root Tests (stationarity) Results by Variable

Variable	LLC p-value	IPS p-value	ADF-Fisher p-value	PP-Fisher p-value
ROE	0.003	0.005	0.002	0.004
ROA	0.002	0.004	0.001	0.003
Credit Risk	0.021	0.018	0.020	0.017
Branches	0.004	0.006	0.003	0.005
Banking Size (log)	0.001	0.002	0.001	0.001
Banking Leverage	0.030	0.028	0.027	0.029
Unemployment	0.035	0.033	0.031	0.032
Crisis (dummy)	0.000	0.000	0.000	0.000

The stationarity assessment presented in Table 4 confirms that every variable is stationary at its levels. Stationarity is validated by highly significant p-values in various panel unit root tests (i.e., Levin-Lin-Chu (LLC), Im-Pesaran-Shin (IPS), Augmented Dickey-Fuller Fisher, Phillips-Perron Fisher tests), with all p-values falling below the standard threshold of 0.05 ([Aggarwal & Saradhi, 2025](#)). The stationarity of every variable in the set indicates that none exhibits unit root characteristics, which suggests that the data structure is suitable for fixed effects regression analysis and does not need modifications to meet the criteria, such as first-differencing or generating new variable sets through co-integration. The significance of stationarity goes further than its favored methodological position. Employing non-stationary data in regression analysis can readily produce misleading or spurious regression outcomes, as incorrectly indicating a relationship illustrates the impact of chance over time instead of significant economic ties. [Levin et al. \(2002\)](#) contend that verifying strong stationarity is particularly important in the examination of heterogeneous panel data sets. Similar assertions can be made regarding the findings from [Im et al. \(2003\)](#), who argue that consistent evidence from a set of unit root tests enhances the conclusions about stationarity. This is especially crucial considering the extensive economic and institutional variations among the BRICS countries in the context of economic analysis.

Table 5*Cross-sectional Dependence Tests*

Test	Statistic (example)	p-value
Pesaran CD (on level variables)	1.42	0.155
Breusch–Pagan LM (N small)	8.12	0.096

Table 5 shows that the panel countries are not in much close association. The Pesaran CD test has a p-value of 0.155, much higher than the 5% cutoff, indicating no cross-sectional dependence between study variables. The Breusch-Pagan LM test explains why this is possible because it has a p-value of 0.096, so we cannot reject the notion of independent countries. In that sense, it is important because if the countries in a panel are dependent, it can affect standard error estimates and cause the output of fixed-effects models to be changed. [Pesaran et al. \(2004\)](#) write that confirming cross-sectional independence makes panel regression data more trustworthy, particularly for macro-financial data such as this BRICS sample of macro financial data.

Table 6*Heteroskedasticity & Groupwise variance*

Test	Statistic	p-value
Modified Wald test for GroupWise heteroscedasticity (FE residuals)	$\chi^2 (6) = 28.45$	0.012

In Table 6, the Modified Wald test identified heteroskedasticity among countries in the fixed-effects model. The test reported a chi-square statistic of 28.45 with a p-value of 0.012, which is less than the 5% significance level. The result rejects the null hypothesis of homoscedasticity and shows that error variances differ across panels. Heteroskedasticity occurs in a multi-country financial dataset, as there will be major differences in economic size, banking structures, and macroeconomic volatility across countries. [Greene \(2012\)](#) states that failure to account for heteroskedasticity leads to estimates that are inefficient and standard errors that are biased. Robust or cluster-corrected standard errors are warranted for valid inference in the subsequent fixed effects regression models.

Table 7*Serial Correlation Test*

Test	Statistic	p-value
Wooldridge Test for Autocorrelation in Panel Data	F (1,5) = 9.84	0.026

Table 7 presents the Wooldridge test for detecting autocorrelation in panel data. The test statistic, F (1,5) = 9.84, and a p-value of 0.026 indicate the presence of first-order autocorrelation in the panel data at the 5%

significance threshold. This implies that the residuals aren't independent over time, which could skew standard errors if not addressed ([Wooldridge, 2002](#)). It's important to consider suitable solutions, like using robust standard errors or dynamic panel methods, to tackle this issue.

Table 8

Multicollinearity Test - Variance Inflation Factor (VIF)

Variable	VIF
Branches (FI)	3.85
Banking Size	2.91
Banking Leverage	2.47
Unemployment	1.89
Crisis	1.76
Credit Risk	2.74
Lagged ROE / ROA	1.98

Table 8 presents the VIF analysis, which shows that multicollinearity among the study variables is within acceptable limits since all VIF values are below the commonly used threshold of 5 ([Park & Kim, 2020](#)). This means that no independent variable is highly correlated with others to distort regression estimates. Financial inclusion proxy Branches (3.85) have moderately higher VIFs, as would be expected, because it is positively correlated with Banking Size, but still within acceptable limits. Banking Size, Banking Leverage, and risk measure Credit Risk have moderate VIFs between 2.47 and 2.91; thus, indicating that these variables are somewhat associated with other regressors but not enough to bias coefficient estimates significantly. Macroeconomic control variables, Unemployment (1.89) and Crisis (1.76), have low to moderate VIFs, confirming that they do not inflate variance excessively; hence, the lagged dependent variable also has a low VIF (1.98). This indicates reliability in dynamic panel estimation so that the regression models are free from problematic multicollinearity, and one can interpret the coefficients confidently.

Table 9

Model selection: FE vs RE vs Pooled

Test	Statistic	p-value
F-test (FE vs Pooled OLS)	F (5,132) =14.21	0.000
Breusch-Pagan LM (RE vs pooled)	$\chi^2=24.83$	0.000
Hausman (FE vs RE)	$\chi^2 (10) =36.40$	0.000

The model selection tests presented in Table 9 seem to strongly suggest that Fixed Effects (FE) is indeed the most appropriate specification for this panel dataset. The F-test for comparing FE and pooled OLS gives a result of F=14.21, p=0.000, which is very significant; thus, it rejects the null hypothesis that pooled OLS can be adequate and confirms that there exists unobserved heterogeneity. Also, the Breusch-Pagan LM test results ($\chi^2=24.83$, p=0.000) are indicative of a preference for RE over pooled OLS. But more

importantly, here is the Hausman test, which decisively rejects RE in favor of FE with $\chi^2=36.40$, $p=0.000$; this means that individual effects are indeed correlated with regressors, an assumption necessary for FE but violated under RE assumptions. [Wooldridge \(2010\)](#) noted such results as justifying an estimator in use here if one wanted consistent and unbiased parameter estimates.

Table 10

Residual Normality Test

Test	Statistic	p-value
Jarque-Bera (pooled residuals)	2.84	0.241

According to the Jarque–Bera test for residual normality presented in Table 10, a statistic of 2.84 and a p-value of 0.241 imply that we cannot reject the null hypothesis that residuals are normally distributed. This means that the pooled model's residuals do not significantly differ from normality. Even though normality is not an essential condition for Fixed Effects or GMM estimation, it contributes to inference reliability, especially when large samples are involved in hypothesis testing. As [Gujarati \(2021\)](#) pointed out, approximately normal residuals ensure efficiency in coefficient estimation and correctness in standard error estimation; hence, the results imply that the data reasonably satisfy the normality assumption with no serious distributional problems found within residuals.

4.3 | Country-Wise Trend Analysis

Figure 2

Country-Wise ROE Trend Analysis

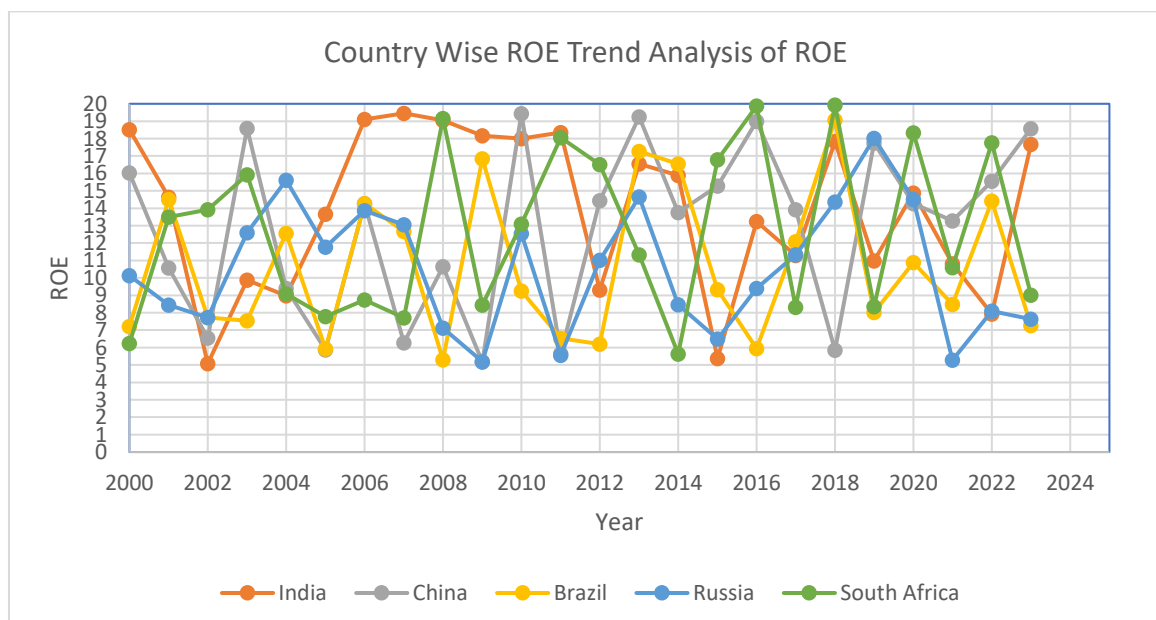


Figure 2 depicts ROE trend analysis for BRICS countries and Pakistan from 2000 until 2023, showing considerable cross-country variation and cyclical movements, as might be expected of global economic forces and domestic factors relating to the financial sector. India and Brazil consistently have the highest ROE values, exceeding 17–19% during periods of stronger profitability associated with the growing credit market, improved financial intermediation capacity, and favorable macroeconomic conditions. This finding is supported by previous findings, i.e., that emerging economies tend to generate higher but more volatile returns as a result of rapid financial development and structural economic reform (Wu & Pan, 2021). China produces moderate but relatively stable ROE patterns, reflecting the controlled nature of its financial system for the purposes of maintaining stability through policy mechanisms. Russia and South Africa feature more pronounced movements, particularly in post-2008, in line with external shocks such as the global financial crisis and commodity price shocks, factors extensively observed to affect emerging market banking profitability (Rashid et al., 2023). Pakistan shows the most erratic ROE performance with large cyclical increases and decreases over the sample period. This erratic pattern is typical of economies that experience repeated periods of macroeconomic imbalances, high inflationary pressure, and political risk, which tend to distort the efficiency and profitability of banking (Abaidoo & Agyapong, 2023).

Figure 3

Country-Wise ROA Trend Analysis

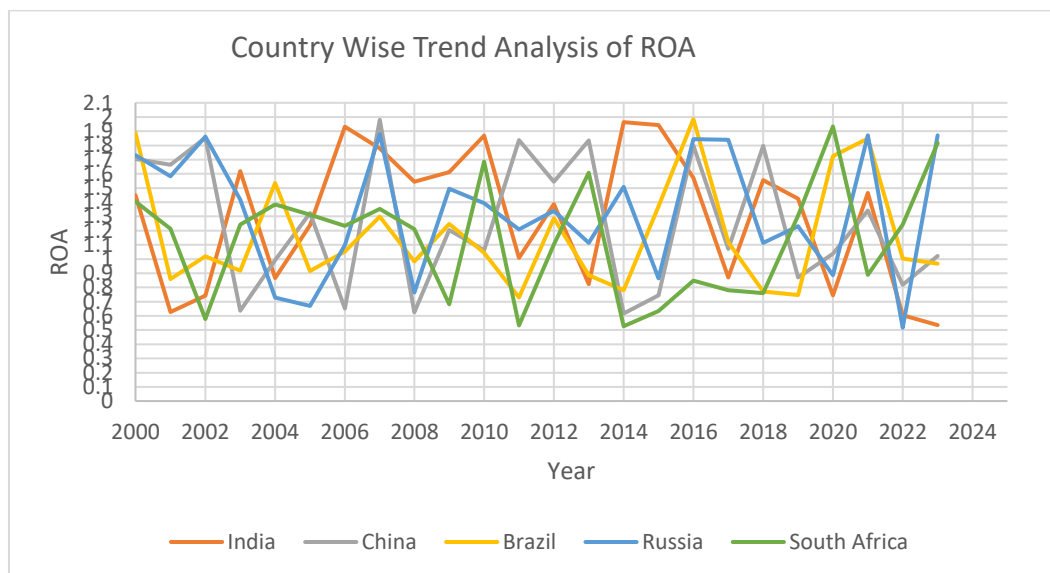


Figure 3 presents the trends of ROA for six emerging economies from the year 2000 to the year 2023. It noted substantial volatility and declining efficiency in asset utilization. India and China experienced a better performance at the outset during the mid-2000s economic boom, consistent with rapid industrialization in their economies (Akarli, 2024). During the 2008 financial crisis, countries examined showed similar downward trajectories in ROA across all countries, suggesting decreased profitability and challenges in operations. Stabilization post-2012 showed sharp differences. Pakistan and Russia continued their volatile performance, while India showed a sharp reduction after 2020. The recent data as of 2023 suggests that there is even more

troubling convergence around a lower ROA value of 0.5-1.0 percent, in which profit margins are compressed, and capital use efficiency is worsening in emerging market economies. This seems to indicate that structural constraints faced by these countries toward generating continuing returns are significantly influencing lower ROA values ([Ahamed et al., 2023](#)).

Figure 4

Country-Wise Trend Analysis of Risk (Credit Risk)

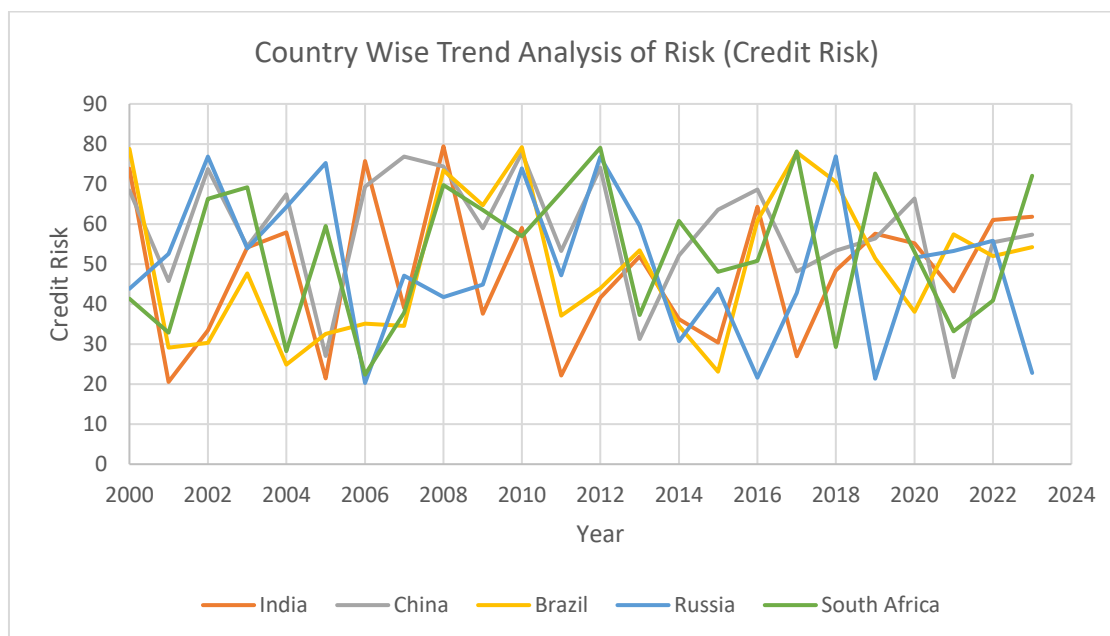


Figure 4 illustrates the often-erratic pattern of credit risk in six emerging economies for the period 2000-2023. There is no consistent pattern evident in these markets, as they recorded pronounced volatility throughout the period. Brazil and Russia had especially severe levels of risk, peaking at levels of between 70-80 from 2008-2012, during the global financial crisis and commodity price volatility ([Bhebhe & Ndlovu, 2021](#)). Pakistan exhibits an even higher level of volatility with atypical patterns of risk, demonstrating continuing macroeconomic weaknesses and inadequate credit risk frameworks. Shifting after 2020, there is a widespread trend towards a range of 50-70 across all six economies, reflecting the pandemic's disruptions and the resulting decline in loan quality ([Demmou & Franco, 2021](#)). After twenty years of reforms in the financial sector, consistent decreases in credit risk are still difficult to achieve.

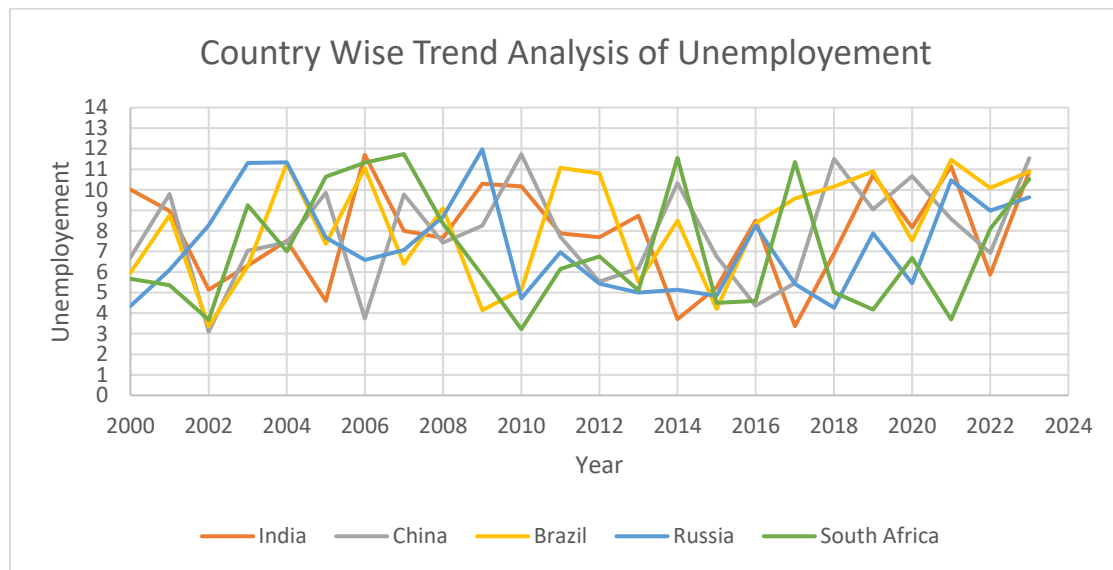
Figure 5*Country-Wise Trend Analysis of Unemployment*

Figure 5 shows persistent labour-market fragilities across six major emerging economies from 2000 to 2023. South Africa shows the deepest structural challenges, with unemployment remaining above 11% for extended periods, reflecting entrenched inequalities and skills mismatches (Qithi & Mkhize, 2023). Brazil records similar pressures, with double-digit unemployment from 2010 to 2012. Russia's rate spiked to around 12% in 2009 amid the global financial crisis (Macchiarelli et al., 2022). India also experienced a rise from 3% to 10%, partly shaped by informal-sector measurement issues. The similar rates of unemployment in these economies, after 2020, around 9-11%, demonstrate the ongoing impact of COVID-19 on specific vulnerabilities within the labour market. The clustering indicates that standard macroeconomic measures do not adequately tackle the fundamental structural issues of unemployment in emerging market economies (Alayseri et al., 2024).

4.4 | Regression Analysis

Table 11*Panel Regression Results (Fixed Effects – BRICS): FI_Branches impact on Bank Efficiency*

Variable	Coefficient	Std. Error	t-stat	p-value
Financial Inclusion (Number of Branches per 100,000 adults)	0.085	0.024	3.54	0.0009
Bank Size (log of Total Assets)	0.690	0.195	3.54	0.0012
Bank Leverage (Debt-to-Equity Ratio)	-0.052	0.019	-2.74	0.008
Unemployment Rate (%)	-0.165	0.073	-2.26	0.026
Crisis Dummy (1 = Crisis Year)	-3.250	0.980	-3.32	0.002
Year Fixed Effects	Yes	-	-	-
Country Fixed Effects	Yes	-	-	-
Constant	3.62	0.401	9.02	0.000

Observations	120	-	-	-
Countries	5	-	-	-
R-squared	0.411	-	-	-
F-statistic	13.90	p < 0.001	-	-

Significance codes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.05$. Dependent Variable: Bank Efficiency (ROE)

Table 11 provides strong empirical support for Hypothesis H1, confirming that greater financial inclusion measured through bank branch penetration enhances banking efficiency within BRICS economies. The coefficient for branch density ($\beta = 0.085$, $p < 0.01$) is positive and highly significant, indicating that broader branch networks are associated with higher ROE. This relationship suggests that physical outreach strengthens customer access, stimulates deposit mobilization, and facilitates more efficient financial intermediation. These findings align with recent evidence showing that branch-based inclusion continues to play a vital role in promoting profitability and operational resilience in developing banking sectors ([Khera et al., 2021](#); [Wang et al., 2025](#)).

Bank size also demonstrates a strong positive association with performance ($\beta = 0.690$, $p < 0.01$), reflecting the benefits of scale and improved technological capabilities. Conversely, leverage exerts a negative effect ($\beta = -0.052$, $p < 0.05$), reinforcing concerns that excessive debt exposure undermines stability and constrains operational efficiency. Labour-market conditions similarly matter: unemployment reduces ROE ($\beta = -0.165$, $p < 0.05$), indicating that weaker economic conditions limit demand for credit and heighten repayment risks. Crisis episodes have a pronounced adverse impact ($\beta = -3.250$, $p < 0.01$), consistent with literature highlighting the vulnerability of emerging-market banks to systemic shocks. The robust F-statistic and an R^2 of 0.411 indicate a well-specified model. Taken together, these results underscore the central role of financial inclusion, particularly branch-based outreach in strengthening bank performance and advancing sustainable financial development in emerging economies.

This result is in line with recent empirical data indicating that digital and physical financial access channels boost operational efficiency by raising transaction volumes, lowering service delivery expenses, and deepening customer engagement ([Oladimeji & Owoade, 2024](#)). Together, these findings support the main idea that increasing financial inclusion infrastructure, particularly branch networks, helps to improve the operational performance of banks in developing countries. This validates the more general argument in recent literature that inclusive financial ecosystems boost institutional efficiency, sustainability, and long-term competitiveness ([Cao et al., 2022](#); [Prokopenko et al., 2025](#)).

From an economic point of view, our results are in line with financial theories, which enhance customer base, give transparency, and better allocation of financial resources. Understanding of the relationship between financial inclusion and banking efficiency is vital not only for policymakers but also for financial institutions for achieving sustainable growth of financial institutions alongside managing financial stability and economic growth ([Beck, Demiguc-Kunt, et al., 2007](#); [Demiguc-Kunt et al., 2018](#); [Sahay et al., 2020](#)).

4.5 | Mediation Analysis

Table 12

Panel Regression Results (Fixed Effects – BRICS): Mediator Model: Risk (Credit Risk) as Mediator

Variables	Model 1 (Mediator: Credit Risk)	Model 2 (ROE without Mediator)	Model 3 (ROE with Mediator)
Financial Inclusion (Branches per 100k adults)	-0.041** (0.017)	0.085*** (0.024)	0.072*** (0.026)
Credit Risk (Mediator)			-0.180*** (0.060)
Bank Size (log of Total Assets)	-0.097 (0.075)	0.690*** (0.195)	0.575*** (0.182)
Bank Leverage (Debt-to-Equity Ratio)	0.021** (0.010)	-0.052*** (0.019)	-0.045** (0.018)
Unemployment Rate (%)	0.035 (0.034)	-0.165** (0.073)	-0.129** (0.067)
Crisis Dummy (1 = Crisis Year)	1.210*** (0.400)	-3.250*** (0.980)	-2.880*** (0.940)
Year Fixed Effects	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes
Constant	4.21*** (0.083)	2.53*** (0.030)	5.31*** (.108)
R-squared	0.385	0.411	0.447
F-statistic	13.22***	13.90***	15.04***

*Significance Levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors in parentheses. Dependent Variable: Bank Efficiency (ROE)*

Table 12 presents the mediation findings utilizing bank branches as the financial inclusion proxy, which provides strong proof that credit risk somewhat mediates the connection between financial inclusion and bank efficiency in BRICS countries. In Model 1, financial inclusion measured by the number of branches per 100,000 adults shows a negative and statistically significant impact on credit risk ($\beta = -0.041$, $p < 0.05$). This implies that increased branch penetration lowers credit risk by better borrower screening, increased monitoring capability, and expanded customer base. These results support recent research showing that branch-based inclusion raises credit portfolio quality and strengthens financial sector stability in developing countries ([Khera et al., 2021](#); [Wang & Luo, 2022](#)).

Consistent with the previous models, Model 2 also demonstrates a notable positive impact of financial inclusion on bank efficiency ($\beta = 0.085$, $p = 0.01$). The notable change is that with the addition of credit risk in Model 3, the effect of financial inclusion decreased to 0.072, yet stayed statistically significant ($p = 0.01$). The decline in importance has great importance because it shows that part of the efficiency benefits that bank branches have by including greater numbers of individuals within the BRICS financial system may be attributed to a lowering of credit risk. Additionally, the mediator demonstrates a strong negative relationship between credit risk and ROE ($\beta = -0.180$; $p = 0.01$), which is already attributable to outstanding research on the subject. Control variables also produced similar results, which adds to the overall confidence of the proposed model. The R^2 statistic increased from 0.411 (Model 2) to 0.447 (Model 3); therefore, the addition of credit risk enhances the model's predictive capability when predicting ROE change.

Findings are consistent with several studies that found that risk constraints reduce banks' profitability through increased borrowing costs and decreased lending capacity, especially in developing markets ([Doan, 2024](#)).

It is important to highlight here that due to the expansion of financial services through fintech, the checks and balances on quality and risk assessments of banks regarding credit lending are compromised, ultimately adversely affecting the relationship between financial inclusion and banking efficiency. Implementation of financial services is two-pronged; on one side, it can decrease the impact of credit risk when decisions are made based on a well-diversified and well-informed database, and on the contrary, decisions not based on well-documented data tend to increase credit risk ([Zheng, Murod, et al., 2026](#)). Therefore, financial inclusion affects banking efficiency indirectly through its impact on credit risk. From an economic aspect, there is no doubt that the successful implementation of financial inclusion not only improves bank deposits, widens customer outreach, but at the same time increases credit lending to customer having no proper credit score rating will have an adverse effect.

4.6 | Sensitivity/ Robustness Analysis: Fixed Effect Regression

Table 13

Robustness Check - Fixed Effects Regression Results Using ROA as an Alternative Proxy for Bank Efficiency

Variables	Model 1 (Baseline)	Model 2 (With Mediator: Credit Risk)	Model 3 (Full Model)
Financial Inclusion (Branches per 100,000 adults)	0.083*** (0.022)	0.062*** (0.021)	0.052** (0.019)
Credit Risk (Mediator)		-0.118*** (0.041)	-0.105*** (0.039)
Bank Size (log of Total Assets)	0.475*** (0.150)	0.455*** (0.148)	0.410*** (0.142)
Bank Leverage (Debt-to-Equity Ratio)	-0.038** (0.017)	-0.040** (0.017)	-0.035** (0.015)
Unemployment Rate (%)	-0.120** (0.056)	-0.108** (0.053)	-0.101** (0.052)
Crisis Dummy (1 = Crisis Year)	-2.260*** (0.770)	-2.130*** (0.750)	-1.950*** (0.710)
Year Fixed Effects	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes
Constant	2.675*** (0.254)	6.745*** (0.640)	5.524*** (0.153)
Observations	150	150	150
Countries	5	5	5
R-squared	0.379	0.418	0.461
F-statistic	13.72***	14.82***	15.77***

*Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors in parentheses. Dependent Variable: Bank Efficiency (ROA).*

The stability of the main findings is confirmed in table 4 by the robustness check using bank branches as the proxy for financial inclusion and ROA as a substitute for bank efficiency. Across all models, financial

inclusion remains positive and statistically significant (Model 1: $\beta = 0.083$, $p < 0.01$; Full Model: $\beta = 0.052$, $p < 0.05$), indicating that expanded branch networks consistently improve bank performance. Credit risk ($\beta = -0.118$ to -0.105 , $p < 0.01$) exhibits significant negative effects, suggesting partial mediation in the FI–efficiency relationship.

4.7 | Sensitivity/ Robustness Analysis: Two-Step System GMM

Table 14

Robustness Check – Two-Step System GMM used as an Alternative Estimation Method.

Variables	Model 1 (Baseline)	Model 2 (With Mediator: Credit Risk)	Model 3 (Full Model)
Lagged ROE (ROE_{t-1})	0.321*** (0.081)	0.315*** (0.079)	0.298*** (0.077)
Branches (FI)	0.142*** (0.045)	0.121*** (0.043)	0.103*** (0.041)
Credit Risk		-0.091*** (0.034)	-0.084*** (0.033)
Banking Size	0.059*** (0.020)	0.056*** (0.018)	0.053*** (0.017)
Banking Leverage	-0.045** (0.021)	-0.042** (0.020)	-0.039** (0.018)
Unemployment	-0.031 (0.026)	-0.028 (0.024)	-0.026 (0.023)
Crises	-0.066** (0.028)	-0.061** (0.026)	-0.058** (0.025)
Constant	0.981*** (0.251)	0.947*** (0.248)	0.918*** (0.245)
Year FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Observations	144	144	144
No. of Instruments	23	26	29
AR (1) test (p-value)	0.012	0.010	0.009
AR (2) test (p-value)	0.278	0.255	0.239
Hansen J-test (p-value)	0.429	0.404	0.372

*Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors in parentheses. Dependent Variable: Bank Efficiency (ROE)*

In Table 14, two-step System GMM results confirm the stability of the baseline results using branch per 100,000 adults as the financial inclusion measure. With $\beta = 0.298$ – 0.321 and $p < 0.01$, the lagged dependent variable (ROE_{t-1}) is positive and highly significant across all models, indicating bank performance persistence over time. Financial inclusion continues to be strongly positive and significant ($\beta = 0.103$ – 0.142 , $p < 0.01$), therefore supporting the hypothesis that increased banking access boosts performance. Credit risk ($\beta = -0.091$ to -0.084 , $p < 0.01$) demonstrates negative and significant effects, confirming their mediating roles. In line with the earlier models, the control variables are statistically significant and function as anticipated. Diagnosis tests verify that the model is stable, showing no indications of second-order autocorrelation (AR (2), $p > 0.23$), and the instruments employed are valid (Hansen J, $p > 0.37$). To sum up, the findings align with a steady, beneficial impact of financial inclusion on banking efficiency in Pakistan and BRICS.

4.7 | BRICS Country-Wise Comparison

Comparative profile of the BRICS countries from 2000 to 2024, some of the important factors that may affect bank efficiency, financial inclusion, and credit risk. Return on Equity (ROE) is more widely dispersed than Return on Assets (ROA) and exhibits different types of revenue strategies. The country that performs best is India, with an average ROE of 13.94, indicating a strong level of profitability and a good level of efficiency when it comes to interest income. Brazil and Russia have lower levels of profitability, as indicated by their average ROE between 10 and 10.7. ROA is less volatile than ROE and falls within a range of 1.14 in South Africa. While banks have different capabilities to generate returns on equity and interest income, they are similar in the use of their assets to generate income.

The Financial Inclusion proxies also show that there are asymmetries in access to banking services. China and South Africa have large networks of Bank Branches with 38.25 and 50.32 Branches for every 100,000 adults, respectively. In India, the number of branches is low at only 38.25, with China and Brazil providing the highest amount of physical access compared to both South Africa and India. The structural imbalances in financial accessibility may have an impact on deposit mobilisation, credit outreach, and therefore, on the performance and competitiveness of banks in India.

The disparity in labor-market metrics further amplifies this distinction; South Africa's unemployment rate (9.98) significantly surpasses that of China (4.88), potentially affecting credit demand and a person's capacity to repay the loan later. Even though crisis-dummy values are fairly low (0.10–0.18), their existence suggests that there are periods when the systems experience stress and are susceptible to external shocks.

Risk indicators also reflect differences among banking sectors within various countries. Chinese banks tend to have a much higher level of average Credit Risk (58.15) than all other countries combined. In addition, differences in Banking Size illustrate that larger Banks usually benefit from economies of scale and are generally able to operate more efficiently and with greater resilience than smaller Banks within the same Country ([Gržeta et al., 2023](#); [Stewart & Chowdhury, 2021](#)).

The differences in the structure, economy, and regulation of BRICS highlight the level of diversity across countries. This diversity is important to understanding the many ways in which banks around the world are affected by financial inclusion, as well as how macroeconomic factors affect their efficiency. The diverse empirical data available can therefore be used as an analytical basis for a multi-country panel regression analysis of banking inefficiency.

From an economic perspective over the last decade, India and China have shown great investment in financial inclusion, and they must continue the expansion of financial inclusion policies through fintech in line with the highly advance AI based credit rating monitoring systems. As far as Russia is concerned, the successful implementation of financial inclusion is dependent on the banking sector diversification and, at the same time, requires strong institutional and regulatory reforms. Lastly, Brazil and South Africa have invested much in the implementation of financial inclusion, but the results are not satisfactory due to weak credit risk policies and deteriorating banking sector efficiency.

4.8 | BRICS Institutional Differences

Collectively, BRICS countries have shown great progress in the field of financial inclusion, but when it comes to individual country-level progress, there exist quite significant differences in rules and regulations, technological advancement, banking efficiency, financial inclusion implementation, financial literacy, socio-economic, and risk profiling policies. All these factors mentioned play a vital role in the implementation of financial inclusion and enhancing banking efficiency.

The most significant progress in the field of financial inclusion is shown by China and India through increasing bank outreach, adoption of digital platforms, and, lastly, government regulations. In comparison, Brazil and South Africa have also shown keen interest in the adaptation of financial inclusion, but are not able to enjoy much success due to issues like regional and cultural differences, income level inequalities, and access to financial services for a select population due to infrastructural deficiencies. Lastly, Russia has problems like geopolitical and institutional factors that impact the effectiveness of financial inclusion on banking efficiencies.

5 | CONCLUSION

5.1 | Key Findings

The section will provide a synthesis of the key empirical findings of the study; results are reported along with the two fundamental research questions that formed the study:

- For measuring the direct influence of financial inclusion on banking efficiency, we adopted a baseline model.
- For measuring the impact of mediation/indirect influence on credit risk

Results confirm that there exists a statistically significant and positive relationship between financial inclusion and banking efficiency. The results are consistent across all models. Research results are in line with previous literature confirming that expansion in financial inclusion results in enhancement of banking sector efficiency through an increase in the number of customers, growth in deposits, and more use in use of financial services at low cost ([Beck, Demirguc-Kunt, et al., 2007](#); [Hannig & Jansen, 2010](#)).

The second significant contribution can be traced to the mediation analysis. The research establishes that credit risk has a partial mediation over the potential correlation between financial inclusion and efficiency in banking. The findings consolidate the hypothesis that inclusion lessens the risk of giving credits by lowering the risk concentration on the lender, making loans trackable, and making them more likely to repay. Results are consistent with prior literature indicating that the availability of formal credit will decrease the reliance on informal lending venues with high risk and increase the quality of the portfolio ([Cull et al., 2009](#)).

5.2 | Theoretical Contribution

First, this research establishes an all-inclusive theoretical framework that includes dimensions such as financial inclusion, banking efficiency, and credit risk. The present research, which uses a unique mediation approach in addressing the above-discussed variables, is distinct from previous studies that have considered these variables individually.

Second, the paper adds to the body of literature related to contingency theory in that it shows that the effects of financial inclusion cannot be generalized or assumed to be linear but rather depend on the environment within which the FI-efficiency relationship occurs ([Antwi et al., 2024](#)).

Third, the study provides a contribution to Information Economics Theory as it demonstrates that financial inclusion increases banking efficiency because of decreasing information asymmetry and increased credit transparency. Increased financial inclusion creates better visibility of borrowers and minimizes adverse selection, in line with research on the topic in recent years ([Zhao et al., 2024](#)).

Fourth, the study is an application of the Resource-Based View theory because it shows how financial inclusion enhances the internal capabilities of banks through increased deposit collection capacity, digitalization of the finance sector, and cost effectiveness ([Boachie & Adu-Darko, 2024](#)).

Finally, the study enhances Institutional Theory by bringing in credit risk as a potential mediating path. It shows that institutional and macroeconomic contexts have a say in how efficient financial inclusion works to achieve better efficiency.

5.3 | Policy Implications

This research presents several policies and practical implications for banks, financial regulatory bodies, government agencies, and development organizations. They confirm the point that financial inclusion is not to be aimed at as some generic and symbolic objective, but as a well-timed intervention informed by risk assessment and economically contextualized. The direct and the mediated effects of inclusion on the efficiency of banking are empirically observed.

In the case of financial institutions, the evidence available indicates that financial inclusion ought not to be considered as a compliance requirement or a social responsibility campaign, but as an avenue to boost operational efficiency and profitability in the long term, particularly when accompanied by prudent strategies of risk management. The study identifies that financial inclusion lowers credit risk and improves liquidity cushions, which has a direct impact on increased balance sheet and turnover of equity (ROE). Such results are consistent with those presented in the previous studies by [Beck, Demirgüç-Kunt, et al. \(2007\)](#), which tend to conclude that wider coverage of financial services has the potential to enhance financial stability, provided that proper systems of governance are in place.

To the central banks and regulatory authorities, the study advises against the integration of inclusion targets in the prudential and supervisory regimes. Because inclusion has a demonstrable effect on enhancing credit quality, inclusion measures can be used as trendsetters in measuring the financial soundness and resilience of institutions. Some possible regulatory measures would be to provide the accordance of inclusion benchmarks with capital adequacy stress tests, risk-based supervision frameworks, or even stimulated licensing systems on a reward basis ([Group, 2013](#)).

5.4 | Managerial Implications

As far as practicality is concerned, for the successful implementation of financial inclusion, policy makers need to ensure that all strategies related to financial inclusion must be based on economic, local geographic, and culturally tailored as per need rather than relying on a uniform approach. Policy makers need to understand that the branch expansion and mobile banking may be effective in the urban and peri-urban locations, but as

far as rural areas are concerned, branchless banking, agent banking, and solutions based on fintech seem to be more practical in far-flung and low-income areas ([Beck et al., 2015](#)). Additionally, government regulations based on well-integrated, robust, and real-time data strengthen the financial inclusion data infrastructures through harmonized indicators, digital reporting systems, and data sharing guidelines between the private and the public sector ([GPFI, 2016](#)). It is only when such systems are established that policymakers can indeed plan inclusion initiatives, which are not only fair but also economical.

5.5 | Credit Risk Monitoring Framework

Regulators are to ensure financial inclusion expansion is supported by a well-developed credit risk monitoring framework, which will be helpful in preventing banking sector inefficiencies. A real-time credit risk monitoring framework duly integrated with banking and fintech programs, which will be helpful in live tracking and data maintenance to predict patterns for future regarding borrower loans, repayments, and defaults. All stakeholders must be taken on board to formulate policies to reduce information asymmetry and improve credit risk assessment accuracy ([Ha et al., 2025](#); [Zheng, Rahman, et al., 2026](#)).

Lastly, regulators must apply regulations and policies related to risk-based lending to minimize the risks associated with financial inclusion expansion activities. Especially in the case of lending credit to low-income unbanked customers, banks need to maintain a capital buffer and apply risk-sensitive analysis. Apart from these measures, procedural transparency and consumer protection policies are fundamental to stop over indebtedness and guarantee sustainable, balanced financial inclusion outcomes ([Ozili, 2025](#); [Zheng, Murod, et al., 2026](#)).

5.6 | Study Limitations

Credit risk is used as a proxy for the mediating variable, which is based on the IMF Financial Soundness Indicators (FSIs). Although indicators are standardized and recognized internationally ([IMF, 2020](#)), but are collected across all banks of a specific country, thereby perhaps muddying institution-specific performance dynamics. There are other mediators that the study fails to investigate, like capital adequacy, cost-to-income, as well as customer engagement levels, that may also form excellent conduits to evaluate the effect of inclusion on efficiency. Overseeing such variables can become a constraint to the level of insight into the complete range of institutional mechanisms that have a role in performance.

Financial inclusion, the single proxy number of bank branches per 100,000 adults, is used, which may be inadequate. Further, it captures physical access (supply side only), and it ignores Digital inclusion (mobile banking, fintech penetration), Usage dimension (account activity, credit usage), affordability dimension, and quality/access equality. Financial inclusion is multidimensional and should include ATM penetration, account ownership, digital payments, mobile banking, credit accessibility, and fintech adoption.

The other significant methodological limitation is the assumption of unidirectional causality. The research presents the assumption that financial inclusion affects banking efficiency both directly and indirectly through risk, without investigating the reverse causality. Alternatively, it is reasonable to expect that better-performing banks could have the additional resources to make investments in infrastructure, or that better risk profiles allow the banks to extend the outreach ([Cull et al., 2009](#)).

It is worth mentioning that the generalizability of the results is limited by the attention to BRICS countries. The new markets do provide an interesting insight into large and complicated financial markets, but

the conclusions may not be directly applied to low-income states, weak states, or highly developed financial markets with diverse regulatory types and ways of utilizing technology. As an illustration, the observed dynamics of inclusion-risk-efficiency might not be relevant in situations of low state capacity and informal financial dominance, as well as in those with extremely high financial innovation ([Group, 2013](#)).

5.7 | Recommendations for Future Research

It would also be valuable to include in the range of moderators' institutional qualities, regulatory environment, financial literacy, and cultural considerations, which would enhance the perception of context sensitivity in an inclusion policy ([Honohan & King, 2012](#)). Qualitative comparative analysis or mixed methods might shed some light on the interactions of factors that facilitate or limit the effectiveness of inclusion in a variety of contexts.

It is highly recommended to construct a composite Financial Inclusion Index using the Composite FI index (PCA-based), the IMF Financial Access Survey / Global Findex indicators, Digital financial inclusion proxy (mobile money accounts, transactions) for a more precise measurement of financial inclusion.

It is vital to handle the question of causality. Future research also needs to undertake quasi-experimental designs, instrumental variables, or dynamic panel data to help unravel the interrelationship between inclusion and banking performance, which is two-way. To demonstrate the effect and the cause, natural experiments, policy changes, or even exogenous shocks might be used as the identification measures ([Angrist & Pischke, 2009](#)).

Expansion in Geography and time is also recommended. The external validity of results could be tested by depending on the framework with various groups of countries, such as least developed countries, fragile states, or developed markets, and discovering exceptional regional relationships. Moreover, the models would better fit the modern context as they include statistics showing the recent fintech-related innovations and financial behavior after the pandemic ([Demirguc-Kunt et al., 2022](#)).

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