

Does Banking Inclusion Induce Credit Risk? Evidence of Reverse Causality in Developing Countries

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ABSTRACT

This paper investigates the dynamic interrelationship between banking inclusion and credit risk across 28 developing countries from 2004 to 2020. A robust empirical approach is employed, combining a panel vector autoregressive model with the generalized method of moments. Within this framework, impulse response functions are used to characterize the interaction between banking inclusion shocks and credit risk, capturing both the magnitude and persistence of their effects over time. Subsequently, forecast error variance decompositions quantify the relative contribution of each variable to the variance in the other, thereby underscoring the strength and direction of their dynamic interdependence. The findings indicate that positive shocks to banking inclusion, characterized by a rapid expansion in access to financial services, are associated with increased credit risk. This rise in risk is primarily attributable to a higher probability of loan defaults, particularly when the pace of inclusion exceeds banks' capacity to adequately assess and manage borrower risk. Conversely, heightened credit risk induces banks to adopt more prudent lending practices, including restricting credit access and increasing borrowing costs. Banks may also constrain the development and deployment of innovative financial products, thereby impeding further progress in banking inclusion. Policy measures should align financial inclusion with effective risk assessment.

Keywords: Banking inclusion, Credit risk, Developing countries, Dynamic interrelationship, Panel vector auto-regression, Impulse-response function.

INTRODUCTION

Over an extended historical period, financial authorities have consistently placed emphasis on maintaining the stability of the global financial system, particularly as persistent financial frictions continue to challenge the world economy (Hasan et al. 2023). The Great Depression of 1929 marked one of the earliest large-scale disruptions. During the 1980s and 1990s, a period characterized by intensified financial liberalization, the United States encountered substantial financial setbacks stemming from elevated-risk lending practices and the depreciation of asset quality. The decade also witnessed the Asian financial crisis in 1997, succeeded by Argentina's financial breakdown in 2001 and the 2007–2008 crisis related to housing-backed securities in the United States. More recently, the abrupt withdrawal of deposits triggered the failure of several regional banks in 2023, including Silicon Valley Bank and Signature Bank in New York. Shortly thereafter, Swiss authorities announced the merger of Credit Suisse with UBS Group AG. In 2024, Republic First Bank, a regional American bank, collapsed amid ongoing financial pressures linked to rising interest rates and real estate vulnerabilities. The trend persisted into 2025 with the failures of Pulaski Savings Bank in Illinois and The Santa Anna National Bank in Texas. These events underscore how excessive risk-taking by banks remains a fundamental source of financial instability (Kirchler et al. 2018).

In response, regulatory reforms, strengthened directives, and enhanced internal controls have been progressively consolidated at the international level following each banking failure episode (Akins et al. 2016). Despite these initiatives, it is unlikely that public authorities will reconsider the adoption and enforcement of stringent capital and liquidity standards, given their critical role in preventing systemic crises (Carletti & Leonello 2019). However, while financial authorities prioritize system stability, commercial banks often restrict access to services for high-risk clients. This limitation increases national financial systems' reliance on

non-bank funding sources, thereby exacerbating financial exclusion and elevating concentration risks (Huynh & Ho 2020). These developments intensify liquidity risks, weaken portfolio quality, and may provoke panic events, consequently raising the likelihood of bank failures (Hua et al. 2023).

Moreover, the international community regularly warns of the risks associated with the gradual withdrawal of global banks from certain markets. These risks affect not only the stability and integrity of the global financial system but also the financial inclusion of emerging and developing nations (Han & Melecky, 2017). This concern is particularly significant given that several studies emphasize the central role of the financial sector as a key driver of economic development. In particular, the literature highlights the benefits that a stable and innovative financial sector brings to economic growth, while also contributing to poverty alleviation and the reduction of inequality (Mwakalila & Muba, 2025; Osuma, 2025). Consequently, integrating populations reliant on informal financial services into the formal system promotes improved income and well-being among disadvantaged groups. Thus, the development of an inclusive financial system is often regarded as a win-win strategy, fostering both economic growth and the strengthening of the banking sector.

Within this context, banking stability has remained a central concern for international institutions, notably the World Bank. A key argument stresses the importance of risk-proportionate regulation designed to limit financial exclusion while promoting banking inclusion (Antwi et al. 2024). Among the proposed measures is universal access to basic banking services, whether through physical infrastructure or digital channels. This approach is viewed as a lever for significantly reducing banking costs while bridging the gap between the formal financial sector and populations excluded from access to finance. It also supports portfolio diversification and reduces concentration risk, thereby contributing to the stability of the banking system. This issue has received particular attention in developing countries. As a result, banking inclusion and stability have emerged as key policy priorities, with growing recognition that these objectives can mutually reinforce one another (Hannig & Jansen, 2010).

However, despite significant progress in developed countries regarding banking inclusion as a policy goal, its stabilizing effect remains less evident in developing economies (Barik & Pradhan, 2021). This discrepancy arises from structural and institutional constraints, including competing policy agendas, limited economic diversification, and fragile banking ecosystems. In many cases, small and medium-sized banks in these countries operate with tight budgets, inadequate infrastructure, and client bases with limited financial capacity, particularly in remote or underserved regions. These constraints hinder the effective deployment of inclusive financial strategies. Furthermore, regulatory frameworks in developing economies often replicate standards designed for advanced systems, focusing on systemic risks in formal banking sectors while overlooking informal financial practices. Consequently, expecting similar banking inclusion–stability outcomes in less mature financial environments may be unrealistic.

While an emerging consensus among international experts recognizes a relationship between financial inclusion and banking system stability, several critical questions remain unresolved. Specifically, the precise nature of the interaction between these two objectives and the optimal strategies to align them remain unclear. Recent studies conducted by institutions such as the World Bank and the International Monetary Fund, alongside economists, emphasize that pursuing financial inclusion and financial stability may require balancing competing priorities, but also offer opportunities for mutual reinforcement. From a theoretical perspective, various conceptual frameworks have been developed to elucidate the complex and multifaceted nexus between financial inclusion and financial stability.

The first theoretical perspective highlights financial inclusion as a key mechanism for enhancing banking stability by integrating small-scale clients into the formal financial system. Expanding the client base increases deposit mobilization and diversifies funding sources, thereby reducing reliance on costly and volatile revenue streams. This diversification mitigates concentration risk by enabling a more balanced allocation of resources, while simultaneously expanding market share and strengthening long-term bank–client relationships. Furthermore, this broad-based inclusion improves management of systemic risks, such as credit and liquidity risks. During periods of financial strain (such as loan defaults or sudden deposit withdrawals), the institution's stability is supported by the continued repayment and deposit activity from other client segments. Small-scale

depositors and SMEs, typically less reactive to internal bank problems or capital market signals, are less predisposed to panic-driven behavior, helping to stabilize funding flows in times of market stress (Demirguc-Kunt & Huizinga, 2010; Huang & Ratnovksi, 2011; Cull et al. 2012). Consequently, financial inclusion enhances banks' capacity to absorb shocks and weather economic downturns (Khan, 2011; Demirgüç-Kunt & Singer, 2017). Additionally, the larger customer base facilitates economies of scale, improving cost efficiency and operational resilience within the banking system (Talbi & Sebai, 2025b).

The second theoretical perspective underscores the nuanced relationship between banking inclusion and banking stability. This view argues that the impact of banking inclusion on stability varies depending on several contextual and institutional factors. These include the extent of information asymmetry and the strength of regulatory mechanisms, both of which influence credit assessment and risk management practices. Banks' risk-taking behavior and the precision of default probability assessments also critically shape this relationship (José & Garcia, 2016). Moreover, the extent of banking service outreach, network accessibility, and the overall level of financial inclusion within a country are key determinants (Prasad, 2010; Khan, 2011). This framework suggests that while banking inclusion can strengthen financial systems, it may also generate vulnerabilities if not accompanied by sound regulation and effective risk mitigation strategies. In addition, numerous studies highlight that the implementation of financial inclusion often requires significant initial investments, particularly in technological infrastructure, which may temporarily strain banks' financial stability (Talbi & Sebai, 2026).

The third theoretical perspective underscores the reverse causality between banking inclusion and banking stability, highlighting the potential for a virtuous cycle between the two. Specifically, improvements in banking stability serve as a catalyst for the expansion of financial services to previously excluded populations. A more resilient banking system enhances institutions' capacity to absorb shocks, mitigates credit risk-related uncertainties, and reduces the costs of financial intermediation. When banks possess sound balance sheets and adequate capital buffers, they are more likely to innovate and absorb the additional costs associated with reaching underserved segments (Claessens, 2006; Hannig & Jansen, 2010; Dittus & Klein, 2011; Rahman, 2014; Mehrotra & Yetman, 2015). This mechanism is closely tied to the credit cycle and broader macroeconomic conditions. During economic downturns, rising nonperforming loans and tighter lending standards often lead banks to exclude higher-risk borrowers, thereby hindering inclusion. Conversely, favorable conditions stimulate financial service demand, improve asset quality, and mitigate solvency and liquidity risks, creating an environment conducive to broader inclusion (Čihák et al. 2021). Ultimately, the inclusive potential of a stable banking system depends on banks' ability to invest in tools that address information asymmetries and enable effective assessment of informal or higher-risk clients (Elsinger et al. 2018; Sebai & Talbi, 2026).

Building on these theoretical insights, the World Bank identifies challenges arising from limited and irregular cross-country time-series data on financial inclusion, which contribute to inconclusive empirical evidence regarding its impact on banking stability. Nevertheless, empirical studies consistently highlight the positive role of financial inclusion in enhancing savings mobilization, increasing transaction frequency, and improving credit access. These mechanisms collectively strengthen banks' ability to assess and manage credit risk more effectively, thereby contributing to overall bank stability (Atellu & Muriu, 2022; Ruan & Jiang, 2024; Jeke, 2025; Srivastava et al., 2025; Han et al., 2025; Elnahass et al., 2026; Damane & Ho, 2026). These findings derive from studies employing diverse econometric techniques, including ordinary least squares (OLS) and the generalized method of moments (GMM).

Nonetheless, poor management of banking inclusion may lead to issues such as over-indebtedness, increased risk of loan defaults, and the formation of speculative bubbles. In this context, some studies, including Yildiz (2022); Awdeh et al., (2025); Damane and Ho (2025) challenge the traditionally positive relationship by demonstrating a negative link between banking inclusion and banking stability. These results are based on GMM and panel quantile models, respectively. Recent research suggests that financial inclusion initially enhances banking stability but may lead to instability when accompanied by rapid or uncontrolled credit expansion (Sebai & Talbi 2024c; Sebai et al. 2025; Kebede et al. 2025; Rahman et al., 2026). This inverted U-shaped pattern is particularly evident in developing countries and has been identified using various

econometric methods, including GMM, dynamic panel threshold regression (DPTR), panel smooth transition regression (PSTR), and panel semi-parametric models. The destabilizing effects of excessive banking inclusion are more pronounced in contexts with weak regulation and low institutional quality (Sebai & Talbi, 2025a).

Overall, the literature underscores the presence of trade-offs and complementarities in the design and implementation of public policies aimed at advancing banking inclusion. Some findings suggest that banking stability may be undermined when inclusion efforts rely on rapid or poorly regulated credit expansion, particularly in environments characterized by weak financial oversight. Conversely, strategies that emphasize the diversification of banking services, the strengthening of deposit and credit flows, the realization of economies of scale, and the expansion of insurance coverage are more likely to enhance the stability of the banking system. Nevertheless, most empirical studies continue to examine stable and inclusive financial systems in isolation, without fully accounting for their potential interdependence. This gap highlights the necessity for a more integrated analytical approach to capture the multifaceted dynamics between banking inclusion and stability.

In light of the discussion above, the present study contributes to the literature on banking inclusion and banking stability in three significant ways:

First, existing research has paid considerable attention to both linear and nonlinear (e.g., U-shaped or inverted U-shaped) relationships between banking inclusion and banking stability. However, the precise nature and direction of this relationship remain ambiguous, posing persistent challenges for both theoretical and empirical investigations. This ambiguity largely stems from the neglect of the inherently dynamic and potentially bidirectional nature of the relationship, including the possibility of reverse causality. A review of the literature suggests that banking inclusion and financial stability may exert mutual influence (Čihák et al. 2021). Accordingly, this study aims to empirically examine the potential causal links between banking inclusion and credit risk. Specifically, the analysis aims to identify two primary effects. The first considers the impact of banking inclusion on banking stability, while the second examines the influence of banking stability on banking inclusion. Clarifying this relationship is essential to ascertain whether greater inclusion undermines portfolio quality or if increased credit risk constrains financial access within communities.

Second, empirical analyses that rely solely on single-equation frameworks to examine the relationship between banking inclusion and credit risk may lead to biased or misleading results. To address this limitation, the present study employs a panel vector autoregression (PVAR) model estimated within a generalized method of moments (GMM) framework, complemented by impulse response function (IRF) analysis. A primary feature of this methodology is its treatment of all variables as endogenous (Holtz-Eakin et al. 1988; Sebai et al. 2024a), which allows it to capture the simultaneous interactions between banking inclusion and credit risk. Additionally, this approach effectively addresses concerns related to endogeneity. Furthermore, by exploiting the panel structure of the dataset, the model controls for unobserved heterogeneity across banks through fixed effects, thereby enhancing the reliability and precision of the estimates. The dynamic interplay between variables is further elucidated via impulse response functions, which trace the temporal effects of shocks in one variable on the other over multiple time horizons.

Third, to the best of our knowledge, no existing studies have explored the dynamic causal nexus between banking inclusion and credit risk at the bank level, particularly in the context of developing countries. These countries often operate under less robust regulatory and supervisory frameworks, coupled with limited technological infrastructure (Barik & Pradhan 2021). Such institutional and structural deficiencies stem from persistent challenges, including weak enforcement of banking regulations, fragmented internal governance within financial institutions, and inconsistent compliance with official directives. Additionally, developing economies frequently face unstable macroeconomic environments, characterized by inflationary pressures, sudden fluctuations in commodity and agricultural prices, climate-related disruptions, geopolitical tensions and external shocks. These conditions reduce the financial resilience of borrowers (particularly small businesses and low-income individuals) who are more susceptible to default in times of economic stress. This vulnerability not only amplifies credit risk but also threatens the overall soundness of the banking system. In

this fragile setting, it is crucial to examine how efforts to expand banking inclusion interact with systemic stability, whether such inclusion acts as a buffer or as a source of fragility.

The structure of the paper is as follows: Section 2 provides an overview of the data and variables. Section 3 details the panel vector autoregression methodology. Section 4 presents the main empirical findings. Section 5 concludes the paper and discusses the implications for policymakers.

Data description, Variables and Descriptive Statistics

Data

This paper investigates the impact of banking inclusion on bank credit risk by analyzing data from 112 banks across 28 developing countries over the period 2004–2020. The selection of these countries, based on the World Bank’s 2020 classification, is justified by their shared economic and financial characteristics. These nations are typically classified as emerging markets undergoing significant economic restructuring, where the banking sector plays a vital role in supporting the real economy. They exhibit similar traits in financial market development, institutional quality, and vulnerability to macroeconomic shocks. Within this context, these countries feature evolving financial infrastructures, expanding yet uneven banking outreach, and ongoing institutional reforms. Most face common challenges such as persistent credit risk, widespread informal financial sectors, and limited banking access for large population segments. Furthermore, these economies remain exposed to external shocks that can amplify financial instability, while contending with financial system fragility and the need for regulatory improvements. In response, many have implemented initiatives over recent decades aimed at broadening financial inclusion and enhancing banking stability.

Although other countries share some economic similarities, this study restricts its sample to those with available and reliable data, as listed in Table 1. Banks were selected based on the completeness of their financial information, with the full list provided in Appendix A. All data used in this study are sourced exclusively from the International Monetary Fund (IMF) and Datastream.

The chosen timeframe ensures consistency across countries and institutions and corresponds to a critical period marked by the expansion of financial inclusion policies in developing economies alongside significant global shocks such as the 2007–2008 financial crisis. This financial turmoil was rooted in the widespread granting of mortgage credit to financially vulnerable households, particularly through variable-rate arrangements. The abrupt and unforeseen increase in interest rates subsequently led to a marked deterioration in subprime loan performance, while the pronounced reduction in deposits placed additional pressure on banks’ financial conditions and contributed to the spread of the shock throughout the financial system. This experience raises concerns about the potential risk implications of banking inclusion, as broader access to credit, particularly variable-rate financing, may expose banks to greater credit risk when lending to borrowers with constrained repayment capacity. The simultaneous expansion of banking inclusion and occurrence of macroeconomic shocks thus offers a relevant setting for assessing the relationship between banking inclusion and credit risk in periods of heightened economic volatility.

Table 1. List of countries:

Developing countries	Argentina, Brazil, Chile, China, Croatia, Czech Republic, Egypt, Federation of Russia, Greece, Hungary, India, Indonesia, Iraq, Kenya, Kuwait, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Saudi Arabia, South Africa, Thailand, Tunisia, Turkey, Ukraine, United Arab Emirates.
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Variables Measures and Descriptive Statistics

Independent variable: Banking inclusion measure

Banking inclusion refers to the extent to which individuals and firms can access and use formal banking services. It constitutes a specific dimension of the broader concept of financial inclusion, which encompasses a

wider range of financial services, including banking, insurance, and other formal financial products. In this study, banking inclusion focuses specifically on access, availability, and usage of banking services.

Indeed, it is inherently a multidimensional concept, encompassing three key dimensions: access, availability, and usage of banking services. Relying on individual measures for each dimension may result in a fragmented view of banking inclusion, potentially leading to an incomplete assessment of its effect on banking stability. Moreover, the literature offers a wide range of indicators for each of these dimensions, yet no consensus has emerged regarding the most appropriate measure. Additionally, the high degree of correlation among these indicators raises concerns about potential bias when they are used simultaneously in a single estimation.

To overcome this methodological challenge, it is appropriate to construct a composite index that synthesizes the various dimensions of banking inclusion by applying the Principal Component Analysis (PCA) approach. This method offers a robust solution by transforming a set of correlated variables into a reduced number of uncorrelated components (Dray & Josse, 2014; Talbi & Sebai, 2025b). PCA is frequently used in empirical studies to assess various aspects of the financial system, including financial depth, institutional quality, and banking stability (Ahamed & Mallick, 2019; Talbi & Sebai, 2025a). It also allows for the assignment of objective weights to the variables based on their contribution to the total explained variance (Malik et al. 2021).

This study adopts the PCA approach with factor rotation to six banking inclusion indicators, which are among the most commonly used in the empirical literature. Specifically, the access and availability dimensions are measured using four indicators: the number of commercial bank branches and automated teller machines (ATMs) per 1,000 square kilometers (BB_Km² and ATM_Km²), reflecting geographical penetration, and per 100,000 adults (BB_POP and ATM_POP), reflecting demographic penetration. The usage dimension is captured by the volume of outstanding loans (OLC) and outstanding deposits (ODC) in the private sector, both expressed as a percentage of GDP.

On the basis of these indicators, the composite banking inclusion index is constructed as follows:

$$\text{Bank_Inclusion indicator} = \sum_{i=1}^n W_{ij} X_i \quad \text{Eq. (1)}$$

Where W_{ij} : designates the weight allocated to each variable. X_i : represents the original indicators that describe the dimension of banking inclusion.

The construction of this composite index enables a more comprehensive representation of banking inclusion and facilitates interpretation while ensuring comparability across countries. Consistent with Talbi & Sebai (2026), the index is normalized on a scale ranging from 0 to 1, where a value of 0 denotes complete banking exclusion and a value of 1 signifies full banking inclusion. The results of the PCA applied to the selected indicators are presented in Table 2.

Table 2. Principal component analysis: Banking Inclusion index of developing countries

	PC_1	PC_2	PC_3	PC_4	PC_5	PC_6
Eigen values	3.076	1.156	0.871	0.706	0.105	0.085
Percentage of variance	0.513	0.193	0.145	0.118	0.017	0.014
Cumulative percentage	0.513	0.706	0.851	0.969	0.986	1.000
Variables	Comp_1	Comp_2	Comp_3	Comp_4	Comp_5	Comp_6
OLS	0.476	-0.281	-0.377	0.246	-0.453	0.535
ODC	0.463	-0.392	-0.342	0.137	0.480	-0.515
BB_Km ²	0.408	-0.193	0.683	-0.106	0.396	0.401
BB_POP	0.360	0.434	0.362	0.598	-0.275	-0.344
ATM_Km ²	0.435	0.090	0.069	-0.733	-0.412	-0.302
ATM_POP	0.273	0.730	-0.372	-0.124	0.402	0.278

Dependent variable: Banking Stability Measure

The literature identifies multiple indicators for assessing banking stability. However, no universally accepted standard exists for determining the most appropriate measure (Malik et al. 2021). Among these indicators, those related to risk exposure are especially prominent. This study focuses on credit risk, which refers to the risk that borrowers fail to meet their contractual repayment obligations, thereby impairing the quality of banks' loan portfolios. Credit risk directly threatens the stability of banking institutions and remains a critical concern for banks (Antwi et al. 2024). Drawing on data availability and consistent with Feghali et al. (2021) and Hakimi et al. (2025), this study adopts the nonperforming loans (NPLL) ratio as the primary proxy for banking stability. The NPLL ratio is defined as the share of nonperforming loans relative to total loans and is measured using a comprehensive bank-level dataset.

Banking strategies typically aim to expand the client base, mobilize deposits, and diversify credit products in order to stimulate economic activity and enhance sectoral performance. However, such strategies may also increase exposure to risks, particularly borrower default, which can compromise loan portfolio quality, weaken banks' financial soundness, and heighten their vulnerability to economic shocks.

The NPLL ratio serves as a key proxy for assessing vulnerabilities within the banking sector because it encapsulates both the efficiency of credit allocation and the robustness of risk management frameworks (Chen et al. 2018; Ozili et al. 2025). An elevated NPLL ratio, therefore, typically indicates a decline in asset quality, which adversely affects banks' profitability and their capacity to extend credit, thereby posing risks to overall financial stability. Moreover, given its sensitivity to macroeconomic dynamics and institutional conditions, the NPLL ratio proves especially effective for tracking systemic fragilities over time (Creel et al. 2014). Consequently, the NPLL ratio constitutes a comprehensive and reliable measure for capturing variations in banking stability and assessing the resilience of banking systems.

Descriptive Statistics and Correlation Matrix

The descriptive statistics for the NPLL ratio and the Bank_Incl index provide a comprehensive overview of credit risk and financial access within the sample. Specifically, the NPLL ratio exhibits a mean value of 6.62% and a median of 3.5%, which indicates that credit risk remains generally moderate, thereby reflecting effective risk management practices within the banking sector. In addition, the banking inclusion index, normalized on a scale from 0 to 1, records an average of 0.32 and a median near 0.29, demonstrating a moderate but substantive level of banking service accessibility. Consequently, this suggests that a considerable segment of the population and firms benefit from formal financial intermediation, thus evidencing progress toward enhanced financial inclusion. Detailed statistics are presented in Table 3 below.

Table 3. Summary statistics

Variables	Obs	Mean	Median	Standard deviation	Min	Max
NPLL	1585	6.618	3.5	10.192	0.01	106.59
Bank_Incl	1794	0.320	0.291	0.194	0	1

The panel VAR approach with GMM estimation

This paper examines the dynamic interrelationship between banking inclusion and credit risk, grounded in the theoretical frameworks proposed by Rahman (2014), Mehrotra & Yetman (2015), and Čihák et al. (2021), which posit a causal linkage between these variables. To empirically assess this causality, the analysis adopts the Panel Vector Autoregression (PVAR) methodology. Originally conceptualized by Sims (1980) for analyzing time series data, the Vector Autoregression (VAR) model was extended to panel data settings by Holtz-Eakin et al (1988). Given these developments, the PVAR framework has gained widespread recognition in the literature as an appropriate empirical approach owing to several methodological advantages. First, it treats each variable in the system as endogenous, allowing for the modeling of reciprocal dynamics between banking inclusion and credit risk (Abbrigo & Love, 2016). Second, by exploiting cross-sectional time series

data, the PVAR model accounts for unobserved heterogeneity across units through fixed effects, thereby controlling for time-invariant individual characteristics (Sebai et al. 2024a).

The PVAR model is commonly specified in the literature as follows:

$$Y_{it} = A_0 + A(L)Y_{i,t-1} + f_i + \varepsilon_{it} \quad ; i = (1, \dots, N); t = 2004, \dots, 2020 \quad \text{Eq. (2)}$$

Where:

Y_{it} : represents a vector of endogenous variables, including banking inclusion (Bank_Incl) and bank credit risk index (NPLL). f_i : denotes bank-specific fixed effects capturing unobserved time-invariant heterogeneity. A_0 : represents a vector of constants. $A(L) = \sum_{j=1}^n A_j L^j$: is a matrix polynomial in the lag operator (L), with coefficient matrices A_j . $\varepsilon_{i,t}$: is a vector of idiosyncratic errors, capturing bank-specific shocks.

Applying this framework to our variables of interest, banking inclusion and credit risk, the system is specified as:

$$\begin{aligned} \text{NPLL}_{it} &= \alpha_0 + \sum_{j=1}^p \beta_j \text{NPLL}_{i,t-j} + \sum_{j=1}^p \beta'_j \text{Bank_Incl}_{i,t-j} + f_i + \varepsilon_{it} \\ \text{Bank_Incl}_{it} &= w_0 + \sum_{j=1}^p \gamma_j \text{Bank_Incl}_{i,t-j} + \sum_{j=1}^p \gamma'_j \text{NPLL}_{i,t-j} + f_i + v_{it} \end{aligned} \quad \text{Eq. (3)}$$

Where:

NPLL_{it} : denotes the credit risk indicator (e.g., nonperforming loans) for bank i at time t . Bank_Incl_{it} : reflects the banking inclusion indicator for bank i at time t . w_0, α_0 : correspond to the constant terms. γ_j, β_j : indicate the coefficients to be estimated. f_i : captures bank-specific fixed effects. v_{it}, ε_{it} : represent the idiosyncratic error terms. p : specifies the lag order.

The Panel Vector Autoregressive (PVAR) approach, estimated using the Generalized Method of Moments (GMM), has gained substantial prominence in recent empirical research for investigating dynamic and potentially nonlinear relationships. For instance, Kim et al. (2018) investigate the relationship between financial inclusion and economic growth in 55 member countries of the Organization of Islamic Cooperation. Similarly, Zouaoui & Zoghalmi (2020) examine the impact of revenue diversification on bank market power across 17 Middle Eastern and North African countries during the period 1993–2014. More recently, Sebai et al. (2024a) analyze the dynamic causal relationship between banking deepening and economic growth volatility in 38 emerging economies over the period 1985–2020. Building on this growing body of literature, the present study employs the PVAR-GMM framework to capture the dynamic causal effects of banking inclusion on credit risk in the banking systems of developing countries.

EMPIRICAL RESULTS

The PVAR-GMM approach helps mitigate potential endogeneity concerns and provides a suitable framework for examining dynamic interrelationships among the variables by treating them as jointly endogenous. In this context, the panel VAR-GMM method necessitates that the variables of interest exhibit stationary distributions. Additionally, determining the lag order (p) in the panel specification is crucial for conducting Granger causality tests. The selection of this approach holds significance as it shapes the structure of the model and can notably impact the test outcomes. Following this, an evaluation of the model's stability (P-VAR) is provided, confirming its reliability and robustness.

The results obtained from the panel VAR-GMM model are subsequently delineated, offering insights into the dynamic interrelationship among the variables of interest. Furthermore, the outcomes of estimating the impulse response functions are presented, illustrating the response of an endogenous variable to an exogenous shock over different time horizons and thereby elucidating the short-term dynamics of the system. Finally, this study

provides detailed decompositions of the forecasting error variance (FEVD), enhancing comprehension regarding the relative importance of each variable for accounting for forecast errors.

Panel unit root test

To conduct estimations using the panel VAR approach, it is imperative that the variables of interest maintain a stationary distribution (Hartwig, 2010). Ensuring stationarity involves employing the Fisher-type unit root test, which relies on the augmented Dickey-Fuller (ADF) test for both the banking inclusion (Bank_Incl) variable and the nonperforming loans (NPLL) measure. The results presented in Table 4 demonstrate that the variables exhibit stationarity at level, indicating their appropriateness for inclusion in the P-VAR analysis.

Table 4. Unit root test

	NPLL (at level)	Bank_Incl (at level)
ADF	-19.138***	-10.228***

Note. (***) denotes statistical significance at the 1% level. The Fisher (ADF) panel unit root test is proposed by Maddala and Wu (1999).

Panel VAR lag selection

The determination of the optimal lag length for the panel vector autoregressive (VAR) model is based on the criteria established by Andrews & Lu (2001). The model selection criteria are computed for first- to third-order panel VAR models, with four lags of banking inclusion and NPLL serving as instruments. According to these criteria, the first-order panel VAR model is selected, as it yields the lowest values for MBIC, AIC, and MQIC. A detailed summary of the panel VAR models for the variables of interest is provided in Table 5.

Table 5. PVAR Lag-Selection Criteria

Lag	CD	MBIC	MAIC	MQIC
Model: Bank_Incl and NPLL				
1	0.9989722	-57.03224	0.755437	-21.30584
2	0.998968	-37.5771	0.9480179	-13.7595
3	0.9988709	-16.55425	2.708314	-4.645446

Note: CD, MBIC, MAIC, and MQIC denote the global determination coefficient, Bayesian information criterion, Akaike information criterion, and Hannan-Quinn information criterion, respectively.

Stability of the panel VAR model

The stability of the panel VAR model constitutes a necessary condition for validating the reliability of the estimated results. Following the methodological framework established by Lütkepohl (2005), this assessment entails computing the modulus of each eigenvalue associated with the model.

As detailed in Table 6, all eigenvalues derived from the estimated model (Eq. 2) exhibit absolute values strictly less than one, thereby satisfying the stability condition. This outcome is further supported by the graphical representation in Fig. 1, which clearly shows that all eigenvalues lie inside the unit circle, confirming the model's stable dynamic structure.

Table 6. Eigenvalue stability condition

Model	Eigenvalue	Eigenvalue	Modulus
	Real	Imaginary	
Model: Bank_Incl and NPLL	0.8312535	0.0056298	0.8312726
	0.8312535	-0.0056298	0.8312726

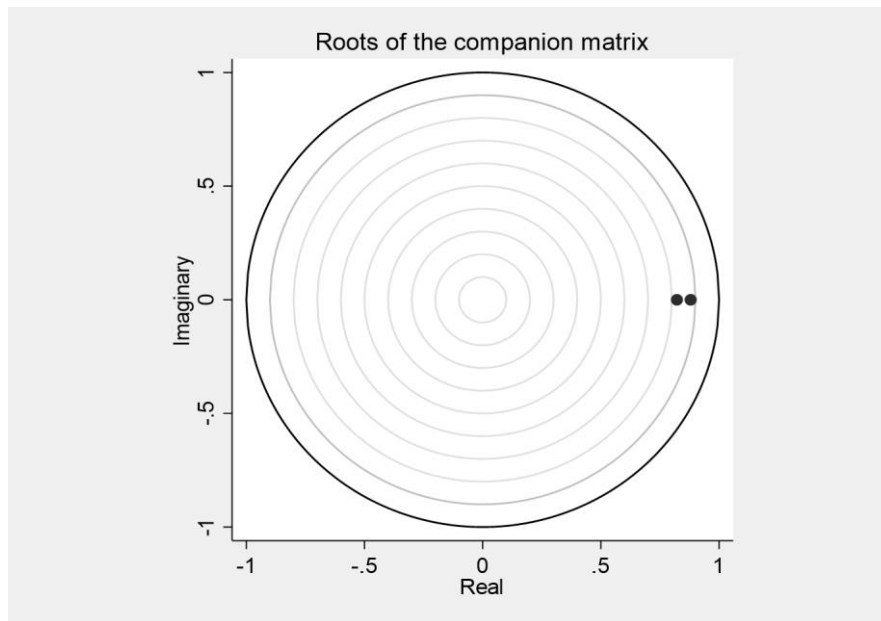


Fig. 1. Graphic of the stability condition of Eigenvalue

Granger causality tests and panel VAR estimations

In the panel VAR framework, all variables are treated as endogenous. Consequently, before proceeding with the estimation of the P-VAR model, it is essential to test for the presence of bidirectional causality among the examined variables. Our findings, as presented in Table 7, provide evidence of such causality, as indicated by p-values below the 5% significance level.

Table 7. Granger-causality test

Model	Null Hypothesis	Chi ²	P-value
Banking inclusion and credit risk	Bank_Incl causes NPLL	5.820	(0.016)
	NPLL causes Bank_Incl	42.760	(0.000)

In line with the aforementioned analysis, the PVAR model estimated via the GMM is considered appropriate for this investigation. This methodology effectively captures the dynamic relationship between Bank_Incl and NPLL. To further elucidate the interactions between these variables, impulse response functions (IRFs) are employed. IRFs trace the effects of a one-time external shock to an endogenous variable on the future trajectory of another variable over a specified time horizon, providing valuable insights into both the intensity and persistence of the shock's impact. These responses are illustrated in Fig. 2, which depicts the effects on the NPLL and Bank_Incl variables, respectively. The shaded bands surrounding each impulse response indicate the 5th and 95th percentile confidence intervals, derived from Monte Carlo simulations with 1,000 replications.

Impulse response function

The impulse response function (IRF) is a critical analytical tool employed to examine the dynamic behavior of

variables over time in response to an exogenous shock. Specifically, it traces how a shock to one variable influences others within the system across a defined time horizon. As illustrated in Fig. 2, the IRF curve remains consistently above the zero line, indicating a positive and dynamic relationship between Bank_Incl and NPLL. This pattern suggests that a positive shock to banking inclusion leads to a significant increase in nonperforming loans.

Nonetheless, this effect does not occur immediately but is preceded by a latency period. Between periods 0 and 1, this delay reflects an adjustment phase during which borrowers assess their repayment capacity, while banks reassess the credit risks associated with expanded lending. The observed lag can be attributed to the time required for borrowers to encounter repayment difficulties and for banks to adjust their provisions accordingly. Moreover, grace periods are commonly granted at loan origination. During this initial phase, borrowers are temporarily exempt from repaying principal and, in some cases, interest. These contractual provisions serve as deferral mechanisms that further postpone the realization of credit risk.

The positive impact of banking inclusion on non-performing loans is particularly pronounced between periods 1 and 4, reaching its peak in period 4. This pattern may reflect the expansion of lending to financially vulnerable borrowers, including those with limited or no prior credit histories, amid unexpected shocks and low sectoral diversification. By period 4, the accumulation of credit risk appears to reach a saturation point in the banking portfolio, resulting in a peak in non-performing loans. Thereafter, a prolonged phase of elevated vulnerability persists, weakening banking institutions and exposing them to systemic pressures that may trigger banking crises or failures. These developments highlight the critical need for timely and effective corrective interventions.

Between periods 4 and 10, the effect of the initial shock gradually diminishes in intensity, although banking inclusion continues to contribute to non-performing loans, albeit at a lower rate. This attenuation likely reflects a gradual adaptation within the banking sector, as institutions strengthen credit risk management through improved borrower assessment models and the accumulation of credit histories generated through ongoing lending activities. This adjustment process can also be understood in light of the lessons of the 2008 global financial crisis, which highlighted the importance of strengthening credit risk assessment and monitoring mechanisms to contain the deterioration of asset quality. In response to the increase in non-performing loans, banks implement proactive measures such as risk mapping, which classifies clients according to ascending levels of risk, from the least to the most risky, thereby facilitating the development of segmented loan portfolios aligned with borrower profiles. Banks may also resort to judicial settlement procedures and debt recovery mechanisms to address defaulted loans and limit their accumulation within banking portfolios.

Conversely, an increase in NPLL generates a negative shock to Bank_Incl. As depicted in Fig. 2, the IRF curve remains consistently below the zero line, confirming the adverse impact of credit risk on access to banking services. In response, banks adopt more conservative lending practices by tightening credit approval criteria, increasing the cost of financial services, and limiting product innovation. These measures disproportionately affect low-income households and small enterprises, thereby further restricting their access to formal banking channels. Notably, the graph (Fig.2 below) reveals the presence of three distinct phases, each reflecting a different magnitude and progression of this adverse effect:

First, between periods 0 and 1, the loan portfolio may still appear relatively sound, as it primarily consists of newly issued credits to borrowers who have yet to exhibit repayment difficulties. At this stage, early indicators of liquidity or solvency stress often remain undetected. However, as borrowers begin to miss payments or delay installments, these loans are progressively reclassified as nonperforming, signaling a deterioration in overall credit quality.

Second, between periods 1 and 5, the increase in credit risk compels banks to further tighten financing conditions, especially for vulnerable or high-risk clients. The worsening quality of the loan portfolio raises banks' risk exposure and financing costs, which in turn constrains their capacity to support productive economic activity. In an environment characterized by heightened uncertainty and narrowing interest margins, banks tend to scale back innovative service offerings, thereby reducing financial outreach to marginal

segments. As a result, banks may temporarily withdraw from fragile sectors, exacerbating financial exclusion. In developing economies, these restrictive effects are magnified by high unemployment rates and persistent income inequality.

Third, between periods 5 and 10, the adverse effect of NPLL on banking inclusion remains significant, although its intensity gradually diminishes over time. As financial conditions stabilize, banks cautiously moderate their credit allocation policies and expand access to financial services. This moderation is implemented with an emphasis on maintaining risk at manageable levels through enhanced screening, rigorous risk assessment, and portfolio diversification strategies.

Overall, the dynamics of this reverse causality depend on the rigorous enforcement of regulations and effective risk management, as well as prevailing economic and monetary conditions in developing countries. Macroeconomic stability and sound monetary policy also significantly influence the interaction between banking inclusion and credit risk.

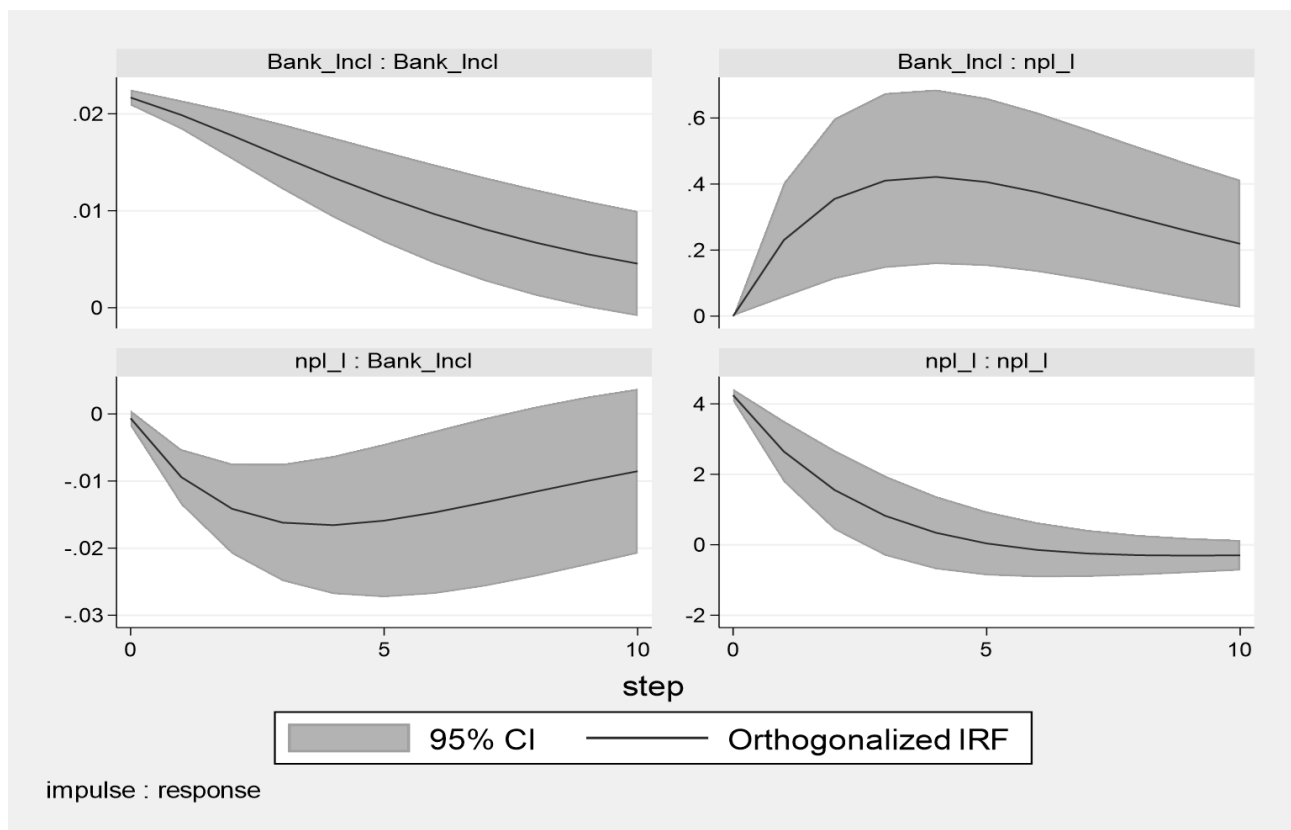


Fig .2. Impulse-Response Function Plots.

Forecast Error Variance Decomposition

To complement the analysis of impulse response functions, forecast error variance decomposition (FEVD) is performed by applying the Cholesky decomposition to the residual covariance matrix of the estimated VAR model. This procedure quantifies the contribution of shocks from each endogenous variable to the forecast error variance of the others. Consequently, FEVD facilitates the identification of variables exerting the most significant influence in explaining the fluctuations of a given variable over various time horizons.

Table 8 below presents the proportions of FEVDs for a 10-year forecast horizon. These results can be explained as follows:

Initially, variations in banking inclusion do not exert a significant effect on fluctuations in nonperforming loans during the first 2 years. It is only after 10 years that changes in banking inclusion explain up to 3.7% of the variance in nonperforming loans. Conversely, fluctuations in NPLL have a significant impact on

Bank_Incl, accounting for up to 46.33% of its variance over a 10-year horizon. The increase in credit risk thus motivates banks to restrict access to financial services and tighten lending criteria, thereby impeding banking inclusion.

After 10 years, 96.29% of the dynamics of nonperforming loans can be explained by their own past variations, indicating that their evolution is largely autonomous and does not result from banking inclusion dynamics. This persistence stems from the prolonged accumulation of doubtful loans, exacerbated by weak banking governance and an unstable macroeconomic environment. Furthermore, adverse market conditions (such as volatility in bond and equity markets) can increase vulnerabilities in bank loan portfolios. In certain contexts, banks' significant holdings of government securities (e.g., treasury bonds) may expose them to additional risks, such as interest rate or sovereign risk, which can indirectly affect the overall risk profile of their loan portfolios over time. Additionally, even when borrowers' financial conditions improve, the detrimental impact of unpaid loans may persist due to regulatory delays, conservative accounting standards, or prudential reporting requirements.

Table 8. Forecast-error variance decomposition

	Model: Bank_Incl/NPLL	
Response Variable and Forecast horizon	Impulse variable	
	NPLL (Credit_Risk)	Bank_Incl
NPLL (Credit_Risk)		
0	0	0
1	1	0
2	0.9978929	0.0021071
3	0.9935352	0.0064647
4	0.9878206	0.0121793
5	0.9817733	0.0182267
6	0.9761876	0.0238123
7	0.9714878	0.0285122
8	0.9677833	0.0322167
9	0.9649953	0.0350047
10	0.9629656	0.0370344
Bank_Incl		
0	0	0
1	0.0009018	0.9990982
2	0.0932523	0.9067477
3	0.1964035	0.8035966
4	0.2790259	0.7209742
5	0.3397382	0.6602618
6	0.3833016	0.6166984
7	0.4143766	0.5856233
8	0.436504	0.563496
9	0.452226	0.547774
10	0.4633545	0.5366454

CONCLUSION

This study investigates the dynamic interrelationship between banking inclusion and credit risk using a dataset of 112 banks across 28 developing countries from 2004 to 2020. To address endogeneity and capture the simultaneous interactions among variables, a panel vector autoregressive (PVAR) model estimated via the Generalized Method of Moments (GMM) is employed. Additionally, impulse response functions (IRFs) and

forecast error variance decompositions (FEVDs) are used to analyze temporal dynamics and quantify each variable's contribution to system-wide fluctuations. To the best of our knowledge, this methodological framework has not previously been applied in this context.

The empirical results indicate that an expansion in banking inclusion is associated with an increase in credit risk. This finding can be attributed to the extension of credit to financially vulnerable borrowers, often characterized by limited repayment capacity and a lack of formal credit histories. This dynamic unfolds in a broader macroeconomic context marked by recurrent shocks, monetary instability, and insufficient sectoral diversification. These factors collectively intensify credit risk and undermine the resilience of the banking system.

Regarding reverse causality, the results indicate that rising bank credit risk levels are associated with a decline in banking inclusion. Specifically, credit risk impedes inclusion by restricting access to financial services (particularly for vulnerable clients), increasing financing costs, and limiting both the acquisition of new customers and the development of innovative financial products. Although this adverse effect persists, its intensity gradually diminishes over time. Therefore, effective credit risk management is essential for banks to foster equitable and inclusive banking practices.

This paper represents the first empirical validation of the theoretical predictions by Claessens (2006), Rahman (2014), and Mehrotra & Yetman (2015). Contrary to the hypothesized virtuous cycle, our analysis reveals that increased inclusion heightens credit risk, which in turn constrains banking inclusion. However, the magnitude of this feedback effect attenuates over time.

In light of these findings, financial regulators are required to strike a careful balance between promoting banking inclusion and managing the associated risks. Particular emphasis should be placed on effective risk management strategies to optimize the benefits of financial intermediation. In this context, portfolio diversification across market segments and economic sectors plays a pivotal role in mitigating concentration risks and ensuring more equitable access to financing. Future research could extend the analysis by employing broader measures of financial inclusion that capture dimensions beyond those reflected in the banking-based indicators used in this study.

REFERENCES

1. Ahamed, M.M., & Mallick, S.K., 2019. Is financial inclusion good for bank stability? International evidence. *Journal of Economic Behavior & Organization*, Vol. 157, pp. 403-427.
2. Akins, B., Li, L., Ng, J., & Rusticus, T.O., 2016. Bank Competition and Financial Stability: Evidence from the Financial Crisis. *Journal of Financial and Quantitative Analysis*, Vol. 51 (1), pp. 1-28.
3. Anarfo, E.B., Abor, J.Y., & Osei, K.A., 2020. Financial regulation and financial inclusion in Sub-Saharan Africa: Does financial stability play a moderating role?. *Research in International Business and Finance*, Vol. 51, pp. 101070.
4. Andrews, D.W.K., & Lu, B., 2001. Consistent model and moment selection procedures for GMM estimation with application to dynamic panel data models. *Journal of Econometrics*, Vol. 101 (1), pp. 123-164.
5. Antwi, F., Kong, Y., & Gyimah, K.N., 2024. Financial inclusion, competition and financial stability: New evidence from developing economies. *Heliyon*, Vol. 10 (13).
6. Atellu, A.R., & Muriu, P., 2022. Does financial inclusion enhance financial stability? Evidence from a developing economy. *Transnational Corporations Review*, Vol. 14 (3).
7. Awdeh, A., Moussawi, C., ElMokdad, G., Roussel, J., 2025. Financial Inclusion and Bank Stability in the MENA Region, *Business & Economics*.
8. Barik, R., & Pradhan, K.A., 2021. Does financial inclusion affect financial stability: Evidence from BRICS nations?. *The Journal of Developing Areas*, Vol. 55.
9. Carletti, E., & Leonello, A., 2019. Credit market competition and liquidity crises. *Review of Finance*, Vol. 23 (5), pp. 855-892.

10. Chen, F.W., Feng, Y., & Wang, W., 2018. Impacts of Financial Inclusion on Non-Performing Loans of Commercial Banks: Evidence from China. *Sustainability*, Vol. 10 (9), pp. 3084.
11. Claessens, S., 2006. Access to Financial Services: A Review of the Issues and Public Policy Objectives. *The World Bank Research Observer*, Vol. 21 (2), pp. 207–40.
12. Creel, J., Hubert, P., & Labondance, F., 2015. Financial stability and economic performance. *Economic Modelling*, Vol. 48, pp. 25–40.
13. Cull, R., Demirgüç-Kunt, A., & Lyman, T., 2012. Financial Inclusion and Stability: What Does Research Show?. Washington D.C. CGAP.
14. Damane, M., Ho, S.Y., 2025. Effects of financial inclusion of small and medium-sized enterprises on financial stability: evidence from selected sub-Saharan African countries. *Journal of Innovation and Entrepreneurship*, Vol. 14 (81).
15. Damane, M., Ho, S.Y., 2026. Effects of financial inclusion on financial stability: evidence from SSA countries. *International Economics and Economic Policy*, Vol. 23 (25).
16. Demirgüç-Kunt, A., & Huizinga, H., 2010. Bank activity and funding strategies: The impact on risk and returns. *Journal of Financial Economics*, Vol. 98, pp. 626-650.
17. Demirgüç-Kunt, A., & Singer, D., 2017. Financial Inclusion and Inclusive Growth: A Review of Recent Empirical Evidence. *World Bank Policy Research Working Paper No. 8040*.
18. Dittus, P., & Klein, M., 2011. On Harnessing the Potential of Financial Inclusion: The Case of Mobile Payments. *BIS Working Papers*, No. 347.
19. Dray, S., & Josse, J., 2015. Principal component analysis with missing values: a comparative survey of methods. *Plant Ecology*, Vol. 216, pp. 657–667.
20. Elnahass, M., Iddouch, K., Rezki, S., Eloueldrhiri, S., 2026. Rewiring finance for inclusion: Digital and traditional mechanisms in African banking. *Emerging Markets Review*, Vol. 72.
21. Elsinger, H., Fessler, P., Feyrer, J., Richter, K., & Timel, A., 2018. Digitalization in financial services and household finance: fintech, financial literacy and financial stability. *Financial Stability Report*, Vol. 35, pp. 50-58.
22. Feghali, K., Mora, N., & Nassif, P., 2021. Financial inclusion, bank market structure, and financial stability: International evidence. *The Quarterly Review of Economics and Finance*, Vol. 80, pp. 236-257.
23. Hakimi, A., Saidi, H., & Adili, L., 2025. Does Financial Inclusion Affect Non-Performing Loans and Liquidity Risk in the MENA Region? A Comparative Analysis Between GCC and Non-GCC Countries. *Economies*, Vol. 13 (5).
24. Hannig, A., & Jansen, S., 2010. Financial inclusion and financial stability: Current policy issues. *Asian Development Bank Institute Working Paper Series*, No. 259.
25. Han, R., & Melecky, M., 2017. Broader use of saving products among people can make deposit funding of the banking system more resilient. *Journal of International Financial Markets, Institutions and Money*, Vol. 47, pp. 89-102.
26. Han, S., Qian, C., Adam, N.A., Karimov, N., Zhang, W., 2025. Understanding the relationship: Financial inclusion's influence on bank stability in emerging economies. *Energy Strategy Reviews*, Vol. 61.
27. Hartwig, J., 2010. Is health capital formation good for long-term economic growth? – Panel Granger-causality evidence for OECD countries. *Journal of Macroeconomics*, Vol. 32 (1), pp. 314–325.
28. Hasan, M.F., Flayyih, H.H., Hadi, M.R., & Omran, W.K., 2023. A Comprehensive Review of Financial Frictions: Causes, Consequences, and Policy Implications. *Ishtar Journal of Economics and Business Studies*, Vol. 4 (2), pp. 1–13.
29. Holtz-Eakin, D., Newey, W., & Rosen, H., 1988. Estimating vector autoregressions with panel data. *Econometrica*, Vol. 56 (6), pp. 1371–1395.
30. Hua, X., Bi, J., & Shi, H., 2023. The appropriate level of financial inclusion: The perspective of financial stability. *China Economic Quarterly International*, Vol. 3 (3), pp. 167-178.
31. Huang, R., & Ratnovski, L., 2011. The dark side of bank wholesale funding. *Journal of Financial Intermediation*, Vol. 20 (2), pp. 248-263.
32. Huynh, C.M., & Ho, T.X., 2020. Institutional quality, shadow economy and air pollution: empirical insights from developing countries. *The Empirical Economics Letters*, Vol. 19 (1), pp. 75-82.

33. Jeke, L., 2025. Financial Inclusion and Bank Stability in Selected SADC Countries. *International Journal of Economics and Financial Issues*, Vol. 15 (1), pp. 113-118.
34. José, M., & García, R., 2016. Can financial inclusion and financial stability go hand in hand? *Economic Issues*, Vol. 21 (2).
35. Khan, H.R., 2011. Financial Inclusion and Financial Stability: Are They Two Sides of the Same Coin?. Speech at Bancon.
36. Kim, D.W., Yu, J.S., & Hassan, M.K., 2018. Financial inclusion and economic growth in OIC countries. *Research in International Business and Finance*, Vol. 43, pp. 1-14.
37. Kirchler, M., Lindner, F., & Weitzel, U., 2018. Rankings and Risk-Taking in the Finance Industry. *The Journal of Finance*, Vol. 73 (5), pp. 2271-2302.
38. Lütkepohl, H., 2005. *New introduction to Multiple Time Series Analysis*. Springer, New York.
39. Malik, A.H., Bin-Md-Isa, A.H., Bin-Jais, M., Rehman, A.U., & Khan, M.A., 2021. Financial stability of Asian Nations: Governance quality and financial inclusion. *Borsa Istanbul Review*, Vol. 22 (2), pp. 377-387.
40. Mehrotra, A.N., & Yetman, J., 2015. Financial Inclusion - Issues for Central Banks. *BIS Quarterly Review*.
41. Mwakalila, E., & Muba, S., 2025. The role of financial inclusion in reducing income inequality and poverty in Africa: A macro-level analysis. *Scientific African*, Vol. 29, pp. 02811.
42. Osuma, G., 2025. The impact of financial inclusion on poverty reduction and economic growth in Sub-Saharan Africa: A comparative study of digital financial services. *Social Sciences & Humanities Open*, Vol. 11, pp. 101263.
43. Ozili, P.K., 2025. Bank non-performing loans research around the world. *Asian Journal of Economics and Banking*.
44. Pham, M.H., & Doan, T.L., 2020. The Impact of Financial Inclusion on Financial Stability in Asian Countries. *The Journal of Asian Finance, Economics and Business*, Vol. 7 (6), pp. 47-59.
45. Prasad, E.S., 2010. Financial sector regulation and reforms in emerging markets: An overview. *National Bureau of Economic Research*.
46. Rahman, A., 2014. The Mutually-Supportive Relationship Between Financial Inclusion and Financial Stability. *Alliance for Financial Inclusion*, Bangkok (1).
47. Rahman, M., Shah, S.F., Albaity, M., 2026. Financial inclusion and bank stability in ASEAN: A non-linear analysis of risk and opportunity. *Research in International Business and Finance*, Vol. 83.
48. Ruan, J., & Jiang, R., 2024. Does digital inclusive finance affect the credit risk of commercial banks?. *Finance Research Letters*, Vol. 62 (A), pp. 105153.
49. Sebai, M., & Talbi, O., 2024a. Exploring the Relationship Between Banking Development Facets and Economic Volatility: Evidence from Developing Nations. *European Journal of Business and Management Research*, Vol. 9 (5), pp. 94-101.
50. Sebai, M., & Talbi, O., 2024c. A dynamic panel threshold regression on financial inclusion-financial stability nexus: Evidence from developing countries. *Economics bulletin*, Vol. 44 (3), pp. 813-831.
51. Sebai, M., & Talbi, O., 2026. Does Greater Banking Inclusion Enhance or Undermine Banking Stability in Tunisia? Evidence from a Nonlinear Analysis. *Naše gospodarstvo/Our economy*, Vol. 72 (1), pp. 37-51.
52. Sebai, M., Talbi, O., & Mehri-Guerchi, H., 2024a. On the Banking Deepening and Economic Volatility Nexus in Emerging Countries: Evidence from a GMM Panel-VAR Approach. *International Journal of Research and Innovation in Social Science*, Vol. 8 (5), pp. 430-442.
53. Sebai, M., Talbi, O., & Guerchi-Mehri, H., 2025. Optimal financial inclusion for financial stability: Empirical insight from developing countries. *Finance Research Letters*, Vol. 71, pp. 106467.
54. Sims, C.A., 1980. Macroeconomics and reality. *Econometrica*, Vol. 48 (1), pp. 1-48.
55. Talbi, O., & Sebai, M., 2025a. Exploring the relationship between financial inclusion and financial stability in BRICS countries: A panel smooth transition regression analysis. *Development and Sustainability in Economics and Finance*, Vol. 6, pp. 100042.
56. Talbi, O., & Sebai, M., 2025b. The optimal level of banking inclusion: Empirical insights on banking efficiency in developing countries. *Development and Sustainability in Economics and Finance*, Vol. 8, pp. 100097.

57. Talbi, O., & Sebai, M., 2026. Does banking inclusion enhance banking performance in developing countries? A dynamic panel threshold regression analysis. *World Development Perspectives*, Vol. 43, pp. 100810.
58. Zouaoui, H., & Zoghalmi, F. (2020). On the income diversification and bank market power nexus in the MENA countries: Evidence from a GMM panel-VAR approach. *Research in International Business and Finance*, Vol. 52, p.101186.

Conflict of interest statement:

The corresponding author states that there is no conflict of interest.

Appendix

Appendix A. List of Banks

1.ABSA BANK - 2.ABSA GROUP LTD Sth - 3.AKBANK TAS - 4.AL AHLI BANK - 5.AL RAJHI BANK - 6.ALLIED BANK LTD - 7.ARAB NATIONAL BANK - 8.ASKARI BANK LIMITED - 9.ATTICA BANK SA -10.AXIS BANK - 11.BAJ - 12.BANCO BBVA PERU - 13.BANCO DA AMAZONIA SA - 14.BANCO DE CHILE - 15.BANCO DE CREDITO -16.BANCO DO NORDE - 17.BANCO MACRO -18.BANCO PAN SA -19.BANCO PINE SA- 20.BANCO SANTANDER - 21.BANCO SANTANDER MEX -22.BANGKOK BANK LIMITED -23.BANK ALFALAH LTD - 24.BANK DANAMON INDO -25.BANK HANDLOWY -26.BANK MAYBANK -27.BANK MILLENNIUM SA- 28.BANK NEGARA -29.BANK OF AYUDHYA PCL -30.BANK OF BAGHDAD PJSC - 31.BANK OF BARODA -32.BANK OF CHINA LTD -33.BANK OF COMMN -34.BANK OF GREECE -35.BANK OF INDIA LTD -36.BANK OF MAHARASHTRA -37.BANK PAN INDONESIA - 38.BANK PEKAO -39.BANK QNB -40.BANK RAKYAT INDO -41.BANK RAYA -42.BANK URALSIB -43.BANK VTB PAO -44.BANQUE SAUDI FRANSI -45.BDO UNIBANK -46.BURGAN BANK KPSC - 47.CANARA BANK -48.CENTRAL BANK -49.CHINA CONSN -50.CHINA MINSHENG BANK - 51.CHINA ZHESHAN -52.CIMB GROUP HOLDIN -53.CIMB THAI BANK PCL -54.CITIC BANK - 55.COMMERCIAL BANK -56.COMMERCIAL INTL BANK -57.CREDITO E INVERSION - 58.DIAMOND TRUST BANK -59.EUROBANK ERGASIAS -60.GULF BANK -61.HABIB BANK LTD - 62.HDFC BANK LIMITED -63.HONG LEONG BANK BHD -64.HONG LEONG FIN -65.ICICI BANK LIMITED -66.ING BANK SLASKI SA- 67.ITAU CORPBANCA -68.ITAU UNIBANCO - 69.KASIKORNBANK PLC -70.KCB GROUP PLC -71.KIATNAKIN BANK -72.KOMERCNI BANKA, A.S -73.KOTAK MAHINDRA BANK -74.KRUNG THAI BANK PCL -75.KUWAIT INTER - 76.MALAYAN BANKING BHD -77.MCB BANK LTD -78.METROPOLITAN BANK -79.NATIONAL BANK -80.NATL BANK OF GREECE -81.OTP BANK NYRT -82.PHILIPPINE NAT'L BK - 83.PHILIPPINE SAVINGS -84.PHILTRUST BANK -85.PUBLIC BANK BHD -86.RAIFFAIZEN - 87.RHB BANK BHD- 88.ROSBANK PAO -89.SANTANDER BANK Poland -90.SAUDI BRITISH BANK -91.SBERBANK ROSSII -92.SCOTIABANK PERU -93.SCOTIABANK CHILE -94.SECURITY BANK -95.SEKERBANK TURKEY -96.SONERI BANK LTD PAKISTAN -97.STANBIC HOLDINGS KENYA -98.STANDARD CHARTERED KENYA -99.STATE BANK OF INDIA -100.THANACHART CAPITAL -101.TISCO FINANCIAL -102.TMB BANK PCL -103.TURKIYE GARANTI BANK - 104.TURKIYE HALK BANKASI -105.TURKIYE IS BANKASI -106.TURKIYE VAKIFLAR - 107.UNION BANK PHILIPPINES -108.UNION BANK OF INDIA -109.UNITED ARAB BANK EMIRATES -110.UNITED BANK LIMITED PAKISTAN -111.UNION BANK OF TUNISIA - 112.ZAGREBACKA BANKA

Source : Datastream (2020)