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DO FINANCIAL INCLUSION AND BANK COMPETITION MATTER FOR BANKS' STABILITY IN ASIA?

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Abstract. This study investigates the effect of financial inclusion (FI), considering micro and macro indicators as well as micro- and macro-FI separately, on the stability of Asian banks and examines the moderating effect of bank competition (BC) on this relationship. Using data from 2011 to 2021, this study examines the relationship between FI, BC, and bank stability (BS). The hypotheses were tested using a "two-step system-GMM framework". The findings were also authenticated using the panel OLS approach. The results indicate that FI (considering micro- and macro-indicators) and micro- and macro-FI have significant positive effects on the stability of Asian banks. However, the impact of micro-FI is greater than that of macro-FI on the BS in Asia. Furthermore, the results manifest that BC has a significant positive impact on BS and positively moderates the relationship between micro-FI and BS, whereas it negatively moderates the relationship between macro-FI and BS. The findings of this study have practical implications for regulators, bankers, and policymakers involved in formulating strategies to enhance Asian banks' stability.

1. Introduction

After the recent "Global Financial Crisis" (GFC), financial inclusion (FI), which ensures that all economic agents have access to and are proficient users of formal financial services (FS), has become a top priority for public policy worldwide. For example, in the wake of the GFC, G20 policymakers acknowledged that the policy objectives of FI, stability, performance, and risk all reinforce one another. Governments have prioritized providing universal banking services to make FI a reality since policymakers have highlighted FI as a major global development impediment (Demirgüç-Kunt et al., 2015). Therefore, in conjunction with multilateral organizations such as the "International Monetary Fund" (IMF), G20, the Alliance for FI, the Consultative Group of Assists the Poor (CGAP), and central banks in emerging and advanced countries have taken numerous steps to advance the inclusive banking agenda. Moreover, developing economies of Asian regions are also keen to enhance the financially inclusive banking system. The GDP growth rate of Asian economies was 200 percent as compared to

industrialized countries in the period 1970–2016 (Nayyar, 2019). The Asian region contributes 37 percent of global banking profit and will also contribute to the global GDP by 50 percent by 2040 (Tonby & Woetzel, 2020). Moreover, due to phenomenal economic growth in the Asian region, FI has attracted the attention of researchers, practitioners, government, policymakers, and academics, as it is among the most effective tools for addressing poverty and income inequality, particularly between the poor and rich.

Recent research has indicated that increased accessibility to FS offers significant ecological and economic benefits. Simultaneously, the invention of financial products has increased competition among banks. Greater competition may be beneficial in terms of quality services and can push banks to take excessive risks for the lust of higher profits. In recent decades, scholars have investigated the different aspects of FI and bank competition. For instance, Ha and Nguyen (2023), Vo et al. (2021), Alvi et al. (2020), Neaime and Gaysset (2018) concluded a positive relationship between FI, stability, income inequality, and poverty by increasing their revenues, reducing their costs, and expanding their market shares in the presence of FI. Conversely, Barik and Pradhan (2021) found a negative relationship between FI and BS due to the probability of default and non-performing loans. Furthermore, Ozili (2018) highlighted the collaboration between digital finance and stability; Marín and Schwabe (2019) uncovered a positive connection between competition and FI. Chinoda and Kwenda (2019), Owen and Pereira (2018), and Saha and Dutta (2020) investigated the relationship between competition, FI, and financial stability. Furthermore, Albaity et al. (2019), Doumpos et al. (2017), Alqahtani and Mayes (2018), and Jungo et al. (2022) concluded that the competition-fragility view holds true, whereas Tan and Anchor (2017), and Carlson et al. (2022) argued that competition enhances the stability of banking institutions.

The existing literature on the relationship between FI and BS is still controversial and requires further investigation. Moreover, there is a lack of research on how BC influences the relationship between FI and BS under the conditions of the current economic environment. The primary objective of this study is to address this gap in the literature by investigating the role of FI in Asian banks stability and the moderating role of BV using a sample of Asian banks. Thus, this study aims to address to questions such as: How does micro-and macro-FI influence BS under the current volatile economic conditions? How does BC impact the stability of Asian banks? How does BC moderate the relationship between FI and BS under the current volatile Asian economic conditions? Finally, this study seeks to determine whether the moderating role of BC varies across micro- and macro-level FI?

This study used data from 2011 to 2021 to examine the relationship between micro- and macro-FI, bank competition, and BS. The hypotheses were tested using a two-step system-GMM framework. The results were also authenticated using the panel OLS technique. The findings show that both micro-and macro-FI have significant positive effects on the stability of Asian banks. However, the impact of micro-FI is greater than that of macro-FI on the stability of banks in Asia. Furthermore, the results reveal that BC has a significant positive impact on BS and positively moderates the relationship between micro-FI and BS, whereas it negatively moderates the relationship between macro-FI and BS.

This study contributes to the existing body of knowledge in four ways. First, it extends the knowledge of FI and BS relationships by elaborating on how micro- and macro- FI influence

the stability of banks in Asia. To the best of the author's knowledge, FI (considering micro and macro indicators), as well as micro-and macro-FI separately have never been systematically tested with BS, nor have their predictive power been examined in the Asian context. It is probably one of the pioneering efforts in the Asian region concerning the interplay of micro-and macro-FI and BS. Therefore, this study not only fills a critical gap in the existing literature but also makes a valuable theoretical contribution to the understanding of micro-and macro-FI and BS in the Asian. The major differences between micro-and macro-FI can be understood as follows. Micro-FI factors, such as the number of ATMs, branches, deposit accounts, and borrowers' accounts, are closely associated with the organization and are under the control of banks (Alvi et al., 2020). Conversely, macro-FI factors, such as private credit to GDP% and insurance premium to GDP%, influence the overall performance of banks and are beyond the control of individual institutions (Alvi et al., 2020). Furthermore, micro-FI factors can influence a specific part of the bank. On the other hand, macro-FI factors can influence the entire banking sector. Micro factors are under the control of banks, whereas it is impossible for banks to control macro factors. Additionally, micro-FI factors demonstrate the strengths and weaknesses of banks individually, while macro-FI factors demonstrate the external opportunities and threats associated with banking institutions.

Second, this study enriches the existing body of literature by examining the impact of BC on the stability of financial institutions, specifically within the contemporary Asian economic landscape. Third, this study reveals that micro-and macro-FI directly and indirectly influence the stability of banks in Asia through the moderating role of bank competition. This study provides an explanation of how and why BC can either fortify or weaken the connection between micro- and macro-FI and the stability of banks in Asia. The current research contributes to the literature by defining micro- and macro-FI as antecedents and BC as a moderating variable for the stability of banks in Asia. These results contribute to the existing body of knowledge by inferring that FI, in conjunction with integrating bank competition, helps enhance Asian banks stability. Notably, this study is pioneering in its investigation of the moderating role of BC in the nexus between micro and macro-FI and BS within the specific context of Asia. Fourth, our study contributes to the literature from a methodological perspective. For instance, we have reported the pre-diagnostics checks for the use of a GMM procedure, which often remains missing in previous studies, and we have also provided post-diagnostics checks for the validity of the empirical results. Finally, our study findings contribute to formulating appropriate guidelines for Asian banks on how to optimize micro- and macro- FI in highly competitive environments. We conclude that FI, BC and BS are indeed complementary for the well-being of society (Ahamed & Mallick, 2019).

2. Literature review and hypotheses development

2.1. Theoretical framework of the study

The theory of financial intermediation elaborates the role of banks as an intermediary for narrowing the gap between borrowers and lenders and to resolve incentive problems by reducing monitoring cost (Demirgüç-Kunt & Klapper, 2012; Diamond, 1984; Diamond & Dybvig, 1983; Honohan, 2008; Ndebbio, 2004). As intermediary banks facilitate customers by

providing them with basic FS, they minimize their costs by diversifying funds and utilizing their funds to earn a superior return. Ndebbio (2004) postulated that the theory of financial intermediation also elaborates the role of "commercial banks" in connecting customers with surplus spending and customers with deficit spending in the financial markets. Furthermore, Diamond (1984) highlighted the role of commercial banks in monitoring representatives of borrowers' behavior through effective measures. Roengpitya et al. (2014) state that banks perform different intermediation activities by selecting a mix of assets and funding structures that lead to achieving business goals.

The theory of finance-growth advocates that a sound financial system provides a foundation to establish a productive and conducive environment for economic growth and development (Bagehot & Street, 1915; Demirguc-Kunt & Levine, 2008; Goldsmith, 1969; McKinnon, 1973; Serrao et al., 2012; Sparatt & Stephen, 2013). It also shows that when the majority of the population is not capable of accessing inexpensive financial products, income inequality and imbalances persist. Consequently, it decelerates the speed of growth and development of the economic system. However, the proper functioning of banks can reduce these imperfections by promoting credit liquidity, efficiency, and the smooth flow of financial resources from traditional sectors to modern growth sectors. Demirgüç-Kunt and Levine (2008) hypothesized that a country's economic development and growth depend on the accessibility of FS. Accordingly, they posit that the policymakers of the countries should develop policies related to the financial sectors on a priority basis, which favors the inclusiveness of the financial system and helps financial development and inclusive growth simultaneously. Sparatt and Stephen (2013) highlight the impact of FI and financial sector stability on economic growth. As a result of promoting competent entrepreneurs, economic growth and development are also enhanced. This theory helps to understand the linkage between the independent variable of the study FI and the dependent variable banks stability based on inclusiveness, financial sectors, and economic growth.

Furthermore, the theory of asymmetric information demonstrates that one investor possesses more information than another investor in the financial market. Although it is a challenging task to distinguish between good and bad borrowers, a lender with more information than other lenders can be in a better position to make a lending decision (Akerlof, 1978; Bofondi & Gobbi, 2003). This theory further adds that in the making of a financial contract, a person with more information about a particular product could negotiate the terms of the contract in a better way than their counterpart. Consequently, investors with less information about the transaction or contract are deprived of the benefits associated with that particular contract. Bofondi and Gobbi (2003) argued that the problems of moral hazard and adverse selection arise due to information asymmetry among borrowers and lenders, resulting in the reduction of credit, which can contribute to financial instability. These moral hazard problems increase the ratio of non-performing loans (NPL) when borrowers provide misleading information to lenders associated with transactions or contracts.

The traditional view of competition fragility proposed by Keeley (1990) demonstrates that competition between banks in the banking industry deteriorates stability by impeding banks "solvency at the individual level. According to this model, the franchise value and profit margin of credit lending institutions are eroded if the level of competition among them is higher.

Consequently, more competition among banks and credit lending institutions induces them to adopt such strategies, which are highly risky, so that they can compensate shareholders" profit margins. However, due to the adoption of high-risk strategies, credit risk exposure increases, which ultimately increases the probability of bankruptcy in a competitive market. Y.-S. Chan et al. (1986) created a link between franchise value and competition by explaining that the increased level of competition in the market curtails the margin of profit of the banks consequential of information reusability. According to them, the motivation of the banks behind the appraisal of credit proposals is to build a quality credit portfolio that depends on the surplus of identifying borrowers with high quality by using reusable information in the loan market. However, the surplus of recognizing borrowers with high-quality profiles is eroded because of more competition in the banking market. Consequently, deterioration in the surplus demotivates banks from apprising their borrowers, which intensifies the credit risk and probability of bankruptcy and decreases the quality of the credit portfolio.

An advocate of the traditional competition-fragility view considers that larger banks are more dominant than small banks in a less competitive environment, as they can build more diversified portfolios and gain more benefits with economies of scale (Diamond & Dybvig, 1983). Likewise, it is more convenient for a few larger banks to supervise and monitor in a less competitive market (Allen & Gale, 2000). Furthermore, Boot and Thakor (2000) argue that larger banks gain a competitive advantage in credit rating and provisioning of credit compared to smaller banks in a less competitive environment. On the other hand, the competition-stability view creates a monopoly due to less competition and less risk exposure in the competitive market. Both views are supported by the empirical and theoretical literature. The competition stability view is contrary to the traditional competition fragility view, which claims that an increased level of competition intensifies the probability of default and non-performing loans as banks and credit lending institutions take excessive risk to compensate their franchise value and profit margin. On the other hand, the competition-stability view postulates that more competition in the industry fosters BS by restricting banks from taking excessive risk. This theory further demonstrates that, in a less competitive environment, banks set high interest rates due to their monopoly, which raises moral hazard and increases the probability of borrowers' default risk. In the literature, advocates of competition stability and competition fragility propound different models to support their arguments.

2.2. Hypotheses development

2.2.1. Financial inclusion and bank stability

The relationship between FI and the BS is an emerging phenomenon; however, the findings are inconclusive. Micro-and macro-FI have distinct effects on BS, both potentially positive and negative. Micro-FI factors, such as the number of ATMs, branches, deposit accounts, and borrower accounts, can positively impact BS. A greater number of accessible ATMs and branches can enhance a bank's reach and customer convenience, potentially increasing its stability by attracting more deposits and borrowers (Alvi et al., 2020; Ofoeda et al., 2024). However, an excessive focus on expansion without proper risk management can lead to overextension, potentially destabilizing the bank. Conversely, macro-FI factors such as private credit as a

percentage of GDP and insurance premiums as a percentage of GDP can also influence BS. Higher private credit levels relative to GDP may signify a more robust and active financial sector, which can be positive for BS as it indicates economic growth and demand for FS. Conversely, excessive private credit growth can lead to credit risk and increase the likelihood of non-performing loans, negatively affecting BS. Regarding insurance premiums, a higher percentage of GDP allocated to insurance can provide a safety net for banks in the face of unforeseen events, thereby contributing positively to their stability. However, inordinate reliance on insurance as a risk-mitigation strategy may lead to complacency in risk-management practices, potentially having a negative impact (Barik & Pradhan, 2021).

Vo et al. (2021) studied the association between FI and the BS by considering bank-level data of 3071 banks over the period from 2008 to 2017. Using the GMM framework, their research illustrated that FI has a significant positive influence on BS. In underdeveloped economies such as Zimbabwe, Sakarombe (2018) employed the System GMM technique using data from 2009 to 2017 and postulated that FI increases BS (Hakimi et al., 2022; Nguyen & Du, 2022). Atellu and Muriu (2022) examine the impact of FI on financial stability in Kenya. The results demonstrate that FI has a positive impact on financial stability. Neaime and Gaysset (2018) examined the influence of FI on poverty, financial stability, and income inequality by taking a large sample of eight countries covering the period 2002–2015 in the MENA region. The empirical analysis showed a positive relationship between FI and financial stability in the MENA region. Furthermore, Alvi et al. (2020) also inspected the linkage between FI and BS in four South Asian economies from 2008 to 2018. The empirical evidence reveals a positive link between FI and BS. Danisman and Tarazi (2020) study the link between FI and BS in the European banking industry. The outcomes of their study demonstrated the stabilizing effect of advanced FI through more digital payments and account ownership in the banking industry of the European Union. Morgan and Pontines (2018) inspected the influence of FI on the financial stability of small and medium enterprises (SMEs) by using panel data over the period of 2005–2011. Their findings revealed a positive link between FI and the financial stability of SMEs. Banna and Alam (2021) inspected the association among digital FI and the stability of the banks and its implications for the time after COVID-19 in the context of the Association of Southeast Asian Nations (ASEAN). The sample of the study consists of an unbalanced panel dataset of 213 banks in four Asian countries (Indonesia, Malaysia, Thailand, and the Philippines) over the period 2011–2019. Empirical evidence suggests a positive impact of digital FI on the stability of banking institutions. Furthermore, Chinoda and Kapingura (2023) found a significant positive relationship between digital FI and BS. Na'im et al. (2021) examined the affiliation between FI and stability of the financial system using panel data of four Asian countries over the period to 2005–2016. They claim that FI encourages financial stability.

In contrast, Barik and Pradhan (2021) explored the association between FI and the stability of banking institutions by taking data from 2005 to 2015 in BRICS countries (India, China, Russia, South Africa and Brazil). By employing the GMM methodology, they demonstrated that FI has a negative and significant influence on the stability of banking institutions, indicating that an increased level of FI deteriorates BS. Kouki et al. (2020) studied the nexus between FI, competition, and stability of banks through a sample of 266 banks of 38 African economies for the period from 2005–2015. They used a GMM estimator procedure and found an

inverse relationship between FI and banking institution stability. Ahmad (2018) studied the nexus between FI and financial stability using a dataset for the years 2011, 2014, and 2017 in the context of the Nigerian financial system. Phan and Doan (2020) studied the association between FI and financial stability of banks using country-level and bank-level data of 42 countries from 2011, 2014, and 2017 in the context of the Asian region. Empirical evidence suggests that FI is not a significant driver of financial stability. Chen et al. (2018) studied the linkage among FI and NPLs by using regional data of China. The panel dataset comprises 31 provinces in China for the time period 2005–2016. Empirical evidence from this study suggests a negative relationship between FI and the ratio of NPLs. They further added that a more inclusive financial system for Chinese financial institutions could be helpful for the reduction of non-performing loans.

Ha_1: *FI (considering both micro and macro indicators) has a statistically significant positive effect on the stability of banking institutions in Asia under current volatile economic conditions.*

Ha_2: *Macro-FI has a statistically significant positive effect on the stability of banking institutions in the Asian region under current volatile economic conditions.*

Ha_3: *Micro-FI has a statistically significant positive effect on the stability of banking institutions in the Asian region under current volatile economic conditions.*

2.2.2. Bank competition and bank stability

BC has a significant impact on BS, both in positive and negative ways. Competition in the banking sector can enhance BS by promoting greater efficiency, innovation, and risk-management practices. Banks facing competition are motivated to improve their services and reduce operational costs to attract and retain customers. This competition can lead to the adoption of advanced technology and improved customer service, thus benefiting both banks and their clients (Fiordelisi & Mare, 2014). Moreover, competitive pressures can encourage banks to strengthen risk management as they strive to maintain a favorable credit rating and secure the trust of depositors. Furthermore, a diverse and competitive banking environment can also reduce the likelihood of systemic risk because a highly concentrated banking sector can exacerbate the impact of a single bank's failure on the entire financial system (Mohd Noor et al., 2020).

However, there are also negative aspects of BC that can potentially undermine stability. Fierce competition may lead some banks to take excessive risks to achieve higher returns, which can result in higher volatility and the potential for financial distress (Minh et al., 2020). This risk-taking behavior can create a "race to the bottom" in terms of lending standards, and may lead to the accumulation of non-performing loans, threatening the overall health of the banking system. Moreover, excessive competition can exert downward pressure on interest rates and profit margins, reducing banks' profitability and, in some cases, their ability to build sufficient capital barriers for challenging times. This may reduce financial stability (Mishkin, 1999).

H_2: *BC has a significant influence on the stability of banking institutions in the current volatile economic conditions of Asia.*

2.2.3. Moderating role of bank competition

BC plays a key role in moderating the relationship between FI and BS because of its impact on the banking sector's overall functioning. FI refers to the accessibility and affordability of FS for all segments of society, especially those traditionally excluded from the formal banking system (Ozili, 2021). BS, on the other hand, relates to a bank's ability to absorb and manage financial shocks and maintain the trust and confidence of depositors (Nier, 2005). The level of competition within the banking industry influences the relationship between FI and BS. Increased competition among banks can enhance the relationship between FI and BS by motivating them to innovate and diversify their services to cater to a more extensive customer base, including previously excluded individuals and businesses. This diversification can lead to improved risk management and a more efficient allocation of resources, which enhances BS (Owen & Pereira, 2018). Moreover, competition can result in lower costs for consumers, making FS more affordable and accessible and further promoting FI (Marín & Schwabe, 2019), which ultimately has a positive impact on BS. Pham et al. (2019) asserted that when banks engage in competition to attract customers, they often introduce new products and services, leading to greater FI by reaching previously underserved populations. This, in turn, can improve the overall stability of the banking system, as a more inclusive system diversifies risk and can be more resilient to economic shocks.

Some researchers disagree that BC positively moderates the relationship between FI and BS. For example, according to Dako et al. (2021), excessive competition in the banking industry can result in a race to the bottom where banks may relax risk management practices and engage in aggressive lending to capture market share. This can lead to increased financial instability, as banks take on more risk to outcompete their rivals. Moreover, intense competition can put downward pressure on interest rates and profit margins, weakening banks' ability to build capital buffers and absorb unexpected shocks, which is essential for overall stability. Musau et al. (2018) examined the association between FI, banks' competitiveness, and credit risk in Kenya by collecting data for 43 banks over the period from 2007 to 2015. The findings confirm that BC partially mediates the relationship between FI and the credit risk of commercial banks. BC can moderate the relationship between FI and BS by influencing the trade-off between opportunities and challenges. While increased competition can drive FI and improve stability through diversification, cost reduction, and innovation, it can also introduce risks if not managed carefully. Striking the right balance between fostering FI and maintaining the stability of the banking sector requires effective regulatory oversight and prudent risk management.

Hb$_3$: *BC moderates the relationship between FI (considering both micro and macro indicators) and the stability of banking institutions in the Asian region under current volatile economic conditions.*

Hb$_4$: *BC moderates the relationship between macro-FI and the stability of banking institutions in the Asian region under current volatile economic conditions.*

Hb$_5$: *BC moderates the relationship between micro-FI and the stability of banking institutions in the Asian region under current volatile economic conditions.*

3. Methodology

3.1. Sampling and data collection

This study explores the influence of FI, encompassing both the micro-and-macro levels, on BS with the moderating role of BC in the Asian region using data from 2011 to 2021. Different types of banking institutions are available in the Asian region, such as commercial, cooperative, saving, investment, agriculture, and industrial banks. We studied commercial banks for the following reasons: The strength of commercial banks is greater than that of all other categories of banks in Asia. The share of commercial banks is greater in banking businesses than in their Asian counterparts. Commercial banks are involved in international transactions for imports, exports, and remittances, which is only possible due to the stable and robust financial system. Commercial banks are more likely to adopt both macro- and micro-FI when they are part of the global economy. This strengthens competition between banks. Our bank selection criteria include the following: i) a bank should remain active throughout the study period; ii) a bank must have more than 300 million assets at the closing date of the study period; and iii) a bank must have desired proxy information throughout the study period. Finally, we collected data for 406 commercial banks across the 12 Asian emerging economies from Bank Focus and the financial statements of banks at an individual level. The data for FI was retrieved from the World Bank. Details of the measurements of the variables are provided in Table 1.

Table 1. Measurement of variables

Variable name	Definition/Calculation
Bank Z-Score (DV)	(RoA+Kit)/SD(RoA)
Financial Inclusion (Micro and Macro) (IV)	Sarma Methodology (2008)
Bank Competition (CR Ratio) Moderator	Calculated on the basis of total deposits of N largest banks in the country
Bank Competition (HHI) Moderator	Calculated on the basis of total deposits of N largest banks in the country
Bank Size (CV)	Log of total Assets
Loan-assets ratio (CV)	Total loans/Total assets
Loan loss provision ratio (CV)	Loan loss provision/total assets (%)
Net interest margin (CV)	Net interest revenue of banks as a share of interest-bearing assets (%)
Operational revenue (CV)	Operational revenues of the banks
Management quality (CV)	Ratio between total earning assets to total assets (%)
Income diversification (CV)	Ratio between non-interest income and total operational income
Capitalization (CV)	Equity ratio of banks
Credit-deposit ratio (CV)	Ratio of credit to deposit of the banks (%)
Deposit-share ratio (CV)	Ratio of deposits to total assets (%)
GDP per Capita (CV)	GDP per capita (%)

End of Table 1

Variable name	Definition/Calculation
GDP growth (CV)	GDP growth (%)
Inflation (CV)	GDP deflator rate of growth (%)
No of ATMs	Number of ATMs per 100,000 adults of population
No of Branches	Number of Bank branches per 100,000 adults of population
No of Deposit Account	Number of deposit accounts per 100,000 adults of population
No of Borrowers Account	Number of borrowers account per 100,000 adults of population
Private Credit to GDP (%)	Total amount of credit to the private sector as a percentage of GDP
Insurance Premium to GDP (%)	Total life and non-life insurance as a percentage of GDP

3.2. Measurement of variables

3.2.1. Dependent variable

The investigators used BS as an endogenous variable. As per existing literature, the "Z-score" is recognized as the most frequently used proxy for the estimation of BS. "Z-score" is an individual measure of bank-level risk and is used to estimate the inverse probability of default. Higher Z-score values exhibit a lower probability of defaults and, subsequently, indicate more stability of banking institutions. Roy (1952) provides theoretical foundation for the construction of Z-score to use as BS measure. He argued that the Z-score captures the distance between financial institutions and insolvency when losses exceed equity (profit > equity). Furthermore, there is a direct link between chances of default and probability (E/A < ROA). where equity is represented by E, Assets are symbolized by A, and return on assets is denoted by ROA. The soundness of each bank is described by the Z-score, as it comprises three vital bank constituents. The first component is called "return on assets (ROA), which is an indicator of profitability"; the second component is "the standard deviation of return on assets which shows risk components"; and the third component ratio of equity assets reflects leverage or equity multiplier. The following formula was used to calculate the z-score:

$$\text{Z-score} = \frac{(ROA) + K_{it}}{\delta(ROA)}. \tag{1}$$

ROA represents return on average assets of bank at time *t*, whereas, $k_{it} = \dfrac{e_{it}}{a_{it}}$ symbolizes the ratio of equity-assets of "*i*" bank at time "*t*". Lastly, σ(*ROA*) denotes the standard deviation of the return on average assets (Ahamed & Mallick, 2019; Alvi et al., 2020). For the sake of data normality, this study used the natural logarithm of the Z-score (Danisman & Tarazi, 2020; Laeven & Levine, 2009). Thus, the Z-score is an appropriate measure for the determination of the distance between solvency and insolvency of banks, and it also highlights the probability of default. A greater distance between solvency and insolvency leads to a more stabilized banking system and reduces the chances of defaults. On the contrary, a smaller distance between solvency and insolvency of the banks indicates an unstable banking system as well as a greater chance of default.

3.2.2. Independent variables

The investigators used micro- and macro-FI as predictor variables. The authors construct three indices for FI based on micro and macro indicators. First, the FI index was calculated by considering both micro and macro indicators. In the second part, both the micro-FI and macro-FI indexes are separately calculated using micro and macro indicators of FI (Ali & Khan, 2020). Furthermore, only one indicator of FI has been used as a proxy in previous studies. However, Sarma and Pais (2011) highlight the usefulness of considering all possible indicators of FI for a more inclusive index. Therefore, this study used six indicators of FI (both micro and macro) for the calculation of the index, which are as follow: (1) Bank-Branches, (2) ATMs, (3) number of borrowers per 100,000 adults of the population, (4) number of deposit accounts per 100,000 adults of the population, (5) insurance premium to the percentage of GDP and (6) private credit to GDP% ratio (Alvi et al., 2020; Kim et al., 2018). The micro-FI index is computed by considering the first four indicators, whereas the macro FI index is calculated by considering the last two indicators following a prior study (Ali & Khan, 2020).

The calculation of the FI index was based on two steps. In the first step, the yearly indicator index of each indicator of FI was constructed using data from 2011 to 2021. The formula for calculating the annual individual indicator index for each indicator is as follows:

$$I_i = \frac{A_i - \text{Min}_i}{\text{Max}_i - \text{Min}_i}, \tag{2}$$

where I_i reflects the indicator index of each indicator, Ai represents the indicator's original value, minimum value of indicator "i" is denoted by Mini and maximum value of the indicator "i" is denoted by Maxi. In the second step, the FI index is computed using data (I_i) of all the indicators over the period from 2021 to 2021 using the following formula:

$$FI = 1 - \frac{\sqrt{(1-D_1)^2 + (1-D_2)^2 + \ldots + (1-D_n)^n}}{\sqrt{n}}, \tag{3}$$

where the names of each indicator of FI is denoted by D_1, D_2 and D_n respectively. The values of the FI index lie between 0 to 1. Where 0 is the indication of minimum FI whereas 1 is the indication of maximum indication (Francis et al., 2022; Alvi et al., 2020; Al-Smadi, 2018; Dienillah et al., 2006).

3.2.3. Moderating variable

The authors use BC as a moderating variable. Based on the literature on traditional industrial organization (IO), the structural measures of BC comprise concentration ratios (CRn) and the Hirschman Herfindahl Index (HHI) (Ijtsma et al., 2017). Advocates of structural measures demonstrate that market structure is the driving force of competition. Lower values of structure measures reflect lower market power and indicate a high level of competition in the industry. Furthermore, Concentration ratios (CRn) and the Hirschman Herfindahl Index were calculated based on total assets, total deposits, and total loans. Detailed information about both indicators is as follows:

(a) Concentration Ratios (CRn)

The structure–conduct–performance and oligopoly theories of Bain (1951) provide foundations for the development of the traditional-industrial organizational approach. In the context of bank competition, the market structure and market power of banking institutions are traditionally measured using the concentration ratio (CRn). The concentration ratio measures banks' market power in financial markets and is based on total assets, total deposits, and total loans. Furthermore, concentration ratio 3 (CR3) and concentration ratio 5 (CR5) were calculated based on data availability. In addition, this research has computed CR3 and CR5 by following the prior studies (Alvi et al., 2020; Khan et al., 2017).

(b) Hirschman-Herfindahl Index (HHI)

HHI also measures the competitiveness of the banking institutions in the banking markets. The computation of the HHI is based on total assets, deposits, and loans. We compute HHI by taking the sum of the squares of each bank's market share in the banking market. Furthermore, this study used the following formula to compute the HHI, following previous studies (Alvi et al., 2020; Bikker & Haaf, 2002; Khan et al., 2017).

$$\text{HHI} = \sum_{i=1}^{n} MS_i^2, \tag{4}$$

where, Hirschman-Herfindahl Index is represented by HHI, MS_i reflects the market shares of bank "i" in the financial market. Moreover, HHI index includes all banks in the financial markets for the calculation of the index.

3.3. Econometric model

This segment contains details of the panel data econometric model used to explore the influence of FI (macro and micro) on BS in the presence of competition in the Asian region. We used a dynamic panel data approach to test our hypotheses for the following reasons. First, we regress panel OLS to explore the impact of FI on BS in the presence of BC in Asia. The static model contains the following mathematical expressions.

$$BANKSTAB_{i,j,t} = \omega_0 + \omega_1 FININC_{j,t} + \lambda m \sum_{m=1}^{n} X_{i,j,t} + \tau k \sum_{k=1}^{n} Z_{j,t} + \varepsilon_{i,j,t}; \tag{5}$$

$$BANKSTAB_{i,j,t} = \omega_0 + \omega_1 FININC_{j,t} + w_2 FININC * BANKCOMP_{j,t} + \lambda m \sum_{m=1}^{n} X_{i,j,t} + \tau k \sum_{k=1}^{n} Z_{j,t} + \varepsilon_{i,j,t}, \tag{6}$$

where, $BANKSTAB_{i,j,t}$ represent BS (dependent variable) of bank "i" in a country "j" at time "t", of bank "i" in a country "j" at time "t", $FININC_{j,t}$ represent FI index (independent variable) of country "j" at time "t", $FININC*BANKCOMP_{i,j,t}$ refer to interaction term of bank "i" of contrary "j" at time "t", $X_{i,j,t}$ represent country-specific control variables $Z_{i,j,t}$ refer to bank-specific variables and $\varepsilon_{i,j,t}$ refer to error term. Country-specific control variables consist of inflation, GDP growth and GDP per capita. Furthermore, bank-specific control variables include bank size, cost to income ratio, loan to assets ratio, loan loss provision ratio, net interest margin,

operational revenue, management quality, income diversification, equity ratio, credit to deposit ratio and deposit share ratio.

The panel OLS post-estimation reveals that the findings of Eq. (5) and Eq. (6) contain the issue of heterogeneity, endogeneity and first order autocorrelation. Resultantly, in the presence of endogeneity, heterogeneity, and correlation issues, both ordinary least square and fixed effect method brought up with inconsistent estimates and severe econometric problems (Hadad et al., 2011). For example, the use of panel OLS fixed effects under the presence of "serial-correlation", heterogeneity, and endogeneity offers biased and downward coefficients (Flannery & Hankins, 2013). Furthermore, the fixed-effect model is unable to capture the phenomenon of time invariant of the banking institutions (Gujarati, 2008).

In order to fix the issue of endogeneity "Two-stage Least Square" (2SLS) is used with the incorporation of instrumental variables. In data analysis, heteroscedasticity is a major concern, especially for banking institutions. But 2SLS does not address the problem of heteroscedasticity which is major concern for cross country banking institutions due to the existence of heterogeneity at individual level (Flannery & Hankins, 2013). Consequently, the standard error values remain inconsistent in the presence of "heteroscedasticity". Moreover, stable coefficient values of instrumental variables unable to make good analysis; hence it offers less efficient coefficients (Gujarati, 2008).

Therefore, the presence of heteroscedasticity is captured by using "GMM estimation" technique with "robust standard error" (Hansen, 1982). GMM estimation technique provides more reliable coefficients as compared to 2SLS by adjusting the issue of heteroscedasticity and does not require the assumption of distributional error term (Hall, 2005). In the GMM estimation endogeneity problem can be fixed by using lag variables of regressor as instrumental variables because there is no perfect correlation between lag variables and unobserved heterogeneity (Baltagi, 2008).

Moreover, Standard "GMM estimation technique" articulated by Arellano and Bond (1991) provides biased results in the existence of serial correlation in the errors. So, this issue is resolved by introducing the concept of System GMM. The estimation of System GMM is more efficient and enhances the accuracy of the estimates as it considers smaller variances Blundell and Bond (1998). Furthermore, the biases related to invariant coefficients of time are also incorporated in System-GMM and particularly when the period is smaller the momentary condition confirms the absence of correlation between the time invariant effect/ unobserved effect/ instrumental variable. Consequently, the potential issues of endogeneity, autocorrelation and heteroscedasticity in the data is reported by the use of dynamic model. Baltagi et al. (2005) highlighted the existence of lagged dependent variable as the unique feature of a dynamic model.

Diagnostic test for System-GMM Estimators

We have performed pre- and post-diagnostic tests for system-GMM estimation. The pre-diagnostic tests include Wooldridge test to confirm the existence of the autocorrelation, "Durbin and Wu Hausman" test for "endogeneity" and the "Brush-Pagan/ Cook-Weisberg" test is applied to confirm the existence of "heteroscedasticity" in the penal data set. Post-diagnostic test includes "AR (2) and Hansen's" test to confirm the absence of second-order correlation and validity of the instruments used.

We used dynamic panel data approach to test study hypotheses which contains the following mathematical expressions:

$$BANKSTAB_{i,j,t} = \omega_0 + \omega_1 BANKSTAB_{i,j,t-1} + \omega_2 FININC_{j,t} + \lambda m \sum_{m=1}^{n} X_{i,j,t} + \tau k \sum_{k=1}^{n} Z_{j,t} + \varepsilon_{i,j,t}; \quad (7)$$

$$BANKSTAB_{i,j,t} = \omega_0 + \omega_1 BANKSTAB_{i,j,t-1} + \omega_2 FININC_{j,t} + \omega_3 FININC * BANKCOMP_{j,t} +$$

$$\lambda m \sum_{m=1}^{n} X_{i,j,t} + \tau k \sum_{k=1}^{n} Z_{j,t} + \varepsilon_{i,j,t}, \quad (8)$$

where, $BANKSTAB_{i,j,t-1}$ refers to lag value of BS (dependent variable) of bank "i" in a country "j" at time "t". We estimated Eq. (7) and Eq. (8) by using a "two-step system GMM estimation", which is well supported in banking by the following studies (Alvi et al., 2020; Abbas & Masood, 2020).

4. Empirical results and discussion

4.1. Descriptive statistics

Table 2 presents the descriptive statistics of all the variables used in the analysis. The average values of ln(Z-score), FI, and micro- and macro-FI are 1.15, 0.30, 0.34, and 0.49, respectively. The standard deviation values of ln(Z-score), FI, and micro- and macro-FI are 1.35, 0.22, 0.30, and 0.21, respectively. The mean, standard deviation, minimum and maximum value of control variables is in line with the statistics values reported by Ahamed and Mallick (2019).

Table 2. Descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Z-score (Ln)	4466	1.154	1.352	–6.028	4.0900
Financial Inclusion	4466	0.301	0.220	0.031	0.740
Micro Financial Inclusion	4466	0.340	0.3029886	0.022	0.995
Macro Financial Inclusion	4466	0.494	0.211	0.008	0.954
Bank Size (Log)	4466	4.050	0.864	1.116	6.606
Cost-Income Ratio	4466	55.334	23.418	15.631	59.836
Loan-Assets Ratio	4466	78.247	4.62069	4.718	95.667
Loan Loss Provision Ratio	4466	0.6013888	1.369	–1.159	41.04957
Net Interest Margin	4466	2.964759	1.951	–2.451	16.808
Operational Revenue	4466	2.217	9.0344	0.215	10.63305
Income Diversification	4466	28.223	19.444	–4.356	196.7041
Management Quality	4466	8.595	6.335	4.167	10.747
Equity Ratio	4466	9.441	9.681	8.593	49.166
Credit-Deposit Ratio	4466	47.606	4.341	7.539597	90.578
Deposit-Share Ratio	4466	73.63521	14.424	6.591	90.664
Inflation	4466	3.376039	2.524828	–0.90043	11.06367
GDP Growth	4466	5.168236	2.372122	0.323207	9.144572
GDP Per Capita	4466	12365.69	14904.09	804.1416	48603.48

4.2. Correlation analysis

Table 3 presents the correlations among the variables, and this study employed correlation analysis to investigate the potential issue of multicollinearity among the independent variables. The results indicate that all the correlation coefficients are relatively small in magnitude (mostly less than 0.70), suggesting that there is no significant multicollinearity problem (Chan et al., 2015).

Table 3. The results of correlation analysis

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1)Z-score	1																	
(2) Financial Inclusion	0.181***	1																
(3) Micro Financial Inclusion	0.123***	0.974***	1															
(4) Macro Financial Inclusion	–0.302***	–0.760***	–0.603***	1														
(5) Bank Size	0.255***	0.363***	0.266***	–0.549***	1													
(6) Cost-Income Ratio	–0.380***	0.289***	0.369***	0.038**	–0.283***	1												
(7) Loan-Assets Ratio	–0.049***	0.012	0.001	–0.029	–0.089***	0.079***	1											
(8) Loan Loss Provision Ratio	–0.338***	–0.140***	–0.133***	0.128***	–0.128***	0.075***	0.768***	1										
(9) Net Interest Margin	0.01	–0.422***	–0.354***	0.524***	–0.446***	–0.088***	–0.02	0.098***	1									
(10) Operational Revenue	0.119***	0.004	–0.032*	–0.121***	0.480***	–0.144***	–0.006	–0.016	–0.057***	1								
(11) Income Diversification	–0.079***	–0.092***	–0.084***	0.092***	0.081***	0.062***	–0.039**	–0.008	–0.396***	0.013	1							
(12) Management Quality	0.041**	0.176***	0.141***	–0.159***	0.072***	–0.067***	0.060***	0.017	–0.241***	–0.067***	0.01	1						
(13) Equity Ratio	–0.023	–0.168***	–0.160***	0.169***	–0.291***	0.014	0.137***	0.151***	0.229***	–0.052***	–0.03	–0.097***	1					
(14) Credit-Deposit Ratio	–0.044**	0.004	–0.005	–0.024	–0.069***	0.068***	0.888***	0.605***	–0.019	–0.003	–0.033*	0.038*	0.117***	1				
(15) Deposit-Share Ratio	–0.034*	0.199***	0.257***	0.01	–0.129***	0.237***	–0.179***	–0.165***	–0.033*	–0.071***	–0.055***	–0.035*	0.078***	–0.166***	1			
(16) Inflation	–0.230***	–0.608***	–0.532***	0.682***	–0.435***	–0.054***	–0.033*	0.066***	0.336***	–0.099***	0.123***	0.022	0.110***	–0.024	0.065***	1		
(17) GDP Growth	–0.153***	–0.605***	–0.729***	0.432***	–0.055***	–0.363***	–0.036*	0.110***	0.229***	0.088***	0.013	–0.177***	0.068***	–0.009	–0.235***	0.287***	1	
(18) GDP Per Capita	0.240***	0.741***	0.687***	–0.775***	0.354***	0.254***	–0.018	–0.205***	–0.459***	0.009	–0.031*	0.167***	–0.172***	–0.017	0.227***	–0.561***	–0.776***	1

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

4.3. Pre-diagnostic tests

Pre-diagnostic tests were performed to assess the endogeneity of FI (considering both micro- and macro-indicators) in the regression model. Moreover, these tests aimed to investigate the presence of heteroscedasticity in the model, and similar assessments were conducted separately for micro-FI and macro-FI. The results of the pre-diagnostic tests for FI (considering micro and macro indicators) displayed in Table 4 show that the Durbin-Wu-Hausman statistic (18.6623) is statistically significant at the 1% level, suggesting no endogeneity issues within the model. Moreover, the Wooldridge and Breush-Pagan/Cook-Weisberg tests yielded values of 15.573 and 113.05, respectively, both of which are significant at the 1% level, indicate an absence of heteroscedasticity.

The outcomes of the pre-diagnostic tests for micro-FI, as presented in Table 5, reveal that the Durbin-Wu-Hausman statistic (22.43) is highly significant at the 1% level, indicating that there are no endogeneity issues within the model. Furthermore, the Wooldridge and Breusch-Pagan/Cook-Weisberg tests produced values of 14.24 and 116.05, respectively, both of which are statistically significant at the 1% level, confirmed the absence of heteroscedasticity.

Table 4. Pre-diagnostic tests for FI (considering micro- and macro indicators)

Details	Model (A)	Model (B)	Model (C)	Model (D)
Durbin, Wu and Hausman	18.6623***	20.5891***	20.2950***	12.1913***
Wooldridge Test	15.573***	16.286***	16.387***	16.534***
Breush Pagan/Cook Weisberg Test	113.05***	103.74***	106.61***	108.38***

Note: *, **, *** represent level of significance at 1%, 5% and 10% respectively.

Table 5. Pre-diagnostic tests for micro-FI

Details	Model (F)	Model (G)	Model (H)	Model (I)
Durbin, Wu and Hausman	22.43***	18.82***	18.75***	16.98***
Wooldridge Test	14.24***	14.73***	14.55***	15.27***
Breush Pagan/Cook Weisberg Test	116.05***	101.97***	104.65***	111.62***

Note: *, **, *** represent level of significance at 1%, 5% and 10% respectively.

Table 6. Pre-diagnostic tests for macro-FI

Details	Model (J)	Model (K)	Model (L)	Model (M)
Durbin, Wu and Hausman	6.67***	6.03***	6.02***	6.77***
Wooldridge Test	18.71***	17.63***	17.69***	18.69***
Breush Pagan/Cook Weisberg Test	122.41***	116.12***	115.12***	170.85***

Note: *, **, *** represent level of significance at 1%, 5% and 10% respectively.

Similarly, the pre-diagnostic tests conducted specifically for macro-FI, as presented in Table 6, reveal statistically significant results at the 1% level for the Durbin-Wu-Hausman statistic (6.67), indicating the absence of endogeneity issues within the model. Furthermore, the Wooldridge and Breusch-Pagan/Cook-Weisberg tests yielded values of 18.71 and 122.41, respectively, which were statistically significant at the 1% level, suggesting the absence of heteroscedasticity concerns. Overall, these results suggest that the "two-step system GMM" technique is appropriate for further analyses.

4.4. Regression analyses

We performed "two-step system GMM" regression analysis to test the hypotheses formally. The results are reported in Table 7. A detailed discussion of the results is presented below.

The hypothesis predicted that FI (considering micro and macro indicators) is positively associated with the BS in Asia under current volatile economic conditions. The results show that FI, as measured by both micro- and macro-indicators ($\beta = 23.633$, $p < 0.001$), has a significant positive impact on BS, supporting Ha1. These findings suggest that an increase in FS accessibility at the individual and small business levels tends to enhance BS. This is because an inclusive financial system diversifies the bank's customer base, reduces risk concentration, and may lead to greater deposit stability, ultimately enhancing the stability of the banking sector. Furthermore, a financially inclusive environment can lead to increased savings and investment, further supporting BS by providing a stable deposit base, and fostering economic growth. These findings are consistent with prior research conducted by Vo et al. (2021), Danisman and Tarazi (2020), Morgan and Pontines (2018), who examined the relationship between FI and BS and found a significant positive relationship between them.

Similarly, the hypothesis predicted that macro-FI has a significant positive influence on the BS in the Asian region. A significant positive relationship was found between macro-FI ($\beta = 1.550$, $p < 0.001$) and BS, lending support to Ha$_2$. These findings suggest that a more comprehensive approach to FI, including policies and initiatives at the macroeconomic level, can contribute to the stability of banks. From an economic perspective, the results verify the

notion that a more comprehensive approach to FI enhances BS. Macro-FI typically involves government policies, regulatory frameworks, and infrastructure development, which promote access to FS at the national level. Such policies can help address systemic issues and encourage responsible financial behavior, leading to a more resilient financial system.

Moreover, the hypothesis predicted that micro-FI would be significantly associated with the BS in Asia. The output of the analysis shows that a statistically significant positive relationship was found between micro-FI and BS (β = 19.350, p < 0.001) so Ha$_3$ was accepted. These findings indicate that as micro-FI increases, BS also increases. From an economic standpoint, the findings confirm that improved access to FS for individuals and small businesses can enhance economic stability by reducing the likelihood of financial crises, promoting overall economic growth, and improving the resilience of the banking sector. When more people have access to banking services and credit, they are better equipped to manage financial shocks and invest in productive activities, which, in turn, contributes to the overall stability of the banking sector and broader economy. Overall, these findings provide significant evidence of the importance of FI in promoting BS.

Furthermore, the hypothesis predicted that BC is positively related with the BS in Asia. The analysis also shows that BC (β = 19.350, p < 0.001) has a significant positive influence on BS, supporting H$_2$. These findings suggest that a competitive environment can be a driving force for "financial stability" in the "banking industry". A competitive environment in the banking sector can drive banks to operate more efficiently, enhance their risk-management practices, and contribute to overall financial stability. Competition in the "banking sector" can also encourage banks to offer better services and products, adopt prudent lending practices, and diversify their portfolios, ultimately leading to a more stable banking environment. These results are consistent with economic principles, which posit that increased competition in the banking sector can result in improved performance and financial stability.

Table 7. Results of two-step system GMM

Variable name	Model (A)	Model (B)	Model (C)	Model (D)
Lagged. Ln-ZScore	0.324*** (.131)	0.173*** (0.095)	0.300*** (0.141)	0.390*** (0.041)
Financial Inclusion (all six indicators)	23.633*** (7.906)			
Bank Competition		14.546*** (6.143)		
Micro-Financial Inclusion			19.350*** (7.010)	
Macro-Financial Inclusion				1.550*** (0.570)
Bank Size	1.275*** (.385)	2.141*** (0.595)	1.071** (0.370)	−0.140 (0.200)
Cost-Income Ratio	−0.006** (0.002)	−0.003 (0.003)	−0.006*** (0.002)	−0.011*** (0.000)
Loan-Assets Ratio	−0.001* (0.000)	−0.004*** (0.000)	−0.001** (0.00)	−0.001*** (0.000)

Variable name	Model (A)	Model (B)	Model (C)	Model (D)
Loan Loss Provision Ratio	−0.260*** (0.067)	−0.263*** (0.081)	−0.252*** (0.060)	−0.381* (0.060)
Net Interest Margin	0.193*** (0.037)	0.190*** (0.0486)	0.161*** (0.031)	0.101*** (0.020)
Operational Revenue	0.004 (0.000)	—0.006 (0.000)	0.001 (0.001)	—0.001 (0.001)
Income Diversification	0.013*** (0.002)	0.007*** (0.001)	0.012* (0.001)	0.002*** (0.000)
Management Quality	0.018** (0.006)	0.019*** (0.007)	0.001** (0.001)	0.003 (0.000)
Equity Ratio	0.041*** (.010)	0.035*** (0.009)	0.031** (0.001)	0.011** (0.000)
Credit-Deposit Ratio	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.001)	0.001*** (0.001)
Deposit-Share Ratio	−0.002 (0.003)	−0.005 (0.003)	−0.004 (0.001)	−0.002 (0.002)
Inflation	0.035** (0.012)	0.109*** (0.039)	0.002 (0.010)	−0.001 (0.000)
GDP Growth	0.032 (0.019)	0.151*** (0.059)	0.012 (0.01)	−0.010** (0.000)
GDP Per Capita	0.002 (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.002*** (0.001)
Time Dummy	Yes	Yes	Yes	Yes
AR (2)	0.427	0.542	0.342	0.673
Hansen Test	0.364	0.440	0.413	0.225

Note: *p < 0.05; **p < 0.01; ***p < 0.001.

4.5. Moderation analyses

Moderation analysis was used to examine the interactive effects of BC on BS in Asia. Moderation analyses were employed to investigate how BC influences the relationship between FI and BS in the Asian context. First, we tested the moderating effect of BC on the relationship between FI (considering micro and macro indicators) and BS. The hypothesis predicted that the impact of FI on BS is contingent upon the level of BC, highlighting the potential moderating role of competition in this complex relationship. The results presented in Table 8 show that FI (β = 21.736, $p < 0.001$) and BC (β = 12.431, $p < 0.001$) were significant predictors of BS. The interaction term of these variables (β = 38.046, $p < 0.001$) also has a significant positive effect on BS, indicating that BC positively moderates the relationship between FI and BS. These findings provide support for Hb_3 and suggest that the relationship between FI and BS is influenced by the level of BC. From an economic standpoint, the findings confirm that increased competition among banks can motivate them to innovate and diversify their services to cater to a broader customer base, including previously excluded individuals and businesses. This diversification can lead to improved risk management and a more efficient

Table 8. Results of moderation effect on the relationship between FI (considering micro- and macro indicators) and BS

Variable name	Model (A)	Model (B)	Model (C)
Lagged. Ln-Z Score	0.288*** (0.125)	0.261*** (0.119)	0.319*** (0.127)
Financial Inclusion	21.736*** (6.905)	36.135*** (11.577)	19.853*** (6.441)
Bank Competition	12.431*** (6.784)	18.753*** (7.567)	10.316*** (6.019)
Interaction-Term CR3	38.046*** (2.883)		
Interaction-Term CR5		60.956*** (20.339)	
Interaction-Term HHI			81.642*** (25.872)
Bank Size	1.236** (0.366)	1.321** (0.386)	1.260*** (0.368)
Cost-Income Ratio	−0.004*** (0.002)	−0.004*** (0.002)	−0.004*** (0.002)
Loan-Assets Ratio	−0.001* (0.000)	−0.001* (0.000)	−0.001* (0.000)
Loan Loss Provision Ratio	−0.257*** (0.063)	−0.251*** (0.062)	−0.257*** (0.065)
Net Interest Margin	0.226*** (0.036)	0.241** (0.038)	0.217*** (0.036)
Operational Revenue	0.002 (0.000)	0.003 (0.000)	0.003 (0.000)
Income Diversification	0.012** (0.002)	0.012** (0.002)	0.012*** (0.002)
Management Quality	0.017*** (0.005)	0.018*** (0.005)	0.019*** (0.005)
Equity Ratio	0.038* (0.010)	0.037*** (0.010)	0.038** (0.010)
Credit-Deposit Ratio	0.001*** (0.000)	0.001** (0.000)	0.001*** (0.000)
Deposit-Share Ratio	−0.002 (0.003)	−0.001 (0.003)	−0.002 (0.003)
Inflation	0.036** (0.012)	0.041* (0.013)	0.040*** (0.012)
GDP Growth	0.069* (0.026)	0.087* (0.031)	0.054*** (0.022)
GDP Per Capita	0.002*** (0.000)	0.002*** (0.000)	0.002** (0.000)
Time Dummy	Yes	Yes	Yes
AR (2)	0.655	0.609	0.567
Hansen Test	0.383	0.431	0.478

Note: Table 8 contains the results for the impact of FI (bank-branches, ATMs, number of borrowers per 100,000 adults of population, number of deposits per 100,00 adults of population, insurance premium to percentage of GDP and private credit percentage of GDP), and bank competition (Using concentration ratio and HHI) on stability of banks (Ln. Z-score). $*p < 0.05$; $**p < 0.01$; $***p < 0.001$.

allocation of resources, ultimately enhancing BS (Owen & Pereira, 2018). Moreover, competition can result in lower costs for consumers, making FS more affordable and accessible and further promoting FI (Marín & Schwabe, 2019), which ultimately has a positive impact on BS. According to Pham et al. (2019), when banks engage in competition to attract customers, they often introduce new products and services, resulting in greater FI and a more stable banking system. To measure BC, three commonly used proxies – Concentration Ratio 3 (CR3), "Concentration Ratio" 5 (CR5), and the "Herfindahl-Hirschman Index" (HHI) – were employed. CR3 was used in model A, whereas CR5 and HHI were used in models B and C, respectively, to further validate the moderation results. The results of models B and C endorse the moderation results of model A.

Next, we examined the moderating impact of BC on the relationship between micro-FI and BS. The hypothesis predicted that the relationship between micro-FI and the stability of banking institutions in Asian is moderated by BC. The results reported in Table 9 show that micro-FI and BC were found to have significant positive effects on BS, with coefficients of 16.430 and 11.803, respectively, and both were statistically significant at $p < 0.001$. However, the interaction term of these two variables produced a coefficient of 23.400, which indicates a significant positive effect on BS. The results suggest that an increase in BC can positively moderate the relationship between micro-FI and BS. These findings provide support for Hb_4 and suggest that the relationship between micro-FI and BS is influenced by the level of BC. Similarly, we measured the level of BC using three commonly used proxies: CR3, CR5, and HHI. CR3 was used in model D, whereas CR5 and HHI were used in models E and F, respectively, to validate the moderation results further. The results of models E and F endorse the moderation results of model D.

Finally, we examined the moderating influence of BC on the relationship between macro-FI and BS. The results presented in Table 10 show that macro-FI (ß = 15.740, $p < 0.001$) and BC (ß = 10.370, $p < 0.001$) have a significant, positive influence on BS. However, the interaction term of these variables (ß = −16.8355, $p < 0.001$) has a significant, negative impact on BS, suggesting that an increase in BC can negatively moderate the relationship between macro-FI and BS. These findings support Hb_5 and suggest that the relationship between macro-FI and BS is influenced by the level of BC. The economic rationale behind this finding stem from the potential downside of excessive competition in the "banking industry". In highly competitive environments, institutions may engage in riskier lending practices or lower their profit margins to outperform competitors. This could lead to increased financial instability and reduced ability to absorb shocks, thus undermining the overall stability of the banking sector (Dako et al., 2021). To validate these results, we used three commonly utilized proxies for BC: CR3, CR5, and HHI. CR3 was used in model G, whereas CR5 and HHI were employed in models H and I, respectively. The results of models H and I confirm the moderation results of model D.

Table 9. Results of moderation effect on the relationship between micro-FI and BS

Variable name	Model (D)	Model (E)	Model (F)
Lagged. Ln-Z Score	0.300*** (0.131)	0.290*** (0.121)	0.301 *** (.131)
Micro-Financial Inclusion	16.430*** (5.330)	25.090*** (7.490)	14.621*** (5.030)
Bank Competition	11.803*** (6.725)	15.630*** (7.567)	8.294*** (5.519)
Interaction-Term CR3	23.400*** (6.890)		
Interaction-Term CR5		33.890*** (9.901)	
Interaction-Term HHI			60.830*** (16.830)
Bank Size	1.090*** (0.340)	1.151** (0.340)	1.101*** (.341)
Cost-Income Ratio	−0.004*** (0.002)	−0.004** (0.002)	−.004*** (.002)
Loan-Assets Ratio	−0.001*** (0.00)	−0.001* (0.00)	−0.002*** (0.001)
Loan Loss Provision Ratio	−0.252* (0.061)	−0.251* (0.062)	−0.250*** (.062)
Net Interest Margin	0.213*** (0.030)	0.213** (0.003)	.202*** (.003)
Operational Revenue	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Income Diversification	0.011*** (0.001)	0.011* (0.001)	0.012*** (0 .001)
Management Quality	0.010* (0.001)	0.010*** (0.001)	0.010* (0.001)
Equity Ratio	0.030*** (0.001)	0.030** (0.001)	0.031*** (0.001)
Credit-Deposit Ratio	0.002*** (0.001)	0.003* (0.001)	.002** (0.001)
Deposit-Share Ratio	−0.003 (0.001)	−0.003 (0.001)	−0.001 (0.001)
Inflation	0.022*** (0.010)	0.021** (0.010)	.0211** (0.010)
GDP Growth	0.052*** (0.021)	0.062* (0.021)	0.042** (.010)
GDP Per Capita	0.001*** (0.000)	0.001** (0.000)	0.002*** (0.000)
Time Dummy	Yes	Yes	Yes
AR (2)	0.592	0.517	0.618
Hansen Test	0.442	0.496	0.461

Note: Table 9 contains the results for the impact of Micro FI (bank-branches, ATMs, number of borrowers per 100,000 adults of population, number of deposits per 100,00 adults of population), and bank competition (Using concentration ratio and HHI) on stability of banks (Ln. Z-score) *p < 0.05; **p < 0.01; ***p < 0.001.

Table 10. Results of moderation effect on the relationship between macro-FI and BS

Variable name	Model (G)	Model (H)	Model (I)
Lagged. Ln-Z Score	0.171*** (0.061)	0.220*** (0.051)	0.231*** (0.051)
Macro-Financial Inclusion	15.740*** (3.110)	12.080*** (2.820)	10.450*** (2.280)
Bank Competition	10.370*** (6.903)	14.306*** (6.274)	19.158*** (3.065)
Interaction-Term CR3	−16.8355*** (3.673)		
Interaction-Term CR5		−10.00*** (2.74)	
Interaction-Term HHI			−34.69*** (8.97)
Bank Size	0.590*** (0.221)	0.470** (0.220)	0.691*** (0.240)
Cost-Income Ratio	−0.010** (0.001)	−0.001** (0.000)	−0.001** (0.001)
Loan-Assets Ratio	−0.001* (0.000)	−0.004*** (0.000)	−0.003** (0.000)
Loan Loss Provision Ratio	−0.301*** (0.070)	−0.310* (0.070)	−0.321* (0.070)
Net Interest Margin	0.111*** (0.030)	0.131* (0.040)	0.141** (0.041)
Operational Revenue	0.001 (0.000)	−0.001 (0.000)	−0.001 (0.000)
Income Diversification	0.002** (0.000)	0.001** (0.000)	0.002*** (0.000)
Management Quality	0.001*** (0.000)	0.001** (0.000)	0.010*** (0.000)
Equity Ratio	0.033*** (0.000)	0.031*** (0.000)	0.031*** (0.000)
Credit-Deposit Ratio	0.001** (0.000)	0.003*** (0.001)	0.004*** (0.001)
Deposit-Share Ratio	−0.002 (0.002)	−0.001 (0.001)	−0.001 (0.000)
Inflation	0.010*** (0.000)	0.021** (0.000)	0.020* (0.010)
GDP Growth	−0.020 (0.010)	−0.000 (0.010)	−0.000 (0.010)
GDP Per Capita	0.002* (0.001)	0.002*** (0.001)	0.002 (0.000)
Time Dummy	Yes	Yes	Yes
AR (2)	0.450	0.597	0.663
Hansen Test	0.370	0.167	0.284

Note: Table 10 contains the results for the impact of Macro FI (insurance premium to percentage of GDP and private credit percentage of GDP), and bank competition (Using concentration ratio and HHI) on stability of banks (Ln. Z-score). *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

4.6. Robustness tests

The effects of FI and BC on BS were further validated through panel OLS using a divided sample based on bank size, comprising large and small banks. The findings are displayed in Table 11 and conform to the baseline results.

Table 11. A Two-step System GMM results of FI

Variable Name	Model (J)	Model (K)	Model (L)	Model (M)	Model (N)
Large banks results					
Lagged. Ln-ZScore	0.228*** (.001)	0.121*** (0.005)	0.331*** (0.001)	0.626*** (0.011)	0.793*** (0.16)
Financial Inclusion	12.122*** (4.880)		14.576*** (5.881)	21.215*** (8.257)	7.551*** (4.661)
Bank Competition		9.445*** (2.414)			
Small banks Results					
Financial Inclusion	9.111633*** (2.301)		11.854*** (3.901)	16.213*** (6.507)	9.558*** (2.141)
Bank Competition		4.256*** (3.313)			
Time Dummy	Yes	Yes	Yes	Yes	Yes
AR (2)	0.270	0.421	0.751	0.7955	0.477
Hansen Test	0.434	0.844	0.533	0.541	0.417

Note: Table 11 contains the results for the impact of Macro FI (insurance premium to percentage of GDP and private credit percentage of GDP), and bank competition (Using concentration ratio and HHI) on stability of banks (Ln. Z-score). *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

5. Conclusions and implications

This study investigates the effect of FI (considering micro and macro indicators) as well as micro- and macro-FI separately, on the stability of Asian banks and examines the moderating effect of BC on this relationship. Using data from 2011 to 2021, this study examines the relationship between FI, BC, and BS. The hypotheses were tested using a "two-step system-GMM framework". The findings were also authenticated using the panel OLS approach.

The results confirm that FI (both micro and macro indicators) and micro- and macro-FI separately have significant positive effects on the stability of Asian banks. However, the impact of micro-FI is greater than that of macro-FI on the BS in Asia. These results suggest that an inclusive financial system that extends services to individuals and small businesses diversifies the bank's customer base, reduces risk concentration, and may lead to greater deposit stability, ultimately enhancing the stability of the banking sector. The results also illustrate that macro-FI, encompassing macroeconomic policies and initiatives, positively influences the stability of banking institutions in Asia. A broader approach to FI, including government policies and regulatory frameworks, plays a significant role in promoting responsible financial behavior and building a more resilient financial system. Moreover, the study highlighted the key role of micro-FI in promoting stability in the banking sector. Enhanced access to FS for

individuals and small businesses can enhance economic stability by diminishing the likelihood of financial crises, boosting overall economic growth, and strengthening the resilience of the banking sector. When a larger number of people have access to banking services and credit, they are better equipped to manage financial shocks and invest in productive activities, which, in turn, contributes to the overall stability of the banking sector.

Furthermore, the results reveal that BC has a significant positive impact on BS and positively moderates the relationship between FI (considering both micro and macro indicators) and BS, micro-FI and BS, whereas it negatively moderates the relationship between macro-FI and BS. These findings suggest that a competitive environment can be a driving force for financial stability in the banking industry. A competitive environment in the banking sector can drive banks to operate more efficiently, enhance their risk-management practices, and contribute to overall financial stability. Competition in the banking sector can also encourage banks to offer better services and products, adopt prudent lending practices, and diversify their portfolios, ultimately leading to a more stable banking environment. when banks engage in competition to attract customers, they often introduce new products and services, resulting in greater FI and a more stable banking system. On the other hand, in highly competitive environments, institutions may engage in riskier lending practices or lower their profit margins to outperform competitors. This could lead to increased financial instability and reduced ability to absorb shocks, thus undermining the overall stability of the banking sector. Therefore, finding the right balance in promoting competition while implementing prudent regulatory measures is essential to ensure that competition remains a driving force for financial stability rather than a source of instability in the banking industry.

Practical implications

The findings of this research have practical implications for stakeholders such as regulators, bankers, and policymakers involved in formulating strategies to enhance BS. The study's findings provide compelling evidence that FI plays an important role in bolstering BS. Therefore, policymakers and regulators should promote and support initiatives that promote access to FS for both individuals and businesses, while also implementing macroeconomic policies that strengthen financial systems. The results suggest that micro-FI has a more profound effect on BS than macro-FI. Thus, financial institutions should focus on developing products and services that address the specific needs of individuals and small businesses to promote greater FI, ultimately leading to a more stable "banking sector." Furthermore, BC positive influence on BS emphasizes the need to maintain a competitive environment within the banking sector. Policymakers and regulators should encourage competition among financial institutions to drive innovation and efficiency, while ensuring that this competition is well-regulated to "prevent excessive risk-taking."

However, the results of the study indicate that BC positively moderates the relationship between FI and BS but negatively moderates the relationship between macro-FI and BS, emphasizing the nuanced nature of these dynamics. Policymakers and regulators must strike a balance to prevent excessive risk-taking in the pursuit of market share, especially when dealing with macro-FI. Overall, this study highlights the importance of a multifaceted approach to achieve and maintain financial stability in the banking sector. Balancing micro- and macro-FI efforts with competitive environments and prudent regulations is key to reaping benefits while mitigating potential risks.

6. Limitations and directions for future research

Finally, we acknowledge that this study is subject to certain limitations that merit consideration in follow-up research studies. For instance, our study is limited to Asian banks, and it is crucial to recognize that banking systems across countries within the region exhibit notable variations due to unique country-specific properties. These variations can significantly affect the relationships between the variables examined. However, owing to the constraints of the current study, we were unable to comprehensively address these nuances. Therefore, a promising avenue for future research is to conduct country-specific analyses to delve deeper into the intricate dynamics among FI, bank competition, and banking sector stability within individual Asian nations. Moreover, investigating the role of technological advancements, digitalization, and FinTech in shaping the dynamics between FI, bank competition, and stability would be pertinent given the rapidly evolving financial landscape. However, our study is limited to analyzing commercial banks due to data constraints. The literature suggests a bank focus database as a reliable dataset of banking institutions. However, it does not contain a complete dataset on investment, cooperation, savings, and micro-financial institutions. Moreover, these institutions do not contain consistent data for creating a balanced dataset for the desired time period. Therefore, for more in-depth insights, future researchers should focus on other categories of banks, such as investment, cooperation, saving, and micro-financial institutions, using alternative data sources. Furthermore, all Asian countries have formulated different policies during "COVID-19", and the effect of "COVID-19" also varies countrywide. Therefore, future researchers should study the impact of "COVID-19" at the micro and macro levels. This study included three country-specific variables: GDP growth, GDP per capita, and inflation. We also suggest that future researchers include other relevant economic variables and country-specific variables as moderating and mediating indicators to clarify the relationship between FI and BS. Lastly, this study suggests that future research probe the effects of micro- and macro-FI on the stability of banking institutions by looking at how the operating environment and government policies affect this relationship.

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References

Abbas, F., & Masood, O. (2020). How do large commercial banks adjust capital ratios: empirical evidence from the US? *Economic Research-Ekonomska Istraživanja*, *33*(1), 1849–1866. https://doi.org/10.1080/1331677X.2020.1763823

Atellu, A. R., & Muriu, P. W. (2022). Does financial inclusion enhance financial stability? Evidence from a developing economy. *Transnational Corporations Review*, *14*(3), 297–311. https://doi.org/10.1080/19186444.2021.2019555

Ahamed, M. M., & Mallick, S. K. (2019). Is financial inclusion good for bank stability? International evidence. *Journal of Economic Behavior & Organization*, *157*, 403–427. https://doi.org/10.1016/j.jebo.2017.07.027

Ahmad, D. (2018). Financial inclusion and financial stability: Survey of the Nigeria's financial system. *International Journal of Research in Finance and Management*, *1*(2), 47–54. https://doi.org/10.33545/26175754.2018.v1.i2a.15

Akerlof, G. A. (1978). The market for "lemons": Quality uncertainty and the market mechanism. In *Uncertainty in economics* (pp. 235–251). Elsevier. https://doi.org/10.1016/B978-0-12-214850-7.50022-X

Al-Smadi, M. O. (2018). The role of financial inclusion in financial stability: Lesson from Jordan. *Banks & Bank Systems*, *13*(4), 31–39. https://doi.org/10.21511/bbs.13(4).2018.03

Albaity, M., Mallek, R. S., & Noman, A. H. M. (2019). Competition and bank stability in the MENA region: The moderating effect of Islamic versus conventional banks. *Emerging Markets Review*, *38*, 310–325. https://doi.org/10.1016/j.ememar.2019.01.003

Ali, J., & Khan, M. A. (2020). Micro and Macro financial inclusion and their impacts on economic growth: Evidence from Asian economies with alternative approaches. *International Transaction Journal of Engineering*, *Management*, & *Applied Sciences & Technologies*, *11*(5), 1–15.

Alqahtani, F., & Mayes, D. G. (2018). Financial stability of Islamic banking and the global financial crisis: Evidence from the Gulf Cooperation Council. *Economic Systems*, *42*(2), 346–360. https://doi.org/10.1016/j.ecosys.2017.09.001

Allen, F., & Gale, D. (2000). Financial contagion. *Journal of political Economy*, *108*(1), 1–33. https://doi.org/10.1086/262109

Alvi, M. A., Rafique, A., & Shehzad, K. (2020). Financial inclusion and bank stability controversy: Evidence from South Asian region. *International Journal of Financial Engineering*, *7*(4), Article 2050038. https://doi.org/10.1142/S2424786320500383

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277–297. https://doi.org/10.2307/2297968

Bagehot, W., & Street, L. (1915). *A description of the money market*. Murray.

Bain, J. S. (1951). Relation of profit rate to industry concentration: American manufacturing, 1936–1940. *The Quarterly Journal of Economics*, *65*(3), 293–324. https://doi.org/10.2307/1882217

Baltagi, B. H. (2008). Forecasting with panel data. *Journal of Forecasting*, *27*(2), 153–173. https://doi.org/10.1002/for.1047

Baltagi, B. H., Bratberg, E., & Holmås, T. H. (2005). A panel data study of physicians' labor supply: The case of Norway. *Health Economics*, *14*(10), 1035–1045. https://doi.org/10.1002/hec.991

Barik, R., & Pradhan, A. K. (2021). Does financial inclusion affect financial stability: Evidence from BRICS nations? *The Journal of Developing Areas*, *55*(1). https://doi.org/10.1353/jda.2021.0023

Banna, H., & Alam, M. R. (2021). Impact of digital financial inclusion on ASEAN banking stability: Implications for the post-Covid-19 era. *Studies in Economics and Finance*, *38*(2), 504–523. https://doi.org/10.1108/SEF-09-2020-0388

Berger, A. N., & DeYoung, R. (1997). Problem loans and cost efficiency in commercial banks. *Journal of Banking & Finance*, *21*(6), 849–870. https://doi.org/10.1016/S0378-4266(97)00003-4

Bikker, J. A., & Haaf, K. (2002). Competition, concentration and their relationship: An empirical analysis of the banking industry. *Journal of Banking & Finance*, *26*(11), 2191–2214. https://doi.org/10.1016/S0378-4266(02)00205-4

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115–143. https://doi.org/10.1016/S0304-4076(98)00009-8

Bofondi, M., & Gobbi, G. (2003). *Bad loans and entry in local credit markets*. (Economic working papers 509). Bank of Italy, Economic Research and International Relations Area.

Boot, A. W., & Thakor, A. V. (2000). Can relationship banking survive competition? *The Journal of Finance*, *55*(2), 679–713. https://doi.org/10.1111/0022-1082.00223

Carlson, M., Correia, S., & Luck, S. (2022). The effect of banking competition on growth and financial stability: Evidence from the national banking era. *Journal of Political Economy*, *130*(2), 462–520. https://doi.org/10.1086/717453

Chan, Y.-S., Greenbaum, S. I., & Thakor, A. V. (1986). Information reusability, competition and bank asset quality. *Journal of Banking & Finance*, *10*(2), 243–253. https://doi.org/10.1016/0378-4266(86)90008-7

Chan, S.-G., Koh, E. H., Zainir, F., & Yong, C.-C. (2015). Market structure, institutional framework and bank efficiency in ASEAN 5. *Journal of Economics and Business*, *82*, 84–112. https://doi.org/10.1016/j.jeconbus.2015.07.002

Chinoda, T., & Kapingura, F. M. (2023). The impact of digital financial inclusion and bank competition on bank stability in sub-Saharan Africa. *Economies*, *11*(1), Article 15. https://doi.org/10.3390/economies11010015

Chinoda, T., & Kwenda, F. (2019). Do mobile phones, economic growth, bank competition and stability matter for financial inclusion in Africa? *Cogent Economics Finance*. https://doi.org/10.1080/23322039.2019.1622180

Chen, F.-W., Feng, Y., & Wang, W. (2018). Impacts of financial inclusion on non-performing loans of commercial banks: Evidence from China. *Sustainability*, *10*(9), Article 3084. https://doi.org/10.3390/su10093084

Dako, A. G., Fiador, V., Agbloyor, E. K., & Abor, J. Y. (2021). *Bank competition and financial inclusion: Evidence from Ghana.* https://publication.aercafricalibrary.org/items/8dc351f6-3a80-4d1f-92d2-2b62cc69e1a7

Danisman, G. O., & Tarazi, A. (2020). Financial inclusion and bank stability: Evidence from Europe. *The European Journal of Finance*, *26*(18), 1842–1855. https://doi.org/10.1080/1351847X.2020.1782958

Demirguc-Kunt, A., & Levine, R. (2008). *Finance, financial sector policies, and long-run growth* (Working paper). World Bank. https://doi.org/10.1596/1813-9450-4469

Demirgüç-Kunt, A., & Klapper, L. F. (2012). *Measuring financial inclusion: The global findex database* (Policy Research Working Paper 6025). World Bank. https://doi.org/10.1596/1813-9450-6025

Demirgüç-Kunt, A., Klapper, L. F., Singer, D., & Van Oudheusden, P. (2015). *The global findex database 2014: Measuring financial inclusion around the world* (Policy Research Working Paper 7255). World Bank. https://doi.org/10.1596/1813-9450-7255

Diamond, D. W. (1984). Financial intermediation and delegated monitoring. *The Review of Economic Studies*, *51*(3), 393–414. https://doi.org/10.2307/2297430

Diamond, D. W., & Dybvig, P. H. (1983). Bank runs, deposit insurance, and liquidity. *Journal of Political Economy*, *91*(3), 401–419. https://doi.org/10.1086/261155

Dienillah, A. A., Anggraeni, L., & Sahara, S. (2006). Impact of financial inclusion on financial stability based on income group countries. *Bulletin of Monetary Economics and Banking*, *20*(4), 429–442. https://doi.org/10.21098/bemp.v20i4.859

Doumpos, M., Hasan, I., & Pasiouras, F. (2017). Bank overall financial strength: Islamic versus conventional banks. *Economic Modelling*, *64*, 513–523. https://doi.org/10.1016/j.econmod.2017.03.026

Fiordelisi, F., & Mare, D. S. (2014). Competition and financial stability in European cooperative banks. *Journal of International Money and Finance*, *45*, 1–16. https://doi.org/10.1016/j.jimonfin.2014.02.008

Flannery, M. J., & Hankins, K. W. (2013). Estimating dynamic panel models in corporate finance. *Journal of Corporate Finance*, *19*, 1–19. https://doi.org/10.1016/j.jcorpfin.2012.09.004

Francis, B. B., Sun, X., Weng, C.-H., & Wu, Q. (2022). Managerial ability and tax aggressiveness. *China Accounting and Finance Review*, *24*(1), 53–75. https://doi.org/10.1108/CAFR-02-2022-0002

Goldsmith, R. W. (1969). *Financial structure and development.*

Gujarati, D. (2008). *Basic econometrics* (pp. 363–369). MeGraw-Hill.

Hadad, M. D., Agusman, A., Monroe, G. S., Gasbarro, D., & Zumwalt, J. K. (2011). Market discipline, financial crisis and regulatory changes: Evidence from Indonesian banks. *Journal of Banking & Finance*, *35*(6), 1552–1562. https://doi.org/10.1016/j.jbankfin.2010.11.003

Hall, A. (2005). *Generalized method of moments*. Oxford University Press. https://doi.org/10.1002/0471667196.ess0300.pub2

Hansen, L. P. (1982). Large sample properties of generalized method of moments estimators. *Econometrica: Journal of the Econometric Society*, *50*(4), 1029–1054. https://doi.org/10.2307/1912775

Ha, D., & Nguyen, Y. (2023). Institutional quality's influence on financial inclusion'impact on bank stability. *Cogent Economics & Finance*, *11*(1), Article 2190212. https://doi.org/10.1080/23322039.2023.2190212

Hakimi, A., Boussaada, R., & Karmani, M. (2022). Are financial inclusion and bank stability friends or enemies? Evidence from MENA banks. *Applied Economics*, *54*(21), 2473–2489. https://doi.org/10.1080/00036846.2021.1992342

Honohan, P. (2008). Cross-country variation in household access to financial services. *Journal of Banking & Finance*, *32*(11), 2493–2500. https://doi.org/10.1016/j.jbankfin.2008.05.004

Ijtsma, P., Spierdijk, L., & Shaffer, S. (2017). The concentration–stability controversy in banking: New evidence from the EU-25. *Journal of Financial Stability*, *33*, 273–284. https://doi.org/10.1016/j.jfs.2017.06.003

Jungo, J., Madaleno, M., & Botelho, A. (2022). The effect of financial inclusion and competitiveness on financial stability: Why financial regulation matters in developing countries? *Journal of Risk and Financial Management*, *15*(3), Article 122. https://doi.org/10.3390/jrfm15030122

Keeley, M. C. (1990). Deposit insurance, risk, and market power in banking. *The American Economic Review*, *80*(5), 1183–1200.

Khan, H. H., Kutan, A. M., Ahmad, R. B., & Gee, C. S. (2017). Does higher bank concentration reduce the level of competition in the banking industry? Further evidence from South East Asian economies. *International Review of Economics & Finance*, *52*, 91–106. https://doi.org/10.1016/j.iref.2017.09.006

Kim, D.-W., Yu, J.-S., & Hassan, M. K. (2018). Financial inclusion and economic growth in OIC countries. *Research in International Business and Finance*, *43*, 1–14. https://doi.org/10.1016/j.ribaf.2017.07.178

Kouki, I., Abid, I., Guesmi, K., & Goutte, S. (2020). Does financial inclusion affect the African banking stability? *Economics Bulletin*, *40*(1), 863–879.

Laeven, L., & Levine, R. (2009). Bank governance, regulation and risk taking. *Journal of Financial Economics*, *93*(2), 259–275. https://doi.org/10.1016/j.jfineco.2008.09.003

Marín, A. G., & Schwabe, R. (2019). Bank competition and financial inclusion: Evidence from Mexico. *Review of Industrial Organization*, *55*(2), 257–285. https://doi.org/10.1007/s11151-018-9673-5

McKinnon, R. I. (1973). *Money and capital in economic development*. Brookings Institute.

Minh, S., Hong, V., Hoang, L., & Thuy, T. (2020). Does banking market power matter on financial stability? *Management Science Letters*, *10*(2), 343–350. https://doi.org/10.5267/j.msl.2019.8.036

Mishkin, F. S. (1999). Financial consolidation: Dangers and opportunities. *Journal of Banking & Finance*, *23*(2–4), 675–691. https://doi.org/10.1016/S0378-4266(98)00084-3

Mohd Noor, N. H. H., Bakri, M. H., Wan Yusof, W. Y. R., Mohd Noor, N. R. A., & Abdullah, H. (2020). The determinants of bank regulations and supervision on the efficiency of Islamic banks in MENA Regions. *The Journal of Asian Finance, Economics, and Business*, *7*(12), 245–254. https://doi.org/10.13106/jafeb.2020.vol7.no12.245

Morgan, P. J., & Pontines, V. (2018). Financial stability and financial inclusion: The case of SME lending. *The Singapore Economic Review*, *63*(01), 111–124. https://doi.org/10.1142/S0217590818410035

Musau, S., Muathe, S., & Mwangi, L. (2018). Financial inclusion, bank competitiveness and credit risk of commercial banks in Kenya. *International Journal of Financial Research*, *9*(1), 203–218. https://doi.org/10.5430/ijfr.v9n1p203

Nayyar, D. (2019). *Resurgent Asia: Diversity in development*. Oxford University Press. https://doi.org/10.1093/oso/9780198849513.001.0001

Ndebbio, J. E. U. (2004). *Financial deepening, economic growth and development: Evidence from selected sub-Saharan African Countries*. African Economic Research Consortium.

Neaime, S., & Gaysset, I. (2018). Financial inclusion and stability in MENA: Evidence from poverty and inequality. *Finance Research Letters*, *24*, 230–237. https://doi.org/10.1016/j.frl.2017.09.007

Nguyen, T. D., & Du, Q. L. T. (2022). The effect of financial inclusion on bank stability: Evidence from ASEAN. *Cogent Economics & Finance*, *10*(1), 1–14. https://doi.org/10.1080/23322039.2022.2040126

Nier, E. W. (2005). Bank stability and transparency. *Journal of Financial Stability*, *1*(3), 342–354. https://doi.org/10.1016/j.jfs.2005.02.007

Na'im, H., Subagiarta, I. W., Wibowo, R., & Wardhono, A. (2021). An empirical study of financial inclusion and financial system stability in ASEAN-4. *The Journal of Asian Finance, Economics and Business*, *8*(7), 139–150.

Ofoeda, I., Mawutor, J. K. M., & Ohenebeng, D. N. F. H. (2024). Financial inclusion, institutional quality and bank stability: Evidence from sub-Saharan Africa. *International Economics and Economic Policy*, *21*, 27–64. https://doi.org/10.1007/s10368-023-00578-5

Owen, A. L., & Pereira, J. M. (2018). Bank concentration, competition, and financial inclusion. *Review of Development Finance*, *8*(1), 1–17. https://doi.org/10.1016/j.rdf.2018.05.001

Ozili, P. K. (2018). Impact of digital finance on financial inclusion and stability. *Borsa Istanbul Review*, *18*(4), 329–340. https://doi.org/10.1016/j.bir.2017.12.003

Ozili, P. K. (2021). Financial inclusion research around the world: A review. *Forum for Social Economics*, *50*(4), 457–479. https://doi.org/10.1080/07360932.2020.1715238

Pham, T. T. T., Nguyen, T. V. H., & Nguyen, K. (2019). Does bank competition promote financial inclusion? A cross-country evidence. *Applied Economics Letters*, *26*(13), 1133–1137. https://doi.org/10.1080/13504851.2018.1540833

Roengpitya, R., Tarashev, N. A., & Tsatsaronis, K. (2014). Bank business models. *BIS Quarterly Review*.

Roy, A. D. (1952). Safety first and the holding of assets. *Econometrica: Journal of the Econometric Society*, *20*(3), 431–449. https://doi.org/10.2307/1907413

Saha, M., & Dutta, K. D. (2020). Nexus of financial inclusion, competition, concentration and financial stability: Cross-country empirical evidence. *Competitiveness Review: An International Business Journal*, *31*(4), 669–692. https://doi.org/10.1108/CR-12-2019-0136

Sakarombe, U. (2018). Financial inclusion and bank stability in Zimbabwe. *Journal of Academic Research in Economics and Management Sciences*, *7*(4), 121–138. https://doi.org/10.6007/IJAREMS/v7-i4/5193

Sarma, M., & Pais, J. (2011). Financial inclusion and development. *Journal of International Development*, *23*(5), 613–628. https://doi.org/10.1002/jid.1698

Serrao, M. V., Sequeira, A., & Hans, B. (2012). *Designing a methodology to investigate accessibility and impact of financial inclusion*. Household finance e-journal-CMBO. SSRN. https://doi.org/10.2139/ssrn.2025521

Sparatt, S., & Stephen, N. (2013). Financial regulation in low income countries. *Banking Growth with Stability*.

Tonby, O., & Woetzel, J. (2020, April 8). *Could the next normal emerge from Asia*. McKinsey & Company.

Tan, Y., & Anchor, J. (2017). Does competition only impact on insolvency risk? New evidence from the Chinese banking industry. *International Journal of Managerial Finance*. https://doi.org/10.1108/IJMF-06-2016-0115

Vo, D. H., Nguyen, N. T., & Van, L. T.-H. (2021). Financial inclusion and stability in the Asian region using bank-level data. *Borsa Istanbul Review*, *21*(1), 36–43. https://doi.org/10.1016/j.bir.2020.06.003