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Article

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FINANCIAL ECONOMICS | RESEARCH ARTICLE

Institutional quality's influence on financial inclusion' impact on bank stability

Dao Ha¹ and Yen Nguyen^{2*}

Abstract: Using the Generalized Method of Moments (GMM), this study examines the influence of institutional quality on the impact of financial inclusion on the stability of 157 banks in 8 ASEAN countries from 2010 to 2020. The results show that financial inclusion negatively hurts bank stability, and this effect will be improved if it is implemented in an environment of good institutional quality. This is verified again in terms of institutional quality aspects. Corruption control, political stability, government efficiency, and the rule of law have positive effects, while regulatory quality has negative effects. The results are consistent across all three measures of bank stability, Zscore, standardized Zscore, and non-performing loans (NPL). With the above results, the study recommends that national governments take steps to improve institutional quality to increase the stability of banks in promoting financial inclusion.

Subjects: Banking; Economics

Keywords: financial inclusion; banking stability; ASEAN; institutional quality

JEL Classifications: G15; G21; G18

1. Introduction

The banking system plays the role of the lifeblood of the economy (Baum et al., 2021; Davies et al., 2010); banking stability ensures the stability of the economy, so studies in the world are very interested in factors affecting banking stability to find solutions to increase the stability of the banking system. Factors affecting bank stability come from bank characteristics such as asset size, equity size, competition, income diversification, and management efficiency (Ahamed & Mallick, 2017; Albaity et al., 2019; Beck et al., 2013; Bermpei et al., 2018; Goetz,

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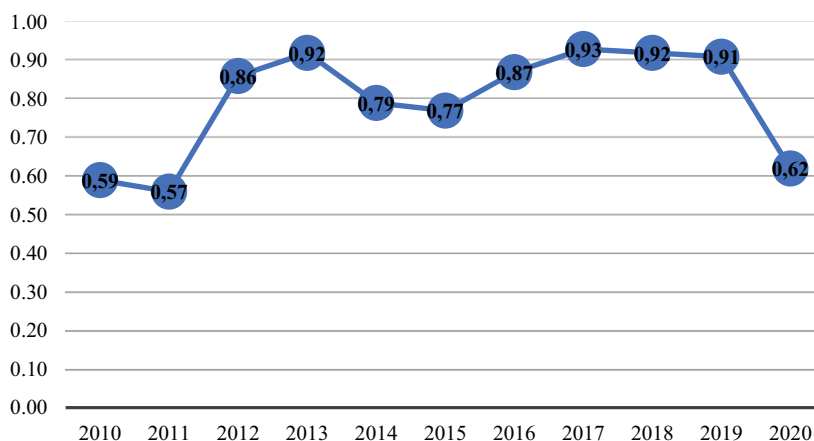
Associate Professor Dao Ha is Vice Rector of Ho Chi Minh University of Banking, Vietnam. She is an expert of the State Bank of Vietnam, a member of many scientific research committees, and the principal investigator of many projects. She has published many articles in high-ranking journals such as *Economic Modeling*, *International Journal of Environmental Research and Public Health*, *Emerging Markets Finance and Trade*, *Journal of Risk and Financial Management*, and *Research Journal*. She is also a member of the editorial board of the *International Journal of Economics, Commerce, and Management* and a reviewer for journals such as the *Afro-Asian Journal of Finance and Accounting*, *Journal of Poverty*, *Journal of Economic Development*, and *Journal of Economics and Development*. She actively participates in community activities and is a member of the council of the Regional Network on Poverty Eradication (RENPER)

2018); macroeconomic factors such as inflation, economic growth rate, unemployment, etc. However, research on banking stability in other countries currently focuses mainly on internal aspects of banks, macro factors, and less attention to institutional quality, financial inclusion, and controversy about the direction of impact. Promoting financial inclusion will change the structure of the financial system and affect banking stability (Ozili, 2020). Financial inclusion helps banks increase savings (Cull et al., 2012; Hannig & Jansen, 2010; Hawkins, 2006), diversify loans (Khan, 2011), and reduce the probability of default, helping maintain stability banking system. However, García (2016) argues that banks will promote financial inclusion without a strict control mechanism by bypassing regulations, lowering lending standards, and lending to risky projects, to risk to offset high transaction costs, which will reduce bank stability. Institutional quality is also seen as a factor that improves bank stability (Bermpei et al., 2018; Dutta & Saha, 2019; Fang et al., 2014; Uddin et al., 2020). This effect is explained by the good institutional quality that reflects the government's formulation and implementation of appropriate policies that guide economic activities, leading to a reduction in adverse effects from financial shocks and ensuring ensure normal and efficient economic activities Fazio et al. (2018) and Klomp and De Haan (2013). Institutional quality also reduces the negative impact of competition on bank stability or the adverse effect of bank marketization on bank stability (Hanafi et al., 2021).

There are few studies on financial inclusion, institutional quality, and bank stability. Ahamed and Mallick (2019) and Saha and Dutta (2022) are two quite comprehensive studies on this issue. With a large dataset of 2635 banks in 86 countries in 2004 – 2012, Ahamed and Mallick (2019) have shown the positive impact of financial inclusion on banking stability and emphasized that this impact will be further reinforced when implemented in an environment of good institutional quality. Agree with Ahamed and Mallick (2019), Saha and Dutta (2022) give similar results when studying this issue with country-level datasets. However, the bank stability in the two studies of these authors is only measured in one way. In this study, to reflect on the bank stability, we use many methods of measurement and comparison and compare the results of different measures more accurately and thoroughly.

ASEAN (Association of Southeast Asian Nations) is a model for rapid economic growth, with an average annual growth rate of more than 5% 2015. In recent years, ASEAN countries have had remarkable economic development. However, that rapid growth has many risks due to ASEAN's relatively large openness, current trade openness is 107.65%, and financial openness is 0.16447%, with relatively low and volatile banking stability in ASEAN countries (Figure 1). In addition, since the 2008–2009 global financial crisis, financial inclusion has become a priority policy of ASEAN countries. In 2009, the Central Bank of Malaysia Act stipulated that the primary function of BankNegara Malaysia (BNM) is to develop and promote financial inclusion; in 2012,

Figure 1. Average Zscore of ASEAN countries.



Indonesia announced its national strategy for financial inclusion (Rahman, 2015); In 2011, Thailand also launched a national plan for financial inclusion (Tambunlertchai, 2015).

ASEAN is a reasonably diverse region with a bank-dependent economy. It is forecast to become the fifth-largest trading region globally, and its role in the global financial system is growing and increasing (Q. K. Nguyen, 2022).

In the context that the impact of financial inclusion on banking stability is still an unanswered question, the fact that an economic region has low banking stability and is potentially contagious to other economies, the shift to focus on promoting financial inclusion raises questions that need to be answered: (1) Does promoting financial inclusion increase banking stability in developing countries? (2) Does this effect vary with different institutional qualities? (3) And for each aspect, how does the institutional quality affect that impact? Answering these questions also provides suggestions for ASEAN's inappropriate policy adjustment.

This research contributes to the literature in several ways. This study adds empirical evidence to the controversial relationship between the impact of financial inclusion on bank stability. Our study has many points of inheritance of the two studies mentioned above and has the following differences: (1) adding two additional aspects in building a financial inclusion index; (2) measuring bank stability by multiple measures instead of just Zscore, which is considered an imperfect indicator because it can mask the risks of countries (Wu et al., 2020); (3) use the additional dummy variable to assign institutional quality based on the level of institutional quality compared to the national average; (4) evaluate the effect of each aspect of institutional quality individually on the impact of financial inclusion on banking stability (5) chose ASEAN to tell a story about financial inclusion, banking stability, and institutional quality in a region with a banking-dependent economy.

The rest of the paper is organized as follows. The next section summarizes the literature. Section 3 introduces data and methodology. Section 4 presents and discusses the results and section 5 concludes.

2. Theoretical and literature review

2.1. Theoretical about banking stability, financial inclusion, and institutional quality

2.1.1. Banking stability

Stability in banking has been a widely discussed topic among regulators and researchers since the global financial crisis of 2008–2009. Several studies have introduced the concept of financial stability in banking (also known as banking stability). Crockett (1997) considered stability in banks to be related to the absence of financial stress, which can lead to losses in larger banks and even bankruptcy in smaller banks. As a result, the most financially stable banks can meet their obligations without outside support. In addition, financial stability can be related to the absence of solid price volatility that damages the system. Therefore, banking stability is a condition to increase the economy's efficiency (ECB, 2005). Borio (2003) considers financial stability based on two main models: micro-prudential and macro-prudential. Micro-prudence efforts aim to reduce the probability of bankruptcy at each bank level. Therefore, "bank runs," which are one of the causes of bank instability (Bonin et al., 2014), can put the bank into bankruptcy (Diamond & Dybvig, 1983; Ngalawa et al., 2016). For example, the "bank run" from American banks in the 1930s, the collapse of Bear Stearns in 2008, and the withdrawal of the Asian joint-stock commercial bank in Vietnam in 2003 (Tuấn, 2016). Lai (2002) argues that banks' illiquidity is the root cause of financial instability. In addition, banks suddenly tighten and shrink credit out of fear of not having enough money to lend or meet the central bank's requirements, especially at any interest rate; this became the cause of the financial crisis (Fratianne & Marchionne, 2009). Thus, banking stability can be generalized as follows: The bank's effective operation and ability to respond well to internal

and external influences, both now and in the future, especially the shocks of the economy, but still maintain the ability to pay for due debts, maintain normal operations.

2.1.2. *Financial inclusion*

There is no unified concept of financial inclusion. Existing definitions of financial inclusion are not always clear-cut, even though they are all built on the same theoretical foundations. The idea of financial inclusion dates to the 1990s. At first, financial inclusion was seen from the problem of financial exclusion. Financial exclusion is when a group of people, especially the poor, cannot or have difficulty accessing financial services because of high costs or complicated procedures (Kempson & Whyley, 1999; Panigyrakis et al., 2002). Since then, banks have begun to focus on developing credit products suitable for the poor; as a result, they can participate in financial markets to improve their income (Dymski & Veitch, 1996; Leyshon & Thrift, 1995; Pollard, 1996).

Over time financial inclusion did not stop at serving credit to the poor through microfinance institutions but expanded to many different objects, providing financial services by non-financial institutions. According to Rangarajan (2008), Arun and Kamath (2015), financial inclusion ensures timely and adequate access to financial services at reasonable costs to meet the needs of different groups of people, especially vulnerable populations. In addition, non-discrimination for all members of society, while Atkinson and Messy (2013) emphasize fairness and equality. Naceur et al. (2017) are concerned with the access and quality of financial services provided. Kim (2011), Akileng et al. (2018) clarify financial services, including account opening, payments, savings, loans, and insurance.

2.1.3. *Institutional quality*

Economists, sociologists, and political scientists have given many concepts of institutions. From an economic perspective, Veblen and Mills (2017) argue that institutions are norms of behavior or rules that define behavior in specific situations, which members of a social group fundamentally accept. Principles and compliance with those rules are self-controlled or controlled by an outside power. North (1990) is considered a pioneer in giving a clear and specific concept of institutions, whereby institutions are the rules of the game in a society; Or, to put it more formally, institutions are human-devised constraints that shape new relationships between people. According to this definition, institutions have three characteristics: first, institutions are devised by people, in contrast to other factors beyond human control, such as geography, weather, and climate; Second, it is the rules of the game (the rules of the game); third, the main effect of institutions is through constraints affecting behavior, thereby creating the structure of human motivation and action (Acemoglu et al., 2005). Commons (1931) 1999 define institutions as rules that constrain the behavior of individuals (which are opportunistic and erratic and erratic), from which it is easy to predict the behavior of individuals. People contribute to speeding up the division of labor and creating goods and materials. Institutions only work when there are accompanying sanctions to handle violations. The institution consists of features of a society, such as organization, rules, and beliefs. These structures guide, direct, and limit human activities (Greif, 2000) or uniformity in behavior and social behavior that all community members accept (Schotter, 2008). This behavior is controlled by the individual or due to external adjustment, so institutions can also be seen as policies chosen by people.

The primary role of institutions is to reduce uncertainty in economic activity and encourage economic development (Samadi, 2019). However, the impact of institutions on the activities of organizations, enterprises, or the economy depends on the quality of institutions. Kaufmann et al. (1931) define institutional quality as the traditional values and institutions by which a country's authority is exercised, reflecting the Government's capacity to formulate and implement its policies (Schneider,). Furthermore, institutional quality reflects the efforts of the rule of law to exercise the political and economic power of the Government to ensure fairness, transparency, and efficiency (UNDP, 1997). In summary, there are many ways to define institutional quality. Still, to evaluate institutional quality, studies are based on factors: power, consistency, robustness, and

performance, specifically through content on corruption, quality of government apparatus, and law compliance (ADB, 2013).

2.2. Literature review on financial inclusion, bank stability and institutional quality

2.2.1. Financial inclusion and bank stability

Previous studies point to the impact of financial inclusion on bank stability in two directions.

Financial inclusion increases the bank's accessibility to small businesses and households and benefits from the retail mobilized capital sources, which are believed to be more stable than wholesale ones. Diversifying loans to small businesses reduces the risk and cost of bank financing, decreases custodial costs and potential losses, enhances their stability, and strengthens the banks crisis (Demirguc-Kunt & Huizinga, 2010; Poghosyan & Martin, 2011). In the financial crisis, these sources help them escape financial crisis difficulties and increase their resilience (Han & Melecky, 2013; Hannig & Jansen, 2010). Banks in Canada in the turbulent times of 2008 Ratnovski and Huang (2008), banks in Austria Rossi et al. (2009), and Islamic banks in Indonesia in 2002–2010 Shaban et al. (2014) are typical examples. This situation is backed by portfolio theory (Boot & Schmeits, 2000). Besides, with attractive interest rate policies, the bank encourages businesses to invest in income-generating projects, positively contributing to economic growth and a healthy banking system (Allen et al., 2021; Kereta, 2007; Morgan & Pontines, 2014; Neaime & Gayssset, 2017). In addition, greater financial inclusion can also reduce information asymmetry by capturing more information about borrowers (Black, 1975; Fama & Jensen, 2005; Rajan, 1992). By expanding branches and installing more ATMs, banks can reach unbanked/underbanked areas, thereby reducing distances and building relationships with customers, helping banks increase efficiency in financial transactions (Degryse & Ongena, 2005; Deng & Elyasiani, 2008; Hauswald & Marquez, 2006).

On the other hand, financial inclusion can also reduce bank stability if credit expansion is excessive, without close supervision from regulators (Dienillah et al., 2018; Mehrotra & Yetman, 2015). Furthermore, improper policy enforcement can lead to instability in banking operations (Kipsha & Zhang, 2013; Čihák et al., 2016). However, banks can control adverse effects with effective customer protection strategies and a rigid monitoring system.

2.2.2. Institutional quality and bank stability

Several studies have recently provided evidence that institutional quality affects bank stability. There are reasons to explain the above effect. First, the asymmetric information problem presents a significant obstacle in channeling funds from savers to borrowers (Lindset et al., 2014; Miller, 2015; Neyer, 2004) and directly affects credit activities (Qu et al., 2018). A good institutional environment reduces problems related to information asymmetry (Cohen et al., 1983; T. S. Ho & Michaely, 1988) and transaction costs (Jude & Levieuge, 2015). For instance, C. P. Nguyen et al. (2018) documented that better institutional quality induced higher credit levels in the banking system in emerging economies from 2002 to 2013, thanks to reducing restrictions from asymmetric information and transaction cost. In this context, if the problem of asymmetric information becomes less severe, commercial banks will be less likely to supply loans to poor creditworthiness borrowers, and borrowers will also be less likely to be involved in risky projects. More importantly, the behavior of bank managers may differ in different contexts regarding their banks' economic situation and condition (Vo & Nguyen, 2014). Therefore, reducing information asymmetry through improving institutional quality can limit moral hazard and reduce the risk of commercial banks, increasing stabilizing banks (Cohen et al., 1983; K. -C. Ho et al., 2019). Second, concrete literature points out that better institutional quality induces a more effective macroeconomic policy (C. P. Nguyen et al., 2018; Su et al., 2019), including banking regulations. As a result, the bank managers would be more careful in supplying credit to borrowers. Third, better institutional quality argues for less uncertainty in the macroeconomic systems as prudential macroeconomic policies (Strobel et al., 2018). For instance, evidence shows that governments in advanced countries

(mostly with high institutional quality) usually implement a counter-cyclical fiscal policy. In addition, political stability can improve loan terms, thus reducing borrowers' moral hazards and defaults. Francis et al. (2014) provide evidence from the syndicated loan market, showing that political uncertainty increases the cost of bank loans.

Furthermore, solid institutions can positively affect corporate transparency and openness and improve the amount and accuracy of borrower information (Bushman & Piotroski, 2006). As a result, banks can reduce adverse selection and price loans more efficiently. In conclusion, any institutional quality improvement will significantly reduce credit and default risk, making the bank more stable.

On the other hand, several studies focus on analyzing the degree of corruption of a country to banking stability. Corruption is often associated with poor governance and institutional quality (Asiedu, 2003; Diaby & Sylwester, 2015; Méndez & Sepúlveda, 2015). Corruption is "abusing public or corporate offices for personal gain" (Bhargava, 2005). Higher levels of corruption disrupt banks' investment and lending decisions, undermine bank profitability and stability, and ultimately destabilize the banking industry (Toader et al., 2018). Toader et al. (2018) practices a study of 144 banks in 40 developing economies and found that lower levels of corruption positively impact bank stability and are associated with reduced credit losses and growth. (Demirgüç-Kunt & Detragiache, 1998, 2005) argue that the widespread corruption of law enforcement explains the emergence of banking crises. The weakness of the legal system negatively correlates with the effectiveness of supervisory activities of the banking system. Therefore, institutional factors play an essential role in explaining banking crises. Mongid (2007) shows that banking crises are positively associated with higher levels of corruption and poor law enforcement. Wei (1999) suggested that corruption can negatively affect credit allocation by increasing information asymmetry between borrowers and lenders, leading to higher-than-normal lending rates.

Similarly, Chen et al. (2015) evaluated the impact of corruption on bank risk-taking at 1200 banks from 35 emerging countries between 2000–2012. They found that bank risk-taking behavior was positively related to corruption. The higher the level of corruption in a country, the higher the risk level of banks. More recently, Prak (2012) assessed the effect of corruption on the banking sector's health using an international database of 70 countries from 2002–2004. The results show that corruption may be associated with a higher NPL ratio in the banking sector, which means lower profitability and greater risk. In addition, the corruption that increases the allocation of bank capital from standard projects to destructive projects and undermines the soundness of banks also negatively affects economic growth. Similar conclusions are also found (Weill, 1999; Zheng et al., 2013). However, Lalountas et al. (2002) point out that corruption can also increase profits for banks in the short term, while in a long time, it is necessary to consider some other factors, such as the ability to repay. Mauro (1995) points out that corruption does not necessarily increase bad loans because even good borrowers can bribe loan officers to speed up loans and bypass the loan approval process.

2.2.3. Institutional quality on financial inclusion's impact on bank stability

Several recent studies have begun to pay attention to the influence of institutional quality on the relationship between bank stability and other factors such as competition, audit committee effectiveness, or risk management effectiveness (Hanafi et al., 2021; Hou & Wang, 2016). However, very few studies in the world examine institutional quality's influence on financial inclusion's impact on banking stability, especially in ASEAN. The most recent study Saha and Dutta (2022) investigated the effect of governance quality on financial inclusion and financial stability in 84 economies between 2004 and 2017. The result of the study shows that institutional quality enhances the positive impact of financial inclusion on bank stability. Another research by Ahamed and Mallick (2019) also shows that institutional quality has a significant role in the relationship between financial inclusion and

banking stability in 87 countries around the world between 2004 and 2012. Accordingly, in a country with good institutional quality, financial inclusion will increase the stability banks.

3. Data and methodology

3.1. Data sampling and collecting

The study uses data from 157 banks in 8 countries of ASEAN (including Cambodia, Laos, Singapore, Philippines, Vietnam, Thailand, and Indonesia) in the period 2010–2020 from Focus Bank Orbis Database to investigate banks' characteristics. This data is screened from 10 countries with more than 400 banks, and collected data are excluded: (i) banks with less than three consecutive years of observations and (ii) banks with outlier data, which may cause measurement errors and thus affect the risk measurement. Financial inclusion indexes are collected from the financial access survey (FAS) database from International Monetary Fund (IMF); economic growth (GDP) and inflation are obtained from the IMF data set, and the institutional quality index is collected from the Worldwide Governance Indicators databases (WGI) from World Bank.

3.2. Measurements of variables

3.2.1. Dependent variable

Z-score is used to estimate the propensity of vulnerabilities more fairly in the banking sector because of its comprehensiveness (incorporation of degree of solvency, profitability, and the variability of revenue), simplicity, and availability. This index is also widely used in the current banking literature to measure bank stability (Al-Shboul et al., 2020; Laeven & Levine, 2009; Louhichi et al., 2020).

$$Z - score_{it} = \frac{ROA_{it} + \frac{E_{it}}{TA_{it}}}{\sigma ROA_{it}}$$

Where ROA and σROA represent the return on assets and its standard deviation, respectively, while E/TA is the equity to total assets ratio. A higher Z-score shows that the bank is more stable and less risky because it is adversely related to the possibility of bank insolvency (Beck et al., 2013; Louhichi et al., 2020). Furthermore, Z-score is transformed into a natural logarithm to smooth out higher values (Bermpei et al., 2018; Fang et al., 2014; Shim, 2019; Smaoui et al., 2020).

To check robustness, we follow Louhichi et al. (2020) and Smaoui et al. (2020) use the non-performing loans to total loans ratio (NPL) as a proxy for bank credit risk. Loans represent a significant source of bank income. A more substantial proportion of NPL shows low quality in the bank loan portfolio and displays that a bank is taking higher risks in lending (Noman et al., 2018). Moreover, comparison depends on the Z score's value, leading to biased results since the same Z-score banks across countries can hide their relative risk in their market (Wu et al., 2020). Therefore, the higher Z-score value of bank A in one country does not mean that bank A is riskier than bank B in another country. To overcome this problem, we follow Wu et al. (2020) using the adjusted Z Score (Zscore N) as the third measure of bank stability.

However, the Z-score is not significant in comparison between two different markets (Wu et al., 2020). Therefore, this study used a normalized Z-score to overcome this problem, like the treatment of (Wu et al., 2020).

$$Zscore_n_{ijt} = \frac{Zscore_{ijt} - \min(Zscore_j)}{\max(Zscore_j) - \min(Zscore_j)}$$

Where $\max(Zscore_j)$ and $\min(Zscore_j)$ indicate the maximum and minimum Z-score values for all banks in country j during the sample period. A higher $Zscore_n_{ijt}$ value shows that the bank is comparatively more stable/less risky than its banks from different countries.

3.2.2. Independent variable

3.2.2.1. Financial inclusion. There are many methods to measure the financial inclusion index, and each has advantages and disadvantages. Individual indicators (for example, the number of adult bank accounts) can provide information on one aspect of financial inclusion, but they ignore the quality and use of financial services. Therefore, building a comprehensive financial index that fully reflects all aspects of financial inclusion is necessary. The literature review shows two synthesis methods: the simple Euclidean average and the PCA. In particular, the Euclidean simple average method is applied by many authors such as (Park & Mercado, 2015; Williams et al., 2017). However, this index has a significant limitation in that the weights of the dimensions are assigned subjectively. Hence, it is only valid for the case of the countries studied (Sarma, 2012). Therefore, some authors, such as Ahamed and Mallick (2019), expressed concern about the accuracy of this method. Principal component analysis (PCA) is a widely used multivariate analytical statistical technique to reduce many correlated variables into a small set of variables such that the resulting new variables are composite. The linearity of the old variables is not correlated with each other without affecting the quality of the newly created variables. This approach cannot use personal information and can cover all aspects of financial inclusion. After considering the pros and cons of the methods, the study decided to use the PCA method to determine the financial inclusion index based on three aspects: penetration, availability, and use, as suggested (Sarma, 2012).

PCA financial inclusion index is calculated and normalized to get values from 0 to 1 from six indicators, namely the number of ATMs per 1000 km² and bank branches per 1000 km², the number of ATMs per 100,000 adults and the number of bank branches for 100,000 adults, and the ratio of credit to private to GDP, and deposit to private to GDP. These indicators have been used extensively in previous studies (Ahamed & Mallick, 2019; Amidžić et al., 2014; Gupte et al., 2012; Lenka et al., 2016). Eigenvalues of the six components are 3.1053, 1.2301, 0.9250, 0.7040, 0.0285 và 0.0069, suggesting that the first component with an eigenvalue greater than 1 is relevant, which explains 52% of the variation of the sample variance. Considering the first component, study creates an index of financial inclusion using weights (i.e., 0.4995, 0.5032, -0.0199, 0.0296, 0.4971 and 0.4989) assigned to the first principal component (Appendix A21).

The calculated new financial index was tested the validity by BDM (2007) method and evaluated the strength by regressing with robust standard errors (Appendix A23).

3.2.2.2. Institutional quality. The institutional quality index is constructed from the six indicators in the Global Governance Index (WGI) dataset, which include Voice and Accountability, Political Stability and the absence of violence/terrorism, Government Efficiency, Regulatory Quality, Rule of Law, and Control of Corruption. The indicators are based on more than 30 fundamental data sources that report governance perceptions of many survey respondents and expert judgments worldwide. Eigenvalues of the six components are 4.5469, 1.1978, 0.1881, 0.0346, 0.0215, and 0.0109, suggesting that the first component with an eigenvalue greater than 1 is relevant, which explains 75% of the variation of the sample variance. Considering the first component, we create an index of institutional quality using weights (i.e., 0.4641, 0.4624, 0.2843, 0.4607, 0.4619 and 0.2536) assigned to the first principal component (Appendix A3).

3.3. Model specification and regression

Based on studies of Saha and Dutta (2022) and Ahamed and Mallick (2019), the model of the influence of institutional quality on the impact of financial inclusion on bank stability is built according:

$$Zscore_{ijt} = \alpha_1 Zscore_{ijt-1} + \theta_1 INS_{jt} + \beta_1 IFI_{jt} + \delta_1 IFI_{jt} * INS_{jt} + \gamma_1 \sum B_{ijt} + \delta_1 \sum M_{jt} + \varepsilon_{it} \quad (1)$$

where i, j, and t are the banks, country, and time indexes. $Zscore_{ijt}$ is the dependent variable reflecting the stability of a bank i in country j at time t. $Zscore_{ijt-1}$ is the lagged variable of the

dependent variable 1-year, IFI_{jt} and INS_{jt} are independent variables, respectively, reflecting the financial inclusion of country j at time t . $\sum^{B_{jt}}$ includes bank-specific control variables (bank size, liquidity, diversification, management quality ...). $\sum^{M_{jt}}$ are country-level macroeconomic variables (inflation, GDP growth). β , γ , and δ are estimated parameters of the model, and ε_{it} is the residual error term.

The variable INS in the variable of interaction between physical quality and financial inclusion is assigned the value of zero if $(INS \leq \bar{\partial})$ or one if $(INS > \bar{\partial})$, where $\bar{\partial}$ is the mean score, average institutional quality.

The variables used in the model are described in Table Appendix A1.

3.3.1. Estimation method

The two-step system generalized method of moments (GMM) estimator, as advanced by (Arellano & Bover, 1995) and (Blundell & Bond, 1998), with robust standard errors (Windmeijer, 2005), is used in this article because of potential endogeneity. The endogeneity is rooted in the potential persistence of bank stability (Agoraki et al., 2011) and the relation between bank stability and the bank-specific and control variables such as size, the loan to assets ratio, the equity to assets ratio, the loan loss provisions to assets ratio, and diversification income (Delis & Staikouras, 2011; Delis, 2012). Moreover, the data sample with a small T ($T = 11$) and large N ($N = 157$) is suitable for using the S-GMM estimation model (Blundell & Bond, 1998). GMM is mainly used to investigate the determinants of bank stability (Dietrich & Wanzenried, 2011; Liu & Wilson, 2010) and is considered an appropriate estimation method to explore the dynamic nature of relationships (Flannery & Hankins, 2013).

Besides, the dependent and lagged dependent variables (L. Zscore) are also considered endogenous as the standard in the literature. Their second or longer lags are considered instrument variables in the model (Blundell & Bond, 1998).

Finally, the results of the two-step system GMM estimator are verified by Hansen's J test for instrument validity and the second-order autocorrelation of the error terms test, AR2 (Arellano & Bond, 1991).

4. Results discussion

4.1. Descriptive statistics

Table 1 presents summary statistics for all variables used in the model. The mean of the Zscore is 0.7943 with a standard deviation of 0.5429, implying that the average ROA would have to decrease by 0.7943 standard deviations to wipe out the bank's equity. The low standard deviation indicates no significant cross-country difference in bank stability. Of the eight countries studied, Malaysia, the Philippines, Singapore, and Thailand have a high level of stability compared with other countries in the region and the regional average. The Z-Score of these countries always ranges from 0.7147 to 1.2032, while the Z-Score for the whole area ranges from 0.6578 to 0.9024.

Regarding the nonperforming loan ratio, the mean is 0.1308, with a standard deviation of 1.6767. The standard deviation is relatively high, indicating a significant difference between countries regarding lousy debt. For the variable of interest, the mean of financial inclusion is 0.2289, with a standard deviation of 0.1834, indicating a significant homogeneity of financial system comprehensiveness across a sample of 8 in our country. The countries with the highest level of financial inclusion include Singapore and Malaysia ... those with low financial inclusion are Cambodia and Laos, but the difference between countries is not significant. But in general, all countries have made efforts to develop financial inclusion, so the financial inclusion index has

Table 1. Descriptive statistics

Variable	Obs	Mean	SD	Min	Max
ZSCORE	1727	0.7943	0.5429	−2.9666	3.0506
LZSCORE	1571	0.8131	0.5546	−2.9666	3.0506
ZSCORE_n	1727	0.5916	0.1767	0	1
LZSCORE_n	1570	0.6973	0.1781	0	1
NPL	1727	0.1308	1.6767	0.0036	0.1967
LNPL	1569	0.1366	1.7514	0.0036	0.1967
IFI	1727	0.2289	0.1834	−0.0875	0.9144
INS	1727	−0.1093	0.6821	−1.7655	1.1336
SIZE	1727	6.7578	0.8091	3.6636	8.6921
LTA	1727	0.6106	0.1331	0.0684	0.9344
LER	1727	0.0860	0.1123	0.0001	1.5022
LLPL	1727	0.0096	0.0153	−0.0757	0.2867
MQA	1727	0.1324	0.0882	0.0078	0.9919
ETA	1727	0.2031	0.1369	0.0034	1.4712
DIV	1727	0.3524	0.4481	−4.6927	3.6915
INF	1727	3.2254	2.1759	−1.1387	18.6773
GDP	1727	4.7521	3.1756	−9.5731	14.5256

improved over the years. With the institutional quality variable, with the mean − 0.1093, the standard deviation of 0.6821 shows that the difference in institutional quality in the 8 ASEAN countries is relatively high, of which Singapore is the country with the highest institutional quality consistently ranked in measures of institutional quality. Countries with low institutional quality, such as Laos and Cambodia.

4.2. Regression results

Regression results by SGMM estimation of model 1 are presented in Table 2.

Table 2 shows that first, while financial inclusion, with the representative variable being the composite index—IFI, has a negative relationship with bank stability, the representative variable is Zscore and Zscore_n, financial inclusion has a positive effect on NPL. This means that financial inclusion increases bad debt, thereby reducing the stability of banks. The results do not match the research expectations. This effect can be explained as follows: Increasing access to finance for people, especially the poor, leads to banks must loosened lending standards, while credit regulations need to be tightened, increasing nonperforming loans, and reducing banks' stability. Research results of Amatus and Alireza (2015), Kouki et al. (2020) and also share the same opinion. Moreover, the financial inclusion variable in the study is determined based on three aspects: the loan and deposit-to-GDP ratio aspects negatively affect banking stability in the studies of Feghali et al. (2021) and Amatus and Alireza (2015), respectively.

Second, for the institutional quality variable, Table 3 shows that the regression coefficient of the institutional quality variable is positive and statistically significant for the Zscore, Zscore_n, and has a negative value for the NPL in ASEAN countries, with coefficients of 0.4714, 0.2588, −0.0314, respectively. That means institutional quality will improve the problem of non-performing loans in banks and thereby increase the level of stability for banks. Better institutional quality will reduce bank credit risk by reducing information asymmetry, directly improving credit quality. Thus, improving the quality of institutions is an essential factor in improving the stability level in these countries. This result is also consistent with the results of Naceur and Goaied (2017), who found that commercial banks' operational efficiency and stability are affected by various institutional and

Table 2. Institutional quality's influence on financial inclusion's impact on the stability

	Zscore	Zscore_n	NPL
L.Zscore	0.3666***		
L.Zscore_n		0.3812***	
L.NPL			0.6372***
IFI	− 4.2869**	− 2.0589***	0.8349***
INS	0.4714***	0.2588***	−0.0314**
IFI*INS	4.2715**	2.0764***	− 0.8335***
LTA	2.1567***	0.5934***	− 0.2052***
SIZE	0.2934***	0.0339	0.0675***
LER	0.3861***	0.0012	0.0792***
LLPL	− 0.0003	−0.0096*	0.0103***
MQA	0.4320***	0.2270***	−0.0067
ETA	3.1549***	0.6559***	− 0.1391***
DIV	− 0.0985***	− 0.0331**	−0.0088***
INF	− 0.0456***	− 0.0097*	− 0.0105 ***
GDP	0.0090	− 0.0069	0.0096***
_cons	−3.2898***	−0.2478***	−0.3147***
Number of observations	942	1412	1568
Number of groups	157	157	157
Number of instrument variables	67	30	82
AR (2)	0.131	0.074	0.315
Sargan	0.449	0.145	0.728
Hansen	0.328	0.298	0.530

Note: ***, **, and * represent statistical significance at 0.01, 0.05, and 0.1, respectively.

regulatory factors. Similarly, research of Uddin et al. (2020) also demonstrates that enhancing government effectiveness, controlling corruption, and improving agents' trust and compliance with the law will reduce banking risks.

Finally, the interaction between financial inclusion and institutional quality positively correlates with Zscore, Zscore_n, and negative with NPL. This result confirms that a successful financial inclusion policy must be implemented in a sound, good institutional environment characterized by the following factors: a high degree of political stability, reasonable control of corruption, a voice of responsibility and citizenship, and strict enforcement of the rule of law. Obviously, as the quality of institutions increases, government policies and regulations related to the performance of contracts and the constraints in transactions become tighter, leading to the fact that actors must comply with the given rules. For example, in lending, customers must be carefully appraised to ensure the ability to recover capital later. Therefore, the interaction between institutional quality and financial inclusion increases banking stability in ASEAN countries. Thus, the negative impact of financial inclusion on banking stability will be minimized if the institutions of the countries are well established. This result supports the study by Ahamed and Mallick (2019) and Saha and Dutta (2022), who found that having financial inclusion positively affects bank stability. This additional effect is more pronounced when banks operate in countries with good institutional quality.

To accurately assess the role of institutional quality on the impact of financial inclusion on banking stability, we continue to consider the individual dimensions of institutional quality (Table 3).

Table 3. Institutional quality aspect's influence on financial inclusion's impact on the stability

Variable	Zscore	Zscore_n	NPL
CCIFI	0.6882***	0.3889***	-0.2171*
PSIFI	2.2323*	1.0284***	-0.8347***
RLIFI	2.1226**	0.5988**	-0.1827***
RQIFI	-5.3134***	-5.3935**	1.0786**
GEIFI	0.6467**	0.1386**	-0.0872***
VAIFI	1.3119	-1.5922	-0.0891

Note: CC: Control of corruption, PS: Political stability, RL: Rule of law, RQ: Regulatory quality, GE: Government effectiveness, VA: Voice and Accountability; ***, **, and * represent statistical significance at 0.01, 0.05, and 0.1, respectively.

Table 3 shows that while the aspects of corruption control, political stability, the rule of law, and government efficiency positively influence the impact of financial inclusion on banking stability, the regulatory quality has a negative effect. In addition, voice and accountability do not affect the above effect.

First is control corruption. At the microeconomic level, corruption is associated with low institutional quality, less efficient institutions in terms of performance and stability, and higher business costs (Asiedu, 2003; Diaby & Sylwester, 2015; Méndez & Sepúlveda, 2015). As a result, corruption can potentially undermine bank profitability and stability. Mongid (2007) shows that banking crises are positively associated with higher levels of corruption and weak law enforcement. In addition, corruption leads to bad behavior, affects the bank's reputation, and makes people distrust the financial system. This is also a barrier preventing people from using formal financial services (Camara et al., 2014). Therefore, controlling corruption is essential to increasing people's confidence in the financial system and encouraging people to use online services, thereby increasing the bank's stability.

Second is political stability. Political instability can lead to the cancellation or delay of investments by domestic enterprises. Such shocks can potentially increase consumer fear and confidence, reducing the need for investment, mainly financed by consumer loans and mortgages. This significantly affects the bank's profitability, leading to higher earnings volatility. As a result, banks face a higher risk of collapse and insolvency, affecting bank stability (Brandt & Gao, 2019; Demir & Danisman, 2021). Many studies have shown that the financial stability of the banking system requires institutional strength, market stability, no tension, and little political volatility between countries or within the country itself. There (Akadir et al., 2020; Alsagr & Almazor, 2020; Cheng & Chiu, 2018; Das et al., 2019).

Third is legislative quality. Several studies provide empirical evidence that higher levels of the rule of law and judicial efficiency enhance regulatory enforcement (Caballero et al., 2004; Daher, 2017). The channels through which the rule of law and greater adjudication efficiency can lead to more vigorous law enforcement increased detection of wrongdoing (Olken, 2007), and increased prosecution and conviction projects (Alt & Lassen, 2012). That means when contracts are strictly enforced, and errors are limited, this is also a way to make people trust the financial system, thereby increasing the level of use and improving bank stability.

Four is government efficiency. Government efficiency shows the executive and management role of the Government in economic activities. With policies and solutions, the Government will effectively manage and control the operations of banks, serving as a basis for increasing people's trust in banks, thereby increasing the use of banks, and using financial services, helping the bank to increase its level of stability.

In addition, the regulatory quality dimension negatively affects the impact of financial inclusion on bank stability. The system of legal documents regulating banking activities in our country today is considered the political and legal environment related to banking activities. We all understand that a stable political and legal environment is the foundation for the bank to develop stably and sustainably. Obviously, the higher the quality of regulations, the better for banking operations. However, from the perspective of the quality of regulatory, it harms the impact of financial inclusion on banking stability, which can be explained as follows: One of the barriers that prevent people from accessing formal financial services is due to strict regulatory procedures such as collateral, minimum balance maintenance (Camara et al., 2014). But on the contrary, the above regulations are requirements to ensure customer repayment, thus ensuring effective and stable banking operations. Therefore, if the regulations are strictly enforced, it will be difficult for people to access financial services; this partly affects the capital source of commercial banks, thereby affecting the bank's stability.

5. Conclusion

Financial inclusion is of great significance to the socio-economic of a country and is the fundamental solution to poverty alleviation and sustainable development. However, implementing financial inclusion can positively or negatively impact bank stability. With data from 157 banks in ASEAN countries for the period 2010 – 2020, the study examines the influence of institutional quality on the impact of financial inclusion on bank stability. Using the GMM method, the results show that although financial inclusion reduces bank stability, this adverse effect is lessened if implemented in an environment of good institutional quality. Therefore, further improvement of institutional quality is key to increasing banking stability in ASEAN countries at a time when governments are promoting a comprehensive financial strategy. The government should continue to improve institutional quality by (1) Strengthening control of corruption, (2) Political stability and consistency in macroeconomic policy management should continue to be maintained to reduce apprehensions about the business environment and risky and uncertain investments, (3) Continuing to strengthen the rule of law improvement, (4) Improve the efficiency of the government in running business activities.

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APPENDIX A1

Variable	Symbol	Definition	Sources
Dependent variables			
Default risk	ZSCORE	Natural logarithm of Z-score	Authors calculation base on Focusbank
Normalized Z-score	ZSCORE_n	Normalized Z-scores by using $[Z - \min(Z)] / [\max(Z) - \min(Z)]$	Authors calculation base on Focusbank
Credit risk (NPL)	NPL	The nonperforming loans to total loans. Higher values mean a riskier loan portfolio and more instability	Authors calculation base on Focusbank
Independence variables			
Financial inclusion	INF	The IFI index is estimated by PCA method from 6 sub-indices as: + the number of ATMs per 1000 km ² and bank branches per 1000 km ² + the number of ATMs per 100,000 people and the number of bank branches for 100,000 adults + the ratio of credit to private to GDP and deposit to private to GDP	IMF
Institutional quality	INS	Average of 6 sub-indices including: Control of Corruption, Rule of law, Regulatory Quality, Government Effectiveness, Political Stability and Absence of Violence, and Voice and Accountability.	IMF
Bank size	SIZE	Natural logarithm of bank assets	Authors calculation base on Focusbank
Loan share	LTA	Loan to total assets	Authors calculation base on Focusbank
Comperitive	LER	The Lerner Index is estimated as $LERit = ((Pit - MCit) / Pit)$. Higher value of Lerner Index indicates less bank competition	Authors calculation base on Focusbank
Provision for loan risks	LLPL	Provision ratio for loans to Total loans	Authors calculation base on Focusbank
Quality of management	MQA	Total earning assets to Total assets	Authors calculation base on Focusbank
Capital risk control	ETA	Equity to Total Assets ratio	Authors calculation base on Focusbank
Diversification	DIV	Non-interest income to Total operating income	Authors calculation base on Focusbank
Economic development	GDP	The annual growth rate of real GDP	IMF
Inflation	INF	Inflation based on the consumer price index	IMF

APPENDIX A2

Table A2.1. Principal components analysis for financial inclusion index

		PC1	PC2	PC3	PC4	PC5	PC6
Eigenvalue		3.1053	1.2301	0.9250	0.7041	0.0285	0.0069
Proportion		0.5176	0.2050	0.1542	0.1173	0.0048	0.0012
Variable	Notation						
The number of bank branches per 1000 km ²	BBKM	0.4995	0.0921	-0.4164	-0.2684	0.1046	-0.6969
The number ATMs per 1000 km ²	ATMKM	0.5032	0.0810	-0.3976	-0.2812	-0.1035	0.7017
The number of bank branches per 100,000 adults	BBPoP	-0.0199	0.7261	-0.2899	0.6220	0.0317	0.0201
The number of ATMs for 100,000 adults	ATMPoP	0.0296	0.6631	0.5323	-0.5254	0.0087	-0.0055
The ratio of to deposit private to GDP.	ODC	0.4971	-0.1137	0.3922	0.2925	0.7004	0.0995
The ratio of credit to private to GDP	OLC	0.4989	-0.0710	0.3839	0.3169	-0.6976	-0.1080

Based on the first principal component, study construct the financial inclusion variable as follows:

$$\text{Financial inclusion (IFI)} = \sum_{i=1}^n w_{ij} * X_i$$

Where w_{ij} are the component's loadings or weights, and X_i are the original variables.

$$\text{IFI} = 0.4995 * \text{BBKM} + 0.5032 * \text{ATMKM} - 0.0199 * \text{BBPoP} + 0.0296 * \text{ATMPoP} + 0.4971 * \text{ODC} + 0.4989 * \text{OLC}$$

Besides, the study follows ideas from BDM (2007) to test the validity of the financial inclusion index. First, the study uses the household-based financial inclusion indicators in the Global Index database to compare with the new financial inclusion index. In several recent studies (Allen et al., 2014; Demirguc-Kunt & Klapper, 2013), the most used indicators are reflective index number of adults with accounts at a financial institution relative to the total number of adults (%) (i.e., the share of household accounts) and adults saving at a financial institution in the past year to a total

number of adults (%) (i.e., proportion household savings). Our new financial inclusion index is positively and significantly correlated at the 1% significance level with the household-based financial inclusion indicators in the Global Findex database.

Table A2.2. Matrix of correlations between alternate financial indicators and newly constructed IFI

	IFI	Share of household account	Share of household saving
IFI	1.0000		
Share of household account	0.2918*	1.0000	
Share of household saving	0.2398*	0.9404*	1.0000

Notes: *** represent statistical significance at 0.1

Then, the study also evaluates the strength of the new index by regressing these variables and new IFI with robust standard errors (see Table A2.2). The result shows that IFI is positive and highly significant in all cases, suggesting IFI is positively related to the Share of household accounts and savings.

Table A2.3. Verifying the strength of the newly constructed index in predicting different financial inclusion indicators

Variables	Share of household account	Share of household saving
IFI	0.1732***	0.3829***
constant	0.1706***	0.1603***
Observation	604	604
R-square	0.836	0.575

Notes: *** represent statistical significance at 0.01

APPENDIX A3

Principal components analysis for institutional quality index

		PC1	PC2	PC3	PC4	PC5	PC6
Eigenvalue		4.5469	1.1978	0.1881	0.0346	0.0215	0.0109
Proportion		0.7578	0.1996	0.0314	0.0058	0.0036	0.0018
Variable	Notation						
Control of Corruption	CC	0.4641	-0.0466	-0.0449	0.2686	-0.8252	-0.1649
Government Effectiveness	GE	0.4624	0.0386	-0.2780	0.2310	0.4785	-0.6520
Political Stability and Absence of Violence	PS	0.2843	-0.6779	0.6581	0.0027	0.1629	0.0014
Regulatory Quality	RQ	0.4607	0.0682	-0.1171	-0.8753	-0.0326	0.0468
Rule of Law	RL	0.4619	-0.0425	-0.3038	0.3111	0.2330	0.7358
Voice and Accountability	VA	0.2536	0.7282	0.6178	0.1076	0.0902	0.0639

Based on the first principal component, the study constructs the institutional quality variable in equation 8.

$$\text{Institutional quality(INS)} = \sum_{i=1}^n w_{ij} * X_i$$

Where w_{ij} are the component's loadings or weights, and X_i are the original variables.

$$\text{INS} = 0.4641 * \text{CC} + 0.4624 * \text{GE} + 0.2843 * \text{PS} + 0.4607 * \text{RQ} + 0.4619 * \text{RL} + 0.2453 * \text{VA}$$



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