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Nguyen Duc Trung; Quynh Lan Thi Du

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*Corresponding author: Trung Duc Nguyen, Banking University HCMC, Banking University HCMC, Vietnam E-mail: trungnd@buh.edu.vn

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FINANCIAL ECONOMICS | RESEARCH ARTICLE

The effect of financial inclusion on bank stability: Evidence from ASEAN

Trung Duc Nguyen 1* and Quynh Lan Thi Du^1

Abstract: After the recent global financial crisis of 2008, the attention of researchers and politicians has focused on both financial inclusion and bank stability. However, we still know little of how the former impacts the stability of financial services providers. This paper focuses on financial inclusion and its influence on bank stability. By using a sample of 102 banks in six countries of ASEAN over the period 2008–19, we achieve the result that the index of financial inclusion has a positive relationship with Zscore and a negative effect on the standard deviation of deposit growth rates and nonperforming loan ratio, which also means that higher level of financial inclusion contributes to greater bank stability. Or, to make it clearer, in an inclusive financial sector, those banks can increase more stable customer deposits and safe loans by providing banking services. The indices calculated for each dimension of financial inclusion, including accessibility, availability, and usage of the formal bank system, also have the same results. Our findings have important policy implications that ASEAN policymakers do not have to face a tradeoff between focusing on reforms to promote financial inclusion and focusing on further improvements in bank stability.

Subjects: International Finance; International Economics; Finance & Economics

Keywords: financial inclusion; bank stability

JEL Classifications: G18; G21; G28; F65.

ABOUT THE AUTHOR

Trung Duc Nguyen, Associate Professor in Finance & Banking, is now working as Deputy President, Banking University HCMC. He got plenty of awards and grants, such as Certificate of Merit of the Governor of the State Bank of Vietnam for contributions to the science and technology activities of the Banking sector in 2014; the certificate of an excellent completion of scientific and technological tasks in 2011, 2012, 2013 (awarded by The Director of the Banking Academy of Vietnam). The preferred fields of research in financial economics, banking, etc.

Quynh Lan Thi Du, PhD in Finance and Banking, is currently a lecturer at the Faculty of Finance, Banking University HCMC. Research conducted on Corporate Finance, Financial Inclusion, Banking, etc.

PUBLIC INTEREST STATEMENT

This article aims to the analysis of the impact of financial inclusion on bank stability. We use an index of financial inclusion (IFI) on three dimensions and also use a separate inclusive finance index for each dimension. What is different about this article compared to previous studies is that we use not only Zscore but also the standard deviation of deposit growth rate and nonperforming loan ratio. These two variables both measure bank stability and represent the two main channels for the effect of financial inclusion on bank stability. We find empirical evidence on the positive impact of financial inclusion on bank stability. Finally, the end of the study suggests policy implications related to improving financial inclusion to promote bank stability in ASEAN countries.

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1. Introduction

The promotion of an inclusive financial system is a policy priority in many countries in recent years (Sarma, 2012), which highlights the issue of financial inclusion—means that all economic agents have access to formal financial services and can use such services effectively (Ahamed & Mallick, 2019). Numerous studies point to the concept and how to measure financial inclusion (see, Garcia, 2016; Iqbal & Sami, 2017; Kalunda, 2014; Shankar, 2013; Sarma, 2008, 2012, 2015; Sarma & Pais, 2011, etc.). The researchers also focus on analyzing and providing pieces of evidence of the positive role of financial inclusion to an economy on both sides: *Macro* (see, Demirgüç-Kunt et al., 2008), and *Micro* (see, Brune et al., 2011; Cole et al., 2013; Dupas & Robinson, 2013; Jack & Suri, 2014).

The studies also show that financial inclusion has beneficial effects on financial stability in general and bank stability in particular. For instance, Hannig and Jansen (2010) argue that financial institutions have to face risks from low-income markets; however, microfinance clients typically have high repayment rates. With the advancement of innovative technology in recent years, formal financial institutions are increasingly searching for new opportunities and markets and recognizing the benefits of a micro-finance style of operations (Ahamed & Mallick, 2019). At a national level, evidence shows that financial inclusion has many implications for allowing households to save and diversify their sources of income, enabling entrepreneurs to have access to financing, and creating a more efficient system of intermediating domestic savings into investments (Prasad, 2010). Demirgüç-Kunt and Huizinga (2010) find that the higher level of non-deposit funding shares, the less stable banks can remain. And during the recent credit crunch, the insufficiency of the wholesale funding was the base for diversifying retail deposit, which cushioned financial institutions from fragility (Hannig & Jansen, 2010). However, banks reducing risk by having more non-wholesale funding as reliance on a higher share of non-deposit funding were prone to lead to the recent demise of investment banking in the US (Demirgüç-Kunt & Huizinga, 2010; Poghosyan & Čihak, 2011).

Nevertheless, on the other hand, some considerable doubts about the role of inclusive finance in bank stability persist because there is no direct empirical evidence on the channels through which financial inclusion affects bank stability (Ahamed & Mallick, 2019; Leyshon & Thrift, 1995). That is an important reason why banks "shy away" from extending financial services to disadvantaged segments of society (Ahamed & Mallick, 2019). Therefore, there probably exists a trade-off between the focus on reforms to promote financial inclusion and further improvements in bank stability (Acharya et al., 2006; Hannig & Jansen, 2010).

In ASEAN,¹ where (Jetin & Mikic, 2016) considered having achievements of regional security and political stability, inclusive finance is deeply concerned, and policymakers implement policy systematically and widely (see, ADB, 2015; ASEAN, 2020; Banerjee & Donato, 2020; Loo, 2019; MAS, 2006; Rahman & Z. A, 2015; Tambunlertchai, 2015; Trujillo et al., 2018; World Bank, 2015). ASEAN Economic Community (AEC) has set a vision to 2025 on financial integration, considers inclusive finance as one of the three essential pillars, and establishes a financial inclusion working group to promote pushing the field (ADB, 2013). In this area, to our knowledge, recent papers pay attention to the level of policy implementation of financial inclusion (e.g., Rahman & Z. A, 2015) or identifying the countries with the highest inclusive finance which are the best potential for Fintech growth, and hence, helping governments formulate policy that improves investment competitiveness (e.g., Loo, 2019)).

While international empirical evidence proves that greater financial inclusion is positively associated with individual bank stability (Ahamed & Mallick, 2019), there is no clear proof of this issue in ASEAN. We found that six countries in ASEAN have bank-based financial systems by using the relative activity measure of banks versus the stock market,² which also means that banking inclusion can be considered as being analogous to financial inclusion (Sarma, 2012), and bank stability can be seen as a decisive factor in financial stability (Segoviano, 2006; Segoviano & Goodhart, 2009). Therefore, the deficiency of research into whether a trade-off relationship between financial inclusion and bank stability exists or not is essential to be remedied. This study is aimed to find empirical evidence on the effect of financial inclusion on bank stability in ASEAN countries. We specifically focus on bank stability as banks are responsible for providing the bulk of financial services to households or firms in any economy (Sarma, 2012). A clear understanding of this link is the profound managerial and economic significance for inclusive financial development and growth. The remaining part of the paper is organized as follows: section 2 discusses concepts of financial inclusion, describes the literature relating to the influence of financial inclusion on bank stability, and then develops a hypothesis. Section 3 describes the variables, models, and sources of data. The empirical results with analyses on the effect of financial inclusion on bank stability are mentioned in section 4. Finally, section 5 concludes with some policy implications.

2. Literature review

2.1. Concepts of financial inclusion

With regard to the inclusive financial concept, there are many views on this issue. ADB (2017) considered financial inclusion as providing official financial products and services to all classes of people, irrespective of their economic situation. World Bank (2018) has determined that financial inclusion is the access of individuals and businesses to useful and affordable financial products and services at reasonable prices and meeting their needs for transactions, payments, savings, credit, and insurance; and these product services are all provided with a sense of responsibility and sustainability. The United Nations (UN) also has access to inclusive financial services at reasonable fees that are provided by diverse organizations, strong and sustainable development (UN, 2015). The center for financial inclusion (CFI) defines financial inclusion as "a state in which everyone who can use them has access to a full suite of quality financial services, provided at affordable prices, in a convenient manner, with respect and dignity. And financial services are delivered by a range of providers, in a stable, competitive market to financially capable clients." (CFI, 2013).

From a research perspective, one of the earliest concepts of Leyshon and Thrift (1995) has identified that inclusive finance is the process by which certain social and individual groups have access to the official financial system. Sinclair (2001) recognizes financial inclusion as the ability to access necessary financial services in an appropriate manner. Knowledge of financial services and products conformance includes financial awareness, knowledge of the bank, banking services channels, and benefits of using financial services through official supply channels. However, it is essential to understand the quality of financial services in the financial inclusion system that is provided with reasonable prices, convenience, and quality assurance for customers.

According to Hannig and Jansen (2010), financial inclusion encourages people not to use banking services in using official financial services so that they have opportunities to access a wide range of services from savings and payments to credit and insurance. Khan (2011) regards financial inclusion as the process of ensuring access to financial services and credit needs to be met for disadvantaged groups such as low-income customers with reasonable costs. These are expressed through accessibility via bank accounts such as saving accounts, through credit access and via bank account payments. In this paper, we follow Sarma (2012) defining financial inclusion *as a process that ensures the ease of access, availability and usage of the formal financial system for all members of an economy*' (page 3), which emphasizes several dimensions of financial inclusion including accessibility, availability and usage of the formal bank system.

2.2. Links between financial inclusion and bank stability

From a theoretical perspective, it is not clear whether an inclusive financial sector has a good impact on bank stability (Ahamed & Mallick, 2019), but we found that there are potential channels that are two prominent include deposits and loans. As regards the former, by exploiting managerial and technical expertise, they can improve operating efficiency and revenues as they have cheaper funding, new lending, and investment opportunities (e.g., Berger & DeYoung, 2001; Demirgüç-Kunt & Huizinga, 2010; Deng & Elyasiani, 2008; Saunders & Wilson, 1996). It is argued in the literature that retail deposits are sluggish, insensitive to risk and provide a stable and cheaper source of long-term funding (e.g., Calomiris & Kahn, 1991; Song & Thakor, 2007), compared to wholesale funding which is extremely volatile and often costly (Demirgüç-Kunt & Huizinga, 2010; Huang & Ratnovski, 2011; Poghosyan & Čihak, 2011). Huang and Ratnovski (2011) show that wholesale financiers are prone to very mild negative information or baseless rumors and are reluctant to roll over short-term funding as they have access to information on the quality of bank projects. Recent empirical studies also show that banks relying more on retail deposits than wholesale funding were more stable during the recent financial crisis (Demirgüç-Kunt & Huizinga, 2010; Poghosyan & Čihak, 2011). Moreover, during the recent credit crunch, when the wholesale funding dried up, the diversified retail deposit base cushioned financial institutions from fragility (Hannig & Jansen, 2010). Therefore, greater diversification in funding strategy associated with financial inclusion in mobilizing deposits should reduce banks' risks and funding costs, enhancing bank stability.

In terms of the latter, the greater financial inclusion is also likely to influence the overall level of lending opportunity for banks by reaching out to unbanked/under-banked areas while extending small credits, and then reducing distance and building strong relationships with customers. Recent literature shows that a considerable distance between lender and borrower undermines banking services' efficacy through intensifying the asymmetric information problem (Degryse & Ongena, 2005; Deng & Elyasiani, 2008; Hauswald & Marguez, 2006). Hauswald and Marguez (2006) develop a model and show that lenders can get precise signals about a borrower's quality if they decrease the distance for the borrower. In addition, banks can also reduce informational asymmetry by obtaining proprietary information about borrowers while providing access to essential financial services (e.g., Black, 1975; Fama, 1985; Rajan, 1992). Akhiabe and Whyte (2003); Deng and Elyasiani (2008) find that geographic diversification enhances bank value, and risk reduction is associated with greater value enhancement and a slighter risk-reduction effect. In a recent study, Adasme et al. (2006), with respect to the portfolio of Chilean banks, show that losses on large loans are greater and more unpredictable than losses on small ones. According to portfolio theory, diversified banks can decrease earning volatility and adverse risktaking incentives through cross-subsidization (Boot & Schmeits, 2000). Moreover, from a firm's perspective, especially firms that need external finance, since more inclusive financial systems with the increasing supply of credit, borrowers will get favorable loan contracts, which is vital to dis-incentivize borrowers from asset substitution—where borrowers utilize the funds to invest in riskier projects, which in turn enhances bank stability as the borrower's default probability decreases.

In addition to the two channels mentioned above, the other can be considered. For example, greater financial inclusion reduces income inequality and poverty (e.g., Beck et al., 2007; Bruhn & Love, 2014; Burgess & Pande, 2005); and increases employment (e.g., Prasad, 2010). The positive effect of financial inclusion on various key socio-economic indicators is indispensable to inclusive economic growth and sociopolitical stability, which in turn could lead to greater efficiency in the financial intermediations and soundness of banks (e.g., Cull et al., 2012; Hannig & Jansen, 2010; Khan, 2011).

Yet, there is currently no research in ASEAN that specifies the way or direction in which inclusive finance affects the stability of banks, but indirectly it can be argued. By researching in these countries, Banerjee and Donato (2020); CARD MRI & UNCDF (2020) recognize the role of inclusive finance in economic development, which is seen as the foundation of creating an environment for bank stability (Ahamed & Mallick, 2019; Cull et al., 2012; Hannig & Jansen, 2010; Khan, 2011). Inclusive finance provides opportunities for poor people to increase their income (CARD MRI & UNCDF, 2020), which means banks can have more potential depositors and borrowers (Banerjee et al., 2020; Han & Melecky, 2014).

Overall, since inclusive finance seems to have multiple positive effects on many aspects of the economy, including banking operations, we, therefore, view the link between financial inclusion and bank stability as ultimately an empirical question.

Hypothesis: Financial inclusion has a beneficial effect on bank stability.

3. Variables, data and methodology

3.1. Measuring financial inclusion

Due to the fact that financial inclusion is a multidimensional process, a multidimensional approach would be appropriate to develop a composite index to measure the level of financial universality. The index of financial inclusion (IFI) proposed by Sarma (2008, 2012) is developed from individual indicators for each dimension of financial inclusion and is called the component index. Accordingly, the calculation of the IFI is based on three basic dimensions: access to financial services, availability of financial services, and ability to use financial services.

More specifically, the accessibility dimension, also called penetration, is assessed by the number of deposit accounts at commercial banks, microfinance institutions, and registered mobile deposit accounts per 1,000 people. The availability of financial services is measured by the number of bank transaction offices, the number of registered mobile financial services agents, and the number of ATMs per 100,000 adults. The dimension of using financial services is assessed by the total volume of credit transactions and the volume of deposits (compared to GDP).

The indices are calculated for each dimension of financial inclusion (di) by using the following formula:

$$d_i = w_i \frac{A_i - m_i}{M_i - m_i}$$
(1)

A_i: actual value of dimension i

mi: lower limit on the value of dimension i (fixed by some pre-specified rule)

M_i: upper limit on the value of dimension i (fixed by some pre-specified rule)

w_i: weight attached to the dimension i.

Formula (1) ensure that $0 \le d_i \le w_i$. The higher value of d_i gets, the more inclusive country achieves in dimension *i*. If there are many dimensions of inclusive finance being considered, a country is represented by an X-point in a multidimensional space, with the formula of calculating the IFI is given below:

$$IFI = \frac{1}{2} \left[\frac{\sqrt{p^2 + a^2 + u^2}}{\sqrt{w_1^2 + w_2^2 + w_3^2}} + \left(1 - \frac{\sqrt{(w_1 - p)^2 + (w_2 - a)^2 + (w_n - u)^2}}{\sqrt{w_1^2 + w_2^2 + w_3^2}} \right) \right]$$
(2)

Financial inclusion has many dimensions, but within the scope of research, Sarma (2012) focuses on three basic dimensions of the inclusive financial system, include: banking penetration, availability of the banking services and usage of the banking system. At this point, point X in Cartesian space is represented as Figure 1.

The weight assigned to the penetration dimension is 1, the availability is 0.5, and the usage dimension is 0.5. Now the formula for IFI is redefined:

Figure 1. Graphical explanation of a 3-dimensional IFI. Source: Sarma (2012)



$$IFI = \frac{1}{2} \left[\frac{\sqrt{p^2 + a^2 + u^2}}{\sqrt{1.5}} + \left(1 - \frac{\sqrt{(1-p)^2 + (0.5-a)^2 + (0.5-u)^2}}{\sqrt{1.5}} \right) \right]$$
(3)

In addition to IFI, we also use the indices calculated for each dimension of financial inclusion according to formula 1, i.e., banking penetration (IFIp), availability of the banking services (IFIa), and usage of the banking system (IFIu). By utilizing all indices above, measuring financial inclusion become more comprehensive.

3.2. Measuring bank stability

We see bank stability as an absence of insolvency problem, bank run (Ngalawa et al., 2016), or nonperforming loan (Allen & Gale, 1998; Guy & Lowe, 2011; Ngalawa et al., 2016). First, following Neaime and Gaysset (2018), we utilize standard deviation of deposit growth rates (sdGrDep) which can also be used to construct a measure of "bank run" (Ngalawa et al., 2016), as a proxy for bank instability in deposit. A less volatile deposit growth rate means the bank is safer from "bank run" and achieves greater stability. In this paper, we transform this index into a natural logarithm (InsdGrDep) to pursue normal distribution.

Second, a traditional useful measure of bank stability used is the nonperforming loan to total assets ratio (e.g., Fernández et al., 2016; Guy & Lowe, 2011; Kasman & Kasman, 2015; Martinez Peria & Schmukler, 2001; Nier & Baumann, 2006) abbreviated to NPLTA. This ratio is expected to become as low as possible, and therefore, the less it is, the more stable the bank becomes.

Finally, we measure the Zscore which is widely used in the literature and considered to be an unbiased and complete indicator of bank riskiness (e.g., Ariss, 2010; Fang et al., 2014; Houston et al., 2010; Laeven & Levine, 2009). The bank's Zscore is inversely related to the probability of bank insolvency (Laeven & Levine, 2009). By using assets returns, volatility and leverage, we calculate the Zscore as follow:

$$Zscore_{it} = \frac{ROA_{it} + EQA_{it}}{\sigma(ROA)_{it}}$$
(4)

Where ROA_{it} and EQA_{it} are the average return-on-assets and the equity-to-assets ratio of bank i in year t, respectively and $\sigma(ROA)_{it}$ is the standard deviation of return-on-assets. We follow

Laeven and Levine (2009) and Ahamed and Mallick (2019) to use the natural logarithm of Zscore in order to reduce skewness.

3.3. Other variables

Other variables include logarithm of total assets (bank size), loan loss provision to total loans, noninterest income to total operating income (income diversification), equity to total assets (capitalization), total earning assets to total assets (management quality), Lerner index (a proxy for market power), GDP growth rate. The description and measuring of control variables are shown in Table 1.

Our model has the form:

Bank Stability_{ijt} = $\beta_0 + \beta_1 IFI_{kjt} + \beta_2 ln(TA)_{ijt} + \beta_3 LossProv_{ijt ijt} + \beta_4 NonIncome_{ijt} + \beta_5 EQA_{ijt} + \beta_6 EatoTA_{iit} + \beta_7 Lerner_{iit} + \beta_8 GDPrate_{it} + \varepsilon_{iit}$

Where: *i*, *j* and *t* subscripts indicate bank, country and year, respectively,

Bank stability includes ln(Zscore), lnsdGrDep and NPLTA

IFI_k includes IFI, IFIp, IFIa, IFIu.

We draw data from sources: (1) the bank-level dataset is compiled from Worldscope (provided by Eikon Datastream) that contains a detailed balance sheet and income statement information for both public and private banks in any given country; (2) the macro data is compiled from the World Development Indicators (WDI); (3) the variables used to construct financial inclusion index are compiled from the IMF-FAS database. Our dataset comprises 102 commercial banks in six member countries of ASEAN over the period 2008–2019.

In order to estimate our specified model, we found the system-GMM dynamic panel estimator is a method compiled of first-differences instrumented on lagged levels and on the ground that it provides a scrupulous cure for endogeneity bias (Blundell & Bond, 1998). In addition, it also holds two measurement errors; the GMM dynamic panel estimator is more robust. Second, if we adequately lagged the instrumental variables, this estimator remains steady. Therefore, we employ the two-step estimator to solve the problems of heteroscedasticity, the autocorrelation of errors, simultaneity bias, and measurement mistakes. To test the validity of the instruments, we use the Hansen test of overidentifying restrictions (Hansen, 1982) with a null hypothesis that there is no correlation between instrumental variables and residual. We also use Arellano-Bond (AR) test with a null hypothesis that there is no second-order autocorrelation.

4. Results and discussions

4.1. Descriptive statistics

Table 2 shows descriptive statistics of the variables collected from the observed sample of 102 banks in ASEAN countries. The mean of ln(sdGrDep) is approximately -2.3315 with a standard deviation of 0.9933, the minimum is -6.1964, and the maximum is 5.2725. The NPLTA variable has a mean of approximately 0.0146 with a standard deviation of 0.0364; the minimum value is 0, and the maximum value is 0.1967. The mean of ln(Zscore) is approximately 1.4318 with a standard deviation of 0.3233, implying that the mean ROA would have to fall by 1.4318 times their standard deviation to exhaust the bank's equity. The minimum value of ln(Zscore) is -0.8642, and the maximum value is 2.0394, indicating a difference in banking stability between banks in different countries, but from the mean and standard deviation, it can be seen that this difference is not too significant.

For the proxy of financial inclusion, the maximum value of IFI is 0.7938, and the minimum value is 0.1664, indicating the heterogeneity in financial inclusion of financial systems. However, the mean

Table 1. Other variables' description and measuring			
Variables	Description and Measuring		
Bank size(InTA)	The <i>logarithm of total assets</i> is used to account for the potential size effect on bank stability, as the too-big-to-fail can destabilize the efficient financial intermediation of the entire banking system.		
Loan loss provision(LossProv)	We use the <i>ratio of loan loss provision</i> to total loans in order to account for individual bank's loan portfolio risk.		
Income diversification(NonIncome)	The ambiguous effect of off-balance-sheet activities of individual banks on stability necessitates considering the <i>ratio of non-interest income</i> to total operating income.		
Capitalization(EQA)	Because well-capitalized banks are assumed to take less risk, we use the <i>equity ratio to total assets</i> to control capital risk.		
Management quality(EAtoTA)	The <i>ratio of total earning assets</i> to total assets is used as better management quality that can mitigate excessive risk-taking.		
Lerner index(Lerner)	We use the <i>Lerner index</i> —the only measure of market power calculated at the bank-level (Ahamed & Mallick, 2019; Berger et al., 2009) as:Lerner _{it} = $\frac{P_{it}-MC_{it}}{P_{it}}$ (5) Where: P _{it} is the price of total assets, the ratio of total revenue (interest and non-interest income) to total assets for bank <i>i</i> at time <i>t</i> .MC is the marginal cost of producing it in an additional unit of output, which is derived from the translog cost function (Berger et al., 2009; Fernández de Guevara et al., 2005) and in this paper, estimated by using a fixed-effects model.This index is interpreted as the inverse of competition; the higher the index is, the greater the pricing power is, which implies less competitive market conditions.		
GDP growth rate	We use GDP growth rate to control for economic growth.		

Source: Authors gathered

value of IFI is 0.4386, and the standard deviation of 0.1856 shows that the heterogeneity between these countries is not too significant. Indicators representing each aspect of financial inclusion, such as the penetration aspect (IFIp), have the maximum value of 0.9963 and the minimum of 0.1001; availability aspect (IFIa) has a maximum value of 0.4011 and a minimum of 0.0716; usage aspect (IFIu) has the maximum value of 0.9672 and the smallest value of 0.1843.

Regarding other variables, the size of the bank, the representative variable ln(TA), has a mean value of 15.6841, a standard deviation of 2.1226, showing that there is not a big difference between banks in the different nations. Variables such as operating profit (EAtoTA), economic growth rate (GDPrate) also have similar conclusions. However, some variables differ between banks, such as provision for loss of debt (LossProv), a ratio of non-interest income (NonIncome), level of equity utilization (EQA).

4.2. Financial inclusion and the stability of bank deposit funding

To analyze the impact of financial inclusion on bank stability, we examine the effect of each financial inclusion dimension and clearly show the effect through the channels mentioned above. First, we are interested in financial inclusion and the volatility of deposit growth. Table 3 presents estimation results representing the impacts of IFI, IFIp, IFIa, and IFIu on volatile deposit growth rate needed to be limited.

Table 2. Summary statistics					
Variable	Mean	Std. Dev	Min	Max	Obs.
ln(sdGrDep)	-2.3315	0.9933	-6.1964	5.2725	1224
NPLTA	0.0146	0.0364	0	0.1967	1068
InZscore	1.4318	0.3233	-0.8642	2.0394	1224
IFI	0.4386	0.1856	0.1664	0.7938	1224
IFIp	0.4403	0.2365	0.1001	0.9963	1224
IFIa	0.2254	0.0988	0.0716	0.4011	1224
IFIu	0.4164	0.2445	0.1843	0.9672	1224
InTA	15.6841	2.1226	6.6373	19.8801	1224
LossProv	0.0109	0.0281	-0.0332	0.4048	1224
NonIncome	1.0661	16.7629	-1.0880	99.5271	1224
EQA	0.1020	0.2682	-3.9607	0.9134	1224
EAtoTA	0.8557	0.0795	0.1387	0.9854	1105
Lerner	0.2203	0.1594	-1.0273	0.5455	1148
GDPrate	0.0529	0.0172	-0.0151	0.1453	1224

Source: Authors' estimates using STATA 16 Software.

Our results point to a significant negative impact of the measures of financial inclusion, including IFI, IFIp, IFIa, and IFIu, on the standard deviation of deposit growth rate, which also means they have a beneficial effect on bank stability of deposit funding. For further detail, the regression coefficient of IFI is -0.8211 (significance at the 1% level); if the IFI increases by 0.01 units, the sdGrDep decreases with the rate of 0.8211%. This means that the more inclusive financial enhancement will reduce the fluctuation of the deposit growth rate, thereby keeping the growth of the deposit stable and helping to stabilize banks. Our results are consistent with the findings of Neaime and Gaysset (2018). Thus, we argue that broader access to and use of finance lead to significantly improved resilience during the distress caused by "bank run".

4.3. Financial inclusion and nonperforming loans

To pursue the goal of remaining stable, banks need to minimize nonperforming loans as low as possible. Table 4 presents results of the effect of IFI, IFIp, IFIa, and IFIu on this dependent variable.

The regression coefficient is -0.0076 (significance at the 1% level), which indicates that if the IFI increase by 0.01 units, the NPLTA ratio decreases by 0.0076 units; other IFI dimension variables have similar results. Our findings indicate that all the measures of financial inclusion, IFI, IFIp, IFIa, and IFIu, have a significant negative impact on nonperforming loans, which also means that in a more inclusive financial sector, banks can reduce credit risk. Adasme et al. (2006) research in Chilean banks and show that small loans coming from the inclusive finance sector are usually safer, and thus, banks can reduce the risk associated with bad debt and maintain stability.

4.4. Financial inclusion and bank stability

Our main aim is to examine the impact of financial inclusion on bank stability using bank-level data; therefore, the main dependent variable is ln(Zscore). The results of regressions of independent variables, including IFI, IFIp, IFIa, and IFIu, are presented in Table 5.

The finding of the study indicates that the measures of financial inclusion—IFI, IFIp, and IFIu, have a significant positive impact on financial stability, as measured by Zscore, which implies that the more the amount of credit provided, the lower the probability that financial institutions would become the default. The result shows that with SGMM (2 steps) method, financial inclusion variables have an impact on the ln(Zscore) proxy for bank stability with high statistical significance at the 1% level. Our finding shows that there exists a positive relationship with the stability of the

Table 3. Estimated results of financial inclusion and the stability of bank deposit funding					
Variable		ln(sdGrDep)			
	IFI	IFIp	IFIa	IFIu	
l.ln(sdGrDep)	0.3023***	0.2910***	0.3267***	0.3145***	
Financial inclusion	-0.8211***	-0.6269***	-0.6626***	-0.5061**	
InTA	-0.1663***	-0.1700***	-0.2032***	-0.1908***	
LossProv	2.5630**	2.3873*	1.7711	3.2551**	
NonIncome	0.0000	0.0003	0.0008	-0.0002	
EQA	-4.4926***	-4.6729***	-5.7944***	-6.5123***	
EAtoTA	4.2236***	4.0664***	3.6495***	3.6191***	
Lerner	0.7917***	0.7667***	0.5204**	0.8732***	
GDPrate	-0.3826	-0.2878	0.1113	-0.5434	
Constant	-1.8397***	-1.6953***	-0.7434*	-0.8216*	
AR2	0.2	0.237	0.19	0.151	
Hansen	0.369	0.361	0.251	0.322	
Observations	880	880	880	880	

***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

Source: Authors' estimates using STATA 16 Software.

banking system—in the study, we used ln(Zscore)—with a significance of 1%. The regression coefficient of the IFI variable is 0.0933, showing that when other factors are unchanged, the country's IFI increases/decreases by 0.01 units, the Zscore increases/decreases by 0.0933%.

These results are consistent with the view that a system with inclusive financial services tends to reinforce banking stability (Ahamed & Mallick, 2019; Han & Melecky, 2014; Khan, 2011; Morgan & Pontines, 2014) and that a higher degree of financial inclusion mitigates excessive risk-taking of an individual bank. In particular, the inclusive financial sector can enable banks to garner adequate

Table 4. Estimated results of financial inclusion and nonperforming loans				
Variable	NPLTA			
	IFI	IFIp	IFIa	IFIu
l.NPLTA	0.3346***	0.3291***	0.3461***	0.3408***
Financial inclusion	-0.0076***	-0.0074***	-0.0014***	-0.0034***
InTA	-0.0003***	-0.0002***	-0.0009***	-0.0007***
LossProv	0.7426***	0.7370***	0.7419***	0.7489***
NonIncome	0.0001***	0.0001***	0.0001***	0.0001***
EQA	-0.1338***	-0.1258***	-0.1574***	-0.1572***
EAtoTA	-0.0339***	-0.0333***	-0.0399***	-0.0394***
Lerner	0.0141***	0.0140***	0.0137***	0.0148***
GDPrate	-0.0587***	-0.0581***	-0.0533***	-0.0548***
Constant	0.0574***	0.0545***	0.0707***	0.0685***
AR2	0.333	0.332	0.343	0.336
Hansen	0.676	0.721	0.567	0.666
Observations	910	910	910	910

***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

Source: Authors' estimates using STATA 16 Software.

Table 5. Estimated results of financial inclusion and bank stability				
Variable	ln(Zscore)			
	IFI	IFIp	IFIa	IFIu
l.ln(Zscore)	0.1923***	0.1932***	0.1960***	0.1785***
IFIk	0.0933***	0.0574***	-0.0434	0.2486***
InTA	0.0476***	0.0490***	0.0501***	0.0385***
LossProv	-2.5901***	-2.5496***	-3.478***	-3.1601***
NonIncome	-0.0012***	-0.0012***	-0.0009***	-0.0008**
EQA	2.0283***	2.1078***	2.3586***	1.9812***
EAtoTA	0.2221**	0.2617***	0.4328***	0.1047
Lerner	0.067	0.0664	0.1974**	0.0282
GDPrate	0.3484**	0.3204**	0.3168*	0.5677***
Constant	-0.074	-0.1277	-0.3278***	0.1449
AR2	0.183	0.193	0.166	0.118
Hansen	0.572	0.59	0.377	0.417
Observations	769	769	769	769

***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

Source: Authors' estimates using STATA 16 Software.

substance retail deposits from a large clientele base; furthermore, it can also alleviate financing constraints of SMEs and also mitigate the post-landing moral hazard and asset substitutions problems; and hence, banks enjoy greater financial stability (Ahamed & Mallick, 2019).

Our results on control variables are also consistent with existing literature. All other variables such as ln(TA), LossProv, NonIncome, EQA, EAtoTA, Lerner, and GDPrate had impacts on ln(Zscore) with different levels of significance (ranging from 1 to 10%). As expected, banks with bigger size, less loan loss provision, lower non-interest income, higher equity ratio, more earning assets, and more competition are more stable. The economic growth variable is statistically insignificant.

5. Conclusion and policy implications

Financial inclusion brings about more economic well-being to individuals and SMEs, but little is known about its impact on bank stability, the main arbiters of financial services in the ASEAN economy. This paper focuses on financial inclusion and the channels through which it impacts bank stability. Using a sample of 102 banks in six countries of ASEAN over the period 2008–19, we find that in the inclusive financial sector, banks can have higher customer deposit funding, reduce nonperforming loans, and thus maintain bank stability. Our results have important policy implications, or to make it clearer, we suggest that bank stability is strongly influenced by the degree of inclusive finance. For more detail, increasing the number of deposit accounts at commercial banks, the number of bank transaction offices, the number of ATMs, and the total volume of credit and deposits broadening banking services to unbanked or under-banked sectors needs to be vigorously promoted and becomes necessary for bank's soundness.

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Author details

Trung Duc Nguyen¹ E-mail: trungnd@buh.edu.vn ORCID ID: http://orcid.org/0000-0002-4559-6966 Quynh Lan Thi Du¹ E-mail: quynhdtl@buh.edu.vn ¹ Banking University HCMC, Banking University Ho Chi Minh

City, Ho Chi Minh City, Vietnam.

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Notes

 ASEAN is an acronym for the Association of Southeast Asian Nations. In this paper, we use a sample of six countries, including Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam, representing the entire ASEAN because the total asset value of the banking systems of these countries accounted for more than 90% of the ASEAN region from 2014 to 2017, and more specifically, it accounted for nearly 97.23% in 2017 (the authors calculate this result with data from World Bank, 2017).

2. We use data from World Bank (2017) to calculate Private Credit by Deposit Money Banks Ratio and Stock Market Total Value Traded Ratio (according to Aslh Demirgiiu-Kunt & Levine, 1999; Levine, 2002). We find that the former ratio is higher than the latter, which means ASEAN countries' financial systems are bank-based.

3. Trung Duc Nguyen: the ORCID iD: https://orcid. org/0000-0002-4559-6966

Quynh Lan Thi Du: the ORCID iD: https://orcid.org/ 0000-0002-5524-776X

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