

Financial inclusion and stability in the Asian region using bank-level data

Duc Hong Vo ^{a,1,*}, Nhan Thien Nguyen ^a, Loan Thi-Hong Van ^b

^a Business and Economics Research Group, Ho Chi Minh City Open University, Viet Nam

^b School of Advanced Study, Ho Chi Minh City Open University, Viet Nam

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Abstract

Financial inclusion drives human development by supporting inclusive growth, economic development, and financial deepening. It has become a key enabler in reducing poverty and boosting prosperity. Financial inclusion can provide billions of currently unbanked adults with access to and active use of affordable financial products and services for their needs from transactions, payments, savings, credit, and insurance. The Asian region is generally considered to have a low level of financial inclusion. In addition, financial inclusion has mostly been ignored in current academic studies on the region. The governments in the region have expressed their concerns about macroeconomic instability associated with extensive financial inclusion. As such, this paper examines the linkage between financial inclusion and financial market stability using a dataset of 3071 banks in the Asian region over the period from 2008 to 2017. This paper uses a generalized method of moments (GMM) approach. Findings in this paper indicate that the higher level of financial inclusion from providing access to banking facilities contributes positively and significantly to stability in the banking sector, leading to greater bank resilience. Financial inclusion can help banks increase revenue, reduce cost, and expand their market share. Policy implications are outlined based on the findings in this paper.

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1. Introduction

The world has witnessed a remarkable economic transformation of Asia into a global economic powerhouse. Over the period 1970 to 2016, the growth rate of the gross domestic product (GDP) in Asia was more than double the rate in the industrialized countries (Nayyar, 2019). This rapid growth, which gained momentum in the 1990s, led to a sharp reduction in absolute poverty in Asia. Asia is expected to contribute 50 percent of global GDP by 2040, representing a real shift in the world's center of gravity (McKinsey Global

Institute, 2019). In addition, the Asian region has the youngest population in the world. Half (2.2 billion) of the world's internet users are in Asia, and China and India together account for one-third (McKinsey Global Institute, 2019). For a decade, Asia has been the world's largest banking market, with USD700 billion in pretax profit, accounting for 37 percent of global banking profit in 2018 (McKinsey Global Institute, 2019). Given this economic growth miracle in the region, financial inclusion, which is arguably one of the most effective tools for reducing poverty and the wealth gap between the rich and the poor, has attracted considerable attention from governments, practitioners, and academics. Financial inclusion is generally defined as the process of ensuring timely access to financial services and adequate credit where needed by vulnerable groups, such as disadvantaged segments and low-income groups at an affordable cost (Rangarajan, 2008).

* Corresponding author.

E-mail address: duc.vhong@ou.edu.vn (D.H. Vo).

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Since 2010, the G-20 and the World Bank have led the initiative for increased financial inclusion to reduce poverty in developing and emerging economies. Financial inclusion is a key tool in reducing extreme poverty. The four supporting pillars of human development as identified spotted by the United Nations (UNDP, 2016) are (1) formulating an employment-led growth strategy, (2) enhancing financial inclusion, (3) investing in human development priorities, and (4) undertaking high-impact multidimensional interventions (win-win strategies).

However, financial inclusion can also threaten the stability of the financial system, as seen, in particular, after the financial crisis in 2008. Potential risks arising from borrowing by low-income segments of the population are mentioned because their participation in the financial sector incurs higher information and transaction costs. In addition, financial instability might increase when low-income borrowers have a poor credit history. The latest World Bank estimates indicate that more than two-thirds of the adult population have access to banking and mobile bank accounts, whereas nearly 1.7 billion adults remain unbanked (World Bank, 2017). Global Findex Data for 2017 reveal that only 69 percent of adults (people age 15 and above) in the world have at least one bank account in the formal financial system. Fifty-six percent of the unbanked adults are women. Cost and distance were each cited by about a quarter of those responding to survey questions. A similar proportion responded that they did not have an account because a family member already has one (World Bank, 2017). This indicates that the benefits of financial inclusion can be wide-ranging. Financial inclusion reduces liquidity risk and increases the stability of deposits and monetary transmission. Any country seeking to enhance economic growth and development and to reduce poverty must find the right balance between financial inclusion and financial stability.

Financial inclusion is characterized by rapid change and technology innovation in the finance sector, including new products and new forms of payment. In this development context in Asia, the banking sector plays an essential role as a driving force for financial inclusion activities. Banks are required to acquire new customers and have more interaction with current customers through the ecosystem. However, a significant portion of the population is still unable to access and use formal financial services, especially the underprivileged, such as the poor or people living in a remote area.

This paper examines the relationship between financial inclusion and bank stability with a focus on the stability and profitability of the banking sector in the Asian region, using bank-level data. This paper uses a sample of 3071 banks across countries in Asia in the period 2008 to 2017.

This paper makes the following contributions to the literature. First, the analysis focuses solely on the Asian region, one of the most dynamic economic regions in the world, with the most up-to-date dataset at the bank level. Our findings have direct policy implications for countries in the region. Second, our empirical analysis takes into account crucial aspects of financial inclusion, including bank characteristics and macroeconomic conditions. Third, in addition to conducting

standard ordinary least squares (OLS) regressions, we use the GMM method, taking into account the endogeneity problems with panel data to ensure the robustness of the findings.

The paper is structured as follows. Following this introduction, Section 2 outlines a brief literature review. Section 3 presents the methodology and data. Empirical findings are presented and discussed in Section 4. Section 5 summarizes the main conclusions and policy recommendations based on the analysis.

2. Literature review

Interaction between financial inclusion and macroeconomic stability has generally been divided into two strands of research. The first strand of academic papers supports a view that financial inclusion will enhance and improve macroeconomic stability, in particular stability of the banking sector for the economy. The second strand of papers with findings supports the view that further financial inclusion will destabilize the banking sector. In this review, each of these strands of academic papers is discussed in turn below.

Several studies have confirmed the positive impact of an increase in financial inclusion on financial stability. Findings in these papers show that financial inclusion leads to more extensive and efficient savings as well as a more stable base of retail deposits. Morgan and Pontines (2014) examined the correlation between financial access and financial stability at small and medium-size enterprises (SMEs) in Armenia. They considered two different measures of financial stability, namely, the bank z score and the nonperforming loan (NPL) ratio. Using a system-GMM dynamic panel estimation on unbalanced panel data between 2005 and 2011, they found significant and positive impacts of financial inclusion on SME lending.

Ahamed and Mallick (2019) considered the effects of financial inclusion on bank stability. On the one hand, they believe that capital extension increases deposits and reduces the marginal cost of providing banking services. On the other hand, implementing an inclusive financial system might be associated with NPLs because of asymmetric information on risky borrowers. The paper used data on 2635 banks in 86 countries between 2004 and 2012. They used banks' z score as a proxy for bank risk or instability. In addition, demographic and geographic indices were used as proxies for financial inclusion. Empirical results in their paper supported a positive link between financial inclusion and bank stability. They believe that when banks adopt an inclusive financial system to increase low-interest deposits, they can benefit from financial inclusion to reduce the marginal costs of funding and additionally to enhance their price power in the money market. Ahmed and Mallick (2019) find financial inclusion a useful supporting tool for banks in stabilizing their financing mechanism. López and Winkler (2019) used a sample of 189 economies over the period 2004–2017, with the key finding that countries with higher financial inclusion are less likely to be harmed by pronounced drops in credit and borrowing. This finding empirically reinforces the view that a more vigorous

process of financial inclusion is positively correlated with a more resilient financial market during a crisis.

Allen et al. (2014) indicated that the enhancement of financial infrastructure and the initiation of mobile banking could offset the distance deficiencies by making financial services more deliverable. These technological innovations help countries with limited physical and financial infrastructure to enhance the diffusion of financial knowledge to underserved consumers. In addition, in studying progress in financial literacy programs in India, Rajesh and Pritee (2019) concluded that the low level of financial infrastructure, together with low financial literacy, low income, and insufficient formal jobs, prevent rural customers from using digital and more advanced financial services. Internet banking gradually plays a role as automatic teller machines in transmitting money over long distances at a lower cost. As a complement to cash, internet banking could also be used as an informal payment method.

Meanwhile, Okpara (2011) observed a bidirectional correlation between financial stability and inclusion, claiming that long-run causality exists between them. Neaime and Gaysset (2018) investigated how financial inclusion influences financial stability, income inequality, and poverty in Tunisia, Libya, Egypt, Yemen, and Syria. The region is an interesting case study of countries that have achieved a high economic growth rate, associated with a stable financial system. However, the region has diverse and segmented demographics. Findings in the paper indicate that financial inclusion is negatively associated with income inequality but positively related to financial stability. This line of thought assumes that the level of financial inclusion is mainly driven by sociological factors. In addition, lower-income groups voluntarily access the available financial resources to improve their economic conditions. On that basis, financial inclusion mitigates income inequality by giving poor households an economically beneficial motivation to strive for improvement, rather than leading to persistent poverty (Linyang, 2018). In an attempt to investigate the level of financial inclusion and its determinants in China and the BRICS (Brazil, Russia, India, China, and South Africa) countries, Fungáčová and Weill (2014) confirmed the contribution of demographic factors (e.g., education, age, and income) to differences between the level of financial inclusion in China and the BRICS countries.

Other rationales for supporting a higher degree of financial inclusion have also been introduced to illustrate how financial inclusion can enhance financial stability. From a macroeconomic perspective, greater access to finance can produce a more diversified funding base at financial institutions. In addition, greater access to finance also leads to a broader spectrum of economic agents who contribute to a more resilient economy. The importance of sustainable economic development based on equity and comprehensiveness has recently attracted attention. Van et al. (2019) presented empirical evidence to support a positive relationship between

financial inclusion and economic development in countries around the globe. In addition, Vo et al. (2019) highlighted the critical role of financial literacy in enhancing disposable income for rural households and SMEs. The authors view these two groups as the most vulnerable sectors of the economy. Findings in these recent papers show that the adequacy of funding provisions limits the presence of a large informal banking sector, leading to more efficient operation of the economy. In addition, financial products and services should be widely provided to various sectors of society. When access to financial products and services is limited, people resort to usury (in which the interest rate for borrowing is unreasonably high), which significantly hinders the effectiveness of monetary policy and might have economic consequences for the economy.

At the same time, previous studies have expressed some skepticism about the positive role of financial inclusion in stability. The main arguments in this strand of the literature focus on the potential risks associated with low-income segments of the population. The participation of those segments in the financial sector incurs higher information and transaction costs because of deficiency in their collateral and credit history. Cihák, Mare, and Melecký (2016) examine whether trade-offs or synergies exist between financial inclusion and financial stability. They found that financial inclusion is more about the range of financial services used by individuals and firms, rather than access to financial services. They argued that access to the financial sector does not indicate the actual use of these services by individuals and firms for their business or their benefits. The results in the paper indicate that a trade-off is found between financial inclusion and financial stability. Extending financial inclusion would contribute to a higher risk of borrowing because of extensive borrowing by individuals and firms.

Mendoza et al. (2009) showed a conditional relationship between financial access and financial stability. They confirmed a significant and negative relationship between financial access (loan accounts per 1000 adults) and NPLs with risk premiums. In another study, Dabla-Norris et al. (2015) developed an equilibrium model to examine the constraints on financial inclusion, including GDP, NPLs, and inequality. Data were collected at the firm level in six Asian and African countries with different levels of economic development. Their results suggested that country-specific effects moderate the impact and the trade-offs between financial inclusion and stability.

Ardic et al. (2013) provided a different explanation for the relationship between financial inclusion and financial stability, arguing that it not only involves data deficiency but also is a nonlinear relationship. Al-Smadi (2018) deviated from the existing literature by using fully modified least squares with time-series data. The study confirmed the weak impact of financial inclusion on financial stability and found adverse effects on financial inclusion from domestic credit, income inequality, and financial integration.

This brief overview of the literature on financial inclusion and macroeconomic stability highlights several issues that are important in our empirical investigation, described below. Previous studies appear to have largely ignored the role of financial inclusion in stability when the focus is on the Asian region and the study uses data at the bank level. Unlike previous studies, which focus on macroeconomic characteristics, our analysis focuses on groups of characteristics, such as bank characteristics, macroeconomic characteristics, and financial inclusion - which is our variable of interest.

3. Data

In this study, the data to construct the financial inclusion index come from various sources, including balance sheets and income statements for banks in the Asian region from the BankScope database; macroeconomic indicators on infrastructure and financial market development from World Bank dataset on World Economic Freedom; and the International Monetary Fund (IMF). Our dataset covers 3071 banks in Asian countries over the ten-year period from 2008 to 2017. This period is selected based on data availability and to include the global financial crisis in 2008–2009, so that we could consider the effect of this global financial crisis in various scenarios in our analyses.³ Countries that lacked the data required for calculating the financial inclusion index were removed from the sample, leaving only countries with the required data in the Asian region for the period 2008–2017 in the sample. Currency values in domestic currency were converted to US dollars at the end of the year.

We begin our regression by setting the model, which illustrates a relationship between financial inclusion and financial market stability, as follows:

$$z\ score_{it} = f(\text{Bank characteristics})_{it} + f(\text{Macroeconomics})_{it} + f(\text{Financial inclusion})_{it} + e_{it}$$

where $f(\text{Bank characteristics})_{it}$ represents bank characteristics that could affect the return on assets (ROA) of bank i at time t . $f(\text{Macroeconomics})_{it}$ includes macroeconomic factors that could have either negative or positive impacts on bank income for bank i at time t . $f(\text{Financial inclusion})_{it}$ is an index that is calculated using four sub-indices, including the number of ATMs per 100,000 adults; the number of bank branches per 100,000 adults; the number of credit cards per 1000 adults; and the number of debit cards per 1000 adults. Finally, the error term e_{it} represents exogenous factors that might have an effect on a bank's z -score.

3.1. Bank risk measurement, an indicator of financial stability

The relationship between financial market stability and economic development are not compellingly clarified so far.

Many researchers also cast doubt on the linkage between financial inclusion and economic development. They refer to this inconclusive relationship between the two as distributional concerns, which state that financial inclusion cannot be deeply enhanced without sacrificing economic development. In order to obtain comprehensive insights into this relationship, previous empirical papers use the z score as a proxy for bank stability. The z score has been widely discussed and considered not only as a gauge of bank operational risk but also profitability and thus as an absolute gauge of financial stability. Banks with the same z score value might engage in activities that optimize the compensation structure and still ensure functional consistency, whereas other banks carry out many risky projects to maximize returns. On the basis of previous studies, including Han and Melecky (2013), Ahamed and Mallick (2019), Vo et al. (2019), Barik and Sharma (2019), Dienillah et al. (2018), and Fang et al. (2014), in this study, we construct the z score as follows:

$$\text{Bank } z\ score_{it} = \frac{ROA + EQA}{sd(ROA)}$$

where ROA denotes the return on assets, EQA is defined as the ratio between total bank equity and total bank assets. Technically, the z score is commonly interpreted as the extent to which returns would have decreased before the bank equity was depleted. In other words, for every standard deviation of bank profitability, the z score represents the specified bank's ability to withstand risk.

3.2. The construction of the financial inclusion index

The financial inclusion index for Asian countries in the sample for the period 2008 to 2017 is constructed using data from the IMF along two different dimensions, each of which represents one aspect of comprehensive financial integration. In this paper, four indicators are used, and they are divided into two groups: the first group proxies for financial supply (*outreach*), and the second group proxies for financial demand (*usage*). The first dimension is generally considered the degree of permeability of financial institutions represented by the number of bank branches and ATMs for specific numbers of adults. More precisely, two indices are used to account for the penetration level of financial inclusion: the number of ATMs per 100,000 people and the number of bank branches for 100,000 adults. For the second dimension (*usage*), we use the number of credit cards and of debit cards per 1000 adults as proxies. Because these four indices tend to move together, we consider it reasonable to assign an equal weight to each of them. As such, in this paper, we use a technique to address their correlation.

Principal component analysis (PCA) is a useful method that is often used to examine the relationship between data and common tests. The PCA approach considers the first component as the factor that might have the highest variation in explaining most of the fluctuations in the dataset. Successive components, in conjunction with the first component, form an

³ We thank the reviewers for these suggestions.

Table 1
The results of principal component analysis.

| Name | Component | Eigenvalue | Difference | Proportion | Cumulative |
|--|-----------|------------|------------|------------|------------|
| Number of bank branches/100,000 adults | Comp1 | 2.86352 | 2.15378 | 0.7159 | 0.7159 |
| Number of ATMs/100,000 adults | Comp2 | 0.709741 | 0.388613 | 0.1774 | 0.8933 |
| Number of credit cards/1000 adults | Comp3 | 0.321128 | 0.215515 | 0.0803 | 0.9736 |
| Number of debit cards/1000 adults | Comp4 | 0.105613 | | 0.0264 | 1.0000 |

orthonormal pattern and capture the remaining unexplained fluctuations.

Ahamed and Mallick (2019) concluded that unbiased results were obtained when the impact of financial inclusion on bank stability was examined. They found that the financial inclusion index, calculated using PCA, is significantly correlated with the macroeconomic data. In order to use PCA, the input data has to be normalized by stipulating the range for every value such that they are in the range [0, 1]. Table 1 presents the PCA results. The first component, whose eigenvalue is higher than one, explains up to 71 percent of the variations in the sample. Because the other three eigenvectors are lower than 1, their proportional probabilities can be used as the weights for calculation of our financial index.

Table 2 presents the financial inclusion index for selected countries in our sample, comprising 18 Asian countries that have the required data. Our estimates indicate that Japan and Australia have the highest degree of financial inclusion compared with the other countries in our sample, whereas Vietnam and Laos have the lowest degree.

Table 2
The estimated financial inclusion index for selected countries in the Asian region.

| Country name | Country code | Mean | Standard deviation |
|----------------------|--------------|-------|--------------------|
| United Arab Emirates | UAE | 0.167 | 0.006 |
| Armenia | ARM | 0.258 | 0.011 |
| Australia | AUS | 0.430 | 0.005 |
| Azerbaijan | AZE | 0.120 | 0.007 |
| Bangladesh | BGD | 0.079 | 0.002 |
| Georgia | GEO | 0.373 | 0.032 |
| Indonesia | IDN | 0.201 | 0.005 |
| India | IND | 0.135 | 0.017 |
| Japan | JPN | 0.496 | 0.002 |
| Kazakhstan | KAZ | 0.073 | 0.003 |
| Lao PDR | LAO | 0.033 | 0.003 |
| Malaysia | MYS | 0.146 | 0.004 |
| Nepal | NPL | 0.097 | 0.013 |
| Pakistan | PAK | 0.093 | 0.003 |
| Philippines | PHL | 0.096 | 0.004 |
| Singapore | SGP | 0.183 | 0.006 |
| Thailand | THA | 0.190 | 0.009 |
| Vietnam | VNM | 0.043 | 0.003 |

Table 3
Descriptive statistics.

| | Mean | Standard Deviation | Skewness | Kurtosis |
|------------------------------|------------|--------------------|------------|----------|
| Z score | 5.788016 | 11.31681 | 8.43528 | 111.657 |
| Bank size | 14.34556 | 2.524763 | -2.552,627 | 3.148028 |
| K index | 21.5985 | 33.50325 | 10.34837 | 145.1483 |
| Operational revenue | 591,356.8 | 3,081,314 | 23.98897 | 979.097 |
| ROA | .8,640,443 | 5.523441 | -17.91752 | 602.4092 |
| Market power | 58.03965 | 333.3471 | 22.9893 | 1432.829 |
| Loan provision | .0567,085 | .095,335 | 6.81494 | 70.95673 |
| GDP per capita | 19,926.68 | 21,635.51 | .6,089,117 | 1.596075 |
| GDP growth | 3.871269 | 2.858051 | -6,321,019 | 3.280975 |
| Financial inclusion index | .2,593,765 | .1,710,086 | .4,682,245 | 1.469412 |
| Infrastructure | 6.568868 | 1.697423 | -2,840,347 | 1.960113 |
| Economic freedom index | 7.177322 | .6,148,933 | -3,337,048 | 2.159161 |
| Financial market development | 6.371884 | .7,330,124 | .1,122,867 | 2.855444 |
| N | 5983 | | | |

Notes: The z score and financial inclusion index are measured as discussed in the text. The bank characteristics include: bank size, measured as the logarithm of total bank assets; K index, which represents capital adequacy; operational revenue, which is the current year's operational revenue; loan provision, which represents the provisions as of the end of the year; ROA, which is the return on assets in the current year; and market power, which is reflected using the Lerner index. GDP per capita and GDP growth are the control variables for macroeconomic conditions. Infrastructure, the economic freedom index, and financial market development are the instrumental variables used in the GMM models. All three variables are measured on a ten-point scale in which 1 is the lowest level of development.

3.3. Descriptive statistics

Table 3 presents the descriptive statistics of all the variables. Japan has the highest financial inclusion index, roughly about 0.49 for the period investigated, following by Australia, with a value of about 0.47.

4. Empirical findings

4.1. The baseline model using the standard OLS technique

We begin our analysis with the baseline model, which employs the standard OLS regression technique. Our regression model is as follows:

$$Financial\ stability_t = f(Financial\ inclusion_t, Bank\ characteristics_{it}, Macroconditions_{jt})$$

The subscripts i , j , and t correspond to bank i , country j , and year t . Financial inclusion is estimated using four sub-indicators that represent the dimensions *financial usage* and *financial penetration*. Bank characteristics are included in our baseline regression, including loan provision, bank size, operational revenue, K index, ROA, and market power.

We conduct tests to confirm the presence of autocorrelation and heteroskedasticity using Wooldridge test, modified Wald test, and Breusch–Pagan test. The results in Table 4 indicate

Table 4
Wooldridge autocorrelation test and modified Wald test.

| Wooldridge test | | Modified Wald test | | Breusch–Pagan test | |
|------------------------------|------------------------------|-------------------------------|---------------------------------|------------------------------|---------------------------------|
| F-test | Existence of autocorrelation | Chi ² test | Existence of heteroskedasticity | Chi ² test | Existence of heteroskedasticity |
| 81.899 ^a (0.0000) | Yes | 6.4e+31 ^a (0.0000) | Yes | 954.21 ^a (0.0000) | Yes |

^a Significant at the 1 level.

Table 5
The VIF and correlation matrix.

| Variables | 1/VIF | VIF | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---------------------------------|--------|------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--------------------|--------------------|--------------------|-------|
| 1 Bank size | 0.5421 | 1.84 | 1.000 | | | | | | | | | | | |
| 2 K index | 0.8143 | 1.24 | -0.152 ^a | 1.000 | | | | | | | | | | |
| 3 Operational revenue | 0.7326 | 1.37 | 0.357 ^a | -0.009 | 1.000 | | | | | | | | | |
| 4 ROA | 0.8786 | 1.14 | 0.037 ^a | 0.045 ^a | 0.001 | 1.000 | | | | | | | | |
| 5 Market power | 0.9927 | 1.01 | 0.012 | -0.010 | -0.008 | -0.022 | 1.000 | | | | | | | |
| 6 Loan provision | 0.8999 | 1.11 | -0.203 ^a | 0.003 | -0.059 ^a | -0.229 ^a | -0.005 | 1.000 | | | | | | |
| 7 GDP per capita | 0.1206 | 8.29 | 0.270 ^a | -0.040 ^a | 0.103 ^a | -0.077 ^a | -0.036 ^a | -0.010 | 1.000 | | | | | |
| 8 GDP growth | 0.1459 | 6.85 | -0.211 ^a | 0.035 ^a | -0.081 ^a | 0.055 ^a | 0.033 ^a | -0.000 | -0.716 ^a | 1.000 | | | | |
| 9 Financial inclusion | 0.1148 | 8.71 | 0.259 ^a | -0.039 ^a | 0.086 ^a | -0.088 ^a | -0.026 | 0.003 | 0.881 ^a | -0.776 ^a | 1.000 | | | |
| 10 Infrastructure | 0.1284 | 7.79 | 0.412 ^a | -0.007 | 0.102 ^a | -0.073 ^a | -0.038 ^a | -0.025 | 0.848 ^a | -0.634 ^a | 0.797 ^a | 1.000 | | |
| 11 Economic freedom index | 0.2525 | 3.96 | 0.190 ^a | -0.004 | 0.089 ^a | -0.048 ^a | -0.022 | -0.040 ^a | 0.767 ^a | -0.560 ^a | 0.760 ^a | 0.795 ^a | 1.000 | |
| 12 Financial market development | 0.3342 | 2.99 | 0.343 ^a | -0.002 | 0.103 ^a | -0.031 ^a | -0.018 | -0.131 ^a | 0.602 ^a | -0.319 ^a | 0.476 ^a | 0.732 ^a | 0.660 ^a | 1.000 |

^a Significant at the 0.05 level.

that both autocorrelation and heteroskedasticity exist in our model. Therefore, we use robust standard errors to address this with the variance-covariance matrix estimator.

In addition, GDP per capita and the GDP growth rate are both used in our model, as in [Ahamed and Mallick \(2019\)](#). The inclusion of these two variables might introduce a multicollinearity problem. We consider these two variables complementary, in particular in the sample of countries with high income per capita and countries with high economic growth rates. Australia, Japan, Singapore, and the UAE have higher income per capita than the other countries in the sample. However, their economic growth rates are lower than those of other countries, such as Vietnam and Thailand. [Table 5](#) presents the correlation matrix and the variance inflation factor (VIF). A VIF of below 10 indicates multicollinearity is not a problem in the model.

4.2. The GMM model

Endogeneity is generally considered inevitable in studies that use panel data set containing general macroeconomic variables. For example, several possible factors could simultaneously change the level of national income and the banking system. These omitted factors could unintentionally compromise the estimated results. In addition, the causality effect between financial inclusion and financial stability warrants attention.

Our analyses indicate that the model used in this study suffers from heteroskedasticity and autocorrelation, so we use GMM to overcome these problems, which is consistent with previous empirical studies ([Sardo & Serrasqueiro, 2017](#); [Tran et al., 2020](#); [Tran & Vo, 2018](#); [Tran & Vo, 2020](#)). [Roodman \(2009\)](#) and [Chan and Hameed \(2006\)](#) also stated that a

GMM estimation can be used to address with the problems of serial correlation and unobservable heterogeneity. The Sargan, Hansen, and Arellano-Bond statistics confirm the validity of our instrumental variables in the GMM estimation.

Our estimated results are in [Table 6](#), including empirical results from the OLS regression which shows a positive relationship between financial inclusion and bank stability. However, our focus is on the findings from the GMM estimations. The findings from our preferred model, Model 1, which includes both GDP growth and GDP per capita, indicate the significant and positive contribution to stability of financial inclusion.

In addition, to enhance the robustness of the findings,² we consider various scenarios in Models 2, 3, and 4. First, we construct Model 2 by excluding GDP growth because of the concern over potential multicollinearity with GDP per capita. Second, we construct Model 3 by excluding GDP per capita because of concern over potential multicollinearity with GDP growth. Third, we construct Model 4 to incorporate the effect of the 2008 financial crisis using a dummy variable.

Our results confirm that financial inclusion positively and statistically contributes to stability in the Asian region, as shown in Models 1, 2, and 3, using dynamic GMM. In contrast, when the effects of the crisis are taken into account, financial inclusion negatively and statistically contributes to stability in the banking sector in the Asian region. However, based on Hansen's test, the findings from Model 4 are not robust. Therefore, we conclude that our overall findings using various scenarios indicate that financial inclusion contributes positively and significantly to macroeconomic stability in the

² We thank the reviewer for this suggestion.

Table 6
Empirical results.

| | OLS Model | GMM Model 1 | GMM Model 2 (excluding GDP growth) | GMM Model 3 (excluding GDP per capita) | GMM Model 4 (dummy variable for the 2009 financial crisis) |
|------------------------------|---------------------------|-----------------------|--|--|--|
| Financial inclusion index | 12.88*** (6.34) | 7.510** (2.06) | 10.49** (2.21) | 13.16* (1.90) | −10.85* (−1.71) |
| Loan provision | −13.44*** (−5.06) | −9.819 (−0.87) | 2.442 (0.32) | 0.514 (0.02) | −4.386 (−0.68) |
| Bank size | 0.488*** (3.99) | 0.3751 (0.49) | −0.896* (−1.75) | 0.619 (0.56) | 0.0536 (0.10) |
| Operational revenue | −0.000000249** (−2.91) | 0.000000449 (0.35) | 0.00000192 (1.26) | −0.000000457 (−0.30) | 0.000000678 (0.86) |
| K index | 0.0315* (2.15) | 0.0878 (1.17) | 0.0765 (0.99) | 0.0521 (0.46) | 0.00762 (0.15) |
| ROA | 0.693*** (5.31) | 1.377*** (2.79) | 0.965** (2.00) | 0.307 (0.65) | 0.152 (0.82) |
| Market power | −0.000110 (−0.19) | 0.000464 (0.97) | 0.000163 (0.03) | −0.000480 (−0.31) | 0.000690 (0.37) |
| GDP per capita | −0.189 (−1.54) | 0.0000770* (−1.75) | 0.000109* (1.89) | | 0.000185*** (3.96) |
| GDP growth | 0.594*** (4.97) | 0.0458 (0.33) | | 0.139 (1.53) | 0.0810 (1.54) |
| Infrastructure | | −1.209* (−1.84) | −1.618*** (−2.83) | −1.049 (−1.54) | −1.462*** (−4.37) |
| Economic freedom index | | −0.385 (−0.65) | −0.486 (−0.47) | −0.393 (−0.23) | 0.869 (0.92) |
| Financial market development | | 1.751** (2.62) | 1.948*** (2.63) | 2.044** (2.36) | 1.683*** (4.56) |
| Constant | −6.688** (−2.85) | −6.730 (−0.54) | −6.679 (−0.50) | −11.75 (−0.62) | −3.573 (−0.31) |
| N | 3704 | 3704 | 3704 | 3704 | 3704 |
| AR (2) Test | | −1.38 (0.167) | −1.06 (0.289) | −0.74 (0.462) | −0.23 (0.816) |
| Hansen test | | 21.44 (0.965) | 10.10 (0.998) | 0.54 (0.910) | 17.82 (0.023) |

Notes: *, **, *** significant at 10 percent, 5 percent, and 1 percent level, respectively.

Asian region over the period 2008–2017. In addition, our analyses as presented in Models 1 and 2 show that ROA, GDP per capita, and financial market development also contribute positively and significantly to stability in the banking sector in the Asian region.

5. Conclusion and policy implications

The outbreak and spread of the COVID-19 virus have caused two global crises, a health crisis and an economic crisis, which have attracted particular attention to the stability of the financial sector in countries everywhere. Stability of the financial sector is critical in providing countries a robust financial buffer in response to these crises. In addition, the concept of steadily inclusive growth based on financial inclusion has drawn considerable attention from policymakers, practitioners, and economists. Many developing countries and international financial institutions have made various attempts to ensure financial stability and an inclusive financial system to enhance economic growth and development. Despite increasing growth in the banking sector and advancement in all areas of it, great concern remains that banks should not provide banking products and services to underserved segments of the population, such as the poor, small businesses,

and people living in remote areas to ensure stability of the banking sector and the economy.

Using a GMM regression, this study is conducted with a sample of 3071 banks in Asian countries for the period 2008 to 2017. We examine various scenarios to ensure the robustness of our findings, which confirm a positive and significant contribution of financial inclusion to macroeconomic stability in Asian countries. Our results suggest that financial inclusion acts as a lubricant for the entire economic system through expanding savings and investment. Furthermore, an inclusive financial system is a conduit for pro-poor policies by governments, which help households to eliminate poverty. Our results indicate that banks could take advantage of more substantial savings and more extensive deposits by rural households to help finance their lending activity. Financial inclusion ensures the stability of the retail basis of deposits. In addition to relying on sources of funding in the capital market, banks could increase and stabilize their operational revenue by targeting the underserved segments of the population. We find that financial inclusion facilitates stability in the financial sector by providing households and SMEs with timely and appropriate financial solutions and products.

Bank profitability is increased by employing a comprehensive strategy and less costly sources of demand deposits.

Additionally, designing a lending mechanism that is tailor-made for borrowers based on specific purposes can reduce the moral hazard issues in banks' daily operations. For this reason, financial inclusion is a significant step in achieving a more stable financial system. In addition, financial inclusion plays a vital role in maintaining a resilient financial system. Financial inclusion and a stable financial system should be considered complementary in policy formation and implementation and should not be considered in isolation from each other.

Many essential policy implications have emerged from our analysis. Extending financial inclusion appears to be appropriate for enhancing stability in the banking sector in the Asian region. As it is one of the most dynamic economic regions in the world, underserved segments of the population, such as the poor, people living in remote areas, and small businesses, should be targeted to ensure that sufficient financial products and services are available. By expanding financial products for those who are underserved, banks will obtain a great opportunity to avail themselves of steady sources of funds for lending activities. Doing so will achieve dual objectives for the banking sector: enhancing the stability of operations in the entire sector and increasing profits.

Laos and Vietnam have the lowest degree of financial inclusion in the Asian region. As such, increasing the degree of financial inclusion in the future would enable them to reach a significant milestone. In particular, in Vietnam, one of the most successful countries in the Asian region and the world in the past two decades in terms of economic growth and development, expanding financial inclusion is necessary and urgent for supporting continuation of economic growth and development. For example, Vietnam, which has approximately 3.5 bank branches for 100,000 adults and a financial inclusion index of 0.045, is far from achieving financial integration and an inclusive financial system in comparison to other Asian countries. Therefore, policies on financial inclusion in Vietnam, and other emerging markets, should be enhanced to encourage an extension of banking services and products to underserved segments of the population, mainly SMEs and households in remote areas.

Declaration of Competing Interest

The authors declare no conflicts of interest.

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