Financial inclusion and bank stability: evidence from capital buffer and capital adequacy ratio

Ozili, Peterson K

2025

Financial inclusion and bank stability: evidence from capital buffer and capital adequacy ratio

Peterson K. Ozili

Abstract

The study examines the effect of financial inclusion on bank stability, and the effect of bank stability on financial inclusion from 2011 to 2020. The study analyses 33 countries which are divided into Asian countries, African countries, European countries, and countries in the region of the Americas and using the panel regression method. It was found that high levels of financial inclusion have a significant positive impact on bank stability. The regional results show that financial inclusion improves bank stability in African countries and in countries in the region of the Americas while financial inclusion impairs bank stability in European countries. The analysis for the impact of bank stability on financial inclusion shows that bank stability has a significant effect on financial inclusion. The regional analysis shows that greater bank stability decreases financial inclusion in European and African countries while greater bank stability increases financial inclusion in countries in the Americas region. The results suggest that the effect of financial inclusion on bank stability, and the effect of bank stability on financial inclusion, depends on how financial inclusion and bank stability are measured and the region examined.

Keywords: financial inclusion, bank stability, capital adequacy ratio, capital buffer, financial inclusion index, automated teller machines, deposits, commercial banks

JEL code: G21, G28.

January 2025

To cite: Ozili, P. K. (2025). Financial inclusion and bank stability: evidence from capital buffer and capital adequacy ratio. *Journal of Chinese Economic and Foreign Trade Studies*.

1. Introduction

We investigate the impact of financial inclusion on bank stability and the impact of bank stability on financial inclusion. In terms of definition, financial inclusion refers to access and usage of affordable formal financial services (Demirgüç-Kunt and Klapper, 2012), while bank stability refers to a condition in which individual banks can carry out their bank intermediation function efficiently and without assistance from external institutions including the government (Nier, 2005; Köhler, 2015; Goetz, 2018). Banks are generally considered to be stable if they have adequate capital adequacy ratio, a good regulatory capital buffer, low insolvency risk (or high Zscore), high liquidity ratio and low single-digit nonperforming loans (Thakor, 2014).

In this paper, we focus on capital-based measures of bank stability because bank capital or the capital buffer is usually the first line of defense to absorb unexpected losses in banks (Farag et al, 2013). Without bank capital, a bank cannot survive. A bank whose capital adequacy ratio is negative or below the minimum regulatory capital adequacy ratio is in distress or failing (Farag et al, 2013). Therefore, having sufficient capital adequacy ratio and a good regulatory capital buffer are good signals of the stability of a bank (Thakor, 2014). Despite the importance of bank capital for bank stability, existing studies have not examined the effect of financial inclusion on capital-based measures of bank stability and have not examined the effect of capital-based measures of bank stability on the level of financial inclusion.

An emerging literature has examined the effect of financial inclusion on bank stability. Majority of these studies showed that financial inclusion affects bank stability through the credit channel and the deposit-liquidity channel (see, for example, Dienillah et al, 2018; Barik and Pradhan, 2021). The credit channel occurs when financial inclusion is achieved through greater access to credit (Barik and Pradhan, 2021). Under the credit channel, it is commonly argued that rapid credit growth could lead to the lowering of loan screening standards and credit monitoring standards which can increase credit risk, lead to rising nonperforming loans and increase bank fragility or bank instability (Barik and Pradhan, 2021), thereby implying a negative impact of financial inclusion on bank stability. A counter argument is that, if regulators can compel banks to tighten their loan screening standards and credit monitoring

standards when extending loans to individuals, SMEs and large corporations, the resulting improvement in credit risk management will ensure that financial inclusion through greater access to credit will improve bank stability (Siddik and Kabiraj, 2018), thereby implying a positive impact of financial inclusion on bank stability. The deposit-liquidity channel occurs when financial inclusion is achieved through many depositors who keep their money in banks. Under the deposit-liquidity channel, it is commonly argued that the increase in the number of depositors (or bank accounts) will increase the deposit base of banks and lead to a more diversified deposit base which can serve as cheap liquidity which banks can use to shore up their liquidity position to make them more stable and resilient to shocks (Han and Melecky, 2013; Hakimi et al, 2022), thereby implying a positive impact of financial inclusion on bank stability. A counter argument is that if depositors and savers are not rewarded with high deposit rates that would motivate them to keep their deposits in banks for a long time, depositors and savers will only keep their funds in banks for a short time. Such deposits will be unstable and may not be readily available for banks to use as cheap liquidity to shore up their liquidity position. This would make banks become potentially unstable, vulnerable to shocks and become fragile (Wang and Luo, 2022), thereby implying a negative impact of financial inclusion on bank stability. While the credit and deposit-liquidity transmission channels are the most common channels through which financial inclusion affects bank stability in the literature (Han and Melecky, 2013; Siddik and Kabiraj, 2018; Hakimi et al, 2022), little attention has been paid to a third channel, which is the financial access point channel, particularly financial inclusion through automated teller machines (ATM) penetration and bank branch expansion.

In this paper, we revisit the impact of financial inclusion on bank stability and focus on the financial access point channel. First, we argue that there is a pass-through between financial inclusion (via ATM penetration) and bank stability because the increasing patronage of existing ATMs by banked adults can increase the demand for debit cards among banked adults, generate fee income for banks, increase bank profitability, and some of the generated profits will be retained and used to boost bank capital and to improve bank stability. We also argue that financial inclusion (via bank branch expansion) can improve bank stability, because bank branch expansion to new locations may lead to inflow of new deposits to banks and generate a more diversified deposit base for banks. The diversified deposits could serve as

cheap liquidity which banks can rely on to shore up their liquidity position and make them more stable and resilient to shocks. This argument suggests that financial inclusion can have a positive impact on financial inclusion via bank branch expansion. However, it is also possible that having many branches can increase bank cost, deplete bank profit, and lower bank equity capital which will adversely affect bank stability. This argument suggests that financial inclusion via bank branch expansion may have a negative impact on bank stability. We test these arguments by examining the effect of financial inclusion on bank stability.

Our study is unique in several ways. First, the existing literature has examined some channels through which financial inclusion affect bank stability (Siddik and Kabiraj, 2018; Dienillah et al, 2018; Barik and Pradhan, 2021; Hakimi et al, 2022), but the literature has not considered the financial access point channel through which financial inclusion might affect bank stability. Our study is unique because we consider the financial access point channel. In the study, we measure financial inclusion using two financial access indicators. These financial access indicators provide additional insights on the specific financial access point that promote or worsen bank stability. Second, the existing literature did not examine the effect of bank stability on financial inclusion. The literature has extensively examined the effect of financial inclusion on bank stability but has not explored how bank stability might affect financial inclusion outcomes. Our study is unique because it is the first study to estimate the effect of bank stability on financial inclusion. Our analysis provide insights on whether bank stability has an adverse effect on financial inclusion. Third, the existing literature used the Z-score to measure bank stability but did not consider capital-based measures of bank stability which are bank capital to total assets ratio and the bank regulatory capital buffer. These capital-based indicators of bank stability provide additional insights on how financial inclusion may affect the capital-based indicators of bank stability. Finally, we differentiate our study from prior study by undertaking sub-sample analyses for different regions, to determine whether unobservable regional characteristics may affect the relationship between financial inclusion and bank stability.

We obtain data for 33 countries from a diverse set of countries across several regions. We use four indicators of financial inclusion and two capital-based indicators of bank stability. We estimate both the impact of financial inclusion on bank stability and the impact of bank stability on financial inclusion. We find that the effect of financial inclusion on bank stability,

and the effect of bank stability on financial inclusion may be positive or negative. The effect vary across regions and depends on how financial inclusion and bank stability are measured.

This study contributes to the literature in the following way. First, this study examines the financial access point channel through which financial inclusion may affect bank stability – an area that not been examined in the extant literature. The insight gained from the analysis will contribute to the existing literature that suggest alternative channels through which financial inclusion affects bank stability (Dienillah et al, 2018; Neaime and Gaysset, 2018; Siddik and Kabiraj, 2018; Alvi et al, 2020; Pham and Doan, 2020; Banna and Alam, 2021). Second, the study estimates the effect of bank stability on financial inclusion – an area that not been examined in the extant literature. The insight gained from the analysis will contribute to the literature that examine the benefits or consequences of bank stability, and with financial inclusion considered to be a potential benefit of bank stability. Third, we use capital-based indicators of bank stability. The insight gained from the analysis will contribute to the banking literature that examine the determinants and consequences of bank stability.

The rest of the study is structured as follows. Section 2 presents the review of the literature. Section 3 presents the methodology used for the study. Section 4 discusses the results, while section 5 presents the conclusion of the study.

2. Theoretical framework and literature review

In this section, we present the theoretical framework for the study and the review of the existing literature.

2.1. Theoretical framework

The theory of bank runs postulated by Diamond and Dybvig (1983) is the theoretical framework used in this study. The theory states that bank runs are caused by depositor panic that lead many depositors to withdraw their funds from banks at the same time. The theory of bank runs establishes a link between financial inclusion (i.e., large number of depositors) and bank stability. The theory shows that banks that have lots of depositors will enjoy significant gains through increase in banks' deposit base, greater access to cheap liquidity

from bank deposits and greater bank stability. However, when there is panic among depositors, depositors may withdraw their money from banks at the same time (Diamond and Dybvig, 1983). Such action will lead to a bank run which would lead to the failure of the affected banks, thereby leading to bank instability (Diamond and Dybvig, 1983). The theory of bank runs shows that high levels of financial inclusion (i.e., large number of depositors) will lead to greater bank stability in the absence of panic among bank depositors. However, high levels of financial inclusion (i.e., large number of depositors) may contribute to banking instability if there is panic among depositors and if depositors initiate a bank run.

2.2. Literature review

The existing literature document a positive, negative, and mixed impact of financial inclusion on bank stability. Some studies showed a positive impact of financial inclusion on bank stability. Banna and Alam (2021) examined the effect of digital financial inclusion on bank stability using a panel data of 574 banks from seven emerging Asian countries from 2011 to 2018. They found that digital financial inclusion has a positive impact on bank stability. Pham and Doan (2020) explored the relationship between financial inclusion and financial stability in 42 Asian countries in 2011, 2014, and 2017. They measured financial inclusion using the usage and accessibility dimensions of financial inclusion, while financial stability was measured by bank Z-score. They found a weak positive effect of financial inclusion on financial stability. Neaime and Gaysset (2018) investigate the impact of financial inclusion on financial stability in eight MENA countries from 2002 to 2015. They found that financial inclusion has a positive impact on financial stability in MENA countries. Siddik and Kabiraj (2018) examined whether financial inclusion promotes financial stability in a cross-country sample from 2001 to 2013. Financial inclusion was measured by the number of SME borrowers to total borrowers and the ratio of outstanding SME loans to total loans, while financial stability was measured using the ZSCORE. They found that financial inclusion, measured by the number of SME borrowers to total borrowers and the ratio of outstanding SME loans to total loans, has a significant positive effect on financial stability.

Ahamed and Mallick (2019) investigate the complementary effect of financial inclusion on bank stability using an index of financial inclusion for 2,913 banks selected from 87 countries and during the 2004 to 2012 period. They found that high levels of financial inclusion led to greater bank stability and the complementary effect is more pronounced when banks have

higher market power and operate in countries that have strong political stability, rule of law, and regulatory quality institutions. Vo et al (2021) examined the association between financial inclusion and financial stability for 3,071 banks in the Asian region from 2008 to 2017. They found that financial inclusion has a significant positive impact on bank stability in Asian countries. Ghosh (2022) undertook a cross-country study and examined the association between financial inclusion and bank stability in the presence of interest rate repression. Ghosh (2022) found that financial inclusion has a significant positive impact on bank stability despite the interest rate repression. Han and Melecky (2013) examined whether financial inclusion made banks safer during the 2008 financial crisis. They examined the relationship between access to bank deposits prior to the 2008 crisis and bank deposit growth during the crisis. They found that greater access to bank deposits can make the deposit funding base of banks more resilient in times of financial stress, thereby making banks safer during crisis. Boachie et al (2021) analysed the relationship between financial inclusion and bank stability in sub-Saharan African countries. They analysed 18 countries in sub-Saharan Africa from 2008 to 2018 and found that financial inclusion has a significant positive impact on bank stability in sub-Saharan African countries. Hakimi et al (2022) investigate the effect of financial inclusion on bank stability in the Middle East and North Africa (MENA) region from 2004 to 2017 and found that greater financial inclusion improves bank stability. They argued that financial inclusion increases the bank deposit base and their liquidity position which significantly increases bank stability. Danisman and Tarazi (2020) investigate whether financial inclusion affects bank stability in European countries. They found that high levels of financial inclusion (through more account ownership and digital payments) increase the stability of European banks, and the positive impact is stronger when financial inclusion efforts are targeted at disadvantaged adults who are young, under-educated, unemployed, and who live in rural areas. Malik et al (2022) investigate the association between financial stability and financial inclusion in Asian countries and found that financial inclusion positively affects financial stability in Asia countries.

Some studies undertake a comparative analysis across regions. Dienillah et al (2018) compared high-income and low-income countries when assessing the impact of financial inclusion on financial stability from 2004 to 2014. They argued that financial inclusion may lead to a reduction in credit standards which can increase credit risk and trigger financial

instability. They found that high-income countries have a high financial stability index and a high level of financial inclusion than low-income countries. They also found that financial inclusion has a positive impact on financial stability in high-income countries. Alvi et al (2020) compared four South Asian countries particularly Bangladesh, India, Pakistan, and Sri Lanka. They assessed 88 commercial banks pooled from these countries from 2012 to 2018 and found that financial inclusion improves bank stability across the four countries. Saha and Dutta (2021) examined the relationship between financial inclusion and financial stability in 92 countries from 2004 to 2014. They compared countries from different income and economic groups and found a U-shaped relationship between financial inclusion and financial stability. Oanh (2023) examined the relationship between financial inclusion and financial stability in 58 countries. The study compared 31 high financial development countries (HFDCs) and 27 low financial development countries (LFDCs) from 2004 to 2020. The study found that financial inclusion and financial stability are positively correlated in LFDCs while financial stability is negatively correlated with financial inclusion in HFDCs. Ozili (2024) compared African countries with non-African countries when examining the effect of gender equality on financial stability and financial inclusion from 2005 to 2021. The study found that gender equality has a significant positive impact on financial stability and financial inclusion in African countries while gender equality has an insignificant effect on financial inclusion in non-African countries.

Existing country-specific studies such as Widarwati et al (2019) argued that the growth of bank accounts (deposits) helps banks to manage their banking services and contribute to financial stability. They examined the relationship between financial inclusion and financial stability in Indonesia. They analysed five sharia banks from 2011 to 2016 and showed that financial inclusion (in terms of the number of deposits) has a positive effect on financial stability. Al-Smadi (2018) examined the relationship between financial inclusion and financial stability in Jordan from 2006 to 2017 and found a weak positive impact of financial inclusion on financial stability in Jordan. In the case of Zimbabwe, Sakarombe (2018) found that financial inclusion increases bank stability in Zimbabwe. Morgan and Pontines (2018) examined the effect of financial inclusion on bank stability. They measured financial inclusion using the share of bank lending to small and medium scale enterprises (SMEs) and measured bank stability using bank nonperforming loans and bank Z score. They found evidence that greater financial inclusion

(through greater lending to SMEs) improves bank stability by reducing nonperforming loans and the default risk of financial institutions.

Other studies showed a negative impact of financial inclusion on bank stability. For instance, Čihák et al (2021) reviewed the existing literature on bank stability and financial inclusion and found a possible co-dependence between bank stability and financial inclusion. They also found that financial inclusion and bank stability are negatively correlated, but the correlations depend on how financial inclusion and bank stability are measured and it also varies across individuals, firms, and country. Kouki et al (2020) investigate the channels through which financial inclusion might affect bank stability in African banks. They constructed a composite index of financial inclusion for 38 African countries from 2005 to 2014 and found a significant negative relationship between financial inclusion and bank stability in Africa countries. Barik and Pradhan (2021) examined the impact of financial inclusion on bank stability among the BRICS countries from 2005 to 2015 and found that financial inclusion has a significant negative effect on bank stability. They argued that the major reasons for the adverse effect of financial inclusion on bank stability are due to rapid credit growth, the lowering of bank credit standards, credit assessment difficulties, rising nonperforming loans, loan default by borrowers, and inadequate banking supervision. Feghali et al (2021) argued that financial inclusion through access to payments and savings accounts may have a neutral or positive effect on bank stability, while financial inclusion through access to credit can weaken bank stability if credit growth occurs without due regard to the repayment ability of borrowers. They test their hypothesis using cross-country data and found that financial inclusion through credit inclusion has an adverse effect on bank stability.

Other studies document a mixed effect of financial inclusion on bank stability. For instance, Amatus and Alireza (2015) investigate the relationship between financial inclusion and bank stability in 35 Sub-Saharan African countries from 2004 to 2011. They used bank ZSCORE to measure bank stability and used outstanding loans and deposits with commercial banks as measures of financial inclusion. They found that financial inclusion in terms of outstanding deposits with commercial banks has a negative effect on bank stability while financial inclusion in terms of outstanding loans from commercial banks has a positive effect on bank stability. García and José (2016) assessed the relationship between financial inclusion and bank stability and argued that credit risk may arise from rapid credit growth through the development of

new financial inclusion institutions and instruments. They also pointed out that broader access to deposits may lead to a more diversified base of deposits which can improve bank stability. Čihák et al (2016) found some trade-offs and synergies between financial inclusion and bank stability in different countries. They found that although greater financial inclusion is associated with greater bank stability, greater financial inclusion could also lead to extensive borrowing by individuals, lead to unexpected losses in the financial system, and lead to more frequent banking crises. Wang and Luo (2022) examined the effect of financial inclusion on bank stability in 36 emerging economies. They examined more than 1,500 commercial banks from 2004 to 2018 and found that high levels of financial inclusion increase bank stability, and the positive effect depends on the state of the business cycle, financing conditions, governmental intensity, and the policy environment. In contrast, financial inclusion has a negative impact on bank stability in countries where there are strong governmental power and a loose financial environment. They further showed that the channels through which financial inclusion affects bank soundness are through risk management and funding stability. Ha and Nguyen (2023) investigate the moderating role of institutional quality on the effect of financial inclusion on the stability of 157 banks in 8 Association of Southeast Asian Nations (ASEAN) countries from 2010 to 2020. They find that financial inclusion adversely affects bank stability, but the adverse effect is mitigated by good institutional quality. Banna et al (2021) examine the effect of fintech-based financial inclusion on banks' risk taking in 24 Organisation of Islamic Cooperation (OIC) countries. They find that higher levels of fintech-based financial inclusion decrease bank's risk-taking behaviour which improves bank stability

While the existing literature document extensive evidence for the impact of financial inclusion on bank stability, the literature has not examined the impact of bank stability on financial inclusion. Our study aims to fill this gap in the literature. Our paper is the first study to examine the impact of bank stability on financial inclusion.

3. Methodology

3.1. The Sample

The financial inclusion indicators data used in this study were obtained from the World Bank Global Financial Development Indicators. Bank stability data were also obtained from the World Bank Global Financial Development Indicators (WBGFDI). The sample size consists of thirty-three (33) countries from several regions (see list of countries in table 1). The sample period covers a 10-year period spanning from 2011 to 2020.

Four commonly used indicators of financial inclusion were employed in the analysis namely the number of ATMs per 100,000 adults (ATM) variable, the number of bank accounts (or depositors) per 1,000 adults (BAC) variable, the number of commercial bank branches per 100,000 adults (BAR) variable, and a financial inclusion index (IFI) (e.g., Hakimi et al, 2022; Ozili, 2024, Pham and Doan, 2020). The financial inclusion index is derived as the weighted average of the ATM, BAC and BAR variables using the weights: (0.3) *ATM, 0.4*(BAC) and 0.3*(BAR). Three commonly used capital-based indicators of bank stability were employed in the analysis namely (i) the bank capital adequacy ratio which is measured as bank capital to total assets ratio, which is also the CAP variable, and (ii) the bank capital buffer which is the BUFF variable. The bank capital buffer variable is derived as the difference between the actual regulatory capital to risk-weighted assets ratio (CAR) and the 8% Basel minimum regulatory capital to risk-weighted assets ratio.

Table 1. Variable description			
Variable	Indicator Name	Short definition	Source
IFI	Financial inclusion index	The financial inclusion index is derived as the weighted average of the individual financial inclusion variables. The weights are classified as follows: 0.3*(ATM), 0.4*(BAC) and 0.3*(BAR).	Author
ATM	ATMs per 100,000 adults	Number of ATMs per 100,000 adults.	WBGFDI
BAC	Bank accounts per 1,000 adults	Number of depositors with commercial banks per 1,000 adults.	WBGFDI
BAR	Bank branches per 100,000 adults	Number of commercial bank branches per 100,000 adults.	WBGFDI
CAP	Bank capital adequacy ratio	Measured as bank capital to total assets ratio (%)	WBGFDI
BUFF	Bank capital buffer	The difference between the actual regulatory capital to risk-weighted assets ratio (CAR) and the 8% Basel minimum regulatory capital to risk-weighted assets ratio.	WBGFDI

Source: World Bank databank

3.2. Model specification

The model used in the regression analysis is specified below. In the first analysis, we assess financial inclusion as a function of bank stability as shown in equation 1. In the second analysis, we assess bank stability as a function of financial inclusion as shown in equation 2.

$$Financial\ inclusion\ indicators\ =\ f(bank\ stability\ indicators)$$

$$(IFI, BAC, BAR, ATM,)i,t\ =\ \beta o + \beta 1 CAPi,t + \beta 2 BUFFi,t + ei,t \ldots . Equation\ 1$$

$$Bank\ stability\ indicators\ =\ f(financial\ inclusion\ indicators)$$

$$(CAP, BUFF)i,t\ =\ \beta o + \beta 1 IFIi,t + BACi,t + BARi,t + ATMi,t + ei,t \ldots . Equation\ 2$$

i = country. t = year. ATM = number of ATMs per 100,000 adults. BAC = number of depositors with commercial banks per 1,000 adults. BAR = number of commercial bank branches per 100,000 adults. IFI = financial inclusion index. CAP = ratio of bank capital to total assets. BUFF = The difference between actual bank capital to total assets ratio and the minimum bank capital to total assets ratio. e = error term.

3.3. Estimation procedure

Regarding the method of analysis, the study used the panel fixed effect regression method to examine whether a causal relationship exists between financial inclusion and bank stability. The reason for using the panel fixed effect regression method for the study is because several financial inclusion studies use the panel fixed effect model to examine the relationship between financial inclusion and other bank-specific and macro variables such as Ahamed and Mallick (2019), Pham and Doan (2020), Feghali et al (2021), and Ozili et al (2023b). The panel fixed effect regression model allows us to control for time-invariant omitted variables which are impossible to observe, and it reduces the potential sources of biases in the estimation in comparison to the random effect model, thereby giving us a less biased estimator (Pesaran and Zhou, 2018).

3.4. Descriptive statistic of the variables

The descriptive statistic for the 33 countries in the sample is reported in Table 2. Regarding the financial inclusion variables, table 1 shows that the average number of bank accounts per 1,000 adults (BAC) was higher in Estonia and Ukraine compared to Cameroun and Rwanda which had the lowest number of bank accounts per 1,000 adults during the period. The average number of ATMs per 100,000 adults (ATMs) was much higher in Saudi Arabia, Israel, Thailand and Uruguay compared to Uganda, Cameroun and Rwanda which had the lowest number of ATMs per 100,000 adults during the period. The average number of commercial bank branches per 100,000 adults (BAR) was much higher in Seychelles, Moldova and Uzbekistan, compared to Estonia, Ukraine and Saudi Arabia during the period. Regarding the bank stability variables, the countries with the highest average bank capital adequacy ratio (CAP) during the period are Georgia, Ghana, Moldova, Samoa and Saudi Arabia, while Bangladesh, Israel and Paraguay had the lowest average bank capital adequacy ratio during the period. The countries with the highest average bank regulatory capital to risk-weighted assets ratio (CAR) during the period are Estonia and Moldova, while Bangladesh and Cameroun had the lowest average bank regulatory capital to risk-weighted assets ratio during the period. The countries with the highest average bank capital buffer (BUFF) during the period are Estonia, Moldova, Rwanda and Zambia, while Bangladesh and Cameroun had the lowest average bank capital buffer during the period.

Table 2. Descriptive statistic for the financial inclusion and bank stability variables

S/N	Countries	ATM	BAC	BAR	CAP	BUFF	IFI
1	Argentina	48.3	1022.7	13.3	12.2	8.3	427.6
2	Bangladesh	7.1	670.8	8.5	5.6	2.8	273.03
3	Cameroon	3.8	86.4	1.9	8.0	1.2	36.3
4	Costa Rica	65.5	1176.3	21.01	9.7	8.7	496.4
5	Croatia	128.9	1436.2	32.3	13.8	14.2	622.9
6	El Salvador	34.3	802.1	12.9	13.3	8.9	335.1
7	Estonia	73.6	2138.1	11.7	11.1	18.3	880.8
8	Eswatini	35.6	473.8	7.06	13.0	13.1	202.3
9	Georgia	72.7	912.6	31.2	14.2	9.4	396.2
10	Ghana	9.1	572.4	6.7	14.3	10.6	233.7
11	Israel	122.02	1025.2	19.3	7.04	6.4	452.4
12	Latvia	63.5	1317.1	18.2	10.5	12.4	551.3
13	Lesotho	12.3	360.2	3.6	11.01	8.8	148.8
14	Malta	54.1	1407.3	33.9	7.9	9.1	589.3
15	Moldova	44.4	1331.3	41.8	15.5	17.7	558.4
16	Namibia	62.5	898.5	12.5	9.1	6.9	381.9
17	Nigeria	15.2	830.9	5.1	9.3	7.9	338.4
18	North Macedonia	56.9	992.7	24.6	10.9	8.2	421.5
19	Paraguay	24.9	316.7	10.3	7.7	8.7	137.2
20	Peru	87.4	782.4	7.5	11.1	6.5	341.4
21	Philippines	24.8	514.07	8.6	10.5	7.8	215.6
22	Poland	65.3	1068.0	30.8	9.2	8.6	456.1
23	Rwanda	4.9	213.2	5.7	14.5	15.2	88.5
24	Samoa	44.3	1014.9	22.4	17.1	19.6	426.03
25	Saudi Arabia	141.13	1922.94	16.97	14.01	10.9	1320.9
26	Seychelles	71.2	1814.2	51.3	9.8	15.1	762.4
27	Thailand	109.5	1221.7	11.7	9.7	9.2	525.1
28	Turkey	77.6	1228.8	17.8	11.1	8.8	520.1
29	Uganda	4.2	250.7	2.7	13.04	13.5	102.3
30	Ukraine	93.7	2061.1	0.7	12.1	8.9	852.7
31	Uruguay	104.2	884.6	11.5	9.9	8.5	388.5
32	Uzbekistan	19.8	654.4	39.7	12.1	10.2	279.6
33	Zambia	13.9	322.2	8.2	11.7	15.1	135.5
	Aggregate statistics:						
	Mean	54.3	959.4	67.5	11.2	10.3	420.3
	Median	51.3	941.7	12.5	11.1	9.4	399.7
	Std. Dev.	42.2	575.4	289.1	2.8	4.6	279.1
	Skewness	1.1	0.9	5.4	0.2	0.6	1.4
	Kurtosis	5.3	4.9	31.1	2.8	3.6	6.1
	Observations	330	330	330	330	330	330

Source: Author's computation

4. Discussion of results

4.1 Correlation results

The Pearson correlation for the variables in table 3 are below 0.80 which suggest that multi-collinearity is not a problem in the empirical analysis. The IFI variable has a significant positive correlation with the BUFF and CAP variables. This indicates that the financial inclusion index is positively correlated with the bank capital ratio (CAP) and the bank capital buffer (BUFF) variables. This implies that financial inclusion and bank capital are positively correlated, and it suggests that high level of financial inclusion is significantly correlated with greater bank stability since adequate bank capital signals that a bank is stable. The BAC variable is significant and positively correlated with the BUFF variable. This indicates that financial inclusion, in terms of the number of depositors, has a significant positive correlation with bank capital buffer (BUFF) and it suggests that a high number of depositors who own bank accounts is significantly correlated with bank stability. The BAR variable is significant and positively correlated with the CAP variable. This indicates that financial inclusion, in terms of bank branch expansion, is significant and positively correlated with bank capital adequacy ratio (CAP) and it suggests that financial inclusion in terms of bank branch expansion is positively correlated with bank stability. Meanwhile, the ATM variable is not significantly correlated with the BUFF and CAP variables. This indicates that financial inclusion, in terms of ATM penetration, is insignificantly correlated with the capital-based bank stability indicators.

Table 3. Pearson correlation for the variables

Variable	ATM	BAC	BAR	CAP	BUFF	IFI
ATM	1.000					

BAC	0.651***	1.000				
	(0.00)	-----				
BAR	0.376***	0.315***	1.000			
	(0.00)	(0.00)	-----			
CAP	0.028	0.086	**0.179*** **	1.000		
	(0.60)	(0.11)	**(0.00)**	-----		
BUFF	0.037	**0.238*** **	0.033	**0.642*** **	1.000	
	(0.46)	**(0.00)**	(0.53)	**(0.00)**	-----	
IFI	**0.700*** **	**0.952*** **	**0.587*** **	**0.128** **	**0.208*** **	1.000
	(0.00)	**(0.00)**	**(0.00)**	**(0.01)**	**(0.00)**	-----

The values in parenthesis are the p-values of the Pearson correlation coefficients.
*** and ** represent statistical significance at the 1% and 5% levels.

Source: Author's computation

4.2. Baseline regression result: Impact of financial inclusion on bank stability

In the full sample regression analysis, we find that the ATM financial inclusion variable (ATM) has a significant positive impact on bank stability in columns 1 & 2 in table 4. The result in column 1 shows that financial inclusion, in terms of ATM penetration (ATM), has a significant positive impact on bank capital adequacy ratio (CAP) in column 1. This indicates that widespread ATM penetration improves bank capital adequacy ratio which leads to greater bank stability in the full sample. The result supports the findings of Dienillah et al (2018) and Neaime and Gaysset (2018) who found a positive impact of financial inclusion on bank stability. A possible explanation for this result is that the patronage of existing ATMs (i) increases the demand for debit cards among banked adults, (ii) generates non-interest income for banks, (iii) increases bank profitability, and (iv) some of the generated profits are retained and used to boost bank capital to improve bank stability. In contrast, financial inclusion, in terms of bank branch expansion and the number of depositors, has an insignificant impact on the two bank stability indicators in columns 1 & 2 in table 4. This result does not support the findings of Dienillah et al (2018) and Neaime and Gaysset (2018) who found a positive impact of financial inclusion on bank stability. Furthermore, the financial inclusion index (IFI) has a

significant positive impact on the capital adequacy ratio and capital buffer of banks in the full sample in column 1 in table 5. The result also supports the findings of Dienillah et al (2018) and Neaime and Gaysset (2018) who found a positive impact of financial inclusion on bank stability.

4.3. African countries subsample analysis

In the African countries subsample, the result in column 3 of table 4 shows that financial inclusion, in terms of ATM penetration (ATM), has a significant positive impact on bank capital adequacy ratio (CAP) which leads to greater bank stability in the African countries subsample. The result supports the findings of Dienillah et al (2018) and Neaime and Gaysset (2018) who found a positive impact of financial inclusion on bank stability. The result indicates that widespread ATM penetration improves the capital adequacy (and stability) of African banks. A possible explanation for this result is that the patronage of existing ATMs will (i) increase the demand for debit cards, (ii) generate non-interest income for African banks, (iii) increase bank profitability and (iv) some of the generated profits will be retained and used to boost their bank capital to improve bank stability. In contrast, the BAC variable has a significant negative impact on the CAP variable in the African countries subsample. This indicates that financial inclusion, in terms of number of bank accounts (or depositors), has an adverse impact on bank capital adequacy ratio which impairs bank stability in African countries. The result supports the findings of Kouki et al (2020), Barik and Pradhan (2021) and Feghali et al (2021) who found a significant negative impact of financial inclusion on bank stability. The implication is that African banks with high levels of financial inclusion via many depositors have a low capital adequacy ratio and are less stable. A possible explanation for this result is that having many depositors may not necessarily translate to greater bank stability because the African banking system do not offer enough incentives that would attract deposits, or make depositors keep their money in African banks for a long time. For this reason, depositors in African countries may not fund their accounts frequently, and even if they fund their accounts, they may not keep their deposits in their bank accounts for a long time. As a result, depositors' funds will not be readily available for banks to use to boost their liquidity position or to generate additional profits so that some of the generated profits will be allocated as 'retained earnings' and used to boost bank capital to improve bank stability. In contrast, financial inclusion in terms of bank branch expansion, has an insignificant impact on the two bank stability

indicators in columns 3 & 4 in table 4. Furthermore, the financial inclusion index (IFI) has a significant negative impact on the capital adequacy ratio and capital buffer of banks in the African countries subsample in columns 3 & 4 in table 5. The result supports the findings of Kouki et al (2020), Barik and Pradhan (2021) and Feghali et al (2021) who found a negative impact of financial inclusion on bank stability.

4.4. Asian countries subsample analysis

In the Asian countries subsample, the result in columns 5 & 6 of table 4 show that financial inclusion, in terms of ATM penetration, bank branch expansion and number of depositors, has an insignificant impact on the two capital-based measures of bank stability which are bank capital adequacy ratio and the bank capital buffer. The coefficients are insignificant. Furthermore, the financial inclusion index (IFI) has a significant positive impact on bank stability via the capital adequacy ratio of banks in the Asian countries subsample in column 5 in table 5. The result supports the findings of Dienillah et al (2018) and Neaime and Gaysset (2018) who found a positive impact of financial inclusion on bank stability.

4.5. American countries subsample analysis

In the Americas countries subsample, the result in columns 7 & 8 of table 4 show that financial inclusion, in terms of the number of depositors (BAC), has a significant positive impact on bank stability via bank capital adequacy ratio and bank capital buffer. This indicates that having many depositors improve bank stability by increasing bank capital adequacy and bank capital buffer. The result supports the findings of Dienillah et al (2018) and Neaime and Gaysset (2018) who found a positive impact of financial inclusion on bank stability. A possible explanation for this result is that the banking system in Americas countries provide enough incentives for depositors to keep their monies in bank accounts for a long time. The deposits will become readily available for use by American banks to generate profits. Some of the generated profits will be retained as 'retained earnings' and used to boost bank capital to improve bank stability. In contrast, financial inclusion, in terms of bank branch expansion and ATM penetration, has an insignificant impact on the two bank stability indicators (CAP & BUFF) in columns 7 & 8 in table 4. Furthermore, the financial inclusion index (IFI) has a significant positive impact on bank stability via the capital adequacy ratio and capital buffer of banks in the Americas countries in the sample in columns 7 & 8 in table 5. The result supports the

findings of Dienillah et al (2018) and Neaime and Gaysset (2018) who found a positive impact of financial inclusion on bank stability.

4.6. European countries subsample analysis

In the European countries subsample, the result in columns 9 & 10 of table 4 show that financial inclusion, in terms of bank branch expansion (BAR), has a significant negative impact on bank stability via bank capital adequacy ratio and bank capital buffer (CAP & BUFF). The result supports the findings of Kouki et al (2020), Barik and Pradhan (2021) and Feghali et al (2021) who found a significant negative impact of financial inclusion on bank stability. This result indicates that bank branch expansion decreases the capital adequacy and capital buffer of banks in European countries. This might be because having many branches could increase bank cost, deplete bank profit and adversely affect bank equity capital. Also, we find that financial inclusion, in terms of the number of depositors (BAC), has a significant positive impact on bank capital adequacy ratio in European countries in our sample. This indicates that having many depositors or bank accounts leads to greater bank stability by increasing bank capital adequacy. A possible explanation for this result is that the banking system in European countries offer enough incentives to depositors that make them keep their monies in banks accounts and for a long time. The deposits are then readily available for use by European banks to generate profits. Some of the generated profits would be retained as 'retained earnings' and used to boost bank capital adequacy position. In contrast, financial inclusion, in terms of ATM penetration, has an insignificant impact on the two bank stability indicators in columns 9 & 10 in table 4. Furthermore, the financial inclusion index (IFI) has an insignificant impact on the capital adequacy ratio and capital buffer of banks in the Americas countries in the sample in columns 9 & 10 in table 5.

Table 4. Impact of financial inclusion on capital-based measures of bank stability (fixed effect panel regression estimation)

	Full sample		African countries subsample		Asian countries subsample		Americas countries subsample		European countries subsample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	CAP	BUFF	CAP	BUFF	CAP	BUFF	CAP	BUFF	CAP	BUFF
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
c	10.05*** (0.00)	11.312*** (0.00)	9.415*** (0.00)	11.055*** (0.00)	6.085*** (0.00)	11.992*** (0.00)	6.731*** (0.00)	8.870** (0.02)	15.273*** (0.00)	19.491*** (0.00)
BAC	0.001 (0.15)	-0.001 (0.26)	-0.002*** (0.00)	-0.001 (0.45)	0.001 (0.26)	0.001 (0.39)	0.004*** (0.00)	0.006** (0.01)	0.001** (0.03)	0.001 (0.27)
BAR	0.005 (0.32)	-0.004 (0.61)	0.115 (0.29)	0.254 (0.25)	0.003 (0.67)	0.007 (0.36)	0.018 (0.87)	0.167 (0.37)	-0.119*** (0.00)	-0.258*** (0.00)
ATM	0.007* (0.09)	-0.002 (0.86)	0.094** (0.01)	-0.096 (0.18)	0.032 (0.27)	0.0203 (0.47)	0.006 (0.11)	0.002 (0.79)	-0.029 (0.12)	-0.042 (0.26)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	83.67	79.02	78.23	78.09	79.87	74.14	83.05	35.56	76.34	69.89
F-statistic	33.27	24.40	17.93	17.43	17.51	12.92	18.01	2.92	16.21	11.94

Source: Author's computation

Table 5. Impact of the financial inclusion index on capital-based bank stability (fixed effect panel regression estimation)

	Full sample		African countries subsample		Asian countries subsample		Americas countries subsample		European countries subsample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	CAP	BUFF	CAP	BUFF	CAP	BUFF	CAP	BUFF	CAP	BUFF
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
c	10.575*** (0.00)	11.112*** (0.00)	11.981*** (0.00)	12.219*** (0.00)	8.112*** (0.00)	6.007*** (0.00)	6.846*** (0.00)	4.045** (0.02)	10.577*** (0.00)	10.881*** (0.00)
IFI	0.002** (0.04)	-0.002 (0.19)	-0.003* (0.06)	-0.006** (0.03)	0.005* (0.09)	0.005 (0.13)	0.011*** (0.00)	0.012** (0.01)	0.002 (0.14)	0.001 (0.64)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	83.47	79.01	76.19	77.55	79.91	74.13	83.58	36.82	76.34	69.34
F-statistic	34.52	25.72	17.67	18.99	19.48	124.32	21.02	3.29	16.21	10.40

Source: Author's computation

4.7. Impact of bank stability on financial inclusion

Existing studies have argued that financial inclusion can improve bank stability (e.g., Aysan et al, 2013; Morgan and Pontines, 2018), but no studies have examined the impact of bank stability on financial inclusion. In this section, we investigate the impact of bank stability on financial inclusion to determine whether bank stability leads to higher or lower level of financial inclusion through ATM penetration, the number of depositors or bank accounts and the number of commercial bank branches.

In the full sample analysis in table 6, the BUFF variable has a significant negative impact on the three financial inclusion indicators (e.g., IFI, BAC and ATM) in columns 1, 2 & 4 in table 6. The results suggest that greater bank stability via strong capital buffer decreases the level of financial inclusion through a decrease in the financial inclusion index, a decrease in the number of bank accounts and decrease in ATM penetration. Meanwhile, the CAP variable has a significant positive impact on only two financial inclusion indicators (i.e., IFI and ATM) in columns 1 & 4 in table 6. This indicates that greater bank stability leads to high levels of financial inclusion through an increase in the financial inclusion index and greater ATM

penetration. The CAP variable also has a significant negative impact on the BAR and BAC variables in columns 2 & 3. The results suggest that greater bank stability via high capital adequacy ratio decreases the level of financial inclusion through a decrease in the number of bank accounts and decrease in bank branches. Overall, the full sample results suggest that bank stability can increase or decrease the level of financial inclusion depending on how financial inclusion and bank stability are measured. However, the positive effect of bank stability on financial inclusion is achieved mostly through greater ATM penetration than through bank branch expansion.

In the African countries subsample in table 6, the BUFF variable has a significant negative impact on financial inclusion in terms of ATM penetration. This result suggests that greater bank stability via strong capital buffer decreases the level of financial inclusion via decrease in ATM penetration in African countries. The CAP variable also has a significant positive impact on financial inclusion in terms of ATM penetration. This result suggests that greater bank stability via high capital adequacy ratio increases the level of financial inclusion via greater ATM penetration in African countries. In contrast, the two capital-based bank stability variables (i.e., BUFF and CAP) have an insignificant effect on the financial inclusion index, number of depositors (BAC) and bank branches (BAR).

In the Americas countries subsample in table 7, the CAP variable has a significant positive effect on the IFI, BAC and ATM variables. These results suggest that greater bank stability via high capital adequacy ratio increases the level of financial inclusion via a high financial inclusion index, greater ATM penetration and bank branch expansion in the Americas countries. The CAP variable also has a significant negative effect on the BAR variable. This result suggests that bank stability via high capital adequacy ratio decreases the level of financial inclusion via bank branch contraction in the Americas countries. In contrast, the BUFF variable has an insignificant effect on the financial inclusion indicators.

In the Asian countries subsample in table 7, the CAP and BUFF variables have an insignificant effect on the IFI, BAC, BAR and ATM variables. Therefore, no meaningful conclusion can be drawn for the Asian region. In the European countries subsample in table 8, the CAP and BUFF variables have a significant negative impact on the BAR variable. This result suggests that bank stability via high capital adequacy ratio and strong capital buffer decrease the level of financial

inclusion through bank branch contraction in European countries. Meanwhile, the CAP and BUFF variables have an insignificant negative effect on the IFI, BAC and ATM variables.

Table 6. Impact of bank stability on financial inclusion for the full sample and African sample (Fixed effect panel regression estimation)

	Full sample				African countries subsample			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	IFI	BAC	BAR	ATM	IFI	BAC	BAR	ATM
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
C	316.94*** (0.00)	723.06*** (0.00)	957.03*** (0.00)	35.377*** (0.00)	405.81*** (0.00)	995.80*** (0.00)	8.353*** (0.00)	16.616*** (0.00)
CAP	16.319*** (0.00)	-37.71*** (0.00)	-1.440* (0.06)	2.685*** (0.00)	-7.389 (0.49)	-19.731 (0.46)	0.161 (0.24)	1.517*** (0.00)
BUFF	-7.746*** (0.00)	-18.14*** (0.00)	-0.548 (0.19)	-1.082** (0.03)	-7.576 (-1.35)	18.177 (0.19)	-0.005 (0.94)	-1.011*** (0.00)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	89.36	84.84	99.77	84.44	82.76	81.63	99.29	96.47
F-statistic	65.29	243.82	3348	42.51	24.76	22.99	695.98	136.36

.

Table 7. Impact of bank stability on financial inclusion for the Asian and Americas subsamples (Fixed effect panel regression estimation)

	Asian countries sub-sample				Americas countries subsample			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	IFI	BAC	BAR	ATM	IFI	BAC	BAR	ATM
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
c	381.71*** (0.00)	775.98*** (0.00)	180.19*** (0.00)	57.514*** (0.00)	121.77*** (0.00)	347.70*** (0.03)	17.087*** (0.00)	-74.791 (0.22)
CAP	6.863 (0.23)	14.927 (0.28)	2.113 (0.41)	0.862 (0.22)	21.080** (0.02)	39.559* (0.06)	-0.545* (0.06)	18.07** (0.02)
BUFF	5.276 (0.36)	10.278 (0.46)	3.248 (0.21)	0.634 (0.36)	0.824 (0.88)	7.142 (0.59)	0.185 (0.33)	-6.961 (0.17)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	96.81	90.42	99.76	97.73	92.36	92.13	91.56	48.41
F-statistic	134.47	42.46	1830.91	189.86	45.63	44.18	40.98	4.46

Source: Author's computation

Table 8. Impact of bank stability on financial inclusion for the European countries (Fixed effect panel regression estimation)

	(1)	(2)	(3)	(4)
	IFI	BAC	BAR	ATM
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
c	417.54*** (0.00)	948.91*** (0.00)	36.301*** (0.00)	90.311*** (0.00)
CAP	16.348 (0.16)	42.182 (1.48)	-0.633* (0.07)	-1.116 (0.13)
BUFF	-2.014 (0.72)	-4.471 (-0.75)	-0.394** (0.02)	-0.358 (-0.33)
Country fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Adjusted R^2	60.69	60.98	91.63	89.88
F-statistic	8.645	8.74	55.16	44.94

Source: Author's computation

5. Conclusion

The relationship between financial inclusion and bank stability continue to receive much attention in the literature. In this study, we investigate both the effect of financial inclusion on bank stability, and the effect of bank stability on financial inclusion. We analysed 33 countries using country-level data.

The empirical results showed that financial inclusion has a significant positive impact on bank stability via higher bank capital adequacy ratio. The regional results showed that financial inclusion via bank branch expansion has a significant negative impact on bank stability in European countries. Financial inclusion via higher number of depositors has a significant positive impact on bank stability in European countries and in countries in the region of the Americas. Financial inclusion via increase in the number of ATMs has a significant positive impact on bank stability in African countries.

The result for the impact of bank stability on financial inclusion showed that greater bank stability in terms of strong bank capital buffer has an adverse effect on financial inclusion through a decrease in the financial inclusion index, bank branch contraction, decrease in the number of depositors and decrease in the number of ATMs while greater bank stability in

terms of strong bank capital buffer has a beneficial effect on financial inclusion through increase in ATM penetration. It was also found that greater bank stability in terms of high capital adequacy ratio leads to high levels of financial inclusion through an increase in the financial inclusion index and greater ATM penetration while greater bank stability in terms of high capital adequacy ratio leads to a decrease the level of financial inclusion through a decrease in the number of bank accounts and decrease in bank branches. Furthermore, we also found that greater bank stability via strong capital buffer leads to a decrease in the level of financial inclusion through bank branch contraction in countries in the European region and through a decrease in ATM penetration in countries in the African region. We further find that greater bank stability in terms of high capital adequacy ratio leads to increase in the level of financial inclusion through increase in the financial inclusion index, greater ATM penetration and bank branch expansion for countries in the Americas region. Overall, the results suggest that the effect of financial inclusion on bank stability, and the effect of bank stability on financial inclusion, may be positive or negative depending on the region examined and how financial inclusion and bank stability are measured.

The practical application of the findings is that it can guide bank supervisors and financial regulators in determining the right balance between increasing financial inclusion and preserving bank stability. The insights gained from this study can assist regulators in determining the level of financial inclusion that would impair bank stability so that they can put in place measures to counter such adverse effect.

The study has three major implications. One implication of the findings is that there are some trade-offs to consider when deciding the strategies to adopt to increase financial inclusion and improve bank stability. The study showed that these trade-offs arise from how financial inclusion and bank stability are measured. For instance, increasing financial inclusion via bank branch expansion can improve bank stability. On the other hand, increasing financial inclusion via ATM penetration can worsen bank stability. Another implication of the findings is that financial inclusion has some beneficial effect for bank stability. The study showed evidence that financial inclusion has positive benefits for bank stability. Another implication of the study for bank capital regulation is that too much capital buffer is not beneficial for financial inclusion because it reduces the level of financial inclusion rather than increase it.

Given the above implications, the study offers three policy recommendations. One, it is recommended that policymakers should understand the trade-offs between increasing financial inclusion and preserving bank stability. They should carefully choose their financial inclusion and bank stability strategies because the strategies they adopt could have positive or negative co-dependencies. Two, it is recommended that policy makers should increase their financial inclusion efforts by increasing the number of ATMs in order to improve bank capital adequacy ratio and enhance bank stability. Three, it is recommended that bank supervisors should not pressure banks to increase their capital buffer. Rather, bank supervisors should find the minimal level of bank capital buffer that would support banks' efforts to increase the level of financial inclusion.

A limitation of the study is that the study used a limited set of financial inclusion indicators. Analysing a wider set of financial inclusion indicators could provide additional insights. Another limitation of the study is that the study did not use bank-level data. Using bank-level data to analyse the relationship between financial inclusion and capital-based measures of bank stability may provide additional insights to advance existing knowledge of the multifaceted effects of financial inclusion on bank stability.

Future studies can investigate the effect of bank stability on financial inclusion using other measures of bank stability and using bank-level data. Future studies can also investigate other indicators of financial inclusion and determine their effect on bank stability. Finally, future studies can examine whether socioeconomic and institutional factors might moderate the effect of bank stability on financial inclusion.

Reference

Ahamed, M. M., & Mallick, S. K. (2019). Is financial inclusion good for bank stability? International evidence. *Journal of Economic Behavior & Organization*, *157*, 403-427.

Al-Smadi, M. O. (2018). The role of financial inclusion in financial stability: lesson from Jordan. *Banks and Bank Systems*, *13*(4), 31-39.

Alvi, M. A., Rafique, A., & Shehzad, K. (2020). Financial inclusion and bank stability controversy: Evidence from South Asian region. *International Journal of Financial Engineering*, *7*(04), 2050038.

Amatus, H., & Alireza, N. (2015). Financial inclusion and financial stability in Sub-Saharan Africa (SSA). *International Journal of Social Sciences*, *36*(1), 2305-4557.

Aysan, A. F., Dolgun, M. H., & Turhan, M. I. (2013). Assessment of the participation banks and their role in financial inclusion in Turkey. *Emerging Markets Finance and Trade*, *49*(sup5), 99-111.

Banna, H., & Alam, M. R. (2021). *Is digital financial inclusion good for bank stability and sustainable economic development? Evidence from emerging Asia* (No. 1242). ADBI Working Paper Series.

Banna, H., Hassan, M. K., & Rashid, M. (2021). Fintech-based financial inclusion and bank risk-taking: Evidence from OIC countries. *Journal of International Financial Markets, Institutions and Money,* 75, 101447.

Barik, R., & Pradhan, A. K. (2021). Does financial inclusion affect financial stability: evidence from BRICS nations? *The Journal of Developing Areas*, *55*(1).

Boachie, R., Aawaar, G., & Domeher, D. (2021). Relationship between financial inclusion, banking stability and economic growth: A dynamic panel approach. *Journal of Economic and Administrative Sciences*, (ahead-of-print).

Čihák, M., Mare, D. S., & Melecky, M. (2016). The nexus of financial inclusion and financial stability: A study of trade-offs and synergies. *World Bank Policy Research Working Paper*, No. 7722.

Čihák, M., Mare, D. S., & Melecky, M. (2021). Financial inclusion and stability: review of theoretical and empirical links. *The World Bank Research Observer*, *36*(2), 197-233.

Danisman, G. O., & Tarazi, A. (2020). Financial inclusion and bank stability: Evidence from Europe. *The European Journal of Finance*, *26*(18), 1842-1855.

Demirgüç-Kunt, A., & Klapper, L. F. (2012). Measuring financial inclusion: The global findex database. *World bank policy research working paper*, No. 6025.

Diamond, D. W., & Dybvig, P. H. (1983). Bank runs, deposit insurance, and liquidity. *Journal of Political Economy*, 91(3), 401-419.

Dienillah, A. A., Anggraeni, L., & Sahara, S. (2018). Impact of financial inclusion on financial stability based on income group countries. *Buletin Ekonomi Moneter dan Perbankan*, *20*(4), 429-442.

Farag, M., Harland, D., & Nixon, D. (2013). Bank capital and liquidity. *Bank of England Quarterly Bulletin,* Q3.

Feghali, K., Mora, N., & Nassif, P. (2021). Financial inclusion, bank market structure, and financial stability: International evidence. *The Quarterly Review of Economics and Finance*, *80*, 236-257.

García, M. J. R., & José, M. (2016). Can financial inclusion and financial stability go hand in hand. *Economic Issues*, *21*(2), 81-103.

Ghosh, S. (2022). Financial inclusion and banking stability: Does interest rate repression matter? *Finance Research Letters*, *50*, 103205.

Goetz, M. R. (2018). Competition and bank stability. *Journal of Financial Intermediation*, *35*, 57-69.

Ha, D., & Nguyen, Y. (2023). Institutional quality's influence on financial inclusion'impact on bank stability. *Cogent Economics & Finance*, 11(1), 2190212.

Hakimi, A., Boussaada, R., & Karmani, M. (2022). Are financial inclusion and bank stability friends or enemies? Evidence from MENA banks. *Applied Economics*, *54*(21), 2473-2489.

Han, R., & Melecky, M. (2013). Financial inclusion for financial stability: Access to bank deposits and the growth of deposits in the global financial crisis. *World bank policy research working paper*, No. 6577.

Köhler, M. (2015). Which banks are more risky? The impact of business models on bank stability. *Journal of financial stability*, *16*, 195-212.

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

Malik, A. H., bin Md Isa, A. H., bin Jais, M., Rehman, A. U., & Khan, M. A. (2022). Financial stability of Asian Nations: Governance quality and financial inclusion. *Borsa Istanbul Review*, *22*(2), 377-387.

Morgan, P. J., & Pontines, V. (2018). Financial stability and financial inclusion: The case of SME lending. *The Singapore Economic Review*, *63*(01), 111-124.

Neaime, S., & Gaysset, I. (2018). Financial inclusion and stability in MENA: Evidence from poverty and inequality. *Finance Research Letters*, *24*, 230-237.

Nier, E. W. (2005). Bank stability and transparency. *Journal of financial stability*, *1*(3), 342-354.

Oanh, T. T. K. (2023). Relationship between financial inclusion, monetary policy and financial stability: An analysis in high financial development and low financial development countries. *Heliyon*, 9(6).

Ozili, P. K., Lay, S. H., & Syed, A. A. (2023b). Impact of financial inclusion on economic growth in secular and religious countries. *Journal of Financial Regulation and Compliance*.,31(4), 420-444.

Ozili, P. K. (2024). Effect of gender equality on financial stability and financial inclusion. *Social Responsibility Journal*, 20(2), 205-223.

Pesaran, M. H., & Zhou, Q. (2018). Estimation of time-invariant effects in static panel data models. *Econometric Reviews*, 37(10), 1137-1171.

Pham, M. H., & Doan, T. P. L. (2020). The impact of financial inclusion on financial stability in Asian countries. *The Journal of Asian Finance, Economics and Business*, *7*(6), 47-59.

Saha, M., & Dutta, K. D. (2021). Nexus of financial inclusion, competition, concentration and financial stability: Cross-country empirical evidence. *Competitiveness Review: An International Business Journal*, *31*(4), 669-692.

Sakarombe, U. (2018). Financial inclusion and bank stability in Zimbabwe. *Journal of Academic Research in Economics and Management Sciences*, *7*(4), 121-138.

Siddik, M. N. A., & Kabiraj, S. (2018). Does financial inclusion induce financial stability? Evidence from cross-country analysis. *Australasian Accounting, Business and Finance Journal*, *12*(1), 34-46.

Thakor, A. V. (2014). Bank capital and financial stability: An economic trade-off or a Faustian bargain?. *Annual Review of Financial. Economics*, 6(1), 185-223.

Vo, D. H., Nguyen, N. T., & Van, L. T. H. (2021). Financial inclusion and stability in the Asian region using bank-level data. *Borsa Istanbul Review*, *21*(1), 36-43.

Wang, R., & Luo, H. R. (2022). How does financial inclusion affect bank stability in emerging economies? *Emerging Markets Review*, *51*, 100876.

Widarwati, E., Sari, P., & Nurmalasari, N. (2019). Role of Financial Inclusion to Stability: The Case of Indonesia's Sharia Banking. *HOLISTICA–Journal of Business and Public Administration*, *10*(1), 7-15.