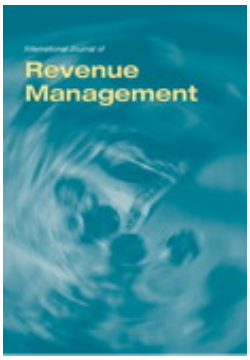
INDERSCIENCE PUBLISHERS
Linking academia, business and industry through research



International Journal of Revenue Management

ISSN online: 1741-8186 - ISSN print: 1474-7332
https://www.inderscience.com/ijrm

Bank capital, institutional quality and bank stability: international evidence

Khanh Hoang, Son Tran, Dat Nguyen, Liem Nguyen

DOI: 10.1504/IJRM.2024.10060251

Article History:

Received:	22 May 2023
Last revised:	17 July 2023
Accepted:	07 August 2023
Published online:	10 January 2024

Bank capital, institutional quality and bank stability: international evidence

Khanh Hoang, Son Tran, Dat Nguyen and Liem Nguyen*

University of Economics and Law,
Ho Chi Minh City, Vietnam
and
Vietnam National University,
Ho Chi Minh City, Vietnam
Email: hcgk@uel.edu.vn
Email: sonth@uel.edu.vn
Email: datnt20704@sdh.uel.edu.vn
Email: liemnt@uel.edu.vn
*Corresponding author

Abstract: This study investigates how capital and institutional quality are associated with bank stability using an aggregate dataset comprising 173 banking systems from 2002 to 2020. First, our study suggests that banks with higher capital tend to be more stable, supporting the moral hazard hypothesis. Second, institutional quality improves financial stability of banks, confirming the role of proper banking environment. We further examine how capital and institutional quality jointly affect banking stability, and find that better institutional quality allows capital to impose a more positive effect on bank stability. However, this relationship is more pronounced with banking systems having low capital, indicating that capital and institutional quality could substitute each other in enhancing bank stability when the former is strong enough. These results are robust to the use of alternative proxies for bank stability and capital. We provide several implications for relevant stakeholders to uphold bank stability.

Keywords: institution quality; bank capital; bank stability.

JEL codes: G21; L22; L25; G33.

Reference to this paper should be made as follows: Hoang, K., Tran, S., Nguyen, D. and Nguyen, L. (2024) 'Bank capital, institutional quality and bank stability: international evidence', *Int. J. Revenue Management*, Vol. 14, No. 1, pp.33–53.

Biographical notes: Khanh Hoang is the Rector and Lecturer of University of Economics and Law. He has published numerous papers on prestigious journals.

Son Tran is the Director of IBT and has profound experience in conducting research projects. AP. He has research published in prestigious international journals in the Scopus/WoS category such as *Borsa Istabul Review*, *Competitiveness Review*, *Asia-Pacific Journal of Business Administration*, and *International Journal of the Economics of Business*.

Dat Nguyen is a Doctorate candidate at the University of Economics and Law. He has published several papers at strong journals.

Liem Nguyen is the Vice Dean of Faculty of Finance and Banking and has graduated with a Doctorate degree in Finance. He has received excellent scientific research awards.

1 Introduction

Excessive risk-taking by banks was a major contributor to the 2007–2009 financial crisis, forcing policymakers in many countries to seek methods to enhance financial stability. One of the solutions is to demand that banks build up capital to withstand shocks in markets and reduce asset substitution issues. With this move, the effectiveness of capital in ensuring bank stability has become a topic of strong interest of academics, practitioners and policymakers. Nonetheless, literature has provided conflicting evidence on the effects of capital as well as capital-related regulations on a bank's stability (Bermpei et al., 2018).

There are two contrasting hypotheses on the impact of capital on bank stability:

1 regulatory view

2 moral hazard view.

The regulatory view suggests that bank capital is positively associated with bank risk, as the regulatory bodies require banks to increase capital in accordance with the amount of risk taken (Shrieves and Dahl, 1992; Jokipii and Milne, 2011; Mateev et al., 2021). In contrast, the moral hazard hypothesis dictates that bank capital has an inverse relationship with risk due to lower asset substitution issue (Allen et al., 2011; Lee and Hsieh, 2013; Jiang et al., 2020). The mixed findings guarantee more research to offer a more well-rounded comprehension of the impact of capital on the stability of banking institutions. This topic is even more relevant as countries have increasingly adopted Basel IV accord which rules that banks raise their capital since 1 January 2023.

In addition to capital, the effect of institutional characteristics on bank stability cannot be neglected. The extant literature contends that proper institutional frameworks reduce transaction costs and tackle asymmetric information issues, enhancing the efficiency of resource allocation in the market (Williamson, 1981). This, in turn, reduces credit risk and channel funds to the most efficient use in the economy. Several papers have shown that the institutional environment can exert a significant impact on financial stability (Barth et al., 2004; Klomp and De Haan, 2012; Uddin et al., 2020; Canh et al., 2021). Literature suggests that countries with institutions that promote efficient supervision and the monitoring of banks (Hoque et al., 2015) respond better to disruptions to their banking systems.

We argue that institutional quality might moderate the impact of capital on bank stability in both directions. Institutional quality and capital are important in maintaining the efficiency of banking markets. Therefore, an improvement in each of the duet could be adequate, while raising the quality of both might be costly for banks to operate. Furthermore, institutional quality could dampen the issues of adverse selection and moral hazard of borrowers (Schiantarelli et al., 2020). Meanwhile, it has also been demonstrated

that informational availability and asymmetry are key determinants of systemic instability (Anginer et al., 2021). As a result, banks do not have to hold more capital to sustain losses from credit risk if institutional quality is high enough; in other words, capital in that case is less useful. These arguments point to a potential negative joint effect of the two factors on bank stability. However, institutional quality could also enhance the effect of capital on bank stability in a positive manner. If institutional quality enables the reduction of information asymmetry and the increase in the effectiveness of bank supervision, higher capital is more likely to signal the true evaluation of heightened credit risk encountered or a desire to cope with credit risk in a more sustainable manner. As a consequence, capital is more able to contain bank risk in a market with better institutional quality (Bermpei et al., 2018).

Our study adds to the existing literature in a number of ways. First, this study investigates the role played by both institutional quality and bank capital towards bank stability. Previous studies, e.g., Canh et al. (2021) and Mateev et al. (2021), only investigate the individual impact of institutional quality and bank capital, on bank risk. Our study deviates from these works by examining both individual and joint roles of institutional quality and capital on the stability of banking sector by using the most updated dataset covering 173 countries from 2002 to 2020. Second, Bermpei et al. (2018) suggest that depending on the institutional climate, capital-related regulations can exert a variety of consequences on bank stability. Institutional frameworks that enable private market discipline, promote information disclosure and reduce information asymmetries can be used to replace capital in containing bank risk-taking.

We argue that institutional quality improvement may moderate the effect of bank capital on bank stability. The investigation of the moderating role of institutional quality is essential since it facilitates the understanding of how the impact of capital on bank stability changes as institutional quality improves. This is, in our opinion, an essential research topic that could offer significant implications for bank policy, given that, unlike other industries, the banking industry is heavily regulated. We intend to provide regulators and policymakers with evidence as to whether: first, the effect of bank capital is positive or negative on bank stability; second, institutions affect the link between bank capital on bank stability in a positive or a negative way. To our surprise, there have been no studies exploiting this joint effect. Compared to Bermpei et al. (2018) identify three institutional quality features (political stability, corruption control, and the rule of law) that may improve regulation implementation capability in 69 emerging and developing countries over the period of 2004 to 2013, we employ a full set of six Worldwide Governance indicators and a sample of both developed and developing countries in a longer and more updated time period (2002–2020). Furthermore, we investigate bank capital, rather than capital-related regulations, which not only focus on the amount of capital but the stringency in terms of how capital is measured. The use of stringency index would lead to severe lack of observations and requires manipulation which affects quality of data. Third, we further examine whether the moderating effect of institutional quality on the link between capital and bank stability differs depending on whether banks have high or capital levels. Fourth, we make sure that our findings are robust through the employment of alternative proxies of bank stability and capital.

The remaining of our study is as follows. Section 2 summarises relevant theories and empirical studies in the fields, on which we build testable hypotheses. Section 3 presents the research methodology, which covers empirical models, estimation strategies, and

variable construction. Section 4 presents the estimation results as well as robustness checks. Section 5 concludes the study with implications for different stakeholders.

2 Literature review

2.1 Capital and bank stability

Theories offer various viewpoints on the impact of capital on bank risk. To start with, stricter capital requirements play an important role in ensuring that banks can sustain severe unplanned losses while satisfying withdrawal requests from customers and other obligations. In line with this argument, theoretical works highlight the role of capital as a buffer in absorbing shocks in earnings and minimising the risk of bank insolvency (Kaufman and Scott, 2003; Von Thadden, 2004; Repullo, 2004).

In times of distress, well-capitalised banks help provide much-needed liquidity to the market, making up for the absence of regulatory involvement. As a result, capital can halt the chain of viral runs associated with information asymmetry. The Panic of 1907, the Great Depression, the Long-Term Capital Management crises and the most recent fiasco of Silicon Valley Bank (SVB) show how information asymmetry can easily trigger systemic collapses, even if many banks were sound ex ante. The Fed, FDIC, and SEC dealt with fundamental market failures and information frictions, resulting in a long period of relative calm in banking and financial markets. Bank failures reduced to a trickle as regulators concentrated on capital and risk. Consistently, capital can enhance bank stability in markets with weak regulatory frameworks that do not allow for private monitoring, quality information disclosure, and/or incentives for proper corporate governance (Decamps et al., 2004). Berger and Bouwman (2013) find that capital improves small banks' survival probability during financial crises and normal times. Laeven et al. (2016) argue that systemic risk and bank capital have a negative relationship during the 2007–2009 financial crisis.

Furthermore, more capital might encourage managers to improve risk management practices and discourage excessive risk-taking, known as 'moral hazard' hypothesis. Greater capitalisation levels lead financial institutions to choosing less risky assets thanks to lower risk-shifting incentives (Calomiris and Kahn, 1991; Furlong and Keeley, 1991; Rochet, 1992). As bank capital reduces asset-substitution incentives, it reduces systemic risk because of high correlation of asset substitution in banking systems. According to Hua (2011), Tan and Floros (2013) and Lee and Hsieh (2013), risk and capital have an inverse relationship.

More recent works also back the negative relationship between bank capital and risk taking (Ding and Sickles, 2018; Jiang et al., 2020). Given the above arguments, our first testable hypothesis is as follows:

Hypothesis 1a Bank capital is positively related to bank stability.

Increased capital, on the other hand, could undermine the stability in banking systems. More capital can lead to increased investment risk and volatility (Koehn and Santomero, 1980). Insiders, according to Besanko and Kanatas (1996), reduce managerial effort as their ownership dwindles in the event of capital increases. Empirical evidence supports a positive relationship between bank risk and capital, according to Jokipii and Milne (2011), Athanasoglou (2011). More recently, Mateev et al. (2022) document a positive

correlation between capital and risk, supporting the regulatory hypothesis. There is also evidence that capital adequacy ratio exerts a positive effect on banks' risk-taking behaviour in the MENA region (Ghanem, 2017).

Based on the above reasoning, our next hypothesis is:

Hypothesis 1b Bank capital is negatively related to bank stability.

2.2 Institutional quality and bank stability

Extant literature offers insights into the significance of institutions by relating differences in economic activities to varied institutional frameworks. Generally, high institutional quality enables the minimisation of transaction costs and levels of asymmetric information (Gugler et al., 2013). As a result, institutional characteristics can have a significant effect on financial stability (Barth et al., 2004; Uddin et al., 2020; Elfeituri, 2022). Countries with weak governance/institutional setups, such as severe corruption, incompetent law enforcement, and other inefficient regulations, tend to have more ailing banks (Levine, 1998; Demirgüç-Kunt and Detragiache, 1998). Appropriate institutional characteristics might support the oversight of financial institutions (Anginer and Demirguc-Kunt, 2014; Hoque et al., 2015). Klomp and De Haan (2014) argue that institutional quality is crucial during a financial turbulence, consolidating the resilience against adverse shocks more effectively.

In a study covering 19 emerging markets, Uddin et al. (2020) suggest that better levels of government efficacy, anti-corruption conduct, accountability, and compliance with law promote bank stability and lower bank risk. Importantly, the authors believe that rule of law and lack of corruption promote financial sector's accountability and stability. Secure property rights and a functioning legal system could lead to overall economic and financial development (Voghouei et al., 2011). For Chinese banks, Hou and Wang (2016) demonstrate that lifting institutional quality can offset the detrimental effect of bank marketisation on bank stability. Bermpei et al. (2018) argue that political stability strengthens the favourable impacts of capital-related regulation and activity limits on bank stability in 69 emerging and developing nations from 2004 to 2013.

Hypothesis 2 Institution quality is positively related to bank stability.

2.3 The joint effect of institution quality and capital on bank stability

On the one hand, banks with adequate capital should be able to improve liquidity in the market, thus compensating for a lack of effective regulations in times of crisis. Capital can stop contagious runs caused by information asymmetry. Therefore, it is expected that capital contributes more effectively to maintaining stability in countries with deficient regulatory systems and/or low institutional quality that do not encourage private monitoring and promote proper information disclosure (Decamps et al., 2004; Anginer et al., 2018). Meanwhile, institutional frameworks can be conducive to private market discipline and encourage information disclosure, thus mitigating the issue of information asymmetries, encouraging loan repayment and containing bank risk-taking (Bermpei et al., 2018). To sum up, more capital plays a more important role in upkeeping stability in countries with weak governance and low institutional quality, and vice versa. These

arguments point to a hypothesis about the negative joint impact of institutional quality and capital on bank stability.

On the other hand, the two factors can also have a positive joint effect on bank stability. Calomiris and Jaremski (2019) find that weaker discipline may allow banks to lower capital buffers and make more loans to riskier borrowers. This can exacerbate moral hazard in credit market and result in more frequent bank failures. On the contrary, Nier and Baumann (2006) suggest that stronger degree of market discipline can result in banks having stronger capital buffers to guard against high portfolio risk. In addition, better institutional quality can be associated with higher monitoring capability and regulatory enforcement (Bermpei et al., 2018), because decent institutions enable the reduction of information asymmetry and the increase the effectiveness of bank supervision. In this context, higher capital is more likely to signal the true evaluation of heightened credit risk encountered or a desire to cope with credit risk in a more sustainable manner. As a consequence, capital should be more able to contain bank risk in a market with better institutional quality.

To sum up, we contend that the institution quality may condition the impact of bank capital on bank stability. We test this hypothesis by studying the interaction effect of institution quality and capital on bank stability.

Hypothesis 3 Institutional quality moderates the effect of capital on bank stability.

3 Data and research methodology

3.1 Data

This study uses macro data covering 173 countries over the period from 2002 to 2020. Our goal is to collect as much information as possible. The choice of period, 2002–2020, reflects the availability of data for some of the explanatory factors. For example, the Worldwide Governance Indicators (WGI) are available every year from the World Bank for the 2002–2020 period (before 2002 data was published every two years). Therefore, the data might not be consistent if we include data before 2002. We obtain aggregate data from various sources. Banking system characteristics and macroeconomic indicators are retrieved from The Global Financial Development Database and the World Development Indicators. Macro data may be more useful for macroprudential assessment of economy-wide financial stability. Macro data with its weighting mechanisms implicitly favours large systemic institutions, while micro data tends to weight institutions equally. Empirical estimates utilising micro data would understate systemic risk if major institutions are more risk-taking than smaller ones due to too-big-to-fail protection. The IMF and central banks employ macro data for financial stability studies (Cihák, 2006). Since 2002, Financial Soundness Indicators (IMF, 2019) and the World Bank's GFDD (Cihák et al., 2012) have been released, both of which are weighted average macro data. This indicates the relevance of macro data in international policy realm. Davis et al. (2019) model the effects of macroprudential policies using macro banking sector data.

In addition, proxies for institutional quality are collected from the WGI. These include measures for government effectiveness, voice and accountability, political stability, the rule of law, regulatory quality and control of corruption.

To avoid the potential bias introduced by outliers, all variables have been winsorised at the 1% and 99% quantiles (except for the institutional quality and macroeconomic variables).

3.2 Methodology

For dynamic models of panel data, we utilise the system generalised method of moments (SGMM) estimator. Baselga-Pascual et al. (2015) identify two sources of endogeneity that must be accounted for when examining the determinants of bank risk:

1 the use of dynamic models

2 the possibility of a two-way relationship between the explanatory and explained variables, e.g., if banks become riskier, they may be compelled to increase their portfolio of liquid assets to protect against premature withdrawals (Kohler, 2015).

As instruments for addressing endogeneity, we employ lagged values of the explained variable and other explanatory variables in the model (Roodman, 2009). In addition, we utilise the two-step GMM estimator because it is efficient and robust to heteroscedasticity and autocorrelation (Roodman, 2009). Panel data is usually plagued with the two issues above. Furthermore, to confirm the validity of the set of instruments, autocorrelation tests and the over-identifying constraints test are used (Roodman, 2009). If the p-values of the two tests are larger than the significance level, this implies the estimates are valid for statistical inferences.

We propose the following dynamic model of bank financial stability to test Hypotheses 1 and 2:

$$\begin{aligned} Zscore_{i,t} = {} & \alpha_0 + \alpha_1 Zscore_{i,t-1} + \alpha_2 Capital_{i,t} + \alpha_3 InstQual_{i,t} \\ & + \alpha_4 Control\ variables_{i,t} + \varepsilon_{it} \end{aligned} \tag{1}$$

We further include *Capital*∗*InstQual* to examine the effect of the interaction between capital and quality of institutions on the stability of banks:[1]

$$\begin{aligned} Zscore_{i,t} = {} & \beta_0 + \beta_1 Zscore_{i,t-1} + \beta_2 InstQual_{i,t} + \beta_3 Capital_{i,t} \\ & + \beta_4 InstQual_{i,t} * Capital_{i,t} + \beta_5 Control\ variables_{i,t} + \varepsilon_{it} \end{aligned} \tag{2}$$

Zscore is used to measure bank stability (Bermpei et al., 2018; Stiroh and Rumble, 2006). Higher Zscores indicate banking systems with lower bank risk and higher stability. Since we obtain the Z-score variable from the Global Financial Development Database, we adhere to the World Bank's definition of Z-score:

$$Zscore = \frac{ROA + E/A}{\sigma_{ROA}}$$

where *ROA* and *E*/*A* are the current values of ROA and the ratio of total equity to total assets, respectively, while σ_{ROA_i} is the standard deviation of ROA. Because of the high skewness of the raw measure of Zscore, its natural logarithm is used instead.

3.2.1 Capital

In line with Abbas et al. (2021), Jiang et al. (2020), Schaeck and Cihák (2012), Mateev et al. (2022), Anginer et al. (2021) and Ashraf et al. (2020), we employ two measures for bank capital: total equity to total assets – EQUITY and the capital adequacy ratio – CAR – bank capital to risk-weighted assets ratio. Our main capital variable is EQUITY, and we use CAR for robustness check.

3.2.2 Institutional quality

Following Dias (2021) that studies a sample of 135 countries, we obtain proxies for institutional quality obtained from the WGI. The WGIs measure institutional quality through surveys conducted in developed and developing nations. There are six indices: voice and accountability (VA), political stability (PS), governmental effectiveness (GE), quality of regulation (RQ), rule of law (RL) and corruption control (CC), all ranging from –2.5 (poor) to 2.5 (high quality). In addition, this measure is also used in other empirical works that focus on emerging countries (Uddin et al., 2020; Etudaiye-Muhtar and Abdul-Baki, 2020).

3.2.3 Control variables

Control variables can be divided into two groups. First, those that belong to bank-specific level are efficiency, profitability, diversification, and liquidity. The second category of determinants covers macroeconomic conditions to control for the diversity in the level of inflation and economic development among the countries.

Specifically, NonII is introduced to account for the influence of revenue diversification, measured as the proportion of non-interest income in total net income (Stiroh and Rumble, 2006; Le, 2021). Consistent with Hamid (2017), the operating expenses to income ratio to measure bank efficiency (EFF). Net interest margin (NIM) gauges a bank's profitability in its main activities (Wang and Lin, 2021). The ratio of liquid assets to bank assets (LIQ) indicates the ability of a bank to meet short-term commitments without liquidating its investments/assets at a loss. Berger and Bouwman (2013) and DeYoung and Torna (2013) suggest that more liquid assets can reduce bankruptcy risk. Gross domestic product growth (GDP) and inflation rate (INF) are included as proxies for macroeconomic conditions in which banks operate (Le, 2021).

4 Results and discussions

4.1 Descriptive statistics

Table 1 shows descriptive statistics for variables in the models. The mean of bank stability (Zscore) is 2.601. VA and PS have negative average values, suggesting that on average countries tend to have problems in terms of voice and accountability and political stability. Only regulatory quality (RQ) tends to receive the most promising outcome among the six dimensions. EQUITY and CAR variables have average values of 11.33 and 11.69, respectively, or capital accounts approximately a tenth of a bank's total assets.

Table 2 presents the pairwise correlation coefficients of the variables. In general, institutional quality is positively correlated with bank stability, supporting the hypothesis

that decent institutions help stabilise banking systems. Meanwhile, bank capital (equity) is negatively linked to bank stability, but CAR is not significantly related to bank stability. Therefore, the evidence of a negative link here is not robust. Nonetheless, these pairwise correlation coefficients simply indicate correlations between two variables without the consideration of the existence of other covariates. Therefore, to ascertain the relationship between explanatory variables and the regressand, it is mandatory to conduct multiple regression as in Section 4.2. Before running regressions, we perform variance inflation factor test to verify if the multicollinearity is severe in our models.

Table 1 Descriptive statistics

Variable	*Proxy for*	*Obs*	*Average*	*Standard deviation*	*Min*	*Max*
Natural logarithm of Zscore	Bank stability	2,815	2.609	0.636	0.527	3.806
EQUITY	Total equity to total assets	1,861	10.055	4.003	1.490	30.352
CAR	Bank capital to risk-weighted assets ratio	1,943	16.943	5.123	1.755	46.821
VA	Voice and accountability	3,195	–0.022	0.981	–2.259	1.801
PS	Political stability	3,196	–0.078	0.971	–3.181	1.755
GE	Government effectiveness	3,180	0.068	0.992	–2.475	2.437
RQ	Regulatory quality	3,180	0.085	0.975	–2.363	2.261
RL	Rule of law	3,195	0.000	0.999	–2.346	2.130
CC	Control of corruption	3,184	–0.003	1.027	–1.905	2.470
NonII	Income diversification	2,757	37.504	13.639	10.119	78.898
EFF	Bank operating efficiency	2,754	56.373	14.167	18.468	96.622
NIM	Bank profitability	2,727	4.585	2.847	0.619	15.355
LIQ	Bank liquidity	2,764	36.461	19.108	6.590	155.208
GDP	Economic growth	3,249	17.295	10.234	0.360	34.780
INF	Inflation	3,249	14.628	9.695	0.360	31.790

Note: All variables have been winsorised at the 1% and 99% quantiles (except for the institutional quality and macroeconomic variables)

4.2 Results and discussions

The coefficients of the lagged dependent variable ($Zscore_{it-1}$) are all significant at the 1% level coefficient in Table 3. This indicates that bank stability has persisted, which supports the study's use of dynamic panel analysis. The p-values of the two tests (Hansen and autocorrelation of order 2) indicate the instruments used are valid and the estimates are reliable for statistical inferences. In Table 3, Zscore serves as a proxy for bank stability (dependent variable). A higher Z-score indicates greater stability or lower risk, and vice versa. Equity and Zscore have positive and statistically significant associations. The findings support Hypothesis 1a on the moral hazard issue that more bank capital translates into greater stability or lower risk, and are consistent with previous studies (Allen et al., 2011; Mehran and Thakor, 2011).

Table 2 Correlation matrix of variables

	Zscore	*EQUITY*	*CAR*	*VA*	*PS*	*GE*	*RQ*	*RL*	*CC*	*NonII*	*EFF*	*NIM*	*LIQ*
Zscore	1.000												
EQUITY	–0.030*	1.000											
CAR	–0.017	0.687*	1.000										
VA	–0.034*	–0.461*	–0.252*	1.000									
PS	0.004*	–0.306*	–0.131*	0.641*	1.000								
GE	0.052*	–0.491*	–0.288*	0.750*	0.724*	1.000							
RQ	0.059*	–0.445*	–0.248*	0.781*	0.722*	0.938*	1.000						
RL	0.057*	–0.497*	–0.260*	0.785*	0.760*	0.959*	0.939*	1.000					
CC	0.081*	–0.467*	–0.236*	0.754*	0.755*	0.939*	0.898*	0.957*	1.000				
NonII	–0.115*	0.029	0.097*	0.072*	0.099*	0.062*	0.007*	0.074*	0.102	1.000			
EFF	–0.128*	–0.019*	0.005	0.196*	–0.020	–0.063*	–0.049	–0.057*	–0.024*	0.344*	1.000		
NIM	–0.032*	0.563*	0.388*	–0.442*	–0.463*	–0.698*	–0.627*	–0.676*	–0.612*	–0.112*	0.114*	1.000	
LIQ	–0.019*	0.007	0.201*	0.028*	0.071*	0.014*	0.008*	0.009*	0.053*	0.365*	0.15*	0.033	1.000
GDP	–0.014	0.193*	0.111*	–0.298*	–0.227*	–0.287*	–0.289*	–0.297*	–0.293*	–0.019	–0.07*	0.234	–0.012

Notes: Values calculated from research sample.
*Significant at 10% level.

Table 3 Equity, institutional quality and bank stability

Zscore	*[1]*	*[2]*	*[3]*	*[4]*	*[5]*	*[6]*	*[7]*	*[8]*	*[9]*	*[10]*	*[11]*	*[12]*
$Zscore_{t-1}$	0.383^{+++} [0.065]	0.414^{+++} [0.060]	0.431^{+++} [0.067]	0.341^{+++} [0.050]	0.496^{+++} [0.062]	0.386^{+++} [0.045]	0.736^{+++} [0.024]	0.357^{+++} [0.048]	0.453^{+++} [0.063]	0.358^{+++} [0.045]	0.482^{+++} [0.064]	0.377^{+++} [0.047]
EQUITY	0.040^{+++} [0.011]	0.031^{+++} [0.010]	0.029^{+++} [0.010]	0.029^{+++} [0.008]	0.034^{+++} [0.010]	0.038^{+++} [0.009]	0.014^{+++} [0.002]	0.026^{+++} [0.008]	0.037^{+++} [0.011]	0.060^{+++} [0.010]	0.030^{+++} [0.011]	0.035^{+++} [0.009]
VA	0.195^{++} [0.087]											
PS			0.132^{+} [0.072]									
GE					0.175^{+++} [0.063]							
RQ							0.159^{+++} [0.023]					
RL									0.182^{+++} [0.068]			
CC											0.150^{++} [0.068]	
EQUITY*VA		0.013^{+} [0.007]										
EQUITY*PS				0.011^{+} [0.005]								
EQUITY*GE						0.024^{+++} [0.007]						
EQUITY*RQ								0.016^{++} [0.007]				
EQUITY*RL										0.037^{+++} [0.008]		
EQUITY*CC												0.020^{+++} [0.007]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.828^{+++} [0.285]	1.904^{+++} [0.242]	1.849^{+++} [0.274]	1.982^{+++} [0.228]	1.448^{+++} [0.295]	1.537^{+++} [0.263]	0.509^{+++} [0.076]	1.888^{+++} [0.228]	1.524^{+++} [0.289]	1.163^{+++} [0.293]	1.668^{+++} [0.287]	1.702^{+++} [0.253]
No. of obs.	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551
No. of groups	124	124	124	124	124	124	124	124	124	124	124	124
AR2 test [p-value]	0.392	0.213	0.244	0.355	0.220	0.546	0.397	0.340	0.221	0.936	0.259	0.420
Hansen test [p-value]	0.413	0.466	0.472	0.143	0.412	0.274	0.536	0.111	0.432	0.570	0.422	0.148

Notes: All variables have been winsorized at the 1% and 99% levels (except for macroeconomic variables).
Robust standard errors are provided in parentheses.
$^{+}$, $^{++}$ and $^{+++}$ indicate significance at 10%, 5% and 1% levels, respectively.

Table 4 CAR, institutional quality and bank stability

Zscore	*[13]*	*[14]*	*[15]*	*[16]*	*[17]*	*[18]*	*[19]*	*[20]*	*[21]*	*[22]*	*[23]*	*[24]*
$Zscore_{t-1}$	0.419^{+++}	0.668^{+++}	0.437^{+++}	0.652^{+++}	0.479^{+++}	0.684^{+++}	0.499^{+++}	0.668^{+++}	0.445^{+++}	0.693^{+++}	0.598^{+++}	0.642^{+++}
	[0.041]	[0.015]	[0.037]	[0.016]	[0.036]	[0.018]	[0.007]	[0.017]	[0.005]	[0.016]	[0.017]	[0.019]
CAR	0.007^{++}	0.009^{+++}	0.007^{++}	0.008^{+++}	0.005^{++}	0.005^{+++}	0.001^{+++}	0.004^{+++}	0.004^{+++}	0.005^{+++}	0.007^{+++}	0.007^{+++}
	[0.003]	[0.001]	[0.003]	[0.001]	[0.002]	[0.001]	[0.000]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
VA	0.148^{+++}											
	[0.046]											
PS			0.101^{+++}									
			[0.036]									
GE					0.100^{+++}							
					[0.036]							
RQ							0.031^{+++}					
							[0.011]					
RL									0.084^{+++}			
									[0.008]			
CC											0.084^{+++}	
											[0.011]	
CAR*VA		0.003^{+++}										
		[0.000]										
CAR*PS				0.002^{+++}								
				[0.001]								
CAR*GE						0.004^{+++}						
						[0.001]						
CAR*RQ								0.002^{+++}				
								[0.001]				
CAR*RL										0.002^{+++}		
										[0.000]		
CAR*CC												0.003^{+++}
												[0.000]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.779^{+++}	0.822^{+++}	1.720^{+++}	0.926^{+++}	1.580^{+++}	0.745^{+++}	1.657^{+++}	0.866^{+++}	1.677^{+++}	0.786^{+++}	1.087^{+++}	0.928^{+++}
	[0.157]	[0.048]	[0.154]	[0.051]	[0.159]	[0.057]	[0.037]	[0.063]	[0.017]	[0.053]	[0.047]	[0.055]
No. of obs.	1,632	1,632	1,632	1,632	1,632	1,632	1,632	1,632	1,632	1,632	1,632	1,632
No. of groups	126	126	126	126	126	126	126	126	126	126	126	126
AR2 test pval	0.278	0.455	0.292	0.472	0.318	0.464	0.303	0.463	0.304	0.449	0.389	0.393
Hansen test pval	0.336	0.466	0.364	0.612	0.253	0.843	0.794	0.777	0.629	0.600	0.598	0.485

Notes: All variables have been winsorised at the 1% and 99% levels (except for macroeconomic variables).
Robust standard errors are provided in parentheses.
$^{+}$, $^{++}$ and $^{+++}$ indicate significance at 10%, 5% and 1% levels, respectively.

In addition, this study aims to examine whether institutional quality has a significant effect on bank stability, using six WGI indicators. The results of columns 1, 3, 5, 7, 9, and 11 in Table 3 suggest that quality of institutions has a significant impact on bank stability. The results support our Hypothesis 2 and are in line with previous studies (e.g., Hou and Wang, 2016; Bermpei et al., 2018; Uddin et al., 2020; Canh et al., 2021; Elfeituri, 2022). The findings validate the view that enhancing institutional quality is an effective measure to tackle information asymmetry and improve monitoring of banks, thus enabling bank stability.

The models 2, 4, 6, 8, 10, and 12 in Table 3 provide the results of the dynamic panel estimations that relate to the joint effect of institution quality and capital on bank stability. The coefficients of interaction terms between six institution quality variables [voice and accountability (VA), political stability (PS), governmental effectiveness (GE), quality of regulation (RQ), rule of law (RL) and corruption control (CC)] and equity are significantly positive, implying that the positive effect of capital on bank stability strengthens at higher levels of institution quality. The results support those in Calomiris and Jaremski (2019) and Nier and Baumann (2006) that capital tends to be employed properly to deal with risk, rather than just opportunistically meet the regulatory requirements. Better institutional quality might facilitate monitoring and enforcement capability, thus increasing banks' stability (Bermpei et al., 2018).

In Table 4, as a robustness check, we adopt an alternative proxy for bank capital, which is capital adequacy ratio (CAR), in line with Mateev et al. (2022), Anginer et al. (2021) and Ashraf et al. (2020). The findings are consistent in terms of significance and the sign of the main variables. Specifically, institutional quality and CAR variables demonstrate a positive relationship with bank stability, consolidating the critical roles of institutional quality and bank capital in maintaining bank stability. Further, as shown in columns 14, 16, 18, 20, 22 and 24 in Table 4 the coefficients of interaction variables between institutional quality and capital ratios are positive and significant, or better institutional quality enables capital to exert a more preferable influence on bank stability.

4.3 Robustness check

In addition to the use of an alternative proxy for capital, we replace Zscore with the ratio of non-performing loans to total loans (NPL) to ascertain the findings in this study. The ratio of non-performing loans to total loans (NPL) serves as an additional indicator of bank stability. This proxy assesses asset quality, and higher values indicate a greater risk level or lower bank stability. We present the re-estimation results in Tables 5 and 6, where we have equity and CAR as proxies for bank capital, respectively. From both tables, bank capital and institutional quality are negatively related to non-performing loans (bank risk), suggesting that higher of bank capital and better institutional quality tend to lower bank risk. The models 26, 28, 30, 32, 34, 36 in Table 5, and columns 38, 40, 42, 44, 46, 48 in Table 6 provide the results of the dynamic panel estimations that relate to the joint effect of institution quality and capital on bank risk. Consistent with the finding in Table 3, the coefficients of interaction terms are all significantly negative, implying that improved quality of institutions allows a stronger beneficial effect of bank capital on bank stability. In conclusion, the results of NPL model consolidate the findings of our Zscore models.

Table 5 Robustness check: proxy for risk (NPL)-proxy for capital (EQUITY)

NPL	*[25]*	*[26]*	*[27]*	*[28]*	*[29]*	*[30]*	*[31]*	*[32]*	*[33]*	*[34]*	*[35]*	*[36]*
NPL_{t-1}	0.795^{+++}	0.799^{+++}	0.791^{+++}	0.817^{+++}	0.735^{+++}	0.712^{+++}	0.713^{+++}	0.692^{+++}	0.846^{+++}	0.802^{+++}	0.683^{+++}	0.681^{+++}
	[0.009]	[0.008]	[0.010]	[0.010]	[0.013]	[0.014]	[0.011]	[0.011]	[0.025]	[0.011]	[0.014]	[0.013]
EQUITY	-0.138^{+++}	-0.150^{+++}	-0.066^{+}	-0.235^{+++}	-0.143^{+++}	-0.187^{+++}	-0.090^{++}	-0.119^{+++}	-0.400^{+++}	-0.083^{+++}	-0.162^{+++}	-0.160^{+++}
	[0.029]	[0.028]	[0.035]	[0.025]	[0.047]	[0.041]	[0.045]	[0.040]	[0.104]	[0.031]	[0.048]	[0.041]
VA	-2.037^{+++}											
	[0.181]											
PS			-2.097^{+++}									
			[0.176]									
GE					-1.871^{+++}							
					[0.256]							
RQ							-0.765^{+++}					
							[0.244]					
RL									-1.209^{++}			
									[0.592]			
CC											-1.424^{+++}	
											[0.228]	
EQUITY*VA		-0.219^{+++}										
		[0.021]										
EQUITY*PS				-0.157^{+++}								
				[0.013]								
EQUITY*GE						-0.256^{+++}						
						[0.022]						
EQUITY*RQ								-0.111^{+++}				
								[0.028]				
EQUITY*RL										-0.175^{+++}		
										[0.025]		
EQUITY*CC												-0.215^{+++}
												[0.020]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.010^{+++}	5.267^{+++}	5.028^{+++}	6.531^{+++}	6.248^{+++}	8.523^{+++}	4.302^{+++}	5.655^{+++}	5.201^{+++}	4.974^{+++}	4.731^{+++}	5.974^{+++}
	[0.497]	[0.408]	[0.445]	[0.511]	[0.917]	[0.801]	[0.817]	[0.900]	[1.547]	[0.472]	[0.769]	[0.780]
No. of obs.	1,487	1,487	1,487	1,487	1,487	1,487	1,487	1,487	1,487	1,487	1,487	1,487
No. of group	124	124	124	124	124	124	124	124	124	124	124	124
AR2 [pval]	0.207	0.261	0.222	0.260	0.246	0.438	0.198	0.270	0.094	0.300	0.250	0.278
Hansen [pval]	0.634	0.686	0.155	0.356	0.584	0.500	0.692	0.542	0.927	0.553	0.239	0.359

Notes: All variables have been winsorized at the 1% and 99% levels (except for macroeconomic variables).
Robust standard errors are provided in parentheses.
$^{+}$, $^{++}$ and $^{+++}$ indicate significance at 10%, 5% and 1% levels, respectively.

Table 6 Robustness check: proxy for risk (NPL)-proxy for capital (CAR)

NPL	*[37]*	*[38]*	*[39]*	*[40]*	*[41]*	*[42]*	*[43]*	*[44]*	*[45]*	*[46]*	*[47]*	*[48]*
NPL_{t-1}	0.824^{+++}	0.817^{+++}	0.774^{+++}	0.814^{+++}	0.743^{+++}	0.797^{+++}	0.793^{+++}	0.786^{+++}	0.762^{+++}	0.760^{+++}	0.691^{+++}	0.708^{+++}
	[0.011]	[0.011]	[0.011]	[0.012]	[0.015]	[0.003]	[0.003]	[0.003]	[0.015]	[0.015]	[0.016]	[0.017]
CAR	–0.047^{+++}	–0.030^{+}	–0.037^{+}	–0.062^{+++}	–0.079^{++}	–0.019^{++}	–0.039^{+++}	–0.036^{+++}	–0.06^{+++}	–0.099^{+++}	–0.086^{+++}	–0.090^{+++}
	[0.016]	[0.016]	[0.019]	[0.025]	[0.030]	[0.009]	[0.007]	[0.005]	[0.027]	[0.029]	[0.029]	[0.029]
VA	–1.691^{+++}											
	[0.199]											
PS			–2.607^{+++}									
			[0.315]									
GE					–3.254^{+++}							
					[0.287]							
RQ							–0.467^{+++}					
							[0.067]					
RL									–1.097^{+++}			
									[0.207]			
CC											–0.995^{+++}	
											[0.209]	
CAR*VA		–0.092^{+++}										
		[0.012]										
CAR*PS				–0.128^{+++}								
				[0.016]								
CAR*GE						–0.086^{+++}						
						[0.003]						
CAR*RQ								–0.031^{+++}				
								[0.002]				
CAR*RL										–0.106^{+++}		
										[0.014]		
CAR*CC												–0.077^{+++}
												[0.010]
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.281^{+++}	3.734^{+++}	7.147^{+++}	7.516^{+++}	9.660^{+++}	4.633^{+++}	3.378^{+++}	3.404^{+++}	4.298^{+++}	5.930^{+++}	4.224^{+++}	4.926^{+++}
	[0.523]	[0.453]	[0.587]	[0.692]	[0.880]	[0.182]	[0.145]	[0.141]	[0.569]	[0.733]	[0.675]	[0.729]
No. of obs.	1,565	1,565	1,565	1,565	1,565	1,565	1,565	1,565	1,565	1,565	1,565	1,565
No. of groups	126	126	126	126	126	126	126	126	126	126	126	126
AR2 [p-value]	0.108	0.166	0.113	0.146	0.215	0.285	0.219	0.263	0.119	0.155	0.144	0.169
Hansen test [p-value]	0.639	0.669	0.283	0.543	0.378	0.524	0.355	0.388	0.738	0.681	0.661	0.473

Notes: All variables have been winsorised at the 1% and 99% levels (except for macroeconomic variables).
Robust standard errors are provided in parentheses.
$^{+}$, $^{++}$ and $^{+++}$ indicate significance at 10%, 5% and 1% levels, respectively.

4.4 The impact of bank capital and institutional quality on bank risk at low and high capital levels

Our final examination is to verify whether the positive joint effect of capital and institutional quality is the same at high and low capital levels. The coefficients of the interaction term are always significantly positive in the previous tables, meaning that better institutional quality should allow capital to play a more positive role in ensuring bank stability. Nonetheless, we reckon that this property of institutional quality only manifests when banks have low capital. We perform the system GMM regression again with two capital regimes: low capital is for banks that have capital lower than the median of the sample and high capital is for banks with capital higher than the median value (Demirguc-Kunt et al., 2010).

Even though we use the whole model, for the sake of brevity, we only present the significance and the value of the coefficients of the interaction terms in Table 7. Interestingly, better institutional environment enables capital to exert a positive effect on bank stability, but this effect is more pronounced at low capital regime. At high levels of capital, this effect is not significant, or even turns negative for VA's case. Therefore, there is evidence that both capital and institutional quality tend to individually enhance bank stability, so they can substitute each other. However, banks with low capital might not be able to provide liquidity in times of crisis or stop the contagious run or sustain losses from large unexpected credit risks; as a result, at low levels, capital might not compensate for a lack of effective institutional quality in maintaining bank stability. Only at high levels could there be a substitution effect between capital and institutional quality. As there could both substitution and support effects between the two factors, the interaction term could be insignificant or turn negative at times.

Table 7 Joint effect of capital and institutional quality on stability (Zscore) at high and low capital levels

Interaction term	*Equity LOW CAP*	*Equity HIGH CAP*	*CAR LOW CAP*	*CAR HIGH CAP*
CC*capital	.0360276^{+++}	–.0091183	.0052554^{+++}	.0020818
GE*capital	.0452087^{+++}	–.0023572	.0065796^{+++}	.0001189
PS*capital	.0487579^{+++}	.008539^{++}	.0051275^{++}	.0007324
RL*capital	.0522577^{+++}	.013008^{++}	.0044772^{+}	.0019431
RQ*capital	.0289435^{+}	–.0022033	.0015692	–.0012057
VA*capital	.05671^{++}	–.0079544^{+}	.0056527^{++}	.0015768
AR2 test p-val > 0.1	Yes	Yes	Yes	Yes
Hansen test p-val > 0.1	Yes	Yes	Yes	Yes

Notes: All variables have been winsorised at the 1% and 99% levels (except for macroeconomic variables). Robust standard errors are provided in parentheses. $^{+}$, $^{++}$ and $^{+++}$ indicate significance at 10%, 5% and 1% levels, respectively.

5 Conclusions and implications

Following turbulences in banking systems, forcing policymakers in many countries to seek methods to enhance financial stability. One of the solutions is to demand that banks build up capital to withstand shocks in markets and reduce asset substitution issues. In addition to capital, the effect of institutional characteristics on bank stability cannot be neglected. Proper institution frameworks reduce transaction costs and tackle asymmetric information issues, enhancing the efficiency of resource allocation in the market. Institutional quality and capital are important in maintaining the efficiency of banking markets. It is essential to investigate the combined effect of these two factors as they are occurring simultaneously; however, few studies have examined this link. This study uses aggregate data of banking systems in 173 countries from 2002 to 2020 to empirically examine how institutional quality and capital are related to a bank's financial stability.

First, the results show that bank stability is related to bank capital. The findings support the moral hazard hypothesis, it is suggested that banks with higher capital have fewer incentives take risk in general. Second, institutional quality has a significant effect on bank stability, in line with the mainstream findings in the literature. Third, we find evidence that institutional quality allows bank capital to impose a more preferable impact on bank stability. However, this effect tends to prevail only for banking systems with low capital. In contrast, capital of well capitalised banks is able to substitute proper institutional settings to some extent.

We suggest several implications for promoting bank stability. To begin with, since capital improves banking stability, policymakers should promote the increase in bank capital. Secondly, improved institutional quality should be conducted to enable a safer banking system, at least via allowing capital to exert a more positive effect on bank stability. It is important that countries with low capital are those that can leverage on high quality institutional characteristics to protect their banks.

Due to the fact that our sample was collected at an aggregate level, one of the limitations of our study is the absence of certain variables of relevance. For instance, bank regulations that could affect bank stability are not accounted for in our model. In future research, additional variables of interest may be added to empirical models to substantiate our findings and expand upon our findings. Lastly, our banking structure and bank stability indicators may or may not reflect actual practice, similar to those used in other studies of this type. Future interviews and surveys with financiers and regulatory authorities may be conducted to learn more about these concerns. Finally, more thresholds to split banking systems into high and low capital could be adopted to ensure the robustness in our findings.

Acknowledgements

The research is funded by the University of Economics and Law, Vietnam National University, Ho Chi Minh City, Vietnam

References

Abbas, F., Rubbaniy, G. and Ali, S. (2021) *Income and Balance Sheet Diversification Effects on Banks' Cost and Profit Efficiency: Evidence from the US*, SSRN 3808379, http://dx.doi.org/10.2139/ssrn.3808379.

Allen, F., Carltti, E. and Marquez, R. (2011) 'Credit market competition and capital regulation', *The Review of Financial Studies*, Vol. 24, No. 4, pp.983–1018, https://doi.org/10.1093/rfs/hhp089.

Anginer, D. and Demirguc-Kunt, A. (2014) 'Has the global banking system become more fragile over time?', *Journal of Financial Stability*, Vol. 13, No. C, pp.202–213.

Anginer, D., Bertay, A.C., Cull, R., Demirgüç-Kunt, A. and Mare, D.S. (2021) 'Bank capital regulation and risk after the global financial crisis', *Journal of Financial Stability*, p.100891, https://doi.org/10.1016/j.jfs.2021.100891.

Anginer, D., Demirguc-Kunt, A., Huizinga, H. and Ma, K. (2018) 'Corporate governance of banks and financial stability', *Journal of Financial Economics*, Vol. 130, No. 2, pp.327–346. https://doi.org/10.1016/j.jfineco.2018.06.011.

Ashraf, B.N., Zheng, C., Jiang, C. and Qian, N. (2020) 'Capital regulation, deposit insurance and bank risk: International evidence from normal and crisis periods', *Research in International Business and Finance*, Vol. 52, p.101188, https://doi.org/10.1016/j.ribaf.2020.101188.

Athanasoglou, P.P. (2011) *Bank Capital and Risk in the South Eastern European Region*, SSRN 1774585, http://dx.doi.org/10.2139/ssrn.1774585.

Barth, J.R., Caprio Jr, G. and Levine, R. (2004) 'Bank regulation and supervision: what works best?', *Journal of Financial Intermediation*, Vol. 13, No. 2, pp.205–248, https://doi.org/10.1016/j.jfi.2003.06.002.

Baselga-Pascual, L., Trujillo-Ponce, A. and Cardone-Riportella, C. (2015) 'Factors influencing bank risk in Europe: evidence from the financial crisis', *The North American Journal of Economics and Finance*, Vol. 34, No. 1, pp.138–166.

Berger, A.N. and Bouwman, C.H. (2013) 'How does capital affect bank performance during financial crises?', *Journal of Financial Economics*, Vol. 109, No. 1, pp.146–176, https://doi.org/10.1016/j.jfineco.2013.02.008.

Bermpei, T., Kalyvas, A. and Nguyen, T.C. (2018) 'Does institutional quality condition the effect of bank regulations and supervision on bank stability? Evidence from emerging and developing economies', *International Review of Financial Analysis*, Vol. 59, pp.255–275, https://doi.org/10.1016/j.irfa.2018.06.002.

Besanko, D. and Kanatas, G. (1996) 'The regulation of bank capital: do capital standards promote bank safety?', *Journal of Financial Intermediation*, Vol. 5, No. 2, pp.160–183, https://doi.org/10.1006/jfin.1996.0009.

Calomiris, C.W. and Jaremski, M. (2019) 'Stealing deposits: deposit insurance, risk-taking, and the removal of market discipline in early 20th-century banks', *The Journal of Finance*, Vol. 74, No. 2, pp.711–754, https://doi.org/10.1111/jofi.12753.

Calomiris, C.W. and Kahn, C.M. (1991) 'The role of demandable debt in structuring optimal banking arrangements', *The American Economic Review*, Vol. 81, No. 3, pp.497–513.

Canh, N.P., Schinckus, C., Su, T.D. and Chong, F.H.L. (2021) 'Institutional quality and risk in the banking system', *Journal of Economics, Finance and Administrative Science*, Vol. 26, No. 51, pp.22–40, https://doi.org/10.1108/JEFAS-01-2020-0012.

Cihák, M. (2006) *How Do Central Banks Write on Financial Stability?*, No. 2006/163, International Monetary Fund.

Cihák, M., Demirgüç-Kunt, A., Feyen, E. and Levine, R. (2012) *Benchmarking Financial Systems around the World*, The World Bank, Washington, DC, USA.

Davis, E.P., Liadze, I. and Piggott, R.. (2019) 'Assessing the macroeconomic impact of alternative macroprudential policies', *Economic Modelling*, Vol. 80, pp.407–428, https://doi.org/10.1016/j.econmod.2018.11.025.

Decamps, J-P., Rochet, J-C. and Roger, B.T. (2004) 'The three pillars of Basel II: optimizing the mix', *Journal of Financial Intermediation*, Vol. 13, No. 2, pp.132–155, https://doi.org/10.1016/j.jfi.2003.06.003.

Demirgüç-Kunt, A. and Detragiache, E. (1998) 'The determinants of banking crises in developing and developed countries', *IMF Staff Papers*, Vol. 45, No. 1, pp.81–109, https://doi.org/10.2307/3867330.

Demirguc-Kunt, A., Detragiache, E. and Merrouche, O. (2010) *Bank Capital: Lessons from the Financial Crisis*, IMF Working Paper No. WP/10/286 [online] https://www.imf.org/external/pubs/ft/wp/2010/wp10286.pdf (accessed 22 November 2022).

DeYoung, R. and Torna, G. (2013) 'Nontraditional banking activities and bank failures during the financial crisis', *Journal of Financial Intermediation*, Vol. 22, No. 3, pp.397–421, https://doi.org/10.1016/j.jfi.2013.01.00.

Dias, R. (2021) 'Capital regulation and bank risk-taking – new global evidence', *Accounting and Finance*, Vol. 61, No. 1, pp.847–884, https://doi.org/10.1111/acfi.12595.

Ding, D. and Sickles, R.C. (2018) 'Frontier efficiency, capital structure, and portfolio risk: an empirical analysis of U.S. banks', *Business Research Quarterly*, Vol. 21, pp.262–277, https://journals.sagepub.com/doi/pdf/10.1016/j.brq.2018.09.002.

Elfeituri, H. (2022) 'Banking stability, institutional quality, market concentration, competition and political conflict in MENA', *Journal of International Financial Markets, Institutions and Money*, Vol. 76, p.101476, https://doi.org/10.1016/j.intfin.2021.101476.

Etudaiye-Muhtar, O.F. and Abdul-Baki, Z. (2020) 'Market structure, institutional quality and bank capital ratios: evidence from developing countries', *European Journal of Management and Business Economics*, Vol. 30, No. 1, pp.92–107, DOI: 10.1108/ejmbe-09-2019-0158.

Furlong, F.T. and Keeley, M.C. (1991) 'Capital regulation and bank risk-taking: a note', *Federal Reserve Bank of San Francisco Economic Review*, Vol. 91, No. 3, pp.34–39.

Ghanem, A. (2017) 'The impact of Basel II on the banking strategies in the Middle East and North African (MENA) region', *Journal of Banking Regulation*, Vol. 18, pp.48–60, https://doi.org/10.1057/jbr.2016.1.

Gugler, K., Mueller, D.C., Peev, E. and Segalla, E. (2013) 'Institutional determinants of domestic and foreign subsidiaries' performance', *International Review of Law and Economics*, Vol. 34, pp.88–96, https://doi.org/10.1016/j.iRL.2013.01.003.

Hamid, F.S. (2017) 'The effect of market structure on banks' profitability and stability: evidence from ASEAN-5 countries', *International Economic Journal*, Vol. 31, No. 4, pp.578–598, https://doi.org/10.1080/10168737.2017.1408668.

Hoque, H., Andriosopoulos, D., Andriosopoulos, K. and Douady, R. (2015) 'Bank regulation, risk and return: evidence from the credit and sovereign debt crises', *Journal of Banking & Finance*, Vol. 50, pp.455–474, https://doi.org/10.1016/j.jbankfin.2014.06.003.

Hou, X. and Wang, Q. (2016) 'Institutional quality, banking marketization, and bank stability: evidence from China', *Economic Systems*, Vol. 40, No. 4, pp.539–551, https://doi.org/10.1016/j.ecosys.2016.01.003.

Hua, W. (2011) 'The capital and risk adjustment under regulatory pressure of Chinese commercial banks', *Management Science and Engineering*, Vol. 5, No. 4, p.41, http://dx.doi.org/10.3968/j.mse.1913035X20110504.z1911.

IMF (2019) *IMF 2019 Financial Soundness Indicators Compilation Guide*, International Monetary Fund, Washington DC.

Jiang, H., Zhang, J. and Sun, C. (2020) 'How does capital buffer affect bank risk-taking? New evidence from China using quantile regression', *China Economic Review*, Vol. 60, p.101300, https://doi.org/10.1016/j.chieco.2019.04.008.

Jokipii, T. and Milne, A. (2011) 'Bank capital buffer and risk adjustment decisions', *Journal of Financial Stability*, Vol. 7, No. 3, pp.165–178, https://doi.org/10.1016/j.jfs.2010.02.002.

Kaufman, G.G. and Scott, K.E. (2003) 'What is systemic risk, and do bank regulators retard or contribute to it?', *The Independent Review*, Vol. 7, No. 3, pp.371–391.

Klomp, J. and De Haan, J. (2014) 'Bank regulation, the quality of institutions, and banking risk in emerging and developing countries: an empirical analysis', *Emerging Markets Finance and Trade*, Vol. 50, No. 6, pp.19–40, https://doi.org/10.1080/1540496X.2014.1013874.

Klomp, J. and De Haan, J. (2012) 'Banking risk and regulation: does one size fit all?', *Journal of Bank & Finance*, Vol. 36, No. 12, pp.3197–3212, https://doi.org/10.1016/j.jbankfin.2011.10.006.

Koehn, M. and Santomero, A.M. (1980) 'Regulation of bank capital and portfolio risk', *The Journal of Finance*, Vol. 35, No. 5, pp.1235–1244, https://doi.org/10.2307/2327096.

Kohler, M. (2015) 'Which banks are more risky? The impact of business models on bank stability', *Journal of Financial Stability*, Vol. 16, pp.195–212, https://doi.org/10.1016/j.jfs.2014.02.005.

Laeven, L., Ratnovski, L. and Tong, H. (2016) 'Bank size, capital, and systemic risk: some international evidence', *Journal of Banking & Finance*, Vol. 69, pp.S25–S34, https://doi.org/10.1016/j.jbankfin.2015.06.022.

Le, T. (2021) *Can Foreign Ownership Reduce Bank Risk? Evidence from Vietnam*, 2 July, DOI: 10.2139/ssrn.3878912.

Lee, C-C. and Hsieh, M-F. (2013) 'The impact of bank capital on profitability and risk in Asian banking', *Journal of International Money and Finance*, Vol. 32, pp.251–281, https://doi.org/10.1016/j.jimonfin.2012.04.013.

Levine, R. (1998) 'The legal environment, banks, and long-run economic growth', *Journal of Money, Credit and Banking*, pp.596–613, https://doi.org/10.2307/2601259.

Mateev, M., Moudud-Ul-Huq, S. and Nasr, T. (2021) 'Capital regulation and market competition in the MENA region: policy implications for banking sector stability during COVID-19 Pandemic', *Global Business Review*, p.09721509211064442, https://doi.org/10.1177/09721509211064442.

Mateev, M., Moudud-Ul-Huq, S., Sahyouni, A. and Tariq, U.M. (2022) 'Capital regulation, competition and risk-taking: policy Implications for banking sector stability in the MENA region', *Research in International Business and Finance*, Vol. 60, p.101579, https://doi.org/10.1016/j.ribaf.2021.101579.

Mehran, H. and Thakor, A. (2011) 'Bank capital and value in the cross-section', *The Review of Financial Studies*, Vol. 24, No. 4, pp.1019–1067, https://doi.org/10.1093/rfs/hhq022.

Nier, E. and Baumann, U. (2006) 'Market discipline, disclosure and moral hazard in banking', *Journal of Financial Intermediation*, Vol. 15, pp.332–361, DOI:10.1016/j.jfi.2006.03.001.

Repullo, R. (2004) 'Capital requirements, market power, and risk-taking in banking', *Journal of Financial Intermediation*, Vol. 13, No. 2, pp.156–182, https://doi.org/10.1016/j.jfi.2003.08.005.

Rochet, J.-C. (1992) 'Capital requirements and the behaviour of commercial banks', *European Economic Review*, Vol. 36, No. 5, pp.1137–1170, https://doi.org/10.1016/0014-2921(92)90051-W.

Roodman, D. (2009) 'A note on the theme of too many instruments', *Oxford Bulletin of Economics and Statistics*, Vol. 71, No. 1, pp.135–158, https://doi.org/10.1111/j.1468-0084.2008.00542.x.

Schaeck, K. and Cihák, M. (2012) 'Banking competition and capital ratios', *European Financial Management*, Vol. 18, No. 5, pp.836–866, https://doi.org/10.1111/j.1468-036X.2010.00551.x.

Schiantarelli, F., Stacchini, M. and Strahan, P.E. (2020) 'Bank quality, judicial efficiency, and loan repayment delays in Italy', *The Journal of Finance*, Vol. 75, No. 4, pp.2139–2178.

Shrieves, R.E. and Dahl, D. (1992) 'The relationship between risk and capital in commercial banks', *Journal of Banking & Finance*, Vol. 16, No. 2, pp.439–457, https://doi.org/10.1016/0378-4266(92)90024-T.

Stiroh, K.J. and Rumble, A. (2006) 'The dark side of diversification: the case of US financial holding companies', *Journal of Banking & Finance*, Vol. 30, No. 8, pp.2131–2161, https://doi.org/10.1016/j.jbankfin.2005.04.030.

Tan, Y. and Floros, C. (2013) 'Risk, capital and efficiency in Chinese banking', *Journal of International Financial Markets, Institutions and Money*, Vol. 26, pp.378–393, https://doi.org/10.1016/j.intfin.2013.07.009.

Uddin, A., Chowdhury, M.A.F., Sajib, S.D. and Masih, M. (2020) 'Revisiting the impact of institutional quality on post-GFC bank risk-taking: evidence from emerging countries', *Emerging Markets Review*, Vol. 42, p.100659, https://doi.org/10.1016/j.ememar.2019.100659.

Voghouei, H., Azali, M. and Law, S.H. (2011) 'Does the political institution matter for financial development?', *Economic Papers: A Journal of Applied Economics and Policy*, Vol. 30, No. 1, pp.77–98, https://doi.org/10.1111/j.1759-3441.2011.00095.x.

Von Thadden, E-L. (2004) 'Bank capital adequacy regulation under the new Basel Accord', *Journal of Financial Intermediation*, Vol. 13, No. 2, pp.90–95.

Wang, C. and Lin, Y. (2021) 'Income diversification and bank risk in Asia Pacific', *The North American Journal of Economics and Finance*, Vol. 57, p.101448, https://doi.org/10.1016/j.najef.2021.101448.

Williamson, O.E. (1981) 'The economics of organization: the transaction cost approach', *American Journal of Sociology*, Vol. 87, No. 3, pp.548–577, DOI: 10.1086/227496.

Notes

1 In Section 4, equation (2) lacks institution quality variables due to multicollinearity issue, evident through variance inflation factor test, which is not tabulated in the current study for the sake of brevity.