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Article

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The interrelationship among bank profitability, bank stability, and loan growth: Evidence from Vietnam

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Abstract: This study investigates the interrelationship among bank stability, profitability, and loan growth in the Vietnamese banking system between 2006 and 2017 using a simultaneous equations model. The findings show the bidirectional links between these variables. More specifically, bank profitability is positively associated with bank stability and vice versa. Loan growth is negatively related to bank stability and vice versa. Also, the findings show a positive interrelationship between bank profitability and loan growth. Nonetheless, these findings suggest the trade-off benefit of pursuing massive loan growth by banks. Nonetheless, our research has implications for bank supervisors, policy-makers, and bank managers.

Subjects: Banking & Finance; Social Sciences; Economics, Finance, Business & Industry; Economics; Econometrics; Finance; Banking; Credit & Credit Institutions

Keywords: bank stability; profitability; loan growth; Vietnam; simultaneous equations model
JEL Classification: G21; G28; G30

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PUBLIC INTEREST STATEMENT

Loan growth has a crucial role in improving bank profitability via increasing their interest income. Since the Vietnamese market opened to foreign banks, the increase in competition led to a decline in interest margins, which decreased the profitability of the banking system as well as led to the exposure to higher risks. Together, higher loan growth would increase systematic bank risk. However, there exist more complicated interrelationship among loan growth, bank profitability and stability. For example, bank profitability has a significant effect on credit expansion since profitable banks can attract more funds. Also, a profitable banking system tends to absorb financial shocks by improving its capital, thus enhance bank stability. In contrast, banks lacking proper risk management and having a high-risk loan portfolio may suffer from a high level of non-performing loans, which ultimately reduces bank profitability. This study is the first attempt to explore the links among loan growth, bank profitability, and bank stability in the Vietnamese banking system.

1. Introduction

In theory, time variation in the aggregate bank credit level should have an impact on its performance and stability. Accordingly, credit availability fosters economic growth by converting savings into investment in the economic upturn (Al-Khouri & Arouri, 2016). Loan growth also has a crucial role in improving bank profitability by increasing their interest income. Empirical studies on loan growth, on the other hand, indicate bank profitability has a significant effect on credit expansion. Together, these suggest the bidirectional between loan growth and profitability.

Furthermore, credit expansion exposures banks to greater risk although it is the main income-generating activity. Al-Khouri and Arouri (2016) argue that a reduction in loan quality would affect bank stability and bank soundness. Prior studies provide evidence that loan growth affects bank stability negatively and exacerbate the banking crisis (Demirgüç-Kunt & Detragiache, 2002; Kaminsky & Reinhart, 1999). In contrast, the bi-directional relationship between loan growth and bank stability may exist. Sound banks are greatly capable of controlling risk due to their high capital and high liquidity. To compete in the banking market, fragile banks are also willing to provide more loans without considering their quality (Igan & Pinheiro, 2011). Furthermore, Al-Khouri and Arouri (2016) found the bi-directional links between bank stability and profitability. This study revisits the interrelationships among loan growth, bank stability, and profitability using the case of the Vietnamese banking system.

Since entering the World Trade Organisation in 2007, Vietnam boasts one of the fastest-growing economies in the world,[1] experiencing an average of approximately 6.2% Gross Domestic Product (GDP) growth per year in real terms. In which the Vietnamese banking system is the backbone of the economy due to the underdeveloped stock market (Le, 2019). The Vietnamese banking system experienced fast loan growth especially from 2007 to 2011 thus may enhance super profit for Vietnamese banks. However, loan growth was much higher than that of deposits and GDP over the examined period, which may cause liquidity risk for the banking sector (Le, 2017a). Consequently, this may affect the banking stability.

Our study contributes to the literature in the following ways. Prior studies mostly examine the determinants of bank performance, risk, and loan growth separately. As the bi-direction among these variables may exist as mentioned above, this necessitates examine them simultaneously. So far, there is one study by Al-Khouri and Arouri (2016) examining the relationships among credit growth, valuation, and stability of the Gulf cooperation council banking industry. It is argued that whether the evidence in these markets reflects the true these relationships in other markets because of the substantial difference in institutional reality and financial environments. In other words, this is much less insight and discussion on the banking industry in emerging economies, especially the Asia-Pacific region. Besides, to the best of our knowledge, this study is the first attempt to investigate the interrelationships among loan growth, profitability, and bank stability in Vietnam. This thus would help banking supervisors examining, controlling, and evaluating the banking system comprehensively.

Our findings show that bank stability has a positive impact on bank profitability and affects loan growth negatively. However, the U-shaped relationship between them may exist. Accordingly, more stable banks to a certain level may be reluctant to invest risky assets, which in turn lower profitability. Also, risky banks are monitored by the State Bank of Vietnam thus—lowering loan growth. Moreover, loan growth is found to enhance bank profitability but up to a certain level, it may decrease profitability due to the increased level of non-performing loans (NPLs). Thus, this confirms the quadratic relationship between loan growth and bank profitability. Loan growth also negatively affects bank stability. However, a decline in loan growth to a certain level would have reduced bank stability because loans are still the main source of bank income in Vietnam. Finally, bank profitability has a positive impact on bank stability and loan growth. The findings also indicate that the relationship between bank profitability and loan growth is quadratic, suggesting that Vietnamese banks should shift toward non-traditional activities to remain a high level of profitability.

The remainder of this study is organized as follows: Section 2 presents the literature review on the relationship between loan growth, profitability, and bank stability. Section 3 describes the methodology and data used. Section 4 discusses the empirical results while Section 5 concludes.

2. Literature review

Theoretically, credit expansion stimulates economic growth via transforming savings into investment. In the context of the Vietnamese banking system, it witnessed extreme loan growth which was much higher than GDP growth and deposit growth since its market opened to foreign banks. Meanwhile, the increase in competition led to a decline in interest margins, which decreased the profitability of the banking system as well as led to the exposure to higher risks (Le, 2017b). Together, higher loan growth would increase systematic bank risk (Le, 2018). In the same vein, Dell'Ariccia and Marquez (2006) and Ong and Maechler (2009) show that loan growth has an impact on bank stability. However, the sign of the relationship between bank stability and loan growth is unclear. Safer banks may have a competitive advantage as a result of lower costs and better risk management, thus allowing them to expand their credit. However, at the higher levels of demand for credit, the ability of banks to control risk starts declining which in turn leads to an increase in NPLs. Consequently, this lowers the bank's profits and reduces loan growth. On the other hand, the moral hazard hypothesis states that less-sound banks may provide more credit to boost profitability to survive or attract more investors. This credit increase may result in high risk and less stability (Kwan & Eisenbeis, 1997). Igan and Pinheiro (2011) further examine the two-way relationship between bank soundness and credit booms and reveal that credit in sounder banks tends to grow faster during the moderate growth periods while this weakens during economic booms. Taken together, the first hypothesis is formed as follows:

H_1: There is no bidirectional causality between loan growth and bank stability.

Furthermore, Molyneux and Thornton (1992) highlight a negative relationship between bank risk and profitability. Banks lacking proper risk management and having a high-risk loan portfolio may suffer from a high level of NPLs, which ultimately reduces bank profitability. However, other studies found bank risk has no impact on bank profitability (Le, 2017b; Tan, 2016) or a positive relationship between them (Le & Ngo, 2020). On the other hand, a profitable banking system tends to absorb financial shocks by improving its capital, thus enhance financial system stability (Athanasoglou et al., 2008; Le, 2018). In contrast, Hellmann et al. (2000) argue that the existence of an inadequate bank regulatory environment and asymmetric information may enhance profitability, which reflects high-risk premia that can cause financial instability. Based on the above arguments, the second hypothesis is constructed as follows:

H_2: There is no bidirectional causality between profitability and bank stability.

As loans are the main source of bank income, loan growth is expected to generate higher profitability. Several studies, however, report the negative relation between loan growth and profitability (Miller & Noulas, 1997; Molyneux & Thornton, 1992) or no significant relationship between them (Al-Khouri & Arouri, 2016). This suggests that excessive loan growth may lead to greater risks, which is then translated to a reduction in bank profitability. On the other hand, profitable banks are more likely to increase credit since they can attract more funds. Several studies show the opposite results (Al-Khouri & Arouri, 2016). Based on these findings, the third hypothesis is established as follows:

H_3: There is no bidirectional causality between loan growth and bank profitability.

In short, prior studies suggests that the relationships among bank stability, profitability, and loan growth can vary according to the banking characteristics and national regulation (John et al., 2008; Kim et al., 2014). When considering the size and impact of some emerging markets such as Vietnam on the world economy, it might be anticipated that there is a gap in the banking literature: there are no empirical studies that examine the interrelationship among bank stability, profitability and loan growth in Vietnam. Therefore, this necessitates conducting this study.

3. Methodology and data

3.1. Methodology

Following Le et al. (2019), ROE, the ratio of the returns (profits before tax) on equity is the proxy for bank profitability. Bank stability is proxied by ZSCORE as measured by a standard deviation of ROA over the sample period, combined with current period values of ROA and EQUITY. Since the distribution of Z-scores is highly skewed, the natural logarithm of Z-scores is used to mitigate this issue. For brevity, we still use the label, "ZSCORE", to represent the natural logarithm of the Z-score in the remainder of this study. Loan growth (LOGR) is measured by the annual percentage change in total outstanding loans of banks. As mentioned above, ROE, ZSCORE, and LOGR represent the three endogenous variables in the simultaneous equation system, with two right-hand-side endogenous variables in each of the three equations. The model is completed by adding exogenous variables that have explanatory power for each of the above endogenous variables.

Following the prior studies such as Le (2017b), Nguyen (2012) and among others, bank profitability is shown to be associated with bank stability, loan growth, market structure, bank efficiency, credit risk, interest rate risk, the covariance of interest rate risk and credit risk, bank size, and economic growth. We also use the quadratic terms of bank stability and loan growth to account for the U-shaped relations that may exist. The following equation is formed:

$$\begin{aligned} ROE_{i,t} = {} & \alpha_0 + \alpha_1 ZSCORE_{i,t} + \alpha_2 LOGR_{i,t} + \alpha_3 HHID_t + \alpha_4 NIETA_{i,t} \\ & + \alpha_5 LLRTA_{i,t} + \alpha_6 LASTF_{i,t} + \alpha_7 COV_{i,t} + \alpha_8 LNTA_{i,t} + \\ & \alpha_9 ZSCORESQ_{i,t} + \alpha_{10} LOGRSQ_{i,t} + \alpha_{11} GDPGR_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{1}$$

where market structure (HHID) is calculated by the square of the ratio of each bank's total deposits to total deposits within the banking sector. HHID ranges from 0 to 1 in the case of a completely concentrated market. The ratio of non-interest expenses to total assets (NIETA) is used to proxy for bank efficiency. The ratio of loan loss reserves to total assets (LLRTA) is employed to proxy for credit risk. The ratio of liquid assets to customers to total short-term funding (LASTF) is used to proxy for interest rate risk. Flannery and James (1984) suggest that interest rate risk exposure is inversely associated with the average maturity of assets. The higher level of short-term assets, for example, the smaller the sensitivity to near-term interest rate changes which may result in reduced interest rate premiums. LASTF can be interpreted as an inverse interest rate risk. The covariance of credit risk and interest rate risk (COV) is estimated by taking the product of these values. Bank size is measured by the natural logarithm of total assets. We also use the quadratic terms of bank stability and loan growth to account for the U-shaped relations that may exist. Accordingly, ZSCORESQ and LOGRSQ are the quadratic terms of ZSCORE and LOGR, respectively. Economic growth (GDPGR) is proxied by the annual GDP growth rate.

Following Le et al. (2019), Al-Khouri and Arouri (2016) and among others, bank stability is related to profitability, loan growth, bank operating leverage, interest rate risk, bank size, and bank intermediation. The following proxies are used to estimate the model:

$$\begin{aligned} ZSCORE_{i,t} = {} & \beta_0 + \beta_1 ROE_{i,t} + \beta_2 LOGR_{i,t} + \beta_3 FATA_t + \beta_4 LASTF_{i,t} \\ & + \beta_5 LNTA_{i,t} + \beta_6 TDTL_{i,t} + \beta_7 ROESQ_{i,t} + \beta_8 LOGRSQ_{i,t} + \mu_{i,t} \end{aligned} \tag{2}$$

We use ZSCORE as measured by a standard deviation of ROA over the sample period, combined with current period values of ROA and EQUITY to proxy for bank stability. The ratio of fixed assets

to total assets (FATA) is used to proxy for a bank operating leverage (Saunders et al., 1990). Interest rate risk is measured by the ratio of liquid assets to customers to short-term funding. Bank size is proxied by the natural logarithm of total assets. The ratio of total deposits to total loans is used to proxy for bank intermediation. The quadratic terms of bank profitability (ROESQ) and loan growth (LOGRSQ) are used to account for the U-shaped relations that may exist.

Following Amador et al. (2013) and Imbierowicz and Rauch (2014), loan growth is associated with bank size, the source of funding, bank reform, inflation, and economic growth. The equation for loan growth is formed as follows:

$$\begin{aligned} LOGR_{i,t} = {} & \gamma_0 + \gamma_1 ZSCORE_{i,t} + \gamma_2 ROE_{i,t} + LNTA_{i,t} + \\ & \gamma_4 DEPOGR_{i,t} + \gamma_5 ZSCORESQ_{i,t} + \gamma_6 ROESQ_{i,t} \\ & + \beta_7 REFORM_t + \beta_8 INF_t + \beta_9 GDPGR_t + v_{i,t} \end{aligned} \tag{3}$$

Bank size is measured by the natural logarithm of total assets (LNTA). The annual change in total deposits (DEPOGR) is used to proxy for the source of funding. Following (Le et al., Forthcoming), REFORM, a dummy variable that takes a value of 1 for the period of 2011–2015, and 0 otherwise is used to control for the effects of banking reform. One of its key terms of reference is to reassess the financial health of credit institutions. Accordingly, banks are required to review their loan approval procedure and to address bad debt before granting new advances. INF, the annual inflation rate is used to control for the effects of inflation. Economic growth (GDPGR) is measured by the annual GDP growth rate.

Due to our unbalanced panel data as discussed later, Panel Unit Root tests (Fisher-Type with subtracting cross-sectional means) as proposed by Choi (2001) is used. The results of significance at the 1% significance level generally suggest that the tested series do not contain a unit root. The series are thus estimated in levels.

Before selecting our model, we test for heteroscedasticity when one or more regressors are endogenous. Breusch and Pagan/Cook-Weisberg test is used to test the null hypothesis of homoscedasticity. We perform Breusch-Pagan/Cook-Weisberg heteroskedasticity tests χ in two steps. First, each of the three equations with pooled OLS with robust standard errors is run. Then, the Breusch-Pagan/Cook-Weisberg tests are performed. The regression Chi-square (χ^2) results and their *p*-values are indicated in Table 2 (here only the results of χ^2 and *p*-values are presented[2]). Table 1 shows that the low p-values demonstrating high heteroscedasticity, suggesting that the GMM method is preferable to deal with this issue.[3]

Equations (1)–(3) are estimated jointly for the following reason. On the surface, these equations may appear to be seemingly unrelated to each other. However, since they are using the same data, the error terms between these three equations may be related. If unaccounted for, the apparent simultaneous equation bias from Equations (1)–(3) can lead to biased and inconsistent estimators due to the correlation between random errors and the endogenous variables. These errors, $\varepsilon_{i,t}$, $\mu_{i,t}$, and $v_{i,t}$ are contemporaneously correlated because they contain the influence of factors that have been omitted from the equations. Since the firms' operation is similar in many respects, it is more likely that the effect of the omitted factors on the interrelationship among loan growth, bank profitability and stability for one firm is similar to that for another firm. If this is the case, $\varepsilon_{i,t}$, $\mu_{i,t}$, and $v_{i,t}$ are capturing similar effects

Table 1. The results of the Breusch-Pagan test

	ROE	ZSCORE	LOGR
Chi-square (χ^2)	2035.57	10.28	25.42
P-value	0.000	0.246	0.003

Table 2. The descriptive statistics of variables used in the simultaneous equations model

	Obs	Mean	STD	Max	Min
ZSCORE	395	2.793	0.670	5.474	−0.602
LOGR	395	0.479	1.017	11.317	−0.407
ROE	395	0.113	0.093	0.567	−0.820
NIETA	395	0.018	0.009	0.080	0.0001
LLRTA	395	0.007	0.012	0.221	0.0001
LASTF	395	0.440	0.188	1.093	0.080
LNTA	395	17.728	1.454	20.907	13.012
FATA	395	0.015	0.013	0.080	0.001
DEPOGR	395	0.561	1.233	12.743	−0.809
TDTL	395	1.163	0.352	2.689	0.260
INF	395	0.088	0.062	0.231	0.009
GDPGR	395	0.061	0.006	0.071	0.052
RF	395	0.423	0.495	1.000	0.000
HHID	395	0.096	0.024	0.156	0.075

ZSCORE, a standard deviation of ROA over the sample period, combined with current period values of ROA and EQUITY; LOGR, the annual percentage change in total outstanding loans; ROE, the ratio of the returns (profits before tax) on equity; NIETA, the ratio of non-interest expenses to total assets; LLRTA, the ratio of loan loss reserves to total assets; LASTF, the ratio of liquid assets to short-term funding; LNTA, the natural logarithm of total assets; FATA, the ratio of fixed assets to total assets; DEPOGR, the annual percentage change in total deposits; TDTL, the ratio of total deposits to total loans; INF, the inflation rate; GDPGR, the economic growth rate; REFORM, a dummy variable that takes a value of 1 for the period of 2011–2015, and 0 otherwise; HHID, Herfindahl-Hirsch Index in terms of total deposits.

and will be correlated. One potential solution to this problem is to estimate the three equations jointly using the panel Generalised Method of Moment (Baltagi, 2008). In panel data, the GMM estimator is considered as more efficient than the fixed or random effects estimator if the strict exogeneity assumption of the regressors fails or if a serial correlation is present (Wooldridge, 2001). As endogeneity is effectively controlled by the framework of the simultaneous equations approach (Greene, 2008), all estimations in the results section are done with the use of system GMM approach which exploits the interactions among the innovations in Equations (1)–(3). The GMM estimator also yields efficiency gains in the presence of endogenous explanatory regressors. We further control for heteroskedasticity and arbitrary autocorrelations by using the Newey-West methodology in estimating these above equations (Newey & West, 1987).

3.2. Data

Bank-specific information was mainly obtained from financial statements of individual Vietnamese banks between 2006 and 2017[4] according to Vietnamese accounting standards. Only commercial banks are selected as they are mainly active players while foreign bank affiliates and joint-venture banks are somewhat limited to operate in the Vietnamese market. Besides, the financial information has been filtered by using two criteria: outliers[5] and those banks without data for any of the considered variables have been dropped. Therefore, we obtain 412 observations corresponding to the numbers of banks that vary from a minimum of 27 in 2006 to a maximum of 38 in 2010. Our unbalanced panel data of 41 banks include five state-owned commercial banks and 36 privately owned commercial banks which together accounted for more than 80% of total assets in the industry. The data for macroeconomic variables are collected from the World Bank. Table 2 provides descriptive statistics of variables used in the simultaneous equations model.

4. Results

Table 4 shows the Granger causality tests of the main variables in this study. The tests are undertaken using two, three, and four lags as suggested by econometric literature (Thornton & Batten, 1985; Wooldridge, 2001). The full Granger-causality test results are then confirmed by the findings in Tables 5–7. In most cases, there are bidirectional causal relationships among ROE, ZSCORE, and LOGR, implying that these variables are significantly related. Data as shown in Table 3 also indicate the ROE has an impact on ZSCORE. Thus, this is crucial to control for these feedback issues using a system estimation method because this simultaneous equation bias can result in inconsistent estimators.

4.1. The interrelationships among bank profitability, bank stability, and loan growth

All versions are estimated with the panel GMM method. The Newey-West methodology is also employed to account for heteroskedasticity and autocorrelation. To alleviate potential endogeneity with bank-level control variables, we follow Fu et al. (2015) by replacing all bank-level explanatory variables with their one-year lagged value in all regressions. Accordingly, the one-year lagged values of the presumably endogenous variables as instruments. More lags of these variables are not introduced in our regressions since they are relatively weak instruments.

The result of the Hansen test (J-statistic) is reported to test the over-identifying restrictions in a system of simultaneous equations (Baltagi, 2008). Data as indicated in Tables 5–7 highlights that the p-value of the Hansen test is statistically not significant in any of the models, and thus the null hypothesis cannot be rejected. Thus, there is no evidence of over-identifying restrictions. In other words, all conditions for the moments are satisfied and the above instruments are accepted.

Table 5 indicates that ZSCORE is positively and significantly associated with ROE, suggesting that bank stability can result in a higher profit. This is comparable with the findings of Al-Khouri and Arouri (2016) in GCC. However, ZSCORESQ is negatively related to ROE, suggesting the U-shaped relationship between ZSCORE and ROE may exist. This may be explained by the fact that "too-safe" banks may be reluctant to invest more risky assets as they strictly follow the regulatory requirements. Therefore, they may lose an opportunity to make high profits while the banking market is getting more competitive. LOGR is found to have a positive impact on ROE, implying that loan growth can improve bank profitability. LOGRSQ, however, impacts ROE negatively, that demonstrating excessive loan growth tends to reduce bank profitability because of a higher level of NPLs. HHID is found to have a positive impact on ROE, thus supporting the structure-conduct- performance hypothesis. This is in line with the findings of Dietrich and Wanzenried (2014) and Saona (2016) who suggest that banks with market power collide to charge high fees on loans and advances and non-traditional activities and lower rates on customer deposits, thus earning higher profits.

Moreover, the positive relationship between LNTA and ROE suggests that as larger operations bear higher costs and/or risk, the large banks may charge higher fees and higher margins, thus enhance their performance. This is comparable with the findings of Maudos and Solís (2009). However, this somewhat does not support the findings of Le (2017b) who demonstrates larger banks that provide more credit tend to have lower margins in Vietnam. This can be explained by the fact that the different proxies of bank profitability are used. In our study, bank profitability is proxied by the returns on equity whereas the net interest margin is used in Le (2017b)'study.[6] GDPGR is found to affect ROE negatively, suggesting that high economic growth improves the business environment and lowers bank entry barriers. The increased competition, thus, dampen banks' profitability. Nonetheless, this is in line with the findings of Tan and Floros (2012) in China.

Table 6 shows that the coefficient of ROE is positive and significant, suggesting that banks may be reluctant to take excessive risks in a very profitable environment. This is in line with the early suggestion of Laeven and Levine (2009) and Al-Khouri and Arouri (2016). ROESQ is also found to have no impact on ZSCORE. Also, the coefficient of LOGR is negative and significant, suggesting banks that are less embedded in loan growth tend to reduce bank credit default. However,

Table 3. Correlation matrix

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
A.ZSCORE	1													
B.LOGR	0.039	1												
	(0.775)													
C.ROE	0.133***	0.072	1											
	(2.666)	(1.428)												
D.NIETA	−0.022	−0.201***	−0.161***	1										
	(−0.436)	(−4.061)	(−3.226)											
E.LLRTA	−0.025	−0.062	0.094*	0.011	1									
	(−0.488)	(−1.224)	(1.865)	(0.222)										
F.LASTF	0.151***	0.134***	0.056	0.027	−0.144***	1								
	(3.018)	(2.689)	(1.107)	(0.529)	(−2.876)									
G LNTA	−0.232***	−0.259***	0.232***	−0.054	0.177***	−0.157***	1							
	(−4.718)	(−5.326)	(4.727)	(−1.066)	(3.567)	(−3.143)								
H.FATA	0.056	−0.047	−0.168***	0.144***	−0.058	−0.259***	−0.3***	1						
	(1.120)	(−0.927)	(−3.378)	(2.889)	(−1.155)	(−5.307)	(−6.231)							
I.DEPOGR	0.105**	0.689***	0.009	−0.216***	−0.067	0.170***	−0.310***	−0.020	1					
	(2.095)	(18.84)	(0.178)	(−4.382)	(−1.327)	(3.416)	(−6.462)	(−0.391)						
J.TDTL	−0.189***	−0.087*	−0.133***	−0.136***	−0.018	0.203***	0.295***	−0.152***	0.082	1				
	(−3.825)	(−1.737)	(−2.661)	(−2.73)	(−0.361)	(4.115)	(6.115)	(−3.047)	(1.641)					
K.INF	0.159***	−0.037	0.078	−0.017	−0.026	0.231***	−0.263***	0.114**	0.045	−0.151***	1			
	(3.188)	(−0.734)	(1.543)	(−0.345)	(−0.52)	(4.7)	(−5.41)	(2.28)	(0.903)	(−3.027)				
L.GDPGR	−0.052	0.178***	0.134***	−0.186***	0.013	−0.021	−0.039	−0.152***	0.137***	−0.105**	−0.245***	1		
	(−1.022)	(3.581)	(2.673)	(−3.746)	(0.256)	(−0.409)	(−0.767)	(−3.053)	(2.744)	(−2.084)	(−5.011)			
M.RF	−0.077	−0.239***	−0.247***	0.269***	0.040	−0.002	0.247***	0.074	−0.212***	0.223***	−0.047	−0.34***	1	
	(−1.534)	(−4.888)	(−5.048)	(5.545)	(0.798)	(−0.043)	(5.046)	(1.467)	(−4.293)	(4.545)	(−0.924)	(−7.179)		

(*Continued*)

Table 3. (*Continued*)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
N.HHID	0.171***	0.292***	0.254***	−0.189***	−0.014	0.073	−0.467***	−0.037	0.291***	−0.226***	0.243***	0.454***	−0.588***	1
	(3.442)	(6.059)	(5.208)	(−3.812)	(−0.280)	(1.453)	(−10.464)	(−0.728)	(6.025)	(−4.608)	(4.962)	(10.114)	(−14.405)	

ZSCORE, a standard deviation of ROA over the sample period, combined with current period values of ROA and EQUITY; LOGR, the annual percentage change in total outstanding loans; ROE, the ratio of the returns (profits before tax) on equity; NIETA, the ratio of non-interest expenses to total assets; LLRTA, the ratio of loan loss reserves to total assets; LASTF, the ratio of liquid assets to short-term funding; LNTA, the natural logarithm of total assets; FATA, the ratio of fixed assets to total assets; DEPOGR, the annual percentage change in total deposits; TDTL, the ratio of total deposits to total loans; INF, the inflation rate; GDPGR, the economic growth rate; REFORM, a dummy variable that takes a value of 1 for the period of 2011–2015, and 0 otherwise; HHID, Herfindahl-Hirsch Index in terms of total deposits. *,**,***Significant at 10, 5, and 1 percent level.

Table 4. Pairwise Granger-causality tests

Number of lags	2		3		4	
Null hypothesis	**F-Statistic**	**Probability**	**F-Statistic**	**Probability**	**F-Statistic**	**Probability**
LOGR does not Granger Cause ROE	2.351	0.097	2.397	0.069	0.890	0.471
ROE does not Granger Cause LOGR	3.751	0.025	1.999	0.115	3.4105	0.009
ZSCORE does not Granger Cause ROE	0.065	0.937	0.348	0.791	2.460	0.046
ROE does not Granger Cause ZSCORE	3.143	0.045	7.783	5.00e-05	12.688	2.00e-09
ZSCORE does not Granger Cause LOGR	0.207	0.813	0.165	0.919	0.5132	0.193
LOGR does not Granger Cause ZSCORE	13.879	2.00e-06	18.409	7.00e-11	6.279	8.00e-05

ZSCORE, a standard deviation of ROA over the sample period, combined with current period values of ROA and EQUITY; LOGR, the annual percentage change in total outstanding loans; ROE, the ratio of the returns (profits before tax) on equity.

Table 5. The determinants of bank profitability

ROE	
Constant	−0.899***(−4.931)
ZSCORE	0.260*(2.044)
LOGR	0.057***(3.426)
HHID	1.271***(5.862)
NIETA	0.062(0.150)
LLRTA	1.500(0.711)
LASTF	0.062(1.546)
COV	−3.359(−0.541)
LNTA	0.030***(7.509)
ZSCORESQ	−0.042*(−1.930)
LOGRSQ	−0.005***(−3.435)
GDPGR	−1.089**(−2.544)
No. Obs	395
J-statistics	0.111

ROE, the ratio of the returns (profits before tax) on equity; ZSCORE, a standard deviation of ROA over the sample period, combined with current period values of ROA and EQUITY; LOGR, the annual percentage change in total outstanding loans of banks; HHID, the Herfindahl-Hirschman Index in terms of deposits; NIETA, the ratio of operating expenses to total assets; LLRTA, the ratio of loan loss reserves to total assets; LASTF, the ratio of liquid assets to short-term funding; COV, the product of LLRTA and LASTF; LNTA, the natural logarithm of total assets, ZSCORESQ, the squared term of ZSCORE; LOGRSQ, the squared term of loan growth, GPDGR, the annual economic growth rate. The table contains results estimated using a simultaneous equations model (SEM) with the GMM estimator and Newey-West method. ROE, ZSCORE, and LOGR represent the three endogenous variables in SEM. *t*-statistics are shown in parentheses, ***Significant at 1 per cent levels, respectively.

Table 6. The determinants of bank stability

ZSCORE	
Constant	5.248***(8.019)
ROE	4.470***(4.132)
LOGR	−0.279**(−2.107)
FATA	2.309(0.871)
LASTF	0.224(1.075)
LNTA	−0.159***(−4.039)
TDTL	−0.084(−0.707)
ROESQ	−2.027(−1.582)
LOGRSQ	0.021*(1.665)
No. Obs	395
J-statistics	0.111

ZSCORE, a standard deviation of ROA over the sample period, combined with current period values of ROA and EQUITY; ROE, the ratio of the returns (profits before tax) on equity; LOGR, the annual percentage change in total outstanding loans of banks; FATA, the ratio of fixed assets to total assets; LASTF, the ratio of liquid assets to short-term funding; LNTA, the natural logarithm of total assets; TDTL, the ratio of total deposits to total loans; ROESQ, the squared term of ROE; LOGRSQ, the squared term of LOGR. The table contains results estimated using a simultaneous equations model (SEM) with the GMM estimator and Newey-West method. ROE, ZSCORE, and LOGR represent the three endogenous variables in SEM. *t*-statistics are shown in parentheses, **,***Significant at 5, and 1 per cent levels, respectively.

Table 7. The determinants of loan growth

LOGR	
CONST	8.586***(3.848)
ZSCORE	−4.025***(−2.709)
ROE	6.850***(4.544)
SIZE	−0.16***(−3.507)
DEPOGR	0.511***(7.565)
ZSCORESQ	0.661**(2.538)
ROESQ	−5.950**(−1.991)
REFORM	0.067(0.838)
INF	−1.326***(−2.656)
GDPGR	−3.777(−0.822)
No. Obs	395
J-statistics	0.111

LOGR, the annual percentage change in total outstanding loans; ZSCORE, a standard deviation of ROA over the sample period, combined with current period values of ROA and EQUITY; ROE, the ratio of the returns (profits before tax) on equity; LNTA, the natural logarithm of total assets; DEPOGR, the change in total deposits; REFORM, a dummy variable that takes a value of 1 for the period of 2001–2015, and 0 otherwise; INF, the inflation rate; GDPGR, the economic growth rate; ZSCORESQ, the squared term of ZSCOREGR, ROESQ, the squared term of ROE. The table contains results estimated using a simultaneous equations model (SEM) with the GMM estimator and Newey-West method. ROE, ZSCORE, and LOGR represent the three endogenous variables in SEM. *t*-statistics are shown in parentheses, *,**, ***Significant at 10, 5, and 1 per cent levels, respectively.

a decline in loan growth (LOGRSQ) to a certain level would have reduced bank stability because loans are the main source of bank income, especially to the case of bank-based economy.

SIZE is negatively and significantly associated with ZSCORE—thus, supporting the too-big-to-fail hypothesis. This suggests that large banks have more incentives to invest more in risky assets. This finding is comparable with those of Beck et al. (2006) and Le et al. (2019).

Table 7 indicates that ZSCORE is negatively associated with LOGR, demonstrating that unstable banks are associated with excessive loan growth—thus supporting the moral hazard hypothesis. A positive impact of ZSCORESQ on LOGR also confirms that risky banks are monitored by the SBV in terms of loan granting, thus lowering loan growth.

ROE is found to have a positive impact on LOGR, suggesting that more profitable banks are associated with loan growth. However, the negative relationship between ROESQ and LOGR suggests that Vietnamese banks have put more attention on non-traditional activities. When the market is so competitive, to maintain a certain level of profitability, banks need to diversify their income source. The coefficient of SIZE is negative and significant, suggesting that larger banks tend to shift away from traditional activities (mainly loans) to off-balance sheet activities and retail banking. DEPOGR is positively and significantly related to LOGR, emphasizing that higher deposit growth results in higher credit growth since banks have more available funds. INF is negatively and significantly associated with LOGR, suggesting that a high inflation rate reduces bank loans.

4.2. Robustness checks

For robustness, we first investigate whether bank ownership has any impact on the interrelationship among bank stability, profitability, and loan growth. OWNER, a dummy variable that takes a value of 1 for a state-owned commercial bank (SOCB), 0 otherwise is included in the SEM. Appendix A shows that SOCBs are more stable than privately owned commercial banks. This is comparable to the findings of Le et al. (2019) who suggest that SOCBs have received implicit support from the government. Furthermore, loan growth is found to have no impact on bank stability. Nonetheless, this confirms our above findings.

Second, when CRISIS, a dummy variable that takes a value of 1 for the period of 2008–09, and 0 otherwise, the same main findings are obtainable as presented in Appendix B. More specifically, CRISIS is positively and significantly associated with LOGR and statistically not significant in ROE and ZSCORE equations. This suggests that the global financial crisis may not affect banks' decision to grant loans during this period, which reflects the fact that Vietnam is less integrated into the global banking system yet. Besides, Vietnamese banks may also benefit from the government's stimulatory packages in response to the impact of GFC via injecting a large amount of money to the Vietnamese economy via the channels of commercial banks. This cheaper fund thus increases lending. Nonetheless, this supports the early findings of Al-Khouri and Arouri (2016) in the GCC market, Dietrich and Wanzenried (2014) in low- and middle-income countries, Le (2019) and Le (2020) in Vietnam. Furthermore, when CRISIS and OWNER variables are included in the model as shown in Appendix C, only the ZSCORE variable becomes insignificant in the ROE equation while other main findings remain unchanged.

We further use an alternative measure of bank stability for robustness checks as indicated in Appendix D. Once again, these main findings are the same as above.

Last, we investigate whether the interrelationship among bank stability, profitability, and loan growth differ between small and large banks as shown in Appendices E and F. Following Le (2019), Fu et al. (2015) and among others, large and small banks are defined as those with total assets above and below the median, respectively. For small banks, bank stability is positively associated with loan growth and negatively related to profitability. This suggests that small banks tend to rely on traditional lending activities, which may reduce their profit in the long run. For large banks, more stable banks that are less diversified tend to have a lower profit. Nonetheless, our main findings are robust.

5. Conclusions

This study investigates the simultaneous determinants of bank stability, profitability, and loan growth in the Vietnamese banking from 2006 and 2017 using the GMM estimator. The findings show the bidirectional relationship between bank stability, profitability, and loan growth.

Nonetheless, sound banks are likely to be more profitable and lower loan growth. Loan growth also improves bank profitability but reduces bank stability while bank profitability has a positive impact on bank stability and loan growth. More interestingly, the findings show a quadratic relationship among these variables. Loan growth to a certain level reduces profitability and bank stability. This implies that bank managers should be cautious to pursue the strategy of massive loan growth and policy-makers should carefully monitor the Vietnamese banking market when loan growth is too fast. Also, the U-shaped relationship between bank profitability and loan growth suggest bank managers that they should shift away from the traditional activity to non-traditional ones to maintain a high level of profitability. Besides, the findings also indicate the negative between bank size and stability—thus, supporting the "too-big-to-fail" hypothesis. This suggests the State Bank of Vietnam should be cautious when approaching future bank mergers with the participation of large banks.

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Notes

1. Just behind China within Asia with an average of approximately 9% GDP growth per year over the same period.
2. The full results of each equation can be provided upon request.
3. See Baum et al. (2003).
4. Since 2005, Vietnamese banks have been encouraged to publish their annual reports to enhance the transparency of the banking system.
5. Outlier values are considered as their cumulative frequency is under 1% or above 99% and their deviation from the mean is higher than three times the variable's standard deviation.
6. Nonetheless, we further test whether the U-shape between bank size and profitability by including the squared term of bank size (LNTASQ). The results show that the coefficient of LNTASQ is positive but statistically not significant although the table of results could not be presented due to the length restriction.

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Appendix A.

Table A1. Regression results when bank ownership is included

	ROE	ZSCORE	LOGR
ROE		3.338***(3.250)	7.042***(4.900)
ZSCORE	0.239* (1.746)		−3.878**(−2.557)
LOGR	0.063***(3.543)	−0.142(−1.236)	
ROESQ		−3.084***(−2.863)	−6.039*(−1.899)
ZSCORESQ	−0.039*(−1.666)		0.640**(2.431)
LOGRSQ	−0.006***(−3.574)	0.007(0.698)	
OWNER	0.006(0.330)	0.360**(2.407)	−0.003(−0.022)
Constant	−0.860***(−4.004)	5.499***(8.750)	8.414***(3.371)
No. Obs	395	395	395
J-statistics	0.11	0.11	0.11

The table contains the results estimated using a simultaneous equations model with the GMM estimator. The same set of control variables is used as indicated in Equations (1)–(3) and OWNER, a dummy variable that takes a value of 1 for a state-owned commercial bank, and 0 otherwise. However, the coefficients on other control variables are not presented in the table due to space constraints. *t*-statistics are indicated in parentheses. *, **,***Significant at 10,5 and 1 per cent levels, respectively.

Appendix B.

Table B1. Regression results when the global financial crisis is included

	ROE	ZSCORE	LOGR
ROE		4.267***(4.253)	6.781***(4.302)
ZSCORE	0.219*(1.734)		−3.596**(−2.476)
LOGR	0.055***(3.343)	−0.246*(−1.840)	
ROESQ		−2.463*(−1.919)	−5.703*(−1.890)
ZSCORESQ	−0.035(−1.623)		0.586**(2.319)
LOGRSQ	−0.005***(−3.319)	0.018(1.405)	
GFC	0.01(1.050)	0.02(0.304)	0.161*(1.647)
Constant	−0.873***(−4.967)	5.109***(7.546)	7.579***(3.553)
No. Obs	395	395	395
J-statistics	0.11	0.11	0.11

The table contains the results estimated using a simultaneous equations model with the GMM estimator. The same set of control variables is used as indicated in Equations (1)–(3) and GFC, a dummy variable that takes a value of 1 for the period of 2008–09, and 0 otherwise. However, the coefficients on other control variables are not presented in the table due to space constraints. *t*-statistics are indicated in parentheses. *, **,***Significant at 10,5 and 1 per cent levels, respectively.

Appendix C.

Table C1. Regression results when bank ownership and the global financial crisis are included

	ROE	ZSCORE	LOGR
ROE		3.086***(3.291)	7.017***(4.548)
ZSCORE	0.205(1.500)		−3.664**(−2.457)
LOGR	0.060***(3.500)	−0.119(−1.024)	
ROESQ		−3.319***(−3.009)	−6.075*(−1.889)
ZSCORESQ	−0.033(−1.423)		0.604**(2.352)
LOGRSQ	−0.006***(−3.513)	0.005(0.505)	
GFC	0.013(1.431)	0.011(0.165)	0.176*(1.794)
OWNER	0.003(0.149)	0.401***(2.684)	−0.003(−0.022)
Constant	−0.858***(−4.102)	5.464***(8.256)	7.535***(3.119)
No. Obs	395	395	395
J-statistics	0.11	0.11	0.11

The table contains the results estimated using a simultaneous equations model with the GMM estimator. The same set of control variables is used as indicated in Equations (1)–(3) and GFC, a dummy variable that takes a value of 1 for the period of 2008–09, and 0 otherwise, and OWNER, a dummy variable that takes a value of 1 for a state-owned commercial bank, and 0 otherwise. However, the coefficients on other control variables are not presented in the table due to space constraints. *t*-statistics are indicated in parentheses. *, **,***Significant at 10,5 and 1 per cent levels, respectively.

Appendix D.

Table D1. Regression results when an alternative measure of bank stability is used

	ROE	AZSCORE	LOGR
ROE		−3.308***(−4.260)	2.166***(4.167)
AZSCORE	0.625***(9.882)		−0.222(−1.234)
LOGR	0.220**(2.142)	1.543**(2.181)	
ROESQ		−2.892***(−7.387)	0.876***(3.754)
AZSCORESQ	−0.093***(−10.289)		0.034(1.340)
LOGRSQ	−0.158*(−1.857)	−1.288**(−2.532)	
Constant	−1.925***(−8.800)	2.102**(2.490)	2.559***(4.461)
No. Obs	395	395	395
J-statistics	0.125	0.125	0.125

AZSCORE, a standard deviation of ROA over the 5-year period, combined with average 5-year period values of ROA and EQUITY. The table contains the results estimated using a simultaneous equations model with the GMM estimator. The same set of control variables is used as indicated in Equations (1)–(3). However, the coefficients on other control variables are not presented in the table due to space constraints. *t*-statistics are indicated in parentheses. *, **, ***Significant at 10,5 and 1 per cent levels, respectively.

Appendix E.

Table E1. Regression results for small banks

	ROE	ZSCORE	LOGR
ROE		−2.216***(−2.940)	8.704***(3.009)
ZSCORE	0.221***(3.060)		−4.717**(−2.066)
LOGR	0.011(0.821)	0.323***(4.135)	
ROESQ		−6.823***(−6.570)	−9.225(−1.434)
ZSCORESQ	−0.039***(−3.272)		0.752**(2.179)
LOGRSQ	−0.001(−0.658)	−0.036***(−4.950)	
Constant	−0.291**(−2.467)	3.260***(17.971)	6.448*(1.796)
No. Obs	193	193	193
J-statistics	0.141	0.141	0.141

Small banks are defined as those with total assets below the median. The table contains the results estimated using a simultaneous equations model with the GMM estimator. The same set of control variables is used as indicated in Equations (1)–(3). However, the coefficients on other control variables are not presented in the table due to space constraints. *t*-statistics are indicated in parentheses. *, **,*** Significant at 10,5 and 1 per cent levels, respectively.

Appendix F.

Table F1. Regression results for large banks

	ROE	ZSCORE	LOGR
ROE		17.303***(4.866)	1.688**(2.072)
ZSCORE	−2.241***(−3.036)		1.561**(2.511)
LOGR	0.445*(1.673)	−1.039(−0.879)	
ROESQ		−36.542***(−4.213)	−2.925*(−1.713)
ZSCORESQ	0.448***(3.013)		−0.308**(−2.431)
LOGRSQ	−0.289(−1.307)	0.587(0.573)	
Constant	2.307***(2.653)	1.191**(2.533)	−1.880***(−2.703)
No. Obs	202	202	202
J-statistics	0.134	0.134	0.134

Large banks are defined as those with total assets above the median. The table contains the results estimated using a simultaneous equations model with the GMM estimator. The same set of control variables is used as indicated in Equations (1)–(3). However, the coefficients on other control variables are not presented in the table due to space constraints. *t*-statistics are indicated in parentheses. *, **,***Significant at 10,5 and 1 per cent levels, respectively.

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