DO MACROECONOMIC UNCERTAINTY FACTORS CAUSE BANKING INSTABILITY? EVIDENCE FROM AN EMERGING ECONOMY

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Abstract: ***The study examines whether instability in macroeconomic factors, such as economic growth, inflation, and money supply, causes Vietnamese commercial banks to be unstable. The OLS regression method only gives a result showing the positive or negative impact of the independent variable on the dependent variable. However, with quantile regression, the bank stability level is divided into many small quantiles, and for each quantile, there is a regression function. The quantile regression results show that GDP growth uncertainty negatively affects banking stability at low quantiles of bank stability; however, in the high quantiles, GDP growth uncertainty has an insignificant impact on bank stability. The results imply that the more volatile the economic growth is, the more unstable the bank will be if banks have low stabilization. However, if banks have high stability, economic growth uncertainty does not affect banking stability. The results of money supply M2 uncertainty impact on bank stability are similar to GDP growth uncertainty. Moreover, high inflation uncertainty reduces bank stability in most of the quantiles of the bank stability.***

• Keywords: *macroeconomic uncertainty; bank stability; quantile regression; GDP growth uncertainty.*

JEL codes: E51, E52, E60

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1. Introduction

There are numerous definitions of financial stability. Most of them have in common that financial stability is about the absence of system-wide episodes in which the financial system fails to function (crises). It is also about resilience of financial systems to stress. (worldbank.org, 2023). Financial stability can also mean a condition in which the three components of the financial system -- financial institutions, financial markets, and financial infrastructure - are stable (bok.or.kr, 2023). Financial institutions are mainly composed of commercial banks. Therefore, a financial institution's stability is bank stability. A stable bank will increase its ability to withstand shocks and reduce the risk of disruption to the business cycle, ensuring banks' cash flow and profits. Bank stabilization creates a more favorable environment for investors and depositors, providing lending capital at a stable price to borrowers. Bank stability depends on macroeconomic factors such as foreign direct investments, money supply, interest and exchange rates, inflation, money supply, and both micro factors. When both macro and micro uncertainty factors happen together, they will strongly affect the bank's business (Bayar & Ceylan, 2017). Rising uncertainty of any form increases information asymmetry since the characteristics of borrowers become opaque. Lenders increasingly struggle to distinguish credit risks during uncertain times, leading to a decline in lending and investment and, consequently, a contraction in economic activity (Phan et al., 2021). Uncertainty typically increases during economic downturns and decreases as the economy improves. Unfavorable fluctuations in the economic environment increase the instability of micro or macroeconomic factors, thereby negatively affecting enterprises' growth rate and profitability (Bloom, 2014). A stable and predictable macroeconomic environment is essential for firms' production and investment and banks' lending decisions. The absence of macroeconomic stability led to high inflation rates and large budget deficits, resulting in a sharp decline in private investment (Mangla & Din, 2015). Similarly, Somoye & Ilo (2009) argue that if banks perceive a stable macro environment more accurately, they will form an expectation that borrowers will be able to pay back and earn good returns on their investment projects. The studies show a relationship between macro uncertainty factors with bank stability. However, studies are evaluated from mean regressions such as FGLS, GMM, while this article draws conclusions based on quantile regression, which considers each small percentile of the dependent variable. Using the quantile regression approach, we analyze in more detail and precisely than the average results. Therefore, it is worth studying whether macroeconomic uncertainty factors lead to unstable banks. The research results will help bank managers in their decisions. First, it can be helpful for commercial banks to have a better

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understanding of macroeconomics and its impact on bank stability to operate prudently, reduce risk, increase income, use cost-effectively, and promote steady operation. Secondly, the research results will be helpful for the State Bank to realize how the impact of macroeconomic policies affects the stability of banks, thereby adjusting macro policies to help the banking system become more stable.

2. Literature review

There is considerable literature supporting the hypothesis that economic uncertainty factors affect the bank performance (Bredin et al., 2009; Bayar & Ceylan, 2017; Dang & Nguyen, 2022), bank lending (Quagliariello, 2009; Whyte, 2010; Ibrahim & Shah, 2012; Yang & Zhou, 2019; Simpasa & Nandelenga, 2022) and only a few foci on assessing the impact of banking instability. However, the theory shows that when a bank's financial performance improves, the bank becomes more stable. NPLs increased, causing more significant losses for banks and hence more instability. Therefore, through financial performance, or bad debt, we can assess the stability of a bank. In addition, empirical studies use the Z-score, calculated as the sum of the bank's return on assets and equity to assets ratio divided by the standard deviation of return on assets, to represent bank stability. Z-score explicitly compares buffers (capitalization and returns) with risk (volatility of returns) to measure the stabilization of the bank, showing that higher values of the Z-score are thus indicative of a low probability of insolvency and greater bank stability. Some studies use the ratio of non-performing loans to represent bank stability; the more extensive the bad debt, the more unstable the bank.

In one of the studies, Bredin et al. (2009) conclude inflation uncertainty in most cases does not harm the output growth performance of an economy that is contrary to their expectations. This evidence implies that macroeconomic uncertainty may even improve macroeconomic performance, i.e. raise output growth and reduce inflation. Whyte (2010) argues that macroeconomic uncertainty does affect bank lending in the short run. Specifically, the volatility of the benchmark interest rate, which is affected by fiscal and monetary policy, was found to be the most critical macroeconomic variable. Therefore, concerns about the sustainability of the current macroeconomic economic environment could partly explain the current weak credit levels. Research by Talavera et al. (2012) for Ukrainian banks indicates that banks increase lending rates when macroeconomic instability decreases. Banks' responses to changes in uncertainty are heterogeneous and depend on individual bank characteristics. It is similarly stated that the effect of macroeconomic conditions on non-performing loans has a different response for each economic sector (Viphindrartin et al., 2021). Topi & Vilmunen (2001) use the conditional variance of consumer or producer inflation or volatility of money supply (M1 and M2) as proxied of macroeconomic uncertainty and investigate the effects of monetary policy on the bank lending channels in Finland. They find that bank lending responds positively to changes in real income and inflation but negatively to monetary policy shocks. Bayar & Ceylan (2017) suggest that macroeconomic uncertainty harms the firm profitability, both return on assets (ROA) and operating profit (ROAF) through firm decision-making. The results show establishing and maintaining a stable macroeconomic environment is of great importance for the profitability of enterprises, thereby achieving sustainable growth and a lower unemployment rate. Valencia (2017) builds a model in which a commercial bank maximizes its benefits. An increase in macroeconomic instability will increase the probability of bank failure. Banks are generally risk-neutral, so credit growth slows down to achieve hedging as uncertainty rises. Empirical studies have shown that all macro uncertainty factors are unlikely to adversely affect financial performance and bank credit. These results give us a prediction of its negative effect on bank stability. In this article, we will test the impact of uncertainty on macro factors such as GDP growth, M2 money supply, and inflation uncertainty on banking stability.

3. Measurement of Macroeconomic Uncertainty

Macroeconomic factors in empirical research represent by proxies such as GDP growth, inflation rate, exchange rate, interest rate, money supply, etc (Viphindrartin et al., 2021). Their uncertainty is measured by variance, standard deviation, or volatility. Talavera et al. (2012), for instance, use the variance of the money supply indicator, the consumer price index, and the volatility of the production price index to represent macroeconomic uncertainty factors. Bayar & Ceylan (2017) study the effect of macroeconomic uncertainty on Return on Assets (ROA) and Return on Operating Profits (ROAF) using exchange rate, interest rate, inflation rate and growth rate volatility proxies to macroeconomic uncertainty. Topi and Vilmunen (2001) use the conditional variance of consumer or producer inflation or volatility of money supply (M1 and M2) as proxied of macroeconomic uncertainty. Adjasi et al. (2008) examined whether the volatility of macroeconomic variables such as exchange rate, money supply, interest rate, inflation rate, and trade deficit affected Ghana Stock Exchange Index returns. In this study, we use macro factors, including GDP growth, inflation rate, and money supply M2, and then

measure their uncertainty using the five-year moving average standard deviation of the past.

4. Measurement of banking stability

In empirical research, bank stability is popularly represented by Z-score. The studies capture bank stability by the natural logarithm of Z-score, where Z-score equals a return on assets (ROA) plus equity-asset ratio (E/A) divided by the standard deviation of ROA (σROA) is quite numerous (Laeven & Levine, 2009; Ozili, 2018; Huang, 2022). In parallel with the ROA component in the Z-score index, the studies replace ROA with ROE as the alternative measures of bank stability (Phan et al. 2022). According to Bourkhis & Nabi (2013), Z-score ratio is an important measure for bank soundness because it is inversely related to the probability of bank's insolvency. Assuming profits are normally distributed, Z-Score measures the probability of a negative return that forces the bank to default, that is, the probability of insolvency of a bank at a given time. A higher Z-Score indicates that the bank has relatively more profits to cover its debt liability and has a lower default risk. Therefore, a higher Z-Score implies a higher degree of solvency, directly measuring bank stability (Bai & Elyasiani, 2013). In addition, Z-score simultaneously considers all three essential aspects in assessing bank performance, including capital adequacy (by the ratio of equity to total assets E/A), profitability (through return on total assets ROA), and risk (by the standard deviation of ROA - volatility of return). The higher the Z-score, the less likely the probability of insolvency is; hence, the bank is more stable and vice versa.

5. Model research

We empirically measure the stability of banking literature using Z-score following the formula below.

$$Z - score = \frac{k + \mu}{\sigma}$$

Where k is equity to total asset ratio (E/A), μ is return on asset ratio (ROA), and is standard deviation of ROA (σROA). The main independent variable is macroeconomic uncertainty we determine GDP growth, money supply M2, and inflation rate volatility by the standard deviation rolling over the previous five years. For the control variable, we follow previous research using bank-specific variables, including bank income growth rate (IGR), funding risk (FUR), ownership concentration (OWC), credit size (TLA), total asset size (SIZ), equity (CAP), loan loss provision (LLP), and loans to deposits ratio (LDR).

We estimate the following regression model:

$$BSI_{it} = \beta_0 + \beta_j M_{it} + \beta_j Z_{it} + \varepsilon_{it}$$

Where BSI is bank stability index as Z-score.

M is vector of macroeconomic uncertainty variables; Z is vector of bank-specific variables.

Table 1. Definition of the Variables

Symbol	Variable Name	Measure	Empirical study
Dependent variables			
BSI	Bank stability	$\log\left(\frac{\text{ROA} + \frac{Equity}{Total\ Asset}}{\sigma(ROA)}\right)$	Laeven & Levine (2009); Beck et al. (2013); Ozili (2018); Goetz (2018); Huang (2022).
Macroeconomic uncertainty variables			
GDPVol	Economic growth uncertainty	The standard deviation of GDP growth	Somoye & Ilo (2009); Yizhong & Song (2014);
INFVol	Inflation uncertainty	The standard deviation of inflation rate	Somoye & Ilo (2009); Talavera et al (2012);
M2Vol	Money supply uncertainty	The standard deviation of money supply	Talavera et al (2012); Viphindrartin et al. (2021)
Bank-specific variables			
Bank-specific variables			
FUR	Funding risk	$\log\left(\frac{\frac{Deposits}{Total\ Asset} + \frac{Equity}{Total\ Asset}}{\sigma\left(\frac{Deposits}{Total\ Asset}\right)}\right)$	Adusei (2015); Ali & Puah (2018).
OWC	Ownership concentration	Largest shareholder rate	Wen & Jia (2010); Agusman et al. (2014).
IGR	Income growth	$\frac{\text{Interest income}_t - \text{Interest income}_{t-1}}{\text{Interest income}_{t-1}}$	Brown & Dinç (2011); Hanafi & Santi (2013); Imbierowicz & Rauch (2014); Adusei (2015); Ghenimi et al. (2017); Dwumfour (2017); Ozili (2018); Huang (2022).
TLA	Loan size	$\frac{\text{Total loans}}{Total\ asset}$	
SIZ	Bank size	Log(Total assets)	
CAP	Equity	$\frac{\text{Equity}}{Total\ asset}$	
LLP	Loans loss provision	$\frac{\text{Loan loss provision}}{Total\ loans}$	
LDR	Loan to deposit	$\frac{\text{Total loan}}{Total\ deposits}$	

6. Research Method

Studies evaluating the impact of macroeconomic uncertainty factors on bank stability use OLS regression if the data used is panel data. If the study uses time series data, the methods used are VEMC and VAR; Our analysis uses panel data from 27 Vietnamese commercial banks from 2012 to 2022. We have balanced panel data with 297 observations. We use the quantile regression method instead of the OLS method because of its advantages over the OLS method. Koenker & Bassett (1982) are the first authors to use the quantile regression method instead of estimating the parameters of the mean regression by the OLS method. Koenker & Bassett (1982) proposed to estimate the regression parameter on each quantile of the dependent variable so that the total absolute difference of the regression function at the quantile η of the dependent variable is minimal. In other words, instead of determining the effect of the independent variable on the mean of the dependent variable, quantile regression will help assess the impact of the independent variable on the dependent variable on each quantile of the dependent variable.

Regression by the OLS method only obtains a single regression line representing the conditional mean of the dependent variable Y according to the values of the independent variable X. Meanwhile, the quantile

regression shows multiple regression functions for each quantile of the dependent variable. Thus, quantile regression has significant advantages over OLS regression. Quantile regression allows the researcher to consider the entire variation of Y_i based on the change of quantile θ€(0,1). On the other hand, according to Hao & Naiman (2007), the quantile regression assumption is not as strict as OLS; for example, the condition of normal distribution and homogeneity of variance is unnecessary. According to Koenker (2005) and Hao & Naiman (2007), quantile regression has the following advantages: quantile regression allows to show in detail the relationship between dependent and independent variables on each quantile of the dependent variable, not just consider this relationship on the mean as OLS regression; In OLS regression, outliers often remove so that the OLS estimate is unbiased. Meanwhile, the quantile regression has robustness, unaffected by such outliers; The parametric tests of quantile regression do not rely on standardization of errors. Furthermore, these tests don't base on any assumptions about the distribution pattern of the regression error; Quantile regression is especially suitable when analyzing regression models with variable variance or in data where the distribution function of the dependent variable is asymmetric around the mean. Then, the quantile regression function on different quantiles will not be the same, showing the various effects of the independent variable on the dependent variable at different quantiles.

7. Research results and discussion.

7.1. Descriptive statistics of research samples

Table 2 describes the statistics of the variables in the research model. We perform detailed statistics for the variable BSI and macroeconomic uncertainty factors to show the minimum and maximum values at the percentiles. For example, the BSI has a mean of 0.0893, a minimum of -0.7734 belonging to the 1% percentile, and a maximum of 0.1172 belonging to the 75% percentile or higher. The variables GDP growth, inflation rate, and M2 supply money uncertainty also exhibit the same values as the bank stability variable.

Table 2: Statistics of variables used in research model

BSI					GDPVol				
	Percentiles	Smallest				Percentiles	Smallest		
1%	0.5034	-0.7734			1%	0.0034	0.0034		
5%	1.0765	0.4148			5%	0.0034	0.0034		
10%	1.2143	0.5034	Obs	297	10%	0.0041	0.0034	Obs	297
25%	1.4613	0.6492	Sum of Wgt.	297	25%	0.0044	0.0034	Sum of Wgt.	297
			Mean	1.7038				Mean	0.0082
50%	1.6918		Std. Dev.	0.4581	50%	0.0056		Std. Dev.	0.0067
		Largest	Min	-0.7734			Largest	Min	0.0034
75%	1.9394	2.9646	Max	4.1213	75%	0.0067	0.0249	Max	0.0249
90%	2.2487	2.9916	Variance	0.2099	90%	0.0192	0.0249	Variance	0.000046
95%	2.4247	3.0062	Skewness	0.2269	95%	0.0249	0.0249	Skewness	1.6869
99%	2.9916	4.1214	Kurtosis	8.0589	99%	0.0249	0.0249	Kurtosis	4.1934
M2Vol					INFVol				
	Percentiles	Smallest				Percentiles	Smallest		
1%	0.0540	0.0540			1%	0.0043	0.0043		
5%	0.0540	0.0540			5%	0.0043	0.0043		
10%	0.0540	0.0540	Obs	297	10%	0.0075	0.0043	Obs	297
25%	0.0626	0.0540	Sum of Wgt.	297	25%	0.0123	0.0043	Sum of Wgt.	297
			Mean	0.0893				Mean	0.0375
50%	0.0968		Std. Dev.	0.0235	50%	0.0218		Std. Dev.	0.0283
		Largest	Min	0.0540			Largest	Min	0.0043
75%	0.1121	0.1172	Max	0.1172	75%	0.0704	0.0757	Max	0.0757
90%	0.1141	0.1172	Variance	0.00055	90%	0.0725	0.0757	Variance	0.00080
95%	0.1171	0.1172	Skewness	-0.3905	95%	0.0757	0.0757	Skewness	0.1949
99%	0.1171	0.1172	Kurtosis	1.5362	99%	0.0757	0.0757	Kurtosis	1.2056

Variable	Obs	Mean	Std. Dev.	Min	Max
IGR	297	0.0921	0.2355	-1.5658	0.9359
FUR	297	1.2875	0.3783	0.3984	2.5868
OWC	297	0.6651	0.1496	0.3488	0.9745
TLA	297	0.5635	0.1309	0.1096	1.0100
SIZ	297	8.0631	0.4993	7.1214	9.2459
LLP	297	0.0135	0.0058	0.0066	0.0773
CAP	297	0.0919	0.0380	0.0406	0.2383
LDR	297	0.8785	0.1933	0.1536	1.8050

7.2. Unit Root test

All variables in research model must be stationary before panel data can be analyzed; the study uses the ADF fisher test, which will remove cross-sectional means by using demean. Table 3 presents the results of the panel unit root test of each variable in the model. Table 3 shows that all four tests strongly reject the null hypothesis that all the panels contain unit roots. The simulation results of Choi (2001) suggest that the inverse normal Z statistic offers the best trade-off between size and power and recommends using it in applications. The study has observed that the inverse logit L∗ test typically agrees with the Z test. Under the null hypothesis, Z has a standard normal distribution, and L∗ has a t distribution with 5N + 4 (139) degrees of freedom. Low values of Z and L∗ cast doubt on the null hypothesis (xtunitroot test - Stata.com).

Table 3: Panel Unit Root Test Result

Ho: All panels contain unit roots Ha: At least one panel is stationary							
		ADF regressions: 0 lags					
		BSI	INFVol	M2Vol	IGR	FUR	OWC
Inverse chi-squared(54)	P	184.1303 ***	92.3254***	201.4696***	299.2618***	185.3220***	173.4948***
Inverse normal	Z	-9.3028 ***	-4.7383***	-10.2774***	-13.6480***	-9.3075***	-8.1117***
Inverse logit t(139)	L*	-9.6446 ***	-4.3421***	-10.6575***	-15.9106***	-9.6890***	-8.8794***
Modified inv. chi-squared	Pm	12.5218 ***	3.6879***	14.1903***	23.6003***	12.6365***	11.4984***
		ADF regressions: 0lags					ADF regressions: 1 lags

		TLA	SIZ	LLP	CAP	LDR	GDPVol
Inverse chi-squared(54)	P	192.2597***	80.3867**	189.3348***	161.9713***	199.3125***	149.6732***
Inverse normal	Z	-8.9952***	- 1.8069**	-8.8613***	-7.7058***	-8.3634***	-7.9692***
Inverse logit t(139)	L*	-9.9480***	-1.8618***	-9.7615***	-8.1094***	-9.9277***	-7.7836***
Modified inv. chi-squared	Pm	13.3040***	2.5391***	13.0226***	10.3895***	13.9827***	9.2062***
Note: *, **, *** represents 10%, 5%, and 1% significance level.							

7.3. Variable correlation matrix

Table 4 presents the pairwise correlation between the variables in the model. Accordingly, the pairwise correlation between GDP growth volatility and banking stability (BSI), between inflation volatility and BSI, is negative and statistically significant at 1%. The pairwise correlation between money supply M2 uncertainty and BSI is also negative but statistically insignificant.

Table 4: Variable correlation matrix

	BSI	GDPVol	M2Vol	INFVol	FUR	OWC	IGR	TLA	SIZ	LLP	CAP	LDR
BSI	1											
GDPVol	-0.1506***	1										
M2Vol	-0.0891	0.1035*	1									
INFVol	-0.2870***	-0.4784***	-0.1998***	1								
FUR	0.1923***	0.1455**	-0.2100***	-0.3834***	1							
OWC	0.0414	-0.0223	0.0153	0.0038	0.0019	1						
IGR	0.0077	0.0214	-0.0842	-0.1090*	0.0194	0.0438	1					
TLA	0.1376**	0.1959***	0.0094	-0.4121***	0.3933***	-0.0253	-0.0515	1				
SIZ	0.1036*	0.2430***	0.0052	-0.3634***	0.2965***	-0.1262**	0.085	0.3475***	1			
LLP	-0.1064*	0.0005	0.1469**	0.0993*	-0.053	0.0144	-0.1553***	-0.2517***	0.1986***	1		
CAP	-0.1055*	-0.0924	0.0439	0.3180***	-0.1306**	0.1522***	-0.1962***	-0.0762	-0.5825***	-0.059	1	
LDR	0.0277	0.1809**	0.1172**	-0.2004***	0.0979*	0.078	0.1663***	0.6084***	0.1440**	-0.2471***	0.1500***	1
*Note: *, **, *** represents 10%, 5%, and 1% significance level.*												

7.4. Discussing research results

OLS regression results in the impact of instability of macro factors on bank stability by a single mean regression function. But with quantile regression, the bank stability level is divided into many small quantiles, and for each quantile, there is a regression function. Taking this advantage, the quantile regression results of Table 5 show that at low quantiles of the BSI variable (Q10, Q20, Q30, Q40, and Q50), the uncertainty of GDP growth has a negative effect on bank stability. This result shows that the more tense the economic growth is, the more unstable the bank will be if banks have low stabilization. However, if banks have high stability, economic growth uncertainty does not affect banking stability. The proof is that the GDPVol variable's regression coefficient is statistically insignificant in the high quantiles of BSI variable (Q60, Q70, Q80, and Q90). Like economic growth uncertainty, integrated money supply uncertainty increases banking stability at the Q10, Q20, Q30, Q40, Q50, Q60, and Q70 quantiles of BSI variable. Money supply uncertainty does not affect bank stabilization for banks with excellent high stability (Q80 and Q90 quantiles of BSI variable). Estimating the effects of GDP growth and money supply uncertainty suggests that when banks have significantly positive returns, high equity, and slightly volatile returns, economic growth, and money supply volatility do not affect bank stabilization because the bank can perform its functions well in unstable macroeconomic conditions. The results show the meaning of the statement on the State Bank of Korea website: "Stability of financial institutions refers to a condition in which individual financial institutions are sound enough to carry out their financial intermediation function adequately, without assistance from external institutions including the government."

Table 5: Estimation results of the impacts of macroeconomic uncertainty factors on bank stability

BSI	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
GDPVol	**-9.176*** **	**-9.349** **	**-10.09** **	**-9.065** **	**-9.969** **	-6.398	-3.567	-1.619	-2.076
	[-2.68]	[-2.12]	[-2.39]	[-2.55]	[-2.54]	[-1.49]	[-0.56]	[-0.29]	[-0.29]
M2Vol	**-3.364** **	**-2.737** **	**-2.547** **	**-2.077** **	**-1.967***	**-2.664** **	**-2.749** **	-1.907	-1.989
	[-2.13]	[-2.32]	[-2.47]	[-2.40]	[-1.66]	[-1.98]	[-2.10]	[-0.99]	[-0.90]
INFVol	-1.931	**-2.193***	**-1.932** **	**-1.411** **	**-1.654***	**-2.908*** **	**-4.158*** **	**-5.815*** **	**-6.424*** **
	[-0.85]	[-1.76]	[-2.02]	[-2.02]	[-1.74]	[-2.95]	[-2.98]	[-2.76]	[-3.68]
IGR	-0.0501	0.0285	0.131	-0.0526	0.00197	0.0508	-0.133	-0.0972	-0.0775
	[-0.43]	[0.21]	[0.98]	[-0.39]	[0.01]	[0.36]	[-0.96]	[-0.48]	[-0.38]
FUR	0.11	0.123	0.158**	0.104	0.113	0.0974	0.0262	0.0714	0.09
	[0.84]	[1.29]	[2.00]	[1.14]	[1.08]	[0.72]	[0.20]	[0.61]	[0.49]
OWC	0.307	0.228	0.183	0.177	0.209	0.0979	0.11	0.0633	-0.0658
	[1.20]	[1.55]	[0.95]	[1.03]	[1.07]	[0.57]	[0.37]	[0.20]	[-0.16]
TLA	0.577	0.587	0.465	0.116	-0.00108	-0.0722	-0.586	-1.112***	-1.550*
	[0.93]	[1.47]	[1.10]	[0.30]	[-0.00]	[-0.18]	[-1.38]	[-2.80]	[-1.94]
SIZ	0.0287	0.0174	-0.0137	-0.00069	-0.0637	-0.0895	-0.0494	0.106	0.13
	[0.32]	[0.19]	[-0.14]	[-0.01]	[-0.62]	[-1.07]	[-0.45]	[0.69]	[1.02]
LLP	7.941	6.002	5.112	1.734	-0.728	-2.81	-2.206	-14.16	-23.16**
	[1.03]	[1.10]	[1.39]	[0.41]	[-0.20]	[-0.90]	[-0.41]	[-1.50]	[-2.20]
CAP	-1.342	0.527	1.025	0.431	-0.49	-0.705	-0.468	0.0902	-0.777
	[-0.96]	[0.44]	[0.79]	[0.38]	[-0.36]	[-0.52]	[-0.33]	[0.06]	[-0.52]
LDR	-0.108	-0.13	-0.0279	0.0563	0.0495	0.0792	0.156	0.22	0.103
	[-0.29]	[-0.42]	[-0.10]	[0.25]	[0.26]	[0.25]	[0.55]	[1.29]	[0.26]
_cons	0.748	0.844	1.077	1.330**	2.065**	2.644***	2.806***	2.070*	2.716***
	[0.84]	[1.23]	[1.44]	[2.25]	[2.35]	[3.57]	[3.39]	[1.68]	[2.98]
N	297	297	297	297	297	297	297	297	297
Pseudo R2	0.2470	0.2678	0.2723	0.2711	0.2702	0.2635	0.2591	0.2660	0.2501
*Standard errors in brackets: * p<0.1, ** p<0.05, *** p<0.01*									

The regression coefficient of inflation uncertainty is an adverse effect and statistically significant at most quantiles of BSI variable, except for the Q10 quantile of BSI variable. Increased inflation uncertainty makes the bank more volatile. As argued by Hatzinikolaou et al. (2002), Caglayan et al. (2015), inflation uncertainty can affect the performance of companies, especially in terms of income and tax structure. For example, the volatility of companies' sales and expenses increases in an uncertain macroeconomic environment, posing the challenge of earnings volatility. On the

other hand, economic efficiency decreases in the presence of inflationary fluctuations because relative price fluctuations lose the advantage of information transmission. Therefore, as the economy has uncertain inflation, bank profits are likely to decrease, bad debt increases, and banking stability weakens. The inflation uncertainty coefficient is statistically insignificant at the Q10 quantile of BSI variable. This result implies that for a bank with a deficient level of stability, inflation volatility has no significance on this stability. Bank instability can be influenced mainly by specific factors.

8. Conclusion and recommendation

With balanced data from 27 Vietnamese commercial banks for 2012-2022 and taking advantage of quantile regression, this paper has obtained exciting results on the impact of uncertain macro factors such as GDP growth, money supply M2, and inflation rate on bank stability. For banks with low stability, GDP growth further reduces stable of the bank. However, for banks with high stability, GDP growth uncertainty has an insignificant impact on their stabilization. Money supply uncertainty affects banking stability with similar results to GDP growth uncertainty. Inflationary uncertainty negatively affects the bank's stability in almost all levels of stabilization, except for banks with deficient levels of stability where inflation uncertainty is not an influencing factor.

The research results suggest solutions for bank managers to enhance financial efficiency and increase stability. Once bank stability is high, the negative impact of GDP growth and M2 money supply volatility will not be a concern. The macro policy management agency needs to control the money supply (M2) for the economy as planned. The State Bank must flexibly use monetary policy management tools to control the money supply to the economy, such as credit lines, open market operations, refinancing interest rates, exchange rates, and reserve requirements. In particular, the State Bank should prioritize the open market operation tool because it can promote the direct effect and quickly reverse the liquidity of the banking system and the money supply in the economy. Stabilizing the money supply helps to stabilize inflation. At the same time, fiscal policy coordinate with monetary policy in stabilizing the value of money to stabilize inflation. Government spending on public investment needs to be coordinated and planned in line with the State Bank's monetary policy direction. Unstable economic growth harms the stability of the banking system. To stabilize economic growth, the government must implement policies encouraging enterprises to diversify export markets and institutional reforms to attract more large investment groups abroad. The corporate bond and stock markets should also be encouraged to help businesses diversify long-term funding and avoid relying too much on the banking system, thereby reducing systemic risks for banks and increasing stabilization of banks.

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