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UNCERTAINTY AND BANK FUNDING LIQUIDITY RISK IN VIETNAM

ABSTRACT: *This paper examines the impact of uncertainty on bank funding liquidity risk. Based on a sample of Vietnamese commercial banks from 2007 to 2019, we show evidence that micro uncertainty in the banking sector leads to higher funding liquidity risk, as proxied by lower deposit ratios. Additional analyses reveal that this nexus widely depends on bank heterogeneity. More precisely, various bank-specific forces that improve banks' financial strength (i.e., an increase in bank return, loan quality, capitalization, liquid assets, and bank size) tend to mitigate the adverse impact of uncertainty on bank funding liquidity risk. Our findings are robust to changes in multiple combinations of regressors, different key bank-level variables to calculate the dispersion of shocks as banking uncertainty measures, and alternative econometric approaches.*

KEY WORDS: *bank deposits, bank-specific characteristics, dynamic models, funding liquidity risk, uncertainty*

JEL CLASSIFICATION: D81, E50, G21, G32

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1. INTRODUCTION

Uncertainty has become a topic of great interest for academics and policymakers, especially since the 2008 global crisis. Accordingly, many harmful consequences of uncertainty have been found, from cutting investment/consumption and increasing unemployment (Aaberge et al., 2017; Caggiano et al., 2017; Drobetz et al., 2018; Gulen & Ion, 2016; Yizhong Wang et al., 2014) to reducing gross national product (Baker et al., 2016; Bloom et al., 2018). Notably, existing studies in the banking literature have also shown adverse effects of uncertainty. For example, in the context of uncertainty, banks are more likely to lose market values (He & Niu, 2018), take on more risk (Chi & Li, 2017; Karadima & Louri, 2021; Wu et al., 2020), experience higher financial instability (Bilgin et al., 2021; Phan et al., 2021), and restraint loan growth (Bordo et al., 2016; Buch et al., 2015; Danisman et al., 2020; Hu & Gong, 2019; Valencia, 2017).

In two recent empirical papers, Berger et al. (2020) and Ashraf (2020) have explored changes in banks' liquidity hoarding behaviours in response to uncertainty shocks. Berger et al. (2020) concentrate on all liquid banking items on and off the balance sheets of US banks, while Ashraf (2020) examines banks' pure liquid asset holdings in 21 major countries, in an identical effort to link economic policy uncertainty with bank liquidity hoarding. They conclude that banks hold more liquidity – with the main emphasis on increased asset liquidity – as a precautionary motive to protect themselves against increased risks of liquidity shortages and funding difficulties that might occur as a result of uncertainty.

Overall, although there has been much analysis of the impact of uncertainty on the banking sectors, some even highlighting bank asset liquidity, the existing literature exploring bank funding liquidity risk in the face of uncertainty is still limited. Funding liquidity has a special role in providing funds that allow banks to repay their due liabilities. Funding liquidity risk describes the inability of a bank to acquire funds as needed with efficiency (Dahir et al., 2018). It can also be defined as a bank's failure to settle obligations immediately (Drehmann & Nikolaou, 2013). While asset liquidity risk relates to the asset side of banks' balance sheets, funding liquidity risk deals with the liability side. Funding liquidity risk is regarded as a critical factor that leads to bank runs (Drehmann & Nikolaou, 2013). Problematic deposit-taking exposes banks to funding liquidity

risks that may predict bank runs (Diamond & Dybvig, 1983). In addition, funding liquidity risk, as denoted by lower deposit ratios, is expected to hamper bank lending activities (Acharya & Naqvi, 2012; Ivashina & Scharfstein, 2010). Therefore, understanding how bank funding liquidity risk reacts to uncertainty is extremely important. In this paper, we fill a gap in the literature by testing whether bank funding liquidity risk is sensitive to a high level of uncertainty.

Uncertainty is expected to influence bank funding liquidity risk through competing routes. On the one hand, in a period of high uncertainty, banks are seen as 'safe shelters' for depositors' assets due to deposit insurance and government guarantees that encourage investors to prefer bank deposits to other investment opportunities (Gatev & Strahan, 2006). When this mechanism dominates, banks can raise more deposits and avoid funding liquidity risk in times of heightened uncertainty. On the other hand, depositors may demand greater deposit rates as a risk premium when they face adverse shocks in uncertain times (Pástor & Veronesi, 2012). If banks cannot afford this demand they are forced to cut their core funds, and thus suffer greater funding liquidity risk. Overall, we could expect the impact of uncertainty on bank funding liquidity risk to be theoretically ambiguous: an increase in uncertainty can lead to a decrease or an increase in bank funding liquidity risk. This ambiguity makes this link an interesting empirical topic to be explored.

Within this framework, we explore the impact of uncertainty on bank funding liquidity risk in the panel dataset of Vietnamese commercial banks for the period 2007–2019. Following most prior studies on bank funding liquidity risk, we proxy it via the ratio of deposits to total assets, greater deposits indicating lower funding liquidity risk. While previous papers have looked at aggregate uncertainty (i.e., economic policy uncertainty) or its subcomponents (e.g., monetary uncertainty or financial uncertainty) (see Al-Thaqeb and Algharabali 2019 for a thorough review), our work considers the uncertainty aspect associated explicitly with the banking sector (Buch et al., 2015). The use of this micro measure which directly displays the uncertainty level in banking could constitute an outstanding supplement to the existing literature on the link between uncertainty and bank activities. Moreover, computation of a banking uncertainty measure based on the cross-sectional dispersion of shocks to bank-level variables may yield multiple advantages. Typically, and unlike market-based measures, it does not demand

market data with a high frequency (Buch et al., 2015), and unlike text-based uncertainty proxies it does not face vulnerability in assuring the reliability and accuracy of newspapers (Baker et al., 2016). In line with Buch et al. (2015), we consider the dispersion of shocks to key bank-level variables, including total assets, short-term funding, and bank profitability. These alternative variables strengthen the conclusions of the paper.

In analysing the impact of uncertainty on funding liquidity risk, we further focus on the different responses of heterogeneous banks. The fact that uncertainty is a common factor to all banks in the same market implies that heterogeneous banks, associated with different financial strengths and bank-specific characteristics, may be driven more or less by uncertainty. Such heterogeneity in banks' reaction to uncertainty could tell us more about the underlying mechanisms behind the impact under investigation. This idea has been well documented in the related literature on the nexus between uncertainty and bank lending. Many studies have shown that this link is extensively moderated by bank capital (Bordo et al., 2016; Buch et al., 2015; Valencia, 2017), asset liquidity (Bordo et al., 2016; Buch et al., 2015; Valencia, 2017), bank size (Bordo et al., 2016), bank risk (Hu & Gong, 2019; Nguyen et al., 2020), and bank profitability (Nguyen et al., 2020). Moreover, in another well-established literature strand on how bank lending responds to monetary shocks, multiple authors consistently claim that banks with weak balance sheets are more sensitive to monetary shocks because of their limited access to alternative funding (e.g., Kashyap & Stein, 1995; Kishan & Opiela, 2000). Therefore, it is of interest to explore the evolution of bank-specific characteristics that shape the link between uncertainty and funding liquidity risk. We do this by empirically interacting uncertainty with a rich set of key bank-specific variables inspired by the existing literature, including bank credit risk, bank return, capitalization, asset liquidity, and bank size.

As a prominent representative of emerging economies, Vietnam offers favourable characteristics for conducting the analysis. Due to the absence of advanced financial instruments to absorb risk, the unfavourable effects of uncertainty may be more completely exposed in emerging markets (Nguyen et al., 2020). Moreover, Vietnam's financial sector depends extensively on the banking system, which plays a vital role in fuelling economic growth (Dang & Dang, 2020). Thus, any excessive funding liquidity risk in Vietnamese banks is more likely to produce

detrimental consequences than in less bank-dependent markets. In recent years, banking uncertainty in Vietnam has experienced a period of sizable fluctuation as a result of multiple forces, such as the 2008 global financial crisis, the bad debt boom in 2012, and even the continuous policy reforms to upgrade the banking system's risk management to international standards (Batten & Vo, 2019). The banking reforms have strongly influenced and significantly modified most of the banks in the system, leading to an important divergence in bank-specific characteristics across individual banks (Dang & Huynh, 2021).

Our paper contributes to the understanding of how uncertainty affects bank operations. We introduce the first evaluation of the impact of uncertainty on bank funding liquidity risk. The theory offers conflicting predictions about how uncertainty drives bank funding liquidity risk; however, to date no empirical analysis has been performed to directly shed light on this link. We also aim to understand the underlying mechanism behind the relationship between uncertainty and funding liquidity risk by exploring how this relationship depends on bank-specific characteristics. We do this by interacting uncertainty with a wide range of bank variables in order to target the right group of banks in the specific contexts. In addition, we conduct our regressions using advanced econometric approaches that work well for dynamic panel models; namely, the generalized method of moments (GMM) estimator and the least squares dummy variable corrected (LSDVC) technique. These estimation methods deal effectively with potential endogeneity and small sample bias, as witnessed in this study. We thereby contribute to a growing body of empirical research that makes use of both GMM and LSDVC regressions as perfect complements (Bogliacino et al., 2012; Boukhatem & Djelassi, 2020; Dahir et al., 2019; Yiwei Wang et al., 2019).

The rest of the paper is organised as follows. Section 2 introduces the methodology and data employed for the empirical analysis. Section 3 presents the main estimation results and robustness checks. Finally, section 4 concludes the paper with relevant implications and future research directions.

2. EMPIRICAL METHODOLOGY AND DATA

2.1 Empirical methodology

We explore the impact of uncertainty on bank funding liquidity risk by regressing the baseline model specification as follows:

$$FLR_{i,t} = \alpha_0 + \alpha_1 \times FLR_{i,t-1} + \alpha_2 \times Uncertainty_{t-1} + \alpha_3 \times BC_{i,t-1} + \alpha_4 \times MC_{t-1} + \varepsilon_{i,t} \quad (1)$$

where *i* is a bank, and *t* denotes a year. The dependent variable FLR is the ratio of total deposits to total assets. In line with many previous papers (Acharya & Naqvi, 2012; Dahir et al., 2019; Khan et al., 2017; Rokhim & Min, 2018; Smaoui et al., 2020), we understand banks with more deposits as banks that have less funding liquidity risk. We insert the lagged dependent variable as an important regressor, since bank funding liquidity risk is likely influenced by its past value. The independent variable of primary interest is *Uncertainty*. To better explain bank funding liquidity risk, we allow for various controls (Hoque & Pour, 2018; Umar & Sun, 2016). *BC* is a set of bank-level controls, including bank return (the return-on-asset ratio), bank credit risk (the ratio of loan loss provisions to gross loans), capital (the equity-to-asset ratio), asset liquidity (the ratio of liquid assets to total assets), and bank size (the natural logarithm of total assets). *MC* is a vector of macroeconomic controls, containing policy rates (refinancing rates established by the central bank) and economic cycles (the annual change in GDP). $\varepsilon_{i,t}$ is the error term. We lag all independent variables to reduce reverse-causality problems and emphasize lagged bank responses.

We estimate the above dynamic model using the two-step system GMM estimator (Arellano & Bover, 1995; Blundell & Bond, 1998). This technique effectively addresses endogeneity issues via the lags of regressors employed as instruments. To validate the GMM regression, we need to limit the number of instruments created (Roodman, 2009) and rely on some diagnostic tests. All of them are carefully described when we report the estimation results.

As mentioned previously, in this paper we utilize bank-level data that carries information regarding banking-market-specific uncertainty. Consistent with Buch et al. (2015), the uncertainty in banking is captured by the cross-sectional dispersion of shocks to assets, short-term funding, and bank profitability. To

obtain such dispersion, we start with the following equation to predict bank-year-specific shocks for each of our key bank-level variables:

$$X_{i,t} = \alpha_i + \beta_t + \varepsilon_{i,t} \tag{2}$$

where $X_{i,t}$ is the bank-level variable selected (total asset growth rate, short-term funding growth rate, and profitability level, separately) for bank *i* at year *t*. The use of all three bank-level variables at the same time helps strengthen the robustness of our work. α_i is bank fixed effects, and β_t is time fixed effects. The residual component $\varepsilon_{i,t}$ is a shock estimation, which is then used in the second step to obtain the cross-sectional dispersion across all bank-specific shocks. Concretely, the standard deviation (*SD*) of the residuals is employed to form the uncertainty measure for the entire banking system in year *t* as follows:

$$Uncertainty_t = SD(\varepsilon_{i,t}) \tag{3}$$

Our uncertainty measure in the banking sector could serve as a good proxy for micro uncertainty stemming from noisy private signals, which is close in spirit to that applied for manufacturing firms by Bloom et al. (2018). Prior authors claim that the cross-sectional dispersion of US firm-level features reveals idiosyncratic differences in information signals across firms.

We go a step further in analysing the effect of uncertainty on bank funding liquidity risk by testing whether the effect is strengthened or weakened under particular conditions. To this end, we reformulate our baseline model as follows:

$$\begin{aligned} FLR_{i,t} = {} & \alpha_0 + \alpha_1 \times FLR_{i,t-1} + \alpha_2 \times Uncertainty_{t-1} + \alpha_3 \times Uncertainty_{t-1} \times BC_{i,t-1} \\ & + \alpha_4 \times BC_{i,t-1} + \alpha_5 \times MC_{t-1} + \varepsilon_{i,t} \end{aligned} \tag{4}$$

where *BC* captures multiple aspects of bank-specific characteristics, as elaborated earlier. The coefficients on the interaction term $Uncertainty \times BC$ indicate whether the effect of uncertainty on bank funding liquidity risk depends on bank heterogeneity. Our approach in this regard sheds light on how uncertainty is translated into bank funding liquidity risk.

2.2 Data

We collected bank-level data from the annual financial reports of 31 commercial banks in Vietnam for the period 2007–2019, subject to data availability. We only kept in our sample the banks that published more than four consecutive years of data. Banks with missing data for the main variables were also eliminated. Apart from bank-level data, we sourced macroeconomic data from the World Development Indicators and the State Bank of Vietnam.

Table 1 displays the summary statistics of our sample. The deposits-to-assets ratio has a mean of 64.05%, implying that on average the deposits of the sample banks equal 64.05% of their total assets. The statistical distributions via the extreme values and the standard deviations of uncertainty measures suggest a substantial fluctuation in uncertainty in the banking system over the years. Other variables also possess considerable volatility.

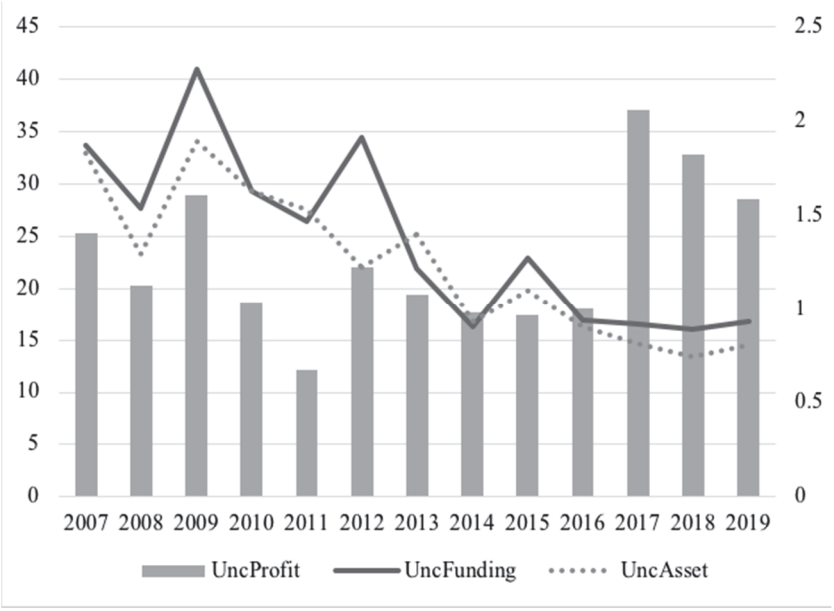
Table 1: Statistics summary

	Mean	Standard deviation	Min	Max
Bank-level characteristics				
Funding liquidity	64.05	13.75	33.22	88.19
Return	1.570	0.868	0.171	3.769
Provision	0.959	0.703	0.035	2.806
Capital	9.984	4.741	4.464	23.831
Asset liquidity	17.347	9.777	5.168	42.289
Size	32.015	1.249	29.879	34.573
Uncertainty measures and macroeconomic factors				
UncAsset	21.936	6.747	13.427	34.091
UncFunding	24.226	7.890	15.995	40.931
UncProfit	1.273	0.386	0.674	2.058
Policy rate	8.021	2.536	6.000	15.000
Economic cycle	6.245	0.640	5.247	7.130

Note: Table 1 summarizes the distribution of all used variables. The sample comprises 31 Vietnamese commercial banks and 383 observations from 2007– 2019. *Funding liquidity* is the ratio of deposits to total assets (%). *Return* is the return-on-asset ratio (%). *Provision* is the ratio of loan loss provisions to gross loans (%). *Capital* is the equity-to-asset ratio (%). *Asset liquidity* is the ratio of liquid assets to total assets (%). *Size* is the natural logarithm of total assets. *UncAsset, UncFunding,* and *UncProfit* are the uncertainty measures for the banking system, calculated by estimating the dispersion of bank shocks to assets, short-term funding, and profitability, respectively. *Policy rate* captures refinancing rates established by the central bank (%). *Economic cycle* reflects the annual change in GDP (%).

Figure 1 displays the changes in uncertainty levels over the years 2007–2019. Asset and funding uncertainty and profitability uncertainty reached their all-time high in 2009. After 2009 the trend of all three uncertainty proxies was downward as a whole, implying a decrease in the level of uncertainty in Vietnam. Interestingly, profitability uncertainty exhibited a slightly different pattern compared to asset and funding uncertainty.

Figure 1: Changes in uncertainty levels, 2007–2019



3. ESTIMATION RESULTS

3.1 Baseline results

Table 2 presents our baseline results for the association between uncertainty and bank funding liquidity risk. As a robustness check, columns 1–3 report the results without macroeconomic factors, while columns 4–6 extend the model by incorporating macroeconomic factors. Alternative measures of uncertainty in banking are also employed. The diagnostic tests (Hansen and AR(1)/AR(2)) and the number of instruments reported ensure that the two-step system GMM estimation is valid to determine the link between uncertainty and bank funding liquidity risk.

Table 2: Baseline regressions

	(1) UncAsset	(2) UncFunding	(3) UncProfit	(4) UncAsset	(5) UncFunding	(6) UncProfit
Lagged dependent variable	0.570***	0.545***	0.616***	0.674***	0.686***	0.708***
	(0.032)	(0.032)	(0.029)	(0.044)	(0.046)	(0.042)
Uncertainty	–0.320***	–0.202***	–2.549***	–0.110***	–0.172***	–1.796***
	(0.058)	(0.033)	(0.383)	(0.035)	(0.039)	(0.447)
Return	–2.175***	–1.866***	–2.583***	–2.788***	–2.415***	–3.086***
	(0.456)	(0.379)	(0.234)	(0.312)	(0.331)	(0.292)
Provision	0.958**	1.443***	1.514***	1.391***	1.325***	1.528***
	(0.441)	(0.403)	(0.389)	(0.324)	(0.336)	(0.303)
Capital	0.482***	0.124	0.122	0.230***	0.201**	0.290***
	(0.167)	(0.081)	(0.076)	(0.084)	(0.086)	(0.104)
Asset liquidity	0.158***	0.071*	0.056	0.055	0.079	0.053
	(0.040)	(0.040)	(0.041)	(0.044)	(0.055)	(0.042)
Size	4.105***	2.285***	2.470***	2.324***	2.167***	2.468***
	(0.797)	(0.353)	(0.262)	(0.299)	(0.375)	(0.360)
Policy rate				0.693***	0.713***	0.551***
				(0.123)	(0.123)	(0.116)
Economic cycle				1.641***	1.069***	2.097***
				(0.259)	(0.299)	(0.317)
Constant	–100.720***	–38.634***	–49.556***	–65.678***	–56.906***	–74.605***
	(27.591)	(10.978)	(9.155)	(8.301)	(9.959)	(9.854)
Observations	352	352	352	352	352	352
Banks	31	31	31	31	31	31
Instruments	26	26	26	28	28	28
AR(1) test	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) test	0.115	0.289	0.261	0.605	0.550	0.451
Hansen test	0.131	0.116	0.105	0.124	0.123	0.129

Note: The table presents results from estimating the baseline model using two-step GMM. The dependent variable is the ratio of deposits to total assets (reverse funding liquidity risk). Uncertainty measures employed in each regression (including *UncAsset, UncFunding,* and *UncProfit*) are shown at the top of each column. Standard errors are given in parentheses. Diagnostic tests are displayed with p-values. ***, **, and * indicate significance at the 1%, 5%, and 10% level respectively.

Across all regressions, we observe that the coefficient on uncertainty, our primary variable of interest, is negative and statistically significant. Given that banks with greater deposits have lower funding liquidity risk and the deposit ratio is our dependent variable, our result suggests that banks tend to engage in higher funding liquidity risk in periods of uncertainty in the banking sector. This linkage is also economically significant. For instance, a standard deviation increase of 1 in the uncertainty measure (6.747 for *UncAsset*, 7.890 for *UncFunding*, or 0.386 for *UncProfit*) is associated with a drop in the deposit ratio of 2.159 (6.747*0.320, column 1), 1.594 (7.890*0.202, column 2), or 0.984 (0.386*2.549, column 3) percentage points, respectively. Such changes are reasonable given that the mean value of the deposit ratio is 64.05%.

In sum, our finding shows that bank funding liquidity deteriorates with banking uncertainty. This evidence is consistent with the argument that due to the greater adverse shocks in periods of uncertainty, depositors may require higher funding premiums from their banks, which leads to an increase in funding costs and a potential decrease in the amount of deposits that banks obtain (Pástor & Veronesi, 2012). Our evidence is the first in the literature on the uncertainty–banking institutions nexus to indicate the linkage between uncertainty and bank funding liquidity risk.

3.2 Heterogeneity across banks

As discussed earlier in the paper, banks with different characteristics, such as bank size, capitalization, asset liquidity, and risk-return profiles, may respond differently to uncertainty shocks. In this section we shed light on this possibility by expanding the baseline model with interaction terms between uncertainty and various bank-specific characteristics. Before considering the results for the interaction terms of main interest reported in Tables 3–7, we should pay attention to results from the standalone uncertainty measures, which consistently indicate negative and significant signs. This pattern implies that the adverse impact of uncertainty on bank funding liquidity risk firmly holds.

Table 3 reports the funding liquidity risk regression results highlighting the interaction term between uncertainty and bank return, *Uncertainty*Return*. All coefficients on the interaction term are positive and statistically significant. The significantly negative coefficient on the standalone uncertainty measure, which is

opposite to those observed for the interaction term, shows that bank return introduces a mitigating effect on the association between uncertainty and bank funding liquidity risk. In other words, more profitable banks are likely to suffer less funding liquidity risk than their less profitable peers if the dispersion of shocks to critical bank-level variables surges. Next, Table 4 presents estimates of the interaction term between uncertainty and bank credit risk, captured by loan loss provisions. Interestingly, we observe negative and significant coefficients on estimates of the interaction *Uncertainty*Provision*. In contrast to the positive interaction estimate witnessed for bank return above, this negative estimate suggests that bank credit risk boosts the link between uncertainty and bank funding liquidity risk. In other words, amid uncertainty a deterioration in a bank's asset portfolio quality tends to increase the funding liquidity risk more than an improvement.

Table 3: Augmented regressions with the moderating role of bank return

	(1) UncAsset	(2) UncFunding	(3) UncProfit	(4) UncAsset	(5) UncFunding	(6) UncProfit
Lagged dependent variable	0.493***	0.429***	0.448***	0.670***	0.676***	0.608***
	(0.030)	(0.043)	(0.049)	(0.040)	(0.046)	(0.055)
Uncertainty	–0.650***	–0.298***	–2.372***	–0.581***	–0.636***	–17.905***
	(0.107)	(0.075)	(0.902)	(0.150)	(0.169)	(3.416)
Uncertainty*Return	0.297***	0.078***	1.382***	0.308***	0.351***	11.487***
	(0.063)	(0.026)	(0.500)	(0.082)	(0.096)	(2.580)
Return	–9.823***	–11.013***	–11.306***	–10.982***	–13.892***	–20.178***
	(1.466)	(1.284)	(1.237)	(1.996)	(2.632)	(3.898)
Provision	2.315***	1.985***	1.818***	2.389***	2.830***	2.746***
	(0.410)	(0.301)	(0.296)	(0.289)	(0.309)	(0.515)
Capital	0.130*	0.588***	0.507***	0.273**	0.371***	0.237*
	(0.077)	(0.087)	(0.089)	(0.114)	(0.118)	(0.128)
Asset liquidity	0.063**	0.104**	0.069	0.074**	0.093**	0.000
	(0.026)	(0.044)	(0.045)	(0.032)	(0.043)	(0.048)
Size	2.790***	4.708***	4.840***	2.788***	3.056***	2.630***
	(0.402)	(0.466)	(0.415)	(0.371)	(0.458)	(0.369)
Policy rate				0.783***	0.972***	1.117***
				(0.135)	(0.146)	(0.185)
Economic cycle				1.533***	1.818***	2.992***
				(0.311)	(0.360)	(0.266)
Constant	–41.197***	–100.856***	–108.526***	–70.163***	–79.797***	–59.408***
	(12.579)	(14.166)	(11.158)	(12.487)	(13.422)	(13.219)
Observations	352	352	352	352	352	352
Banks	31	31	31	31	31	31
Instruments	27	27	27	29	29	29
AR(1) test	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) test	0.380	0.626	0.416	0.514	0.364	0.257
Hansen test	0.194	0.361	0.377	0.198	0.106	0.144

Note: Table 3 presents results from estimating the augmented model using two-step GMM. The dependent variable is the ratio of deposits to total assets (reverse funding liquidity risk). Uncertainty measures employed in each regression (including *UncAsset, UncFunding,* and *UncProfit*) are shown at the top of each column. Standard errors are given in parentheses. Diagnostic tests are displayed with p-values. ***, **, and * indicating significance at the 1%, 5%, and 10% levels respectively.

Table 4: Augmented regressions with the moderating role of bank credit risk

	(1) UncAsset	(2) UncFunding	(3) UncProfit	(4) UncAsset	(5) UncFunding	(6) UncProfit
Lagged dependent variable	0.547***	0.485***	0.606***	0.699***	0.706***	0.722***
	(0.027)	(0.035)	(0.029)	(0.043)	(0.053)	(0.049)
Uncertainty	–0.083	–0.188***	–1.315***	–0.081**	–0.140***	–1.495***
	(0.056)	(0.037)	(0.456)	(0.036)	(0.033)	(0.487)
Uncertainty*Provisio n	–0.237***	–0.086***	–1.128***	–0.117***	–0.160***	–0.894***
	(0.053)	(0.021)	(0.330)	(0.041)	(0.038)	(0.326)
Return	–2.132***	–2.493***	–4.324***	–2.710***	–2.235***	–3.077***
	(0.378)	(0.242)	(0.457)	(0.388)	(0.404)	(0.398)
Provision	8.767***	1.931***	9.282***	1.703***	4.923***	1.718***
	(1.161)	(0.442)	(0.775)	(0.363)	(0.978)	(0.299)
Capital	0.082	0.161*	0.119	0.329***	0.152	0.293**
	(0.102)	(0.097)	(0.113)	(0.097)	(0.115)	(0.122)
Asset liquidity	0.108***	–0.073	0.156***	0.057	0.106*	0.025
	(0.039)	(0.046)	(0.045)	(0.042)	(0.059)	(0.049)
Size	1.790***	2.900***	1.519***	2.653***	1.969***	2.500***
	(0.284)	(0.338)	(0.278)	(0.306)	(0.489)	(0.415)
Policy rate				0.849***	0.994***	0.615***
				(0.122)	(0.152)	(0.132)
Economic cycle				1.412***	1.079***	2.161***
				(0.344)	(0.332)	(0.330)
Constant	–28.440***	–50.722***	–25.248**	–77.420***	–55.321***	–76.554***
	(10.840)	(11.444)	(10.322)	(8.742)	(16.202)	(14.115)
Observations	352	352	352	352	352	352
Banks	31	31	31	31	31	31
Instruments	27	27	27	29	29	29
AR(1) test	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) test	0.219	0.325	0.205	0.393	0.493	0.415
Hansen test	0.194	0.177	0.381	0.135	0.140	0.174

Note: Table 4 presents results from estimating the augmented model using two-step GMM. The dependent variable is the ratio of deposits to total assets (reverse funding liquidity risk). Uncertainty measures employed in each regression (including *UncAsset, UncFunding,* and *UncProfit*) are shown at the top of each column. Standard errors are given in parentheses. Diagnostic tests are displayed with p-values. ***, **, and * indicate significance at the 1%, 5%, and 10% levels respectively.

In addition to return-risk profiles, other standard bank-level factors also matter. Table 5 displays the effect of banking uncertainty on funding liquidity risk, conditional on banks' capital ratio. The interaction term *Uncertainty*Capital* is positive and significant in most columns, implying that given an increase in uncertainty, the funding liquidity risk of better-capitalized banks increases less. In uncertain periods, these better-capitalized banks can partially shield their funding liquidity against shocks. Similarly, in Table 6, the coefficient of the interaction term *Uncertainty*Asset liquidity* is positive and statistically significant in most columns, confirming that when uncertainty in the banking sector is high, banks hoarding more liquid assets may experience a smaller decline in deposits than banks with less liquid assets. Finally, we examine whether bank size can alter the adverse effect of uncertainty on bank funding liquidity risk. Consistently, our results show that the estimate for the interaction term *Uncertainty*Size* in Table 7 is positive and highly significant, suggesting that funding liquidity risk is less pronounced in larger banks during times of high uncertainty.

Table 5: Augmented regressions with the moderating role of bank capital

	(1) UncAsset	(2) UncFunding	(3) UncProfit	(4) UncAsset	(5) UncFunding	(6) UncProfit
Lagged dependent variable	0.585***	0.613***	0.634***	0.780***	0.804***	0.782***
	(0.029)	(0.026)	(0.031)	(0.041)	(0.042)	(0.045)
Uncertainty	–0.382***	–0.194***	–4.994***	–0.514***	–0.395***	–5.323***
	(0.043)	(0.036)	(0.674)	(0.054)	(0.047)	(0.695)
Uncertainty*Capital	0.005*	0.017***	0.591***	0.007**	0.013***	0.462***
	(0.003)	(0.004)	(0.075)	(0.003)	(0.003)	(0.074)
Return	–1.888***	–2.676***	–3.319***	–2.335***	–2.610***	–3.555***
	(0.386)	(0.362)	(0.347)	(0.299)	(0.235)	(0.315)
Provision	1.225***	1.438***	1.333***	0.850**	0.967***	1.127***
	(0.445)	(0.507)	(0.495)	(0.342)	(0.345)	(0.384)
Capital	0.192*	–0.046	–0.157	0.250*	0.108	0.005
	(0.104)	(0.084)	(0.097)	(0.133)	(0.119)	(0.114)
Asset liquidity	0.125***	0.067*	0.086**	0.179***	0.154***	0.082*
	(0.035)	(0.037)	(0.038)	(0.045)	(0.030)	(0.045)
Size	2.640***	2.931***	3.356***	2.409***	2.425***	2.963***
	(0.263)	(0.271)	(0.284)	(0.447)	(0.477)	(0.382)
Policy rate				1.013***	1.213***	0.703***
				(0.118)	(0.164)	(0.123)
Economic cycle				0.100	1.633***	1.950***
				(0.271)	(0.251)	(0.275)
Constant	–51.974***	–64.999***	–79.466***	–64.129***	–78.262***	–93.113***
	(10.080)	(10.136)	(10.386)	(14.305)	(13.621)	(11.431)
Observations	352	352	352	352	352	352
Banks	31	31	31	31	31	31
Instruments	27	27	27	29	29	29
AR(1) test	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) test	0.159	0.178	0.226	0.160	0.296	0.387
Hansen test	0.132	0.111	0.106	0.130	0.142	0.154

Note: Table 5 presents results from estimating the augmented model using two-step GMM. The dependent variable is the ratio of deposits to total assets (reverse funding liquidity risk). Uncertainty measures employed in each regression (including *UncAsset, UncFunding,* and *UncProfit*) are shown at the top of each column. Standard errors are given in parentheses. Diagnostic tests are displayed with p-values. ***, **, and * indicate significance at the 1%, 5%, and 10% levels respectively.

Table 6: Augmented regressions with the moderating role of bank asset liquidity

	(1) UncAsset	(2) UncFunding	(3) UncProfit	(4) UncAsset	(5) UncFunding	(6) UncProfit
Lagged dependent variable	0.545***	0.508***	0.490***	0.813***	0.635***	0.615***
	(0.026)	(0.044)	(0.029)	(0.055)	(0.058)	(0.040)
Uncertainty	–0.300***	–0.190***	–13.588***	–0.353***	–0.146***	–13.274***
	(0.064)	(0.038)	(0.899)	(0.078)	(0.046)	(1.009)
Uncertainty*Asset liquidity	0.007***	0.006***	0.949***	0.010***	0.003	0.835***
	(0.001)	(0.001)	(0.059)	(0.003)	(0.002)	(0.076)
Return	–1.921***	–6.884***	–2.483***	–4.757***	–8.993***	–2.955***
	(0.456)	(1.250)	(0.261)	(0.897)	(0.811)	(0.374)
Provision	4.180***	4.038***	1.306***	8.106***	6.002***	1.480***
	(0.965)	(1.053)	(0.402)	(1.399)	(1.016)	(0.400)
Capital	0.258**	0.601***	–0.045	0.257	0.848***	0.157
	(0.125)	(0.219)	(0.074)	(0.290)	(0.200)	(0.104)
Asset liquidity	0.351***	0.289***	1.155***	-0.122	0.094	0.971***
	(0.031)	(0.105)	(0.066)	(0.101)	(0.086)	(0.081)
Size	1.022**	3.559***	2.414***	0.296	4.136***	2.556***
	(0.425)	(0.690)	(0.315)	(1.177)	(0.314)	(0.375)
Policy rate				1.290***	0.327	0.350***
				(0.133)	(0.219)	(0.123)
Economic cycle				1.937***	1.711***	2.386***
				(0.468)	(0.480)	(0.383)
Constant	3.061	–74.222***	–23.135**	–16.619	–121.276***	–55.951***
	(15.197)	(24.434)	(10.863)	(41.559)	(11.616)	(9.641)
Observations	352	352	352	352	352	352
Banks	31	31	31	31	31	31
Instruments	27	27	27	29	29	29
AR(1) test	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) test	0.171	0.637	0.191	0.163	0.816	0.255
Hansen test	0.136	0.149	0.155	0.181	0.191	0.148

Note: Table 6 presents results from estimating the augmented model using two-step GMM. The dependent variable is the ratio of deposits to total assets (reverse funding liquidity risk). Uncertainty measures employed in each regression (including *UncAsset, UncFunding,* and *UncProfit*) are shown at the top of each column. Standard errors are given in parentheses. Diagnostic tests are displayed with p-values. *** and ** indicate significance at the 1% and 5% levels respectively.

Table 7: Augmented regressions with the moderating role of bank size

	(1) UncAsset	(2) UncFunding	(3) UncProfit	(4) UncAsset	(5) UncFunding	(6) UncProfit
Lagged dependent variable	0.536***	0.590***	0.634***	0.679***	0.711***	0.699***
	(0.029)	(0.036)	(0.037)	(0.043)	(0.050)	(0.051)
Uncertainty	–4.837***	–5.522***	–74.585***	–3.445*	–4.686***	–50.450**
	(0.500)	(0.561)	(14.036)	(1.818)	(1.328)	(23.204)
Uncertainty*Size	0.145***	0.167***	2.223***	0.105*	0.142***	1.498**
	(0.016)	(0.017)	(0.427)	(0.057)	(0.041)	(0.712)
Return	–1.621***	–1.384***	–2.447***	–2.504***	–2.083***	–2.834***
	(0.367)	(0.420)	(0.248)	(0.530)	(0.514)	(0.469)
Provision	1.135***	0.943**	1.531***	1.125***	0.994***	1.577***
	(0.428)	(0.436)	(0.390)	(0.381)	(0.372)	(0.328)
Capital	0.085	0.151*	0.063	0.251***	0.230**	0.203
	(0.086)	(0.086)	(0.080)	(0.087)	(0.101)	(0.127)
Asset liquidity	0.070*	0.088*	0.069	0.065	0.083	0.056
	(0.037)	(0.046)	(0.047)	(0.043)	(0.058)	(0.049)
Size	–0.970*	1.911***	–0.551	0.020	–1.401	0.340
	(0.538)	(0.676)	(0.742)	(1.459)	(1.332)	(1.224)
Policy rate				0.617***	0.646***	0.464***
				(0.131)	(0.124)	(0.134)
Economic cycle				1.842***	1.350***	1.857***
				(0.270)	(0.340)	(0.343)
Constant	65.954***	91.644***	47.140**	6.549	53.254	–2.613
	(17.622)	(20.334)	(22.365)	(48.002)	(41.641)	(41.017)
Observations	352	352	352	352	352	352
Banks	31	31	31	31	31	31
Instruments	27	27	27	29	29	29
AR(1) test	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) test	0.632	0.485	0.404	0.755	0.754	0.543
Hansen test	0.113	0.123	0.112	0.129	0.125	0.126

Note: Table 7 presents results from estimating the augmented model using two-step GMM. The dependent variable is the ratio of deposits to total assets (reverse funding liquidity risk). Uncertainty measures employed in each regression (including *UncAsset, UncFunding,* and *UncProfit*) are shown at the top of each column. Standard errors are given in parentheses. Diagnostic tests are displayed with p-values. ***, **, and * indicate significance at the 1%, 5%, and 10% levels respectively.

Overall, the estimation results in Tables 3–7 reveal that an increase in bank return, capitalization, asset liquidity, and bank size may help alleviate the link between uncertainty and bank funding liquidity risk, while an increase in bank credit risk tends to exacerbate the detrimental effect of uncertainty. All of our results remain unchanged when alternative uncertainty measures are used and a series of different regressors are included. Overall, our findings show that in Vietnam, stronger banks may be less affected by the dispersion of bank shocks. In this regard, the funding liquidity risk of the more profitable, less risky, better capitalized, more liquid, and larger banks in periods of high uncertainty will be smaller. Market participants underestimate financially weaker banks (Jayaratne & Morgan, 2000). Consequently, depositors may realize greater adverse shocks when involved with these banks and therefore demand a much greater funding premium during times of high uncertainty, which may amplify the funding liquidity risk. Our results are broadly in line with the literature showing that banks with weak balance sheets are more subject to macroeconomic shocks due to their more limited funding access (Kashyap & Stein, 1995; Kishan & Opiela, 2000). All in all, our findings with conditional patterns shed light on the potential mechanism through which uncertainty drives bank funding liquidity risk.

3.3 Robustness tests

Thus far, our findings are not sensitive to different uncertainty measures and different sets of regressors. However, a sensitivity check with an alternative econometric technique needs to be conducted, as the recent literature claims that the GMM estimator may work poorly when the data panel is small (Bogliacino et al., 2012; Boukhatem & Djelassi, 2020), as in our case. To solve this problem, we re-estimate our dynamic models using the LSDVC approach, which is proven to be highly effective when the sample of cross-section units is small and the panel data are strongly unbalanced (Bruno, 2005). Following prior studies, we display bootstrapped standard errors with 50 times replication while performing the LSDVC estimator (Bogliacino et al., 2012; Boukhatem & Djelassi, 2020).

Tables 8–9 present the robustness check results from LSDVC regressions. We only show LSDVC (Anderson-Hsiao) estimates; other LSDVC regressions (Anderson-Hsiao and Blundell-Bond) yielded similar patterns but are not shown for brevity. Though the significance level of our estimates slightly decreases with the alternative econometric approach, our key findings remain unaltered. The negative coefficients on standalone uncertainty measures point to the detrimental

effect of uncertainty on bank funding liquidity risk. The same conditionality is detected as found previously, under which banking uncertainty modifies funding liquidity risk heterogeneously.

Table 8: Robustness checks with the moderating roles of bank credit risk and return

	(1) UncAsset	(2) UncFunding	(3) UncProfit	(4) UncAsset	(5) UncFunding	(6) UncProfit
Lagged dependent variable	0.725***	0.710***	0.651***	0.714***	0.717***	0.772***
	(0.040)	(0.044)	(0.033)	(0.051)	(0.053)	(0.051)
Uncertainty	–0.260*	–0.208	–1.288**	–0.017	–0.097**	–1.596***
	(0.136)	(0.134)	(0.596)	(0.039)	(0.042)	(0.487)
Uncertainty*Return	0.152*	0.086	0.859**			
	(0.085)	(0.083)	(0.346)			
Uncertainty* Provision				–0.125***	–0.116**	–1.524***
				(0.046)	(0.047)	(0.426)
Return	–7.530***	–6.259***	–10.518***	–3.295***	–2.762***	–3.464***
	(2.188)	(2.384)	(0.975)	(0.518)	(0.543)	(0.502)
Provision	2.304***	2.341***	4.601***	2.215***	4.300***	2.394***
	(0.363)	(0.458)	(1.155)	(0.392)	(1.040)	(0.363)
Capital	0.353***	0.340***	0.654***	0.376***	0.198*	0.372***
	(0.115)	(0.108)	(0.179)	(0.129)	(0.118)	(0.122)
Asset liquidity	0.114***	0.133***	0.183***	0.069	0.118**	0.064
	(0.037)	(0.050)	(0.056)	(0.045)	(0.057)	(0.046)
Size	2.774***	2.677***	4.403***	2.700***	2.036***	2.550***
	(0.338)	(0.369)	(0.423)	(0.354)	(0.462)	(0.316)
Policy rate	0.623***	0.638***	0.373**	0.713***	0.770***	0.571***
	(0.118)	(0.120)	(0.155)	(0.097)	(0.128)	(0.119)
Economic cycle	1.756***	1.628***	2.154***	1.488***	1.275***	2.290***
	(0.259)	(0.265)	(0.476)	(0.328)	(0.280)	(0.307)
Constant	–81.553***	–77.614***	–131.763***	–80.895***	–58.850***	–82.464***
	(11.233)	(11.622)	(11.906)	(12.992)	(16.543)	(11.560)
Observations	352	352	352	352	352	352
Banks	31	31	31	31	31	31

Note: Table 8 presents results from estimating the augmented model using LSDVC (Anderson-Hsiao). The dependent variable is the ratio of deposits to total assets (reverse funding liquidity risk). Uncertainty measures employed in each regression (including *UncAsset, UncFunding,* and *UncProfit*) are shown at the top of each column. Bootstrapped standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels respectively. Other LSDVC estimates (Arellano-Bond and Blundell-Bond) yield similar patterns, but are not reported for brevity.

Table 9: Robustness checks with the moderating roles of bank capital, asset liquidity, and bank size

	(1) UncAsset	(2) UncFunding	(3) UncProfit	(4) UncAsset	(5) UncFunding	(6) UncProfit	(7) UncAsset	(8) UncFunding	(9) UncProfit
Lagged dependent variable	0.776***	0.782***	0.828***	0.812***	0.706***	0.678***	0.718***	0.726***	0.722***
	(0.048)	(0.049)	(0.051)	(0.054)	(0.043)	(0.043)	(0.043)	(0.049)	(0.052)
Uncertainty	−0.371***	−0.320***	−5.558***	−0.174**	−0.108**	−10.681***	−3.151	−4.586***	−45.718*
	(0.059)	(0.054)	(0.816)	(0.080)	(0.051)	(1.061)	(2.048)	(1.295)	(24.894)
Uncertainty*Capital	0.009**	0.013***	0.396***						
	(0.004)	(0.004)	(0.085)						
Uncertainty*Asset liquidity				0.011***	0.001	0.599***			
				(0.003)	(0.003)	(0.086)			
Uncertainty*Size							0.098	0.141***	1.354*
							(0.063)	(0.040)	(0.765)
Return	−2.831***	−2.892***	−3.918***	−5.307***	−8.843***	−3.454***	−3.046***	−2.527***	−3.183***
	(0.544)	(0.482)	(0.451)	(0.980)	(0.770)	(0.453)	(0.714)	(0.673)	(0.587)
Provision	1.261***	1.329***	1.791***	9.473***	5.652***	1.873***	1.608***	1.460***	1.896***
	(0.407)	(0.418)	(0.346)	(1.377)	(1.033)	(0.394)	(0.459)	(0.432)	(0.359)
Capital	0.347**	0.174	0.104	0.136	0.950***	0.161	0.319**	0.272**	0.207
	(0.139)	(0.151)	(0.124)	(0.318)	(0.245)	(0.112)	(0.132)	(0.129)	(0.146)
Asset liquidity	0.169***	0.145***	0.114***	−0.133	0.209*	0.648***	0.092**	0.104*	0.098*
	(0.041)	(0.041)	(0.044)	(0.101)	(0.109)	(0.094)	(0.042)	(0.057)	(0.051)
Size	2.775***	2.601***	2.803***	0.237	4.349***	2.347***	0.197	−1.443	0.485
	(0.579)	(0.461)	(0.373)	(1.209)	(0.681)	(0.343)	(1.788)	(1.346)	(1.274)
Policy rate	0.741***	0.883***	0.622***	0.921***	0.342	0.380***	0.502***	0.514***	0.374***
	(0.105)	(0.162)	(0.113)	(0.117)	(0.231)	(0.112)	(0.114)	(0.103)	(0.113)
Economic cycle	0.512*	1.503***	1.929***	2.211***	1.660***	2.224***	1.923***	1.487***	1.887***
	(0.290)	(0.227)	(0.290)	(0.434)	(0.467)	(0.339)	(0.247)	(0.312)	(0.294)
Constant	−79.572***	−80.985***	−90.715***	−16.333	−135.067***	−56.136***	−3.572	51.921	−8.927
	(21.278)	(13.910)	(13.165)	(43.196)	(20.776)	(11.530)	(58.911)	(42.223)	(42.912)
Observations	352	352	352	352	352	352	352	352	352
Banks	31	31	31	31	31	31	31	31	31

Note: Table 9 presents the results from estimating the augmented model using the LSDVC (Arellano-Bond). The dependent variable is the ratio of deposits to total assets (reverse funding liquidity risk). Uncertainty measures employed in each regression (including *UncAsset, UncFunding,* and *UncProfit*) are shown at the top of each column. Bootstrapped standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

4. CONCLUSION

Employing a sample of Vietnamese commercial banks for the period 2007–2019, this paper investigates the effect of uncertainty on bank funding liquidity risk. We measure uncertainty in the banking sector using the dispersion of shocks to key bank-level variables and capture funding liquidity risk via the deposit ratio. Though there is much empirical analysis on how banks react to uncertainty, our paper is the first to focus on funding liquidity risk in the context of uncertainty. Our findings show that uncertainty in banking increases funding liquidity risk. Inspired by previous authors, we also explore whether bank-specific characteristics can weaken or intensify how banks respond to uncertainty shocks. Our findings across different aspects of bank characteristics tend to converge toward a uniform pattern that shows that greater financial strength of banks, captured by an increase in bank return/loan quality/capital/asset liquidity/bank size, can weaken the impact of uncertainty on bank funding liquidity risk. Not only are our findings robust to different combinations of regressors, but they also remain unchanged when different key bank-level variables are employed to calculate the dispersion of bank shocks as banking uncertainty measures or different estimation approaches are adopted, such as dynamic GMM and LSDVC.

Our findings have certain policy implications. Banking uncertainty is an essential factor explaining banks' funding liquidity risk, which regulatory authorities should keep it in mind when issuing policies that can alter the level of uncertainty. Given that funding liquidity risk may adversely affect bank operations and, further, the real economy, actions to reduce uncertainty and stabilize the banking sector should be prioritized. Another caveat highlights the importance of focusing on certain groups of banks as a bonus policy to mitigate the detrimental impact of uncertainty on funding liquidity risk. In other words, a consistent framework to improve the financial strength of banks should be considered.

Our analysis has some limitations. It only features one market and a modest database, and in this market we only consider banking uncertainty computed by bank-level data as a single kind of uncertainty. Due to data limitation, we only focus on bank deposits as a whole, though different deposit sources (e.g., demand deposits and saving deposits) may differ significantly. Future research could expand our work to other markets using different forms of uncertainty and a further breakdown of deposit structure. It would also be interesting to separate

periods of low uncertainty from periods of high uncertainty in order to examine the link between uncertainty and bank operations.

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