

Thuy Tien Ho

Article

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Micro Uncertainty and the Lending Channel: Bank-level Evidence in an Emerging Market

Thuy Tien Ho[†]

University of Finance - Marketing, Ho Chi Minh City, Vietnam

ABSTRACT

Purpose: Existing research on uncertainty and bank lending has focused entirely on aggregate uncertainty (i.e., economic policy uncertainty) and its subcomponents, but not considering other uncertainty measures from the specific perspective of financial markets, especially the banking sector. The paper tests the influence of uncertainty on loan growth using bank-level data in Vietnam during 2007-2019.

Design/methodology/approach: The paper focuses on a new uncertainty measure in banking computed by the dispersion of shocks to key bank-level variables. The study also fixes the issues of potential endogeneity bias by using dynamic panel models with the generalized method of moments (GMM) estimator.

Findings: Uncertainty in banking hampers loan growth. The adverse influence of uncertainty on lending is more pronounced for banks that are smaller, more poorly capitalized, less liquid, riskier, and less profitable. In addition, the paper also provides evidence that bank lending under uncertainty is not moderated by bank ownership, i.e., the paper does not find a discrepancy in the banking uncertainty-bank lending nexus between state-owned banks and private counterparts.

Research limitations/implications: Regulatory bodies should enhance their scrutiny concerning uncertainties within the banking sector, recognizing their potential to adversely affect bank lending, a critical catalyst for fostering economic activity. Simultaneously, it is imperative to implement concurrent policies aimed at mitigating the deleterious consequences of uncertainty in bank lending.

Originality/value: First, this paper is interested in an emerging market, given that the evidence from emerging markets has remained remarkably scarce. Second, this paper approaches the banking sector's uncertainty and assesses its link with bank lending. Third, this study contributes to the literature by investigating the nuanced conditions influencing the impact of uncertainty through an extensive array of moderating factors. Interestingly, this paper is the first to examine the conditional role of state ownership thus far.

Keywords: bank lending, bank-level shocks, emerging market, state ownership, uncertainty

I. Introduction

Uncertainty can exert considerable unfavorable

impacts on investments (Gulen & Ion, 2016; Kang et al., 2014), employment (Caggiano et al., 2017), and even the economy as a whole (Baker et al., 2016; Bloom, 2014). Research on uncertainty has become particularly hot in recent years, especially since good measures for quantifying uncertainty have been developed (for example, the economic policy

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[†] Corresponding author: Thuy Tien Ho

E-mail: tienht@ufm.edu.vn

uncertainty index of Baker et al. (2016)). In this stream, a group of scholars has explored the response of the banking systems amid uncertainty shocks and thereby indicate many important results. Concretely, they focus on the impact of uncertainty on various aspects of banks, such as loan pricing (Ashraf & Shen, 2019), bank valuation (He & Niu, 2018), loss provisioning (Danisman et al., 2020; Ng et al., 2020), and liquidity hoarding (Berger et al., 2022). Of which, bank lending has attracted the most attention from scholars since it is a key indicator of banking operation that plays a vital role in fueling economic growth (Bordo et al., 2016; Buch et al., 2015; Danisman et al., 2020; Hu & Gong, 2019; Nguyen et al., 2020; Valencia, 2017). Most studies emphasize that uncertainty weakens bank lending.

The implications of uncertainty on bank lending have been broadly addressed for developed markets, particularly the US and the Euro area, mainly due to the dominant part of these markets and the fact that the application of preferred uncertainty measures is uniquely relevant here. Very few papers pay attention to emerging economies. This leads to a biased understanding and a lack of comprehensiveness of the topic, since developed countries' findings may not apply to emerging economies. The potential reason is that such emerging economies exhibit differences in banking market structures, institutional and regulatory backgrounds, which constitute less mature financial systems (Meslier et al., 2014). Importantly, uncertainty in emerging economies has been sizably higher than in advanced economies (Bloom, 2014) and banking structures in emerging markets are more vulnerable to uncertainty shocks (Nguyen et al., 2020). So, these observations may warrant different effects of uncertainty on bank lending from the perspective of emerging markets.

Moreover, existing research on uncertainty and bank lending has focused entirely on aggregate uncertainty (i.e., economic policy uncertainty) and its subcomponents (e.g., monetary policy, fiscal policy, and financial uncertainty), but not considering other uncertainty measures from the specific perspective of financial markets, especially the banking sector.

This methodology is beset by limitations, primarily stemming from its reliance on the foundational premise that heightened aggregate uncertainties contribute to an escalation in the overall uncertainty within the banking sector; consequently, financial institutions are expected to modify their lending behaviors in response to this increased uncertainty (Caglayan & Xu, 2019); furthermore, it should be noticed that the consequences of different types of uncertainty on bank behaviors will also be different (Wu et al., 2021). Taken together, motivated by these stylized facts, this study extends the current strand of research by exploring uncertainty in the banking sector and its impact on bank lending for Vietnam, an important and typical emerging market.

Buch et al. (2015) advocate for an uncertainty measure tailored to the banking sector, achieved by computing the cross-sectional dispersion of shocks to essential variables utilizing bank-level data. The notable advantage of this micro uncertainty measure lies in its ability to circumvent the constraints associated with the accessibility and high-frequency nature of market data, prerequisites for market-based uncertainty proxies. Additionally, it alleviates concerns regarding the precision and reliability of information present in newspapers, as required for text-based uncertainty indices (Baker et al., 2016; Bilgin et al., 2021). These issues are relevant for emerging markets that have not yet reached the mature level as Vietnam. With easy access to key bank-level variables, one can almost calculate uncertainty in banking for all different markets. All in all, computation efforts with bank-level data could yield a measure of uncertainty specific to the banking sector, containing additional information on uncertainty in the banking system, from which research results and implications are more precise and better informed.

In examining the relationship between uncertainty and bank lending, the existing literature further dissects this connection by proposing that the reaction of bank lending activities to uncertainty shocks is contingent upon bank-specific characteristics. However, prior studies only focus on several standard factors without exploiting a comprehensive framework, and

the evidence is mixed regarding conditional effects of uncertainty. For example, Buch et al. (2015) verify the negative association between uncertainty and bank lending in the US after using the dispersion of bank-level shocks to capture uncertainty in banking. They also reveal that this effect is mitigated at banks that have larger buffers of capital and liquidity. Their findings are also supported by Valencia (2017), who utilize the dispersion of economic growth forecasts as an uncertainty measure. In another vein, Bordo et al. (2016) examine economic policy uncertainty and indicate that this factor restrains the US loan growth. Their additional investigation suggests that the unfavorable effects of economic policy uncertainty on bank lending are strengthened for larger-sized banks, but weakened for banks with higher capitalization levels and more liquid assets. Adding to the results of Bordo et al. (2016), Hu and Gong (2019) display that the negative effect of economic policy uncertainty on bank loan growth is greater for riskier banks, but weaker for more diversified banks, after using a research sample of 19 major economies. In contrast to the mentioned above studies, Danisman et al. (2020) scrutinize five prominent European countries and ultimately observe that the adverse effects of economic policy uncertainty on bank lending are more conspicuous for well-capitalized banks while being less pronounced for larger banks. Interestingly, we can conclude about the mixed evidence found in the literature by looking at the work of Nguyen et al. (2020) that explores the effects of economic policy uncertainty on aggregate bank credit growth for a global sample. They find that the unfavorable effects of uncertainty are enhanced in more liquid and more profitable banking systems, but are reduced in larger, better-capitalized, and riskier ones.

The extant empirical studies offer an interesting background for our analysis. Accordingly, in testing the impacts of uncertainty on loan growth using the data from Vietnam during 2007-2019, this study will fill in the literature gap by comprehensively examining a broad set of banks' characteristics and financial strength, ranging from standard indicators (bank size,

capital, and liquidity) to more informative variables that are unusually employed (bank risk and bank return). We also make our work more relevant to the context of government-oriented countries by considering the role of state ownership in the uncertainty-bank lending nexus. Surprisingly, no research has solved this issue thus far, although theoretically, state ownership could strongly modify banking behavior and thereby potentially drive the impact of uncertainty. Notably, we construct the uncertainty measure in banking based on the two-step procedure by Buch et al. (2015) to calculate the dispersion of shocks to key bank-level variables.

Vietnam provides a favorable context for conducting experiments. First, Vietnam is currently operating a relatively underdeveloped capital market and thus, fueling economic growth heavily depends on bank lending (Huynh et al., 2022; Nguyen, 2023; Phung & Khuong, 2017). Second, substantial negative volatility in banking activities ensued due to elevated levels of non-performing loans, the global financial crisis, and an inadequate capital buffer, thereby contributing to heightened uncertainty during the research period (Dang, 2020). Third, the Vietnamese banking system has undergone significant reforms in the past decade, prompting considerable transformations among banks, encompassing shifts in business strategies, risk appetite, and substantial alterations in balance sheets (see the work of Nguyen et al. (2016) for specific and significant bank reforms in Vietnam). Fourth, regardless of the reforms implemented, especially bank privatization, state-owned banks still dominate the banking market in Vietnam and play an important part in transmitting policies of monetary authorities to the real economy (Vo, 2016).

Our paper brings three contributions to the extant literature on uncertainty and bank lending. First, we are interested in an emerging market that the literature has not explored yet. The research stream has been popularly dedicated to developed economies, while the evidence from emerging markets has remained extremely scarce. An exception is Nguyen et al. (2020), who use country-level data to examine the impacts of economic policy uncertainty on credit

growth in both developed and emerging markets. The shortcoming of this paper is that the heterogeneity in individual banks' reaction to uncertainty is completely neglected with the cross-country analysis utilizing aggregate data. Different from this paper, we rely on bank-level data to conduct analysis. Second, we approach the uncertainty in the banking sector and thereby assess its link with bank lending. As discussed earlier, our uncertainty measure with multiple advantages pointed out is developed by Buch et al. (2015) to reflect uncertainty specific to the banking sector. After building this indicator, Buch et al. (2015) also test its link with bank lending for the US market. Nevertheless, a notable limitation of their empirical approach is the omission of potential endogeneity bias and the persistent characteristics inherent in bank lending. In this paper, we fix these issues by using dynamic panel models with the generalized method of moments (GMM) estimator. Third, we contribute to the literature by investigating the nuanced conditions influencing the impact of uncertainty through an extensive array of moderating factors. While standard bank-specific characteristics (including bank size, capital, and liquidity) are often used in previous papers, more informative variables (including bank risk and return) are rarely discussed. Interestingly, our paper is the first to examine the conditional role of state ownership thus far. In doing so, our results consistently document that financially weaker banks may be more affected by adverse uncertainty shocks. This finding is in line with the literature strand dedicated to exploring the working of the bank lending channel of monetary policy transmission.

II. Methodology and Data

A. Uncertainty Measures in Banking

The uncertainty measure in the banking sector operates on the fundamental premise that heightened uncertainty leads to decreased predictability of future

outcomes. From the standpoint of a financial institution, such as a bank, reduced predictability due to increased uncertainty is manifested by a broader dispersion of shocks to key bank-level variables (Buch et al., 2015). Consistent with the theoretical model and empirical application suggested by Buch et al. (2015), we first apply the following equation to figure out bank-year-specific shocks of each variable:

$$\Delta \log(Bank_{i,t}) = a_i + b_t + \epsilon_{i,t} \quad (1)$$

in which $\Delta \log(Bank_{i,t})$ is the growth rate of assets or short-term funding (in percent). We estimate this equation for the level of bank profitability (captured by operating profits to assets ratio) since it is a flow variable. a_i and b_t denote bank fixed effects and time fixed effects, respectively. With this setting, the residual $\epsilon_{i,t}$ from the regression could display shocks to our bank-level variables, so it is collected to compute the cross-sectional dispersion of shocks.

After obtaining bank-specific shocks, we move on to calculate banking uncertainty by utilizing the standard deviation for the residual $\epsilon_{i,t}$:

$$Uncertainty_t = Standard\ deviation(\epsilon_{i,t}) \quad (2)$$

B. Model and estimation technique

We employ the dynamic panel model specified as follows:

$$\begin{aligned} Lending_{i,t} = & \alpha_0 + \alpha_1 \times Lending_{i,t-1} + \alpha_2 \\ & \times Uncertainty_{t-1} + \alpha_3 \times Bank_{i,t-1} \\ & + \alpha_4 \times Macro_{t-1} + \epsilon_{i,t} \end{aligned} \quad (3)$$

where the dependent variable $Lending_{i,t}$ is the annual growth rate of gross loans from bank i in year t relative to year $t-1$. The one-year lag of our dependent variable as an independent regressor is to capture the persistence of bank lending, which has been extensively allowed in the literature. Uncertainty is captured by one of our banking uncertainty variables.

We include a strong bundle of control variables in our model, following the well-known literature strand on determinants of bank lending behavior (Dang & Huynh, 2021, 2023; Huynh, 2023). For bank-level controls exhibited in vector *Bank*, we have bank size (natural logarithm of total assets), bank capital (the ratio of equity capital to total assets), bank liquidity (the ratio of cash and dues from banks to total assets), bank return (the ratio of operating profits to total assets), bank risk (the ratio of loan loss reserves to gross loans), and bank ownership (dummy variable that equals 1 for state-owned banks and 0 otherwise). For macroeconomic controls displayed in vector *Macro*, we introduce the economic cycles measured by the growth rate of gross domestic product (GDP) to control for loan demand, and we also take into account the monetary policy transmission of the bank lending channel by incorporating the short-term lending rates.

To address endogeneity more comprehensively, we employ the two-step system GMM estimations (Arellano & Bover, 1995; Blundell & Bond, 1998), which utilize the lags of regressors as instruments. To justify the consistency of the GMM estimations, we need some diagnostics tests such that: the Hansen test indicates no over-identification problem in the estimations, and autocorrelation tests illustrate the first- but no second-order autocorrelation in the residuals.

We investigate the mechanisms behind the uncertainty and bank lending link by augmenting the baseline equation with interaction terms involving banking uncertainty and modifying factors.

$$\begin{aligned}
 Lending_{i,t} = & \alpha_0 + \alpha_1 \times Lending_{i,t-1} + \alpha_2 \\
 & \times Uncertainty_{t-1} + \alpha_3 \\
 & \times Uncertainty_{t-1} \times Bank_{i,t-1} \\
 & + \alpha_4 \times Bank_{i,t-1} + \alpha_5 \\
 & \times Macro_{t-1} + \epsilon_{i,t}
 \end{aligned} \quad (4)$$

To make a more comprehensive work than those performed previously, we employ a rich set of modifying factors that can well serve our purpose,

which range from standard bank-specific characteristics (i.e., bank size, capital, and liquidity) to more informative variables that could adequately capture bank incentives and risk-taking behavior (i.e., bank risk and return). Our identification strategy is closely related to the one widely implemented to study the bank lending channel of monetary policy transmission (Amidu & Wolfe, 2013; Gambacorta, 2005; Kishan & Opiela, 2006; Grosse & Gart, 2001; Forsyth & Harjoto, 2009). Additionally, given that many studies indicate that state ownership is a fundamental factor to explain the difference in bank risk-taking and lending behavior (e.g., Brei & Schclarek, 2015; Fungáčová et al., 2013), we try to examine the moderating role of state ownership in shaping bank loan growth amid uncertainty.

C. Data

We accumulate bank-level data from financial reports of Vietnamese commercial banks for the period of 2007-2019. We eliminate observations with incomplete or missing bank-year accounting variables. For macroeconomic data, we source economic growth from the World Development Indicators and average lending rates from the International Financial Statistics. Table 1 defines and describes all variables employed.

The mean value of loan growth is 29.812%, meanwhile the distance from its minimum and maximum value is large (from -2.885% to 108.203%), showing that the bank lending considerably expands during the time and sustainably varies among banks in our sample. Most bank-specific variables display high standard deviations, supported by the fact that the Vietnamese banking system has experienced a period of tremendous reforms and changes in activities and performance. The average for the state ownership dummy is 0.136, indicating that around 14% of the banks in our research sample are state-owned.

Looking into the correlation coefficients in Table 2, we first notice that the dispersion of asset and funding shocks is highly correlated with each other,

but both of them are not sizably correlated with the dispersion of profitability shocks. On the one hand, this observation may justify using these uncertainty measures as alternative variables and, on the other hand, may offer additional information on the uncertainty aspect in the banking sector. As another critical point, the correlations between independent variables are small (with coefficients all lower than 0.80), indicating that severe multicollinearity should be regarded as a minor concern of the study.

III. Empirical Results

A. Baseline Results

Table 3 displays the outcomes derived from the baseline equation, employing three measures of banking uncertainty grounded in the dispersion of distinct shocks. The coefficients on uncertainty measures are consistently significant and negative, suggesting the adverse effect of uncertainty in the banking sector; in other words, greater banking

Table 1. Variable descriptions and summary statistics

	Definitions	Min	Max	Standard deviation	Mean
<i>Bank-level variables</i>					
Loan growth	Annual growth rate of gross loans (%)	-2.885	108.203	28.852	29.812
Size	Natural logarithm of total assets	30.020	34.269	1.215	32.008
Capital	Equity capital to total assets (%)	4.939	20.470	4.364	9.869
Liquidity	Liquid assets (cash and dues from banks) to total assets (%)	5.570	36.034	9.182	17.114
ROA	Operating profits to total assets (%)	0.248	3.147	0.808	1.548
LLR	Loan loss reserves to gross loans (%)	0.543	2.499	0.501	1.266
SOB	Dummy variable that equals 1 for state-owned banks and 0 otherwise	0.000	1.000	0.343	0.136
<i>Country-level variables</i>					
Dispersion (Asset)	Cross-sectional uncertainty proxy derived from banks' asset growth	13.427	34.091	6.747	21.936
Dispersion (Funding)	Cross-sectional uncertainty proxy derived from banks' funding growth	15.995	40.931	7.890	24.226
Dispersion (Return)	Cross-sectional uncertainty proxy derived from banks' return level	0.674	2.058	0.386	1.273
Lending rates	Average short-term lending rates (%)	6.960	16.954	3.322	10.350
Economic cycles	Annual growth rate of gross domestic products (%)	5.247	7.130	0.640	6.245

Table 2. Correlations among variables

	Loan growth	Size	Capital	Liquidity	ROA	LLR	SOB	Dispersion (Asset)	Dispersion (Funding)	Dispersion (Return)	Lending rates	Economic cycles
Loan growth	1.000											
Size	-0.300	1.000										
Capital	0.120	-0.720	1.000									
Liquidity	0.360	-0.400	0.240	1.000								
ROA	0.130	0.120	0.210	0.050	1.000							
LLR	-0.330	0.410	-0.230	-0.260	0.060	1.000						
SOB	-0.140	0.600	-0.350	-0.160	0.220	0.400	1.000					
Dispersion (Asset)	0.500	-0.390	0.310	0.500	0.250	-0.040	0.020	1.000				
Dispersion (Funding)	0.440	-0.380	0.320	0.450	0.250	-0.020	0.020	0.870	1.000			
Dispersion (Return)	0.060	0.140	-0.160	-0.100	0.040	-0.140	0.000	-0.310	-0.140	1.000		
Lending rates	0.060	-0.320	0.320	0.460	0.200	0.100	0.010	0.620	0.580	-0.500	1.000	
Economic cycles	0.020	0.220	-0.250	-0.090	0.040	-0.180	0.010	-0.390	-0.500	0.380	-0.450	1.000

uncertainty reduces banks' loan growth. This finding holds for all three uncertainty measures, thus slightly differs from the work of Buch et al. (2015). Prior authors indicate the exception for the dispersion of short-term funding shocks when using bank-level data in the US to test the link between cross-sectional banking uncertainty and bank lending for the first time. Quantitatively, our effect is also economically sizable, as a one standard deviation increase in banking uncertainty may depress the loan growth rate by 7.603 (1.127×6.747), 3.432 (0.435×7.890), and 1.977 (5.123×0.386) percentage points in the case of the dispersion of shocks to assets, funding and profitability, respectively (columns 7-9 of Table 3).

Our findings affirm and contribute to the existing literature regarding the influence of uncertainty on bank lending. This particular strand of literature has seldom delved into micro uncertainty within the financial markets of emerging economies. In our study, we gauge banking uncertainty by examining the dispersion of various shocks to key bank-level variables, thereby emphasizing a crucial and distinctive source of uncertainty. Regarding the demand-side impact, it is posited that heightened uncertainty prompts firms and households to defer their investments and expenditures, resulting in a decline in credit demand (Bloom et al., 2013). Uncertainty also influences bank lending via multiple channels through the supply-side effect. Uncertainty could lead to an increase of the external financing costs (as investors require a higher funding premium) or more difficulty for refinancing of banks in the interbank market (Brogaard & Detzel, 2015; Pástor & Veronesi, 2012), causing banks to limit their loan supply. Additionally, in uncertain times, banks may behave more prudently and delay granting loans in awareness of uncertainty (Ng et al., 2020).

B. The Heterogeneity across Banks with Different Standard Bank-Specific Characteristics

As extensively deliberated in the preceding section, banks characterized by standard attributes such as

size, capitalization, and liquidity may respond differentially to uncertainty shocks. We conduct extended regressions to elucidate this potential variation, explicitly focusing on interaction terms involving bank size, liquidity, and capitalization with banking uncertainty. The outcomes are detailed in Table 4.

Interestingly, the coefficient on all interaction terms between bank-specific characteristics and uncertainty is statistically significant and positive, indicating that the negative impact of uncertainty on loan growth may be mitigated by an increase in bank size, capitalization, and liquidity. In other words, our findings imply that banks that are smaller, more poorly capitalized, and less liquid, tend to be more sensitive to uncertainty shocks in the banking system. These findings remain unchanged under different banking uncertainty measures based on the dispersion of bank-level shocks. Quantitatively, our interaction terms' coefficients also highlight our findings' economic plausibility. For instance, the face values in columns 3, 6, and 9 (Table 4) indicate that an increase of one standard deviation in bank size, bank capital, and bank liquidity could mitigate the adverse impacts of a change of one standard deviation in banking uncertainty (measured by the dispersion of profitability shocks) on loan growth by approximately 0.156 ($0.333 \times 0.386 \times 1.215$), 2.390 ($1.419 \times 0.386 \times 4.364$), and 2.552 ($0.720 \times 0.386 \times 9.182$) percentage points, respectively.

Our results using micro uncertainty are in line with some previous studies. In particular, an increase in bank size (Danisman et al., 2020), bank capital and liquidity (Bordo et al., 2016; Buch et al., 2015; Valencia, 2017) could mitigate the negative effect of economic policy uncertainty on bank loan growth. Nevertheless, our findings also challenge those indicating that the unfavorable effects of economic policy uncertainty on bank lending are strengthened for larger-sized banks (Bordo et al., 2016) and better-capitalized banks (Danisman et al., 2020). Overall, complementing these previous studies, we display a uniform pattern that is interestingly consistent with the research strand on the bank lending channel of monetary policy pass-through. By looking

Table 3. Impacts of banking uncertainty on loan growth

Dependent variable: Annual growth rate of gross loans	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dispersion (Asset)	Dispersion (Funding)	Dispersion (Return)	Dispersion (Asset)	Dispersion (Funding)	Dispersion (Return)	Dispersion (Asset)	Dispersion (Funding)	Dispersion (Return)
Lagged dependent variable	0.129*** (0.021)	0.157*** (0.020)	0.136*** (0.023)	0.275*** (0.015)	0.192*** (0.011)	0.274*** (0.016)	0.166*** (0.023)	0.074*** (0.025)	0.220*** (0.035)
Uncertainty	-0.824*** (0.164)	-0.357*** (0.101)	-3.330*** (1.100)	-0.823*** (0.092)	-0.262*** (0.066)	-4.944*** (0.767)	-1.127*** (0.114)	-0.435*** (0.072)	-5.123*** (0.792)
Size	-3.142** (1.287)	-3.039 (2.111)	-2.945 (2.074)				-2.881** (1.163)	-3.277** (1.479)	-7.662*** (1.782)
Capital	1.232*** (0.413)	0.925* (0.485)	0.039 (0.620)				0.595* (0.343)	0.459 (0.377)	-0.769 (0.505)
Liquidity	0.680*** (0.094)	0.648*** (0.074)	0.555*** (0.070)				0.686*** (0.078)	0.568*** (0.073)	1.329*** (0.241)
ROA	-1.914 (1.531)	-2.501 (2.048)	1.743 (3.086)				-0.002 (0.720)	-0.221 (0.774)	9.457*** (2.522)
LLR	-1.502 (1.352)	-2.869* (1.498)	-5.400*** (1.387)				-5.282*** (1.607)	-6.915*** (1.689)	-1.297 (2.933)
SOB	11.037*** (3.457)	9.412*** (3.163)	4.826** (2.159)				9.402*** (2.845)	9.698*** (3.087)	9.831* (5.695)
Economic cycles				-10.354*** (0.933)	-10.250*** (0.847)	-3.786*** (1.158)	-11.766*** (1.288)	-12.169*** (1.200)	-8.871*** (1.221)
Lending rates				-1.169*** (0.112)	-0.691*** (0.104)	-0.968*** (0.133)	-0.083 (0.216)	-0.435 (0.280)	-4.547*** (0.427)
Observations	350	350	350	350	350	350	350	350	350
Banks	31	31	31	31	31	31	31	31	31
AR(2) test (p-value)	0.119	0.301	0.110	0.209	0.144	0.350	0.171	0.108	0.344
Hansen test (p-value)	0.144	0.141	0.120	0.123	0.108	0.266	0.114	0.148	0.232

Notes: Standard errors are reported in parentheses. ***, ** and * denote the significance levels of 1%, 5% and 10%, respectively.

Table 4. Impacts of banking uncertainty on loan growth moderated by bank size, capitalization, and liquidity positions

Dependent variable: Annual growth rate of gross loans	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dispersion (Asset)	Dispersion (Funding)	Dispersion (Return)	Dispersion (Asset)	Dispersion (Funding)	Dispersion (Return)	Dispersion (Asset)	Dispersion (Funding)	Dispersion (Return)
Lagged dependent variable	0.088* (0.040)	0.077*** (0.017)	0.058*** (0.018)	0.122*** (0.038)	0.125*** (0.022)	0.155*** (0.026)	0.121*** (0.032)	0.102*** (0.028)	0.083*** (0.024)
Uncertainty	-1.270*** (0.182)	-0.418*** (0.061)	-1.582** (0.661)	-1.162*** (0.160)	-0.679*** (0.077)	-13.207*** (1.635)	-1.346*** (0.14)	-0.903*** (0.087)	-4.681*** (0.830)
Uncertainty*Size	0.021*** (0.004)	0.071*** (0.004)	0.333*** (0.030)						
Size	-4.509*** (1.240)	2.698* (1.408)	-1.348 (0.920)						
Uncertainty*Capital				0.055*** (0.011)	0.112*** (0.012)	1.419*** (0.290)			
Capital				-0.095 (0.260)	-0.816*** (0.298)	-3.982*** (0.843)			
Uncertainty*Liquidity							0.022*** (0.005)	0.016*** (0.003)	0.720*** (0.073)
Liquidity							0.480*** (0.088)	0.407*** (0.070)	0.244*** (0.06)
<i>Controls</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Observations	350	350	350	350	350	350	350	350	350
Banks	31	31	31	31	31	31	31	31	31
AR(2) test (p-value)	0.523	0.362	0.112	0.255	0.134	0.677	0.439	0.107	0.130
Hansen test (p-value)	0.168	0.238	0.130	0.194	0.213	0.179	0.135	0.171	0.147

Notes: Standard errors are reported in parentheses. ***, ** and * denote the significance levels of 1%, 5% and 10%, respectively.

into measures of banks' financial strength, we can argue that financially stronger banks (i.e., banks that are larger, better capitalized, and more liquid) could more easily gain access to alternative funding sources in the market to protect their loan portfolios against adverse uncertainty shocks (Amidu & Wolfe, 2013; Gambacorta, 2005; Kishan & Opiela, 2006).

C. The Conditional Impacts of Bank Risk and Return Profiles

In this study, we strongly claim that bank risk and return must be carefully taken into account, together with other standard bank-specific characteristics as previously discussed, when examining the response of bank lending to uncertainty shocks. Our motivation is that as a result of financial innovation, variables measuring bank size, liquidity, and capitalization (the standard indicators employed to explore the mechanism behind the impact of uncertainty in the bank lending channel) become less indicative of banks' willingness and ability to originate loans. Instead, financial innovation has modified bank incentives towards taking risks and searching for yields (Altunbas et al., 2010; Orzechowski, 2017). It should also be noted that in the prior related paper that explores both advanced and emerging markets, Nguyen et al. (2020) attribute bank profit and bank risk to be important factors that drive the capacity of banks to protect their loans granted from uncertainty shocks. Nevertheless, when using country-level data for relevant experiments, they fail to uncover the heterogeneity across different banks. So, this issue should be fixed in our paper by relying on bank-level data to shed light on how banks of different return and risk profiles react to uncertainty.

Similar to our empirical design before, we interact banking uncertainty with bank return and risk measures and conduct the extended regressions with interaction terms. For the robustness purpose, we use alternative variables to capture bank return and bank risk: besides the ratio of profits to total assets, we employ the ratio of profits to equity; apart from

loan loss reserves, we use non-performing loans to gross loans. We report the estimates for the conditional roles of bank return in Table 5 and bank risk in Table 6. Through most estimations, we find that the impact of uncertainty on bank lending is consistently conditioned by bank risk and return. In particular, the interaction term of uncertainty and bank return enters positively and significantly in Table 5, implying a more pronounced negative effect of uncertainty on loan growth for less profitable banks. Next, in Table 6, the coefficient of uncertainty interacting with bank risk is significantly negative, confirming a weaker effect of uncertainty on bank lending for less risky banks. The marginal impacts found are also economically significant. For example, the impact of a one standard deviation change in banking uncertainty (measured by the dispersion of funding shocks) on bank lending might be reduced by about 6.254 ($0.981 \times 7.890 \times 0.808$) and 2.811 ($0.711 \times 7.890 \times 0.501$) percentage points, when bank return increases and bank risk decreases by one standard deviation, respectively (column 2 of Table 5 and column 2 of Table 6).

A possible and consistent explanation for our findings is that based on the logic of the asymmetric information banking model, high-profit and less-risk banks may have various competitive advantages such as reduced asymmetric information, lower funding costs, and being perceived as safer by market participants (Altunbas et al., 2010; Orzechowski, 2017). Consequently, these banks may be in a better position to tackle the detrimental effect of uncertainty on bank lending. Thus, our findings once again lend support to those exhibited in the bank lending channel of monetary policy transmission and concur with our own findings obtained previously in subsection 3.2 for the marginal effects of standard bank-specific characteristics.

Table 5. Impacts of banking uncertainty on loan growth with respect to bank profitability

Dependent variable: Annual growth rate of gross loans	(1)	(2)	(3)	(4)	(5)	(6)
	Dispersion (Asset)	Dispersion (Funding)	Dispersion (Return)	Dispersion (Asset)	Dispersion (Funding)	Dispersion (Return)
Lagged dependent variable	0.196*** (0.025)	0.184*** (0.027)	0.209*** (0.023)	0.190*** (0.052)	0.114*** (0.043)	0.148*** (0.036)
Uncertainty	-0.994*** (0.135)	-0.026 (0.087)	-3.076* (1.631)	-1.379*** (0.229)	-0.601*** (0.124)	-11.418*** (1.292)
Uncertainty*ROA	0.781*** (0.102)	0.981*** (0.114)	8.988*** (1.050)			
ROA	-11.703*** (2.902)	-22.389*** (3.224)	-12.435*** (3.661)			
Uncertainty*ROE				0.073*** (0.010)	0.098*** (0.008)	1.147*** (0.206)
ROE				0.076 (0.166)	-0.526*** (0.202)	0.618* (0.333)
<i>Controls</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Observations	350	350	350	350	350	350
Banks	31	31	31	31	31	31
AR(2) test (p-value)	0.481	0.338	0.235	0.899	0.147	0.277
Hansen test (p-value)	0.172	0.159	0.106	0.141	0.123	0.169

Notes: Standard errors are reported in parentheses. *** and * denote the significance levels of 1% and 10%, respectively.

Table 6. Impacts of banking uncertainty on loan growth with respect to bank risk

Dependent variable: Annual growth rate of gross loans	(1)	(2)	(3)	(4)	(5)	(6)
	Dispersion (Asset)	Dispersion (Funding)	Dispersion (Return)	Dispersion (Asset)	Dispersion (Funding)	Dispersion (Return)
Lagged dependent variable	0.149*** (0.039)	0.131*** (0.028)	0.058*** (0.020)	0.214*** (0.032)	0.131*** (0.039)	0.100*** (0.037)
Uncertainty	-1.334*** (0.168)	-0.724*** (0.068)	-1.638** (0.789)	-1.038*** (0.159)	-0.616*** (0.110)	-4.593*** (0.904)
Uncertainty*LLR	-0.012 (0.124)	-0.711*** (0.117)	-4.294*** (0.678)			
LLR	-3.304* (1.788)	-10.057*** (1.153)	-6.911*** (2.155)			
Uncertainty*NPL				-0.400*** (0.082)	-0.036 (0.069)	-1.325*** (0.420)
NPL				-0.196 (0.648)	-2.120*** (0.540)	-1.542*** (0.524)
<i>Controls</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Observations	350	350	350	350	350	350
Banks	31	31	31	31	31	31
AR(2) test (p-value)	0.279	0.190	0.118	0.122	0.121	0.284
Hansen test (p-value)	0.100	0.123	0.120	0.216	0.277	0.172

Notes: Standard errors are reported in parentheses. ***, ** and * denote the significance levels of 1%, 5% and 10%, respectively.

D. Banking Uncertainty and Bank Lending: State-Owned Versus Private Banks in an Emerging Market

Apart from the bank-level characteristics discussed above, there appears a consensus that state ownership could lead to transformations in the banking markets and hence influence how banks react to macro-economic shocks. From an empirical viewpoint, some current works have linked state ownership with monetary policy transmission via the bank lending channel (Drakos et al., 2016; Yang & Shao, 2016). However, the literature is absent about the differential impact of state ownership on the relationship between bank lending and uncertainty.

Brei and Schclarek (2015) suggest that state-owned banks differ from private counterparts in terms of the operational goal to stabilize the economy and state-owned banks also enjoy more advantages such as better access to recapitalization funds and higher trustworthiness from depositors. Empirically, previous studies indicate a strong link between bank lending and bank ownership, in line with the political view of state ownership (Carvalho, 2014; Infante & Piazza, 2014). Some authors even find that, especially after the periods of economic downturn and credit

crunch, state ownership of banks can be valuable in offering them with multiple privileged resources to fight against the financial turmoil (De Haas et al., 2015; Fungáčová et al., 2013). Taken together, since state ownership provides banks with numerous buffers against uncertainty shocks, we conjecture that the lending activities of state-owned banks are less affected by uncertainty.

To perform empirical analysis, we interact the state ownership dummy with different uncertainty measures. We report the estimation results in Table 7. We observe that the interactions of banking uncertainty measures with the state ownership dummy are not statistically significant. These results indicate the absence of deviation in how banks of different ownership originate their loans amid uncertainty. In other words, bank lending's reaction of state-owned banks and private banks is not different from each other under uncertainty. The standalone ownership dummy is also insignificant, implying no difference in banking lending behavior in times of uncertainty. In a relatively closed vein, Buch et al. (2015) explore the role of bank ownership and then conclude that this factor does not drive the uncertainty-bank lending nexus since there is only weak evidence that foreign and domestic banks respond dissimilarly to uncertainty.

Table 7. Impacts of banking uncertainty on loan growth: private versus state-owned banks

Dependent variable: Annual growth rate of gross loans	(1)	(2)	(3)
	Dispersion (Asset)	Dispersion (Funding)	Dispersion (Return)
Lagged dependent variable	0.242*** (0.066)	0.097** (0.044)	0.030** (0.014)
Uncertainty	-2.196*** (0.252)	-0.985*** (0.305)	-2.313** (0.925)
Uncertainty*SOB	-1.048 (1.523)	0.223 (2.290)	20.874 (16.062)
SOB	33.997 (30.773)	-5.407 (56.684)	-22.580 (21.009)
<i>Controls</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Observations	350	350	350
Banks	31	31	31
AR(2) test (p-value)	0.167	0.115	0.104
Hansen test (p-value)	0.192	0.119	0.103

Notes: Standard errors are reported in parentheses. *** and ** denote the significance levels of 1% and 5%, respectively.

So, our findings complement the work of Buch et al. (2015).

IV. Conclusion

The paper aims at exploring the hot topic of how bank lending changes in response to uncertainty shocks. Our findings are summarized as follows. First, greater banking uncertainty reduces bank loan growth. Though different measures give different inferences about uncertainty, our uncertainty measure in the banking sector still yields consistent results with those obtained in other studies, thus strongly supporting the adverse effect of uncertainty on bank lending. Second, banks with standard individual characteristics, including bank size, capitalization, and liquidity, react differently to uncertainty in banking. Concretely, financially weaker banks (banks that are smaller, more poorly capitalized, and less liquid) tend to be more responsive to uncertainty shocks. Further conditional analysis, using more informative variables in capturing risk-taking and searching-for-yield incentives of banks, reveals a weaker effect of uncertainty on bank lending for less risky and more profitable banks. Collectively, this consistent set of results jointly reflects a key mechanism in the supply-side effect and partially challenges those in other works with mixed patterns, that is, banks with more competitive advantages may be in a better position to tackle the detrimental effect of uncertainty on bank lending. Third, in an effort to make our analysis more relevant to the context of an emerging market, we also document that the link between micro uncertainty and bank lending tends to be immune to the ownership of banks, i.e., bank lending's reaction of state-owned banks and private banks is not different from each other under uncertainty.

Some implications are derived from our findings. Hence, regulatory authorities should exercise increased vigilance regarding uncertainty in the banking sector, given its potential to exert a detrimental impact on

bank lending—a pivotal source for driving economic activity. During this process, there is also a need to adopt parallel policies to alleviate the adverse effects of uncertainty on banking lending. For instance, the evidence of the supply-side effect at the level of individual banks suggests that regulations to help improve banks' financial strength and alter bank characteristics appropriately should be encouraged to provide cushions for banks' core activities against uncertainty shocks. Besides, such conditional impacts could also contribute with policy implications that target the right bank groups when regulatory supervisors in banking are in charge.

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