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Monetary policy uncertainty, market structure and bank risk-taking: Evidence from China

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ABSTRACT

We identify the impact of monetary policy uncertainty (MPU) on bank risk-taking by exploiting the regional heterogeneity of bank market structure in China. Our findings show that a bank facing more competition will take more risks following an increase in MPU, compared with a bank facing less competition, thus confirm a positive impact of MPU on bank risk-taking. In addition, we find that MPU positively affects bank risk-taking by deteriorating its profitability and balance sheet. These findings suggest that the central bank can alleviate bank risks by enhancing the transparency of monetary policy.

1. Introduction

The influence of monetary policy uncertainty (MPU) on economic activities has been an important subject of research in the aftermath of the Great Recession. An extensive literature points out that a bank's leverage and risk-taking are negatively associated with the short-term interest rates (Borio and Zhu, 2008; Dell'Ariccia et al., 2017). It is therefore a natural step forward to contemplate that MPU might have a pronounced impact on bank risk-taking, since the uncertainty of short-term rate movement constitutes a main element in MPU. While there is an emerging literature on MPU and its impacts, it primarily focuses on financial markets and non-financial firms,[1] paying much less attention to bank risk-taking[2].

We fill this gap by identifying the relationship between bank risk-taking and MPU using the regional heterogeneity approach of Nakamura and Steinsson (2018). In particular, we exploit differential bank market structure across prefectural cities in China. Bank market structure is determined by market competitiveness, as measured by the Herfindahl-Hirschman index (HHI) in bank asset shares at the city-level. Following Keeley (1990), bank market structure is closely related to bank risk-taking. In addition, Drechsler et al. (2017) show that market structure is also a primary determinant of the influence on bank behaviors by monetary policy. Consequently, we hypothesize that regional differences in market structure will lead to differential bank risk-taking behaviors, under the same MPU shocks.

We estimate a panel regression model accordingly, with a sample of 465 Chinese commercial banks over the period of 2007–2020.

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[1] See, for example, Kurov and Stan (2018), Husted et al. (2020), Lakdawala et al. (2021), and Fasani et al. (2022).

[2] Phan et al. (2021) and Wu et al. (2021) both focus on the general measure of economic policy uncertainty and its impact on bank risk-taking using the cross-country data, and largely dismiss the identification issue. Ouyang et al. (2022) investigate the spillover effect of the US MPU on bank systemic risk in the emerging markets.

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The reason of choosing China as our research setting is twofold. First, China's monetary policy making is less transparent than those of advanced economies, and there is no officially pronounced policy rules existing in China. As a result, time to time there are considerable debates and speculations on the future trajectories of monetary policy in China, which translate into an overall high level of MPU with significant fluctuations over time. Second, while China's banking market is the largest one in the world with rich heterogeneity across regions, the entire banking sector is subject to a unified regulatory framework nationwide. As a result, it provides us with a rare opportunity to more precisely identify the impact of MPU on bank risk-taking by exploiting the cross-region heterogeneity in bank market structure. This is important, since MPU is an aggregate time series measure, which renders it very difficult to identify a causal relationship solely relying on the time variations in MPU per se.

We find that a bank located in a less concentrated market structure, hence facing more competition, will take more risk after an increase in MPU. This confirms a positive impact of MPU on bank risk-taking. The principal results still hold when additional endogeneity concerns on the measure of MPU are taken into account. Moreover, we find that a rise in MPU increases bank risk-taking by deteriorating its profitability and balance sheet.

Our paper makes two contributions to the existing literature. First, a substantial body of literature has examined the nexus between MPU and corporate performance, such as firm investment (Husted et al., 2020), and firm risk-taking (Luo et al., 2022), while we pay closer attention to the nexus between MPU and bank performance, especially bank risk-taking. Second, the existing literature mainly focuses on the effect of level changes in monetary policy (i.e., measured by the short-term interest rate) on bank risk-taking (Borio and Zhu, 2008; Dell'Ariccia and Marquez, 2013; Dell'Ariccia et al., 2017), and by far only a few papers investigate the relationship between MPU and bank risk-taking but do not directly address the identification issue. This paper, in contrast, presents evidence on the positive impacts of MPU upon bank risk-taking identified via regional heterogeneity in bank market structure in China, and provides further evidence on the two channels, profitability and balance sheet, through which MPU affects bank risk-taking.

The rest of paper is organized as follows. Section 2 formulates the model and examines that relationship between MPU and bank risk-taking. Section 3 investigates the channels through which MPU affects bank risk-taking. Section 4 concludes.

2. Empirical analysis

2.1. The model settings

Exploiting the regional heterogeneity in market structure across prefectural cities, we specify the following panel regression to identify the impact of MPU on bank risk-taking:

$$RISK_{ic,t} = \beta_1 + \beta_2 MPU_{t-1} + \beta_3 MPU_{t-1} \times HHI_{c,t-1} + \beta_4 HHI_{c,t-1} + \boldsymbol{X}_{i,t}^{\top}\boldsymbol{\phi} + \boldsymbol{Z}_{t}^{\top}\boldsymbol{\theta} + \alpha_i + \epsilon_{ic,t}, \quad (1)$$

where *i, c, t* index for bank, city and year, respectively; *RISK* denotes bank risk-taking; *MPU* is an indicator of China's monetary policy uncertainty constructed by Huang and Luk (2020)[3]; *HHI* is the city-level bank market structure measured by Herfindahl-Hirschman index in bank asset shares for city *c* where bank *i* is located; *X* and *Z* are vectors of control variables at the bank and macro levels; and α_i is bank fixed effect[4]. We also control for year fixed effect α_t below to fully absorb all macro-level variations.

2.2. Sample and data sources

We construct a panel data sample comprising 465 Chinese commercial banks over the period of 2007–2020. We exclude the policy and foreign banks, and also the banks with observations less than 3 years. The sample includes all state-owned banks, joint stock banks, city commercial banks, and more than 300 rural commercial banks. The assets of sample banks account for 98% of the total assets of China's banking sector.

We consider for the three indicators of bank risk-taking: Z-score (*ZSCORE*), non-performing loan ratio (*NPL*), and provision coverage ratio (*PC*). Note that Z-score and provision coverage ratio take logarithmic value[5]. Following Laeven and Levine (2009), the Z-score is defined by

$$ZSCORE_{i,t} = \left(ROA_{i,t} + EAR_{i,t}\right) / \sigma\left(ROA_{i,t}\right), \quad (2)$$

where *ROA* is the return on assets, *EAR* is the equity-to-asset ratio, and σ(*ROA*) denotes the standard deviation of *ROA*. The bank-level

[3] The original MPU index is monthly. To ensure the compatibility with the other data in terms of the frequency, we transform the monthly index to the annualized index simply by taking average. The monthly index is constructed using 114 mainland Chinese newspapers, by far the most comprehensive one on China's policy uncertainty, and is available at https://economicpolicyuncertaintyinchina.weebly.com.

[4] We do not include the city fixed effects, since except for a few large banks operating across the entire country, most banks in our sample are small banks operating within one city. As a result, even if the city fixed effects are added, they will largely be absorbed by the bank fixed effects.

[5] Provision coverage ratio is transformed by taking natural logarithm, since its distribution is highly right-skewed.

Table 1
Summary statistics.

Variables	Obs	Mean	Std. Dev.	Min	Max
Bank-level variables					
ZSCORE	3674	3.255	0.539	1.230	4.468
NPL	3375	0.018	0.013	0.001	0.094
PC	3140	5.471	0.500	3.800	7.183
SIZE	3674	10.909	1.612	7.612	15.889
ROE	3674	0.124	0.057	0.001	0.319
EFFI	3674	0.613	0.142	0.303	1.000
DTL	3674	0.814	0.127	0.427	0.985
LTD	3674	0.653	0.120	0.362	1.200
RES	3674	0.182	0.062	0.068	0.474
HHI	3674	0.103	0.039	0.046	0.224
Macro-level variables					
MPU × HHI	3674	0.504	0.203	0.204	1.217
MPU	3674	4.847	0.309	4.394	5.429
GDP	3674	0.070	0.019	0.023	0.106
M2	3674	0.125	0.041	0.083	0.266
INF	3674	−0.001	0.017	−0.062	0.040
BOOM	3674	4.255	0.097	4.136	4.449
SCI	3674	7.964	0.190	7.507	8.172
ISI	3674	3.998	0.252	3.468	4.415
CCI	3674	4.699	0.078	4.561	4.825
EGDP	3674	6.792	2.130	1.200	10.500

Notes: This table reports summary statistics for the main variables used in the baseline model.

controls include the natural logarithm of bank assets (*SIZE*), return on equity (*ROE*), operating cost to operating income ratio (*EFFI*), deposit to liability ratio (*DTL*), loan to deposit ratio (*LTD*), reserve ratio (*RES*), and city-level *HHI*.[6] Bank-level data, including *HHI*, are obtained from the China Banking Database (CBD).[7] To control for macroeconomic conditions, we retrieve from the CSMAR database GDP growth (*GDP*), M2 growth (*M2*), inflation (*INF*), Bank Boom Index (*BOOM*) and Shanghai Composite Index (*SCI*), with the last two in logarithm. Following Husted et al. (2020), we also control for expectations of future economic conditions, including the one-year-ahead projected GDP growth (*EGDP*) from the World Bank, and Consumer Confidence Index (*CCI*) plus Investor Sentiment Index (*ISI*) in logarithm from the CSMAR database. The definition and measurement of the variables are described in Table A.1.

To limit the influence of outliers, we winsorize all bank-level variables at 1% and 99% level. No macro variable is winsorized. Table 1 reports summary statistics of all variables.

2.3. Results

Table 2 reports the estimation results of Eq. (1). In even columns, we additionally control for the year fixed effect. As shown in columns (1) and (2), the coefficients of the interaction term are positive and significant at 5% level, indicating that a higher level of market competition (less concentration) enhances the positive effect of MPU on bank risk-taking, as the Z-score is an inverse indicator for bank risk-taking. Intuitively, interest margins in general are lower for banks in a more competitive market, so that they are more vulnerable to MPU shocks which raise funding uncertainty and costs. In addition, these banks may face a dilemma on credit rationing and market shares as MPU rises. Credit rationing could attenuate risk exposure to MPU, but doing so might undermine their market shares. When the loss of market shares has a persistent effect on the banks' businesses, they are less likely to ration loans in response to a rise in MPU. Thus, market competition is associated with a significantly stronger effect of MPU on bank risk-taking. The same logic also applies to the alternative indicators of bank risk-taking, see columns (3)–(6).

2.4. Robustness checks

As argued by Gulen and Ion (2016) and Kaviani et al. (2020), the news-based policy uncertainty index is subject to possible measurement error. Although this index is designed to measure monetary policy uncertainty, it may nonetheless embed other information, such as general economic uncertainty unrelated to monetary policy. To address this problem, we use a method developed by Kaviani et al. (2020) to regress the Chinese MPU on the Korean counterpart, and then take the residuals as an alternative measure of the

[6] Except for the state-owned banks and joint stock banks, most banks in China operate within the cities they headquartered. Only a handful city and rural commercial banks operate across cities or provinces, but the business shares outside the home cities are typically limited. For a state-owned or joint stock bank, we use the average of city level HHIs where the bank has branches, weighted by the ratio of the number of branches in a city to the total number of branches of the bank.

[7] The CBD is a newly constructed database on China's banking sector, covering more than 1,000 banks over the past two decades. To our knowledge, the CBD is the most comprehensive micro database for banks in China, and the coverage outweighs other popular bank-level database, including Bankscope/Bankfocus, WIND and CSMAR.

Table 2
The impact of MPU on bank risk-taking.

	(1) ZSCORE	(2) ZSCORE	(3) NPL	(4) NPL	(5) PC	(6) PC
MPU × HHI	1.129***	0.738**	−0.082***	−0.062***	6.077***	4.943***
	(0.298)	(0.311)	(0.021)	(0.023)	(0.875)	(0.907)
MPU	−0.232***		0.008***		−0.513***	
	(0.035)		(0.002)		(0.092)	
HHI	−6.119***	−3.697**	0.421***	0.301**	−29.012***	−22.162***
	(1.601)	(1.684)	(0.113)	(0.121)	(4.585)	(4.802)
SIZE	−0.051*	−0.102***	0.002**	0.004***	−0.078	−0.205***
	(0.027)	(0.030)	(0.001)	(0.001)	(0.059)	(0.065)
ROE	−1.620***	−1.522***	−0.027***	−0.031***	1.631***	1.853***
	(0.209)	(0.212)	(0.007)	(0.007)	(0.359)	(0.355)
EFFI	−0.813***	−0.787***	0.028***	0.027***	−0.638***	−0.597***
	(0.069)	(0.069)	(0.003)	(0.003)	(0.121)	(0.117)
DTL	0.696***	0.663***	0.006**	0.007***	−0.467***	−0.530***
	(0.078)	(0.076)	(0.003)	(0.003)	(0.166)	(0.163)
LTD	0.531***	0.516***	0.013***	0.015***	−0.833***	−0.895***
	(0.071)	(0.070)	(0.004)	(0.004)	(0.133)	(0.134)
RES	0.032	0.001	−0.001	0.000	0.391	0.292
	(0.131)	(0.132)	(0.009)	(0.009)	(0.242)	(0.243)
GDP	8.398***		0.035		3.833	
	(1.288)		(0.080)		(3.735)	
M2	−3.346***		0.035**		−4.326***	
	(0.284)		(0.016)		(0.646)	
INF	−0.418		−0.045***		3.691***	
	(0.268)		(0.013)		(0.588)	
BOOM	0.245**		−0.028***		1.774***	
	(0.096)		(0.005)		(0.216)	
SCI	0.241***		−0.005***		0.268***	
	(0.029)		(0.001)		(0.082)	
ISI	−0.114***		0.000		−0.027	
	(0.025)		(0.001)		(0.065)	
CCI	−1.113***		0.017**		−0.947***	
	(0.147)		(0.007)		(0.326)	
EGDP	−0.064***		0.001*		−0.097***	
	(0.010)		(0.001)		(0.030)	
Constant	7.759***	3.948***	−0.009	−0.044***	5.598***	7.890***
	(0.598)	(0.362)	(0.033)	(0.015)	(1.271)	(0.836)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes
Adj. R^2	0.303	0.318	0.285	0.294	0.345	0.362
Num. banks	465	465	452	452	444	444
Obs.	3674	3674	3375	3375	3140	3140

Notes: This table reports the OLS panel regression where the dependent variable is bank risk-taking using the three alternative measures: Z-score (*ZSCORE*), non-performing loan ratio (*NPL*), and provision coverage ratio (*PC*). Standard errors are clustered at the bank level and reported in parenthesis. *, **, and *** denote 10%, 5%, and 1% statistical significance, respectively.

Chinese MPU (*RMPU*).[8] Given the fact that China and Korea have close economic ties with high levels of trade between the two countries due to geographical proximity, many economic uncertainty shocks that influence one of the two countries should also affect the other. Since the economic size of China is much greater than that of Korea, the economic uncertainty shocks to the Chinese economy are more likely to affect the Korean economy than the reserve. Thus, the residuals may represent a cleaner version of the Chinese MPU, which is less contaminated by economic uncertainty.

Table 3 reports the results by replacing *MPU* with *RMPU* in Eq. (1). Evidently, the results are robust to this alternative measure. In addition, the benchmark results are also robust to measuring HHI by loan shares, controlling for other types of policy uncertainties, and using the dynamic GMM estimation[9].

3. Inspecting the mechanisms

The preceding results have shown that higher level of bank competition will amplify the effect of MPU on bank risk-taking. In this section, we investigate the two channels through which MPU affects bank risk-taking: profitability and balance sheet conditions. To

[8] The frequency of MPU used in the regression is monthly. We convert the monthly residuals to the annualized residuals simply by taking average.
[9] Due to the limited length of the paper, these results are provided upon request.

Table 3
Robustness checks: residual MPU.

	(1) ZSCORE	(2) ZSCORE	(3) NPL	(4) NPL	(5) PC	(6) PC
RMPU × HHI	1.012**	1.051**	−0.091***	−0.081***	6.886***	6.319***
	(0.414)	(0.424)	(0.025)	(0.026)	(1.160)	(1.188)
RMPU	0.095		0.001		−0.032	
	(0.066)		(0.003)		(0.153)	
HHI	−0.392	−0.155	0.013	0.003	1.125	1.743
	(0.468)	(0.476)	(0.020)	(0.021)	(1.167)	(1.204)
Constant	3.794***	3.935***	0.101***	−0.043***	−1.289	7.827***
	(0.564)	(0.362)	(0.026)	(0.015)	(1.087)	(0.844)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes
Adj. R^2	0.302	0.318	0.289	0.295	0.356	0.363
Num. banks	465	465	452	452	444	444
Obs.	3674	3674	3375	3375	3140	3140

Notes: This table reports the results of OLS panel regression where monetary policy uncertainty is measured by the residual (*RMPU*) in the regression of the Chinese MPU on the Korean MPU. Standard errors are clustered at the bank level and reported in parenthesis. *, **, and *** denote 10%, 5%, and 1% statistical significance, respectively.

Table 4
Inspecting the mechanisms.

Panel A: The first stage regression						
	(1) PROFIT	(2) MARGIN	(3) FIN	(4) DEBTR	(5) LEV	(6) CAR
MPU × HHI	0.011**	0.036***	0.383***	−0.102***	−16.311***	0.251***
	(0.005)	(0.012)	(0.128)	(0.024)	(4.471)	(0.039)
MPU	−0.004***	−0.013***	−0.051***	0.021***	3.186***	−0.022***
	(0.001)	(0.001)	(0.014)	(0.003)	(0.548)	(0.005)
HHI	−0.047**	−0.113*	−1.818**	0.545***	89.047***	−1.181***
	(0.025)	(0.064)	(0.659)	(0.121)	(23.808)	(0.205)
Panel B: The second stage regression						
	ZSCORE	ZSCORE	ZSCORE	ZSCORE	ZSCORE	ZSCORE
PROFIT	41.299***					
	(7.051)					
MARGIN		10.133***				
		(2.150)				
FIN			3.044***			
			(1.042)			
DEBTR				−11.139***		
				(1.029)		
LEV					−0.072***	
					(0.006)	
CAR						2.960***
						(0.844)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Num. of banks	452	390	445	452	452	443
Obs.	3661	2818	3489	3661	3661	3467
Kleibergen-Paap F statistic	27.75	54.94	5.41	20.84	13.05	18.14
Stock-Wright P-value	0.000	0.000	0.000	0.000	0.000	0.000

Notes: This table reports the results for the 2SLS regression where the endogenous regressors are channel variables, and excluded exogenous variables are MPU_{t-1}, $MPU_{t-1} \times HHI_{t-1}$ and HHI_{t-1}. The Kleibergen-Paap F statistic is the test statistic for weak identification, and the Stock-Wright P-value is the test statistic for weak-instrument robust inference. Robust standard errors are reported in parenthesis. *, **, and *** denote 10%, 5%, and 1% statistical significance, respectively.

evaluate possible mechanisms, we use a two-stage least squares (2SLS) regression approach. We are interested in how the variations in bank's profitability and balance sheet conditions caused by MPU and its interaction with bank market structure will affect bank risk-taking. This naturally fits into the framework of 2SLS, where the first stage regression of a channel variable on MPU and the interaction term captures exactly the variations in the channel variable, and thus the second stage regression can identify correctly the impact upon bank risk-taking transmitted by the channel variable. Note that a simple OLS regression of bank risk-taking on a channel variable suffers from endogeneity issues, chief among which is the omission of potential variables. Theoretically, bank risk-taking, profitability, and balance sheet conditions are all determined jointly by bank's optimizing decisions, given all sorts of shocks exogenous to the bank. For instance, it is likely that the trade war between China and the US will move bank risk-taking and profitability simultaneously. Yet,

given that MPU in China is unlikely to be related to the trade war, it can serve as a valid IV since MPU is closely related to bank's profitability. Analogously, some bank-specific factors, such as corporate governance and corporate culture, may affect both bank risk-taking and its balance sheet conditions, but such factors are not easily observed and controlled for in an OLS regression. Given that MPU and bank market structure are unlikely to be linked to these unobserved factors, an IV estimation will more accurately identify our desired effect. To sum up, the 2SLS framework accomplishes two tasks simultaneously, one for channel evaluations, and the other for reducing endogeneity biases.

In the first-stage regression, we estimate the effect of MPU on a particular channel variable:

$$M_{ic,t} = \beta_1^M + \beta_2^M MPU_{t-1} + \beta_3^M MPU_{t-1} \times HHI_{c,t-1} + \beta_4^M HHI_{c,t-1} + \boldsymbol{X}_{i,t}^{\top}\boldsymbol{\phi}^{\mathbf{M}} + \boldsymbol{Z}_t^{\top}\boldsymbol{\theta}^{\boldsymbol{M}} + \alpha_i + \epsilon_{ic,t}, \tag{3}$$

where $M_{ic,t}$ is a channel variable of the banks, and the definitions of the other variables are the same as those of Eq. (1). All coefficients are indexed by superscript M to distinguish those from the baseline model. As in the benchmark model, the identification primarily relies on the interaction term of MPU and HHI. Then in the second stage regression, the dependent variable is regressed on the fitted value $\widehat{M}_{ic,t}$ implied by the first-stage regression:

$$RISK_{ic,t} = \gamma + \delta\widehat{M}_{ic,t} + \boldsymbol{X}_{i,t}^{\top}\boldsymbol{\psi} + \boldsymbol{Z}_t^{\top}\boldsymbol{\eta} + \alpha_i + \epsilon_{ic,t}, \tag{4}$$

where δ is the key coefficient that captures the impacts of the variations in channel variable mainly caused by MPU and HHI upon bank risk-taking.

3.1. Profitability

The existing literature has emphasized that increased uncertainty will raise the costs of debt financing due to higher likelihood of default incurred (Greenwald and Stiglitz, 1990; Gilchrist et al., 2014). For banks, an increase in MPU leads to higher uncertainty of marginal funding costs, which translates into higher overall costs of bank liability by increasing the shadow costs of bank liquidity management, and thereby reducing their profitability. In this paper, we consider the three measures of profitability: operating profit to asset ratio (*PROFIT*), net interest margin (*MARGIN*), return on financial assets (*FIN*). Net interest margin is defined as the net interest divided by the sum of reserves, loans, financial and interbank assets.

As shown in Columns (1)–(3) of Table 4, an increase in MPU undermines the bank's profitability, and higher market competition will enhance the negative effects of MPU. In addition, the second-stage regression results show that bank risk-taking is positively associated with profitability, irrespective of the measures of profitability. Together with the first-stage regression results, it suggests that an increase in MPU raises bank risk-taking by reducing its profitability.

3.2. Balance sheet

The balance sheet theory postulates that increased uncertainty generates downward pressure on asset prices, leading to a deterioration in the banks' balance sheets. In particular, increased MPU leads to a decline in firms' investment and production (Mumtaz and Zanetti, 2013; Born and Pfeifer, 2014; Husted et al., 2020), and consequently, raises the costs of debt financing and the likelihood of default on their loans. In this way, the banks' asset side may deteriorate. Moreover, increased MPU will drive up interbank rates and destabilize interbank positions, generating a negative impact on the banks' liability side. We use the three measures to proxy for the bank's balance sheet condition: debt-to-asset ratio (*DEBTR*), leverage ratio (*LEV*) and capital adequacy ratio (*CAR*). Note that bank leverage is defined as the ratio of assets over equity.

As shown in Table 4, we find that increased MPU deteriorates the bank's balance sheet by enhancing its debt ratio and leverage, and lowering its capital adequacy ratio. Consequently, bank risk-taking rises. In addition, higher bank competition strengthens the positive effects of MPU on bank risk-taking. That is, a bank facing more competition will take more risks following an increase in MPU, compared with a bank facing less competition.

4. Conclusion

In this paper, we identify the impact of MPU on bank risk-taking by exploiting the regional heterogeneity of market structure in China. Our findings show that a bank facing more competition will bear more risks, given an increase in MPU, confirming that higher MPU exacerbates bank risk-taking. Our results are robust to using alternative measures of risk-taking and accounting for additional endogeneity concerns. In addition, we find that MPU positively affect bank risk-taking by deteriorating its profitability and balance sheet. An important implication of this study is that the central bank should enhance the transparency of monetary policy making. In doing so, it could curb bank risk-taking, and thus maintain financial stability.

CRediT authorship contribution statement

Xinyu Ge: Conceptualization, Formal analysis, Software, Validation, Supervision, Writing – review & editing. **Yan Liu:** Conceptualization, Methodology, Data curation, Validation, Funding acquisition, Writing – review & editing. **Jiali Zhuang:** Investigation, Data curation, Visualization, Project administration, Writing – original draft.

Table A.1
Variable descriptions.

Variables	Definition	Measurement
Bank-level variables		
ZSCORE	Z-score	The natural logarithm of the Z-score
NPL	Non-performing loan ratio	The natural logarithm of NPL
PC	Provision coverage ratio	Provisions/Non-performing loans
SIZE	Bank size	The natural logarithm of total assets
ROE	Return on equity	Net profit/Equity
EFFI	Operating efficiency	Operating cost/Operating income
DTL	Deposit to liability ratio	Deposits/Liabilities
LTD	Loan to deposit ratio	Loans/Deposits
RES	Reserve ratio	Reserves/Deposits.
PROFIT	Profitability	Operating profit/Total assets
MARGIN	Net interest margin	Net interest/ (Reserves+Loans+Financial assets+Interbank assets)
FIN	Return on financial assets	Investment income/Financial assets
DEBTR	Debt ratio	Total liabilities/Total assets
LEV	Leverage ratio	Total assets/Equity
CAR	Capital adequacy ratio	Total capital/Risk-weighted assets
HHI	Herfindahl-Hirschman index	The natural logarithm of the city-level HHI by assets
Macro-Level variables		
MPU	Monetary policy uncertainty index	The natural logarithm of the annualized index
GDP	GDP growth	
M2	M2 growth	
INF	Inflation	Year-on-year CPI growth rate
BOOM	Bank boom index	The natural logarithm of the index
SCI	Shanghai composite index	The natural logarithm of the index
ISI	Investor sentiment index	The natural logarithm of the index
CCI	Consumer confidence index	The natural logarithm of the index
EGDP	One-year-ahead projected GDP growth	

Notes: This table describes the definition and measurement of the variables. The bank-level data is obtained from the CBD database, and the macro-level data, except for MPU and the one-year-ahead projected GDP growth, is obtained from the CSMAR database. The monthly MPU index is constructed by Huang and Luk (2020), and available at https://economicpolicyuncertaintyinchina.weebly.com. We convert the monthly frequency to the annual frequency simply by taking average. The one-year-ahead projected GDP growth is obtained from the World Bank.

Declarations of Competing Interest

None.

Data availability

Data will be made available on request.

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Appendix

References

Borio, C., and H. Zhu. 2008, Capital regulation, risk-taking and monetary policy: a missing link in the transmission mechanism? BIS Working Paper No. 268.
Born, B., Pfeifer, J., 2014. Policy risk and the business cycle. J. Monet. Econ. 68, 68–85.
Dell'Ariccia, Giovanni, Marquez, Robert, 2013. Interest rates and the bank risk-taking channel. Annu. Rev. Financ. Econ. 5, 123–141.
Dell'Ariccia, G., Laeven, L., Suarez, G.A., 2017. Bank leverage and monetary policy's risk-taking channel: evidence from the United States. J. Finance 72 (2), 613–654.
Drechsler, I., Savov, A., Schnabl, P., 2017. The deposits channel of monetary policy. Q. J. Econ. 132, 1819–1876.
Fasani, S., Mumtaz, H., Rossi, L., 2022. Monetary policy uncertainty and firm dynamics. Rev. Econ. Dyn. Forthcoming.
Greenwald, B.C., Stiglitz, J.E., 1990. Macroeconomic models with equity and credit rationing. Asymmetric Information, Corporate Finance, and Investment. University of Chicago Press, pp. 15–42.
Gilchrist, S., Sim, J.W., Zakrajsek, E., 2014. Uncertainty, financial frictions, and investment dynamics. Natl. Bureau Econ. Res. 20038. Working Paper.
Gulen, H., Ion, M., 2016. Policy uncertainty and corporate investment. Rev. Financ. Stud. 29 (3), 523–564.

Huang, Y., Luk, P., 2020. Measuring economic policy uncertainty in China. China Econ. Rev. 59, 101367.
Husted, L., Rogers, J., Sun, B., 2020. Monetary policy uncertainty. J. Monet. Econ. 115, 20–36.
Kaviani, M., Kryzanowski, L., Maleki, H., Savor, P., 2020. Policy uncertainty and corporate credit spreads. J. Financ. Econ. 138, 838–865.
Keeley, M.C., 1990. Deposit insurance, risk, and market power in banking. Am. Econ. Rev. 80 (5), 1183–1200.
Kurov, A., Stan, R., 2018. Monetary policy uncertainty and the market reaction to macroeconomic news. J. Bank. Finance 86, 127–142.
Laeven, L., Levine, R., 2009. Bank governance, regulation and risk-taking. J. Financ. Econ. 93 (2), 259–275.
Lakdawala, A., Moreland, T., Schaffer, M., 2021. The international spillover effects of US monetary policy uncertainty. J. Int. Econ. 133, 103525.
Luo, W., Wang, Y., Zhang, X., 2022. Monetary policy uncertainty and firm risk-taking. Pacific-Basin Financ. J. 71, 101695.
Mumtaz, H., Zanetti, F., 2013. The impact of the volatility of monetary policy shocks. J. Money Credit Bank. 45 (4), 535–558.
Nakamura, E., Steinsson, J., 2018. Identification in macroeconomics. J. Econ. Perspect. 32 (3), 59–86.
Ouyang, Z., Dou, Z., Wei, L., Vasa, L., 2022. Nonlinear spillover effect of US monetary policy uncertainty on China's systematic financial risks. J. Bus. Econ. Manag. 23 (2), 364–381.
Phan, D.H.B., Iyke, B.N., Sharma, S.S., Affandi, Y., 2021. Economic policy uncertainty and financial stability–is there a relation? Econ. Model. 94, 1018–1029.
Wu, J., Li, H., Zheng, D., Liu, X., 2021. Economic uncertainty or financial uncertainty? An empirical analysis of bank risk-taking in Asian emerging markets. Finance Res. Lett. 39, 101542.