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Policy uncertainty and bank lending

Dung Viet Tran
Banking University Ho Chi Minh City

Abstract

The paper investigates a channel through which economic policy uncertainty may harm the real economy through bank lending behavior by using a dataset of US bank holding companies. We document a negative association between EPU and bank lending, meaning that banks are more likely to originate less loans in the time of high EPU. This negative effect is more pronounced with smaller banks. The effect of policy uncertainty on bank lending is actually uniform in sign but grows significantly in magnitude with the increase of quantiles, suggesting that policy uncertainty lowers bank lending in banks at all levels of bank lending. Additionally, the infla-tion risk EPU and the new-based element EPU are likely to have the highest effects on banks' risk-taking behavior, while the tax code expiration has positive impacts. We believe the study provides implications for various managers, investors and policy makers.

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Contact: Dung Viet Tran - dungtv@buh.edu.vn.
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1 Introduction

In the aftermath of the crisis, economic policy uncertainty (EPU) increases remarkably due to complicated developments in politics and economies worldwide (Bloom (2009), Nelson and Katzenstein (2014), Bloom et al. (2018), Tran and Nguyen (2019)). A recent but growing literature documents important and salient consequences of EPU on the real economy as well as on the corporate decisions. EPU is a main factor of determining the risk for equity pricing (Brogaard and Detzel (2015)), is priced in the equity options market as a risk factor (Kelly, Pástor, and Veronesi (2016)), and has negative consequences to the stock prices (Pastor and Veronesi (2012)), or stock liquidity (Nagar, Schoenfeld, and Wellman (2019)). Firm borrowing costs are also highly affected by the high policy uncertainty (Kaviani et al. (2017)). Studies also reveal that policy uncertainty has a significant effect on firm's M&A activities (Nguyen and Phan (2017), Bonaime, Gulen, and Ion (2018)), payout policy (Tran (2020)). Such uncer-tainty may lead firms to invest less and hire fewer employees (Baker, Bloom, and Davis (2016), Gulen and Ion (2016), Julio and Yook (2012)) and cause households to expense less and save more. In this paper, we examine a channel through which economic policy uncertainty may harm the real economy through bank lending behaviors.

Banks play an important role in the economy, these financial institutions transform primary securities issued by deficit units into secondary securities that are less risky, more liquid, and more convenient to surplus units. They are sensitive and adverse to uncertainty (Gissler, Oldfather, and Ruffino (2016)). There are two strands of literature explaining the impacts of economic policy uncertainty to the bank lending decisions. On the one hand, some may argue that economic policy uncertainty might induce banks to reduce their lending. When policy uncertainty is high, firms and household are more likely to hoard liquidity by prudent, reduce their expenses, consumptions and investments. Banks may supply less credit since they are less certain on the feasibility of the projects. In some extent, banks try to prevent the liquidity shocks by holding more liquid assets, selling illiquid assets (in an extreme case, at fire-sale prices) (Diamond and Rajan (2011)). This lead to a lower of lending during the time of high policy uncertainty. We call this hypothesis Uncertainty-Credit Crunches Hypothesis.

On the other hand, economic policy uncertainty induces a rise of the risk-taking behav-ior of banks through the channels of liquidity and credit. In the time of high uncertainty, firms are more likely to hoard liquidity to mitigate any future negative shocks. Households also increase their savings either by consuming less or by working more (Giavazzi and McMahon (2010), Aaberge, Liu, and Zhu (2017)). Acharya and Naqvi (2012) suggest that in times of

high uncertainty, banks experience an increase of liquidity since investors are more likely to switch from direct investments to savings in the form of bank deposits. This 'flight to quality' leaves banks flush with liquidity, lowering the sensitivity of bankers' payoffs to downside risks and inducing excessive credit volume. We call this hypothesis the Uncertainty-Credit Expansion Hypothesis.

Following prior literature, we use the change on bank loans (LENDING) as our primary measure of bank lending. We also use alternative measure such as credit growth which takes into account the amount of unused commitments as suggested in Cornett et al. (2011), and still find similar results. We rely on the policy uncertainty index developed by Baker, Bloom, and Davis (2016) as a proxy for EPU. The EPU index is a news-based index of policy uncertainty, which is constructed based on the weighted average of news articles that contain key terms related to policy uncertainty, tax expirations, CPI and government spending (Tran and Nguyen (2019)).

This study contributes to the existing literature in different ways. First, this study con-tributes to a growing strand of literature on the relationship between EPU and bank decisions. We extend this literature by investigating an important potential channel through which EPU may affect the real economy through reducing bank lending. Second, our study to the best of our knowledge provide one of the first evidence on the effect of policy uncertainty to bank lending across the distribution of bank lending. Our study stresses the negative effect of policy uncertainty on lending is strengthened for banks that lend more. We believe that our study can provide implications for regulators, policy makers, managers, and investors, when making decisions in a world of increasing economic political uncertainty.

Our empirical study typically examine the effect of EPU on bank lending by using a large sample of US banks from 2000:Q1-2017:Q4, and find a consistent evidence on the nega-tive relationship between EPU and the lending decisions of banks. This evidence is consistent with Ashraf and Shen (2019) who recently document that EPU is associated with higher aver-age interest rates on bank gross loans, and with higher loan spreads, when using syndicated loan deals data. Hu and Gong (2019) also suggest that EPU significantly hinders the growth of bank credit, but the effect varies across banks.[1]

Our main finding survives when adding more control variables, using different subsam-ples, alternative econometric techniques. We also perform the quantile regressions to release the assumptions of the homogeneity of the effects of EPU on bank lending taking, and find that the effect of policy

[1]We thank an anonymous referee for this remark.

uncertainty on bank lending is actually uniform in sign (negative) but grows significantly in magnitude (more negative) with the increase of quantiles, suggesting that policy uncertainty lowers bank lending in banks at all levels of bank lending.

Size is also a factor that shows a range of possible impacts from EPU. We take bank sizes into consideration and find that banks at all sizes are affected during high EPU, but with different amplitudes. Smaller banks are more likely to decrease their loan growth than larger banks.

We also carry out our main model using different components of EPU and find that the inflation risk EPU and the new-based element EPU are likely to have the highest effects on banks' risk-taking behavior, while the tax code expiration has positive impacts. Our main findings are robust with different robustness tests, including the instrumental variables ap-proach and alternative measures of EPU and risks.

The paper is organized as follows. Section (2) contains literature review and hypotheses on the relationship between EPU and bank risk. Section (3) describes our dataset, and variables, and descriptive statistics. We present our econometric approach, our empirical results in Section (4). A discussion of robustness tests is provided in Section (5). Section (6) identifies potential explanations for the linkage of EPU and bank risk. Section (7) concludes the study.

2 Literature review and hypotheses

There are two strands of literature explaining the impacts of economic policy uncertainty to the bank lending decisions. On the one hand, some may argue that economic policy uncertainty might induce banks to reduce their lending. Facing high policy uncertainty, these financial institutions tend to be more prudent, and postpone to originate loans and investments in anticipation of potential uncertainty. Economic policy uncertainty may lead to an increase of the external financing costs, aggravate the fnancial constraints of banks (Greenwald and Stiglitz (1990), Pastor and Veronesi (2012), Gilchrist, Sim, and Zakrajšek (2014), Brogaard and Detzel (2015)), leading banks to reduce their loan origination. Additionally, managers are more likely to become risk adverse when facing high economic policy uncertainty (Panousi and Papaniko-laou (2012)), and behave homogeneously in time of rising macroeconomic uncertainty (Chen and Funke (2003), Calmès and Théoret (2014)).

Under the perspective of the real options, prior literature suggests that banks reduce loans origination in times of high uncertainty (e.g. Bernanke (1983), Dixit and Pindyck, Gulen and Ion (2016)). Since policy uncertainty

may last for a limited period, the postpone of making loans in times of uncertainty allows banks to be more flexible to exploit profitable opportunities in the future. That is called the real–options-induced delay effects (Gulen and Ion (2016)). These arguments lead us to the first hypothesis called *Uncertainty-Credit Crunches Hypothesis*.

H1a. Policy uncertainty reduces bank lending

On the other hand, economic policy uncertainty induces a rise of the risk-taking behav-ior of banks through the channels of liquidity and credit. In the time of high uncertainty, firms delay investments in anticipation of potential negative perspectives, and are more likely to hoard liquidity to mitigate any future negative shocks. Households also increase their savings either by consuming less or by working more (Giavazzi and McMahon (2010), Aaberge, Liu, and Zhu (2017)). Acharya and Naqvi (2012) suggest that in times of high uncertainty, banks experience an increase of liquidity since investors are more likely to switch from direct in-vestments to savings in the form of bank deposits. This 'flight to quality' leaves banks flush with liquidity, lowering the sensitivity of bankers' payoffs to downside risks and inducing excessive credit volume. Furthermore, in times of uncertainty, the government is believed to extend far beyond the de-jure boundaries of insured depositors, and de-facto protect other banks liability holders (Tran and Nguyen (2018)), weakening the overall market discipline (Cubillas, Fonseca, and González (2012), Berger and Turk-Ariss (2014)). This may induce an increase in bank risk taking behaviors though excessive credit origination. We call this hypothesis the *Uncertainty-Credit Expansion* Hypothesis.

H1b. Policy uncertainty increases bank lending

3 Data sample and descriptive statistics

3.1 Sample banks

We retrieve the data from quarterly Y-9C regulatory reports comprising US bank holding companies (BHCs) with assets from $150 million and over. The data range covers the period of 2000:Q1 to 2017:Q4. We exclude all observations with incomplete or missing bank-quarter financial data on accounting variables. Following Berger and Bouwman (2013), we replace all observations whose ratio of total equity over total assets less than 1% with 1% to avoid any distortion in ratios including equity. We also exclude all observations with negative or nonex-istent outstanding loans or deposits. To reduce the effects of outliners, we winsorized all financial ratios at 1% level on their distribution's top and bottom. Table 1 defines all main variables.

Table 1. Definitions of Variables
This table provides definitions of all variables used in the research.

Variable	Definition
LENDING	The growth rate of loans
EPU	Economic policy uncertainty Barker et al. (2016)
SIZE	Size is computed by the natural logarithm of gross total assets
CAP	Cap is computed by book value of equity over gross total assets
EARNINGS	Income before taxes, provisions recognized in income over gross total assets
GROWTH	Growth is the growth rate of gross total assets
DUMMY LOSS	A dummy variable that equals 1 if net income is negative, and 0 otherwise
NII	Noninterest income / Net operating income

3.2 Variables

Our variable of dependent is the lending growth (LENDING) of bank i at time t. We use the growth rate of loans following prior literature (Cornett et al. (2011), Ibrahim and Rizvi (2017), Kim and Sohn (2017)) as the main proxy in our investigation. In the robustness tests, we also use alternative measure such as credit growth which also takes into account the unused commitments (off-balance sheet) in addition of bank loans (on-balance sheet) as suggested in Cornett et al. (2011).

Our variable of interest – the economic policy uncertainty is proxied by the U.S. EPU index developed by Baker, Bloom, and Davis (2016). The index is constructed daily and month-ly based on the weighted average of the following components: 1/2 on the broad news-based policy uncertainty index and 1/6 on each of the other three measures (the tax expirations index, the federal, state, local purchases disagreement measure, and the CPI forecast disagreement measure). Refer to Baker, Bloom, and Davis (2016) for the construction of the index. Following Gulen and Ion (2016), for each bank, the EPU variable is computed as the natural logarithm of the arithmetic average of the BBD index. For other tests, we create natural logarithm of each component of the EPU index to investigate their impacts on the bank lending behavior.

In our models, we include control variable as suggested from the literature (See e.g. Acharya, Berger, and Roman (2018), Berger et al. (2018)). The used control variables are the gross total assets (SIZE), capital ratio (CAP-

ITAL), earnings (EARNINGS), dummy variable for loss (DUMMY LOSS), non-interest income (NII) and non-performing loans (NPL). We also use some additional variables, such as deposits (DEPOSITS), dividends (DIVDENDS), GDP growth rate (GDP) and unemployment (UNEMP). We also control for the fixed-effects of commercial banks.

3.3 Descriptive statistics

Table (2) provides the summary statistics of all variables. The average of LENDING is 0.02, meanwhile the difference between its minimum and maximum values is large (-0.09 – 0.224), indicating that the bank lending fairly varies in our sample. The maximum value of EPU is 215.9 and its minimum value is 63.118, while its mean is 110.348, showing that the examined period is quite volatile; possibly because the examined period includes the financial crisis of 2007-2009.

Table 2. Main Variable Summary Statistics

Panel A: This table presents summary statistics for the main variables of U.S. BHCs used in the research. The sample period covers from 2000:Q1 to 2017:Q4. All financial variables are winsorized at 1% level on top and bottom of the distribution.

	N	mean	sd	min	max
LENDING	70,711	0.020	0.046	(0.090)	0.224
EPU	70,711	110.348	33.857	63.118	215.891
Size	70,711	13.716	1.351	12.089	19.109
Capital	70,711	0.092	0.030	0.019	0.220
Earnings	70,711	0.016	0.009	(0.020)	0.051
Dummy Loss	70,711	0.079	0.269	0.000	1.000
NII	70,711	0.227	0.136	0.000	0.814

Panel B:

	LENDING	*EPU*	*Size*	*Capital*	*Earnings*	*Dummy Loss*	*NII*
LENDING	1						
EPU	-0.2091*	1					
Size	-0.0326*	0.1383*	1				
Capital	0.0071*	0.0259*	0.0501*	1			
Earnings	0.1074*	-0.1497*	0.0667*	0.2562*	1		
Dummy Loss	-0.1956*	0.2361*	0.0580*	-0.1286*	-0.4786*	1	
NII	-0.0176*	0.0500*	0.3807*	0.0666*	0.1480*	0.0096*	1

The correlation between EPU and LENDING is significantly -0.208***, indicating the negative relationship between uncertainty and bank lending. It means banks are likely to reduce loan growth during the period of high EPU.

4 Does policy uncertainty impact bank risk-taking behaviour?

4.1 Model specifications

The aim of our research is to investigate the relation between LENDING and EPU. The empirical specification is as follows:

$$LENDING_{i,t-k\_1,t} = \alpha + \beta_1 EPU_{i,t-k} + \beta_2 CONTROL_{i,t-k} + \delta_i + {}_{i,t-k}$$

where the dependent variable of *LENDING* and *EPU* are measured by proxies described in subsection 3.2.2, and *CONTROL* is the vector of the control variables discussed in subsection 3.2.3. δ_i are bank fixed-effects. ε is the error term. The usage of a fixed-effects model in our main regressions is motivated by the fact that differences in bank risk are partially explained by the characteristics that are unobservable but constant across time bank (e.g. bank culture, managers). Since there exists the bias from within-group correlation in the sample, the standard errors are corrected for heteroscedasticity, and adjusted for clustering at bank level (Petersen (2009)). We do not include the time fixed effects following the prior literature (e.g. Gulen and Ion (2016)), but in unreported tests, we find similar findings when including time-fixed-effects.

We use lag of one quarter for all independent variables to ensure their predetermination relative to LENDING. In an unreported test, we use alternative lags (e.g.: 2,3,4). In all specifications, we still have similar results. The problem of simultaneity and endogeneity are addressed extensively in Section (5).

4.2 Empirical results

Table 3. Baseline Multivariate Analysis This table presents regression estimates of the relationship between EPU and LENDING. The dependent variable is LENDING and the main independent variable is EPU. The sample period covers from 2000:Q1 to 2017:Q4. All financial variables are winsorized at 1% level on top and bottom of the distribution. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. Standard errors are clustered at the BHC level. Robust standard errors are in parentheses.

	Baseline model	EPU_DQRT	Residual of EPU	Additional variables	Exclude M&A	Exclude crisis	Balanced panel data	Average analysis	Annual data	Prais-Winsten	Newey-West	Cluster two-way
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
EPU	-0.014***	-0.002***	-0.002***	-0.017***	-0.014***	-0.015***	-0.010***	-0.033***	-0.031***	-0.017***	-0.018***	-0.018***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.005)	(0.005)	(0.001)	(0.001)	(0.004)
Size	-0.028***	-0.029***	-0.022***	-0.028***	-0.022***	-0.028***	-0.015***	0.002***	-0.134***	-0.000	0.000	0.000
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)	(0.001)	(0.007)	(0.000)	(0.000)	(0.000)
Capital	0.194***	0.169***	0.295***	0.184***	0.129***	0.217***	0.133**	-0.090***	0.759***	-0.016	-0.041***	-0.041*
	(0.025)	(0.025)	(0.034)	(0.025)	(0.022)	(0.027)	(0.057)	(0.024)	(0.126)	(0.010)	(0.010)	(0.024)
Earnings	-0.260***	-0.244***	-0.320***	-0.139***	-0.232***	-0.282***	-0.125	0.081	-0.843***	-0.020	0.009	0.009
	(0.045)	(0.046)	(0.062)	(0.047)	(0.042)	(0.051)	(0.090)	(0.126)	(0.306)	(0.033)	(0.034)	(0.056)
Npl	-0.567***	-0.674***	-0.458***	-0.589***	-0.561***	-0.546***	-0.566***	-0.248***	-1.854***	-0.551***	-0.526***	-0.526***
	(0.024)	(0.022)	(0.027)	(0.024)	(0.023)	(0.025)	(0.067)	(0.075)	(0.117)	(0.014)	(0.015)	(0.038)
Dummy Loss	-0.013***	-0.014***	-0.011***	-0.011***	-0.014***	-0.014***	-0.019***	-0.010	-0.075***	-0.009***	-0.012***	-0.012***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.009)	(0.005)	(0.001)	(0.001)	(0.001)
NII	0.008*	0.009*	0.007	0.002	0.006	0.005	0.006	-0.008	0.013***	-0.003	-0.003	-0.003
	(0.004)	(0.004)	(0.006)	(0.005)	(0.004)	(0.005)	(0.008)	(0.006)	(0.004)	(0.002)	(0.002)	(0.004)
Deposits				0.012*								
				(0.006)								
Dividends				0.003***								
				(0.001)								
Unemployment				-0.022								
				(0.101)								
GDP				-0.027***								
				(0.007)								
Constant	0.464***	0.420***	0.312***	0.548***	0.385***	0.460***	0.283***	0.155***	2.024***	0.115***	0.115***	0.115***
	(0.020)	(0.020)	(0.031)	(0.023)	(0.019)	(0.021)	(0.038)	(0.021)	(0.094)	(0.004)	(0.004)	(0.019)
Observations	60,919	60,919	20,344	60,050	60,166	54,106	10,782	2,581	13,122	60,919	60,919	60,919
R-squared	0.143	0.140	0.120	0.155	0.152	0.137	0.114	0.109	0.318	0.078		0.108
Number of rssd9001	2,572	2,572	2,139	2,567	2,571	2,569	211		2,291			
BFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N_clust	2572	2572	2139	2567	2571	2569	211	2581	2291	.	.	.

Table (3) reports our estimation of the effects between EPU and bank lending. In our baseline model (Model (1)), we find a negative and statistically significant at the 1% level, suggesting that banks are more likely to reduce lending in high policy uncertainty environment. More specifically, one standard deviation increases of EPU, all other things being equal, leads to a decrease of lending of 4 bps (i.e. the coefficient on EPU, -0.014, multiplies by the standard deviation of EPU, 0.297). The value of mean of 0.020 and a standard deviation of 0.046 implies that the decrease of lending is economically significant, is equivalent of 20%.

In Model (3), we rank EPU variable into quartiles and create a variable called EPU_DQRT, which takes value ranging from 1 (low) to 4 (high). This approach generates greater variation in the distribution of uncertainty within our sample of study. We still obtain similar results.

Prior literature suggests that EPU may in some extent capture the effects of macroeco-nomic uncertainty. To mitigate concerns about collinearity between policy and economic uncertainty, we employ a 2-step model to isolate the effects of policy uncertainty from those of macroeconomic uncertainty (Tran (2019), Tran and Nguyen (2019)). Particularly, in the first step, we regress EPU on the fourth economic uncertainty variables (the VXO implied volatility index; the cross-sectional standard deviations of profit growth; the GDP forecast data; and the Jurado, Ludvigson, and Ng (2015) index) and obtain the residuals. Then, we re-perform our baseline model with In Model (1), we re-run our baseline model using the residual of EPU as a proxy for EPU. We obtain qualitatively the same result.

Although including control variables documented in literature, there might exist some correlated and omitted variables. In Model (4), we include other explanatory variables in order to remove the influence of potentially confounding factors on the relationship between EPU and bank lending. In Model (4), we include deposits ratio (DEPOSIT), dividend (DIVIDEND), and other macroeconomic variables such as unemployment rate of the state where locates the bank's headquarter and GDP growth rate. We obtain similar result.

In Model (5), we exclude all banks that engage M&A (proxies as the growth rate of assets over quarter higher than 20%) since banks may decide to acquire target banks that focus more on loan distribution. The coefficients on EPU are fairly similar, suggesting that our results are not driven by the sample of M&A banks.

Our data sample covers the global financial crisis of 2007-2009, which may induce a large structural break in bank's behaviors. This simultaneous rise in policy uncertainty and decrease in bank lending during the crisis rise a challenge for the causal interpretation of our results, as our regressions

can just be capturing the effects of general economic conditions. To address this issue, in Model (6), we perform our main model by excluding the crisis period. The results still hold in this subsample.

Next, in Model (7), we use the balanced panel data for our main model to mitigate the possible impacts of bank defaults and M&A activities on our investigation, but with the price of over-representation of "successful" banks (Tran, Hassan, and Houston (2019)). The obtained results are still robust.

In Model (8), we use an average data sample where we average all variables over bank's lifetime. This cross-sectional analysis is motivated by Stiroh and Rumble (2006), since it shows the clear measure of bank's strategic choices. In Model (9), we use annual data instead of quarterly data. In all specifications, we obtain similar results.

We end up our investigation when carrying out different tests, such as the Paris-Winsten for taking care of possible serial correlation (Model (10)), Newwey-West to produce consistent estimates in the case of existing autocorrelation and possible heteroskedasticity (Model (11)), and two-way cluster procedure for the correction of both cross-sectional correlation and serial correlation (Model (12)). In all specifications, we obtain similar results.

Regarding the control variables, we find that larger, well-performed, bad quality of loan portfolio banks tend to originate less of loans. Well-capitalized banks and banks with higher proportion of non-interest incomes experience higher loan growth. Next, banks with negative profits seem to issue less loan, since the coefficient on DUMMY LOSS is statistically negative.

In sum, the results show consistent evidence of lower loan growth during the period of high uncertainty, which confirm our *Uncertainty-Credit Crunches Hypothesis*.

4.3 The impacts of policy uncertainty across bank lending's distribution - Quantile regressions

Investors, regulators, and policy makers seem to be more interested in banks behaviors at the tails of the distribution of lending, since extremely low (high) loan growth may in same extent negatively affect the economy due to the problem of credit allocation to the real sector (Tran, Hassan, and Houston (2019)).

Table 4. Quantile regressions

This table presents regression estimates of the relationship between EPU and LENDING using quantile regressions. All financial variables are winsorized at the 1% and 99% levels. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. Numbers in parentheses are t-statistics.

	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
EPU	-0.0130***	-0.00959***	-0.0142***	-0.0148***	-0.0158***	-0.0166***	-0.0182***	-0.0205***	-0.0251***
	(0.000931)	(0.00202)	(0.000424)	(0.000464)	(0.000538)	(0.000594)	(0.000647)	(0.000959)	(0.00140)
Size	0.00299***	0.00368***	0.000869***	0.000133**	-0.000457***	-0.00105***	-0.00175***	-0.00232***	-0.00265***
	(0.000183)	(0.000606)	(6.62e-05)	(6.03e-05)	(7.94e-05)	(9.16e-05)	(0.000141)	(0.000169)	(0.000420)
Capital	-0.0822***	-0.0461***	-0.0875***	-0.0905***	-0.0922***	-0.0980***	-0.0968***	-0.0982***	-0.0178
	(0.00849)	(0.0153)	(0.00605)	(0.00630)	(0.00595)	(0.00624)	(0.00714)	(0.00980)	(0.0192)
Earnings	-0.0289	-0.215***	0.101***	0.129***	0.135***	0.160***	0.153***	0.138***	-0.0139
	(0.0354)	(0.0687)	(0.0309)	(0.0297)	(0.0294)	(0.0263)	(0.0270)	(0.0310)	(0.0619)
Npl	-0.530***	-0.462***	-0.515***	-0.504***	-0.506***	-0.506***	-0.508***	-0.529***	-0.584***
	(0.0116)	(0.0370)	(0.00966)	(0.00717)	(0.00729)	(0.00785)	(0.0111)	(0.0161)	(0.0208)
Dummy Loss	-0.0183***	-0.0240***	-0.0131***	-0.0125***	-0.0116***	-0.0115***	-0.0116***	-0.0110***	-0.0110***
	(0.000936)	(0.00294)	(0.000801)	(0.000727)	(0.000738)	(0.000751)	(0.000891)	(0.000915)	(0.00193)
NII	-0.0394***	-0.0722***	-0.0172***	-0.0111***	-0.00648***	-0.00347**	0.00363**	0.00934***	0.0298***
	(0.00186)	(0.00313)	(0.00169)	(0.00192)	(0.00134)	(0.00148)	(0.00178)	(0.00186)	(0.00349)
Constant	0.0240***	-0.0251**	0.0734***	0.0916***	0.110***	0.129***	0.153***	0.183***	0.223***
	(0.00365)	(0.0126)	(0.00198)	(0.00232)	(0.00284)	(0.00310)	(0.00365)	(0.00461)	(0.00685)
Observations	60,919	60,919	60,919	60,919	60,919	60,919	60,919	60,919	60,919

In this section, we perform quantile regressions, which release the assumption of the homogeneity of the effects of EPU on bank lending taking (Tran, Hassan, and Houston (2019), Tran, Hassan, and Houston (2019)). The results are presented in Table (4). The coefficients of EPU in Models (1) - (9) show the effect of EPU on LENDING is actually uniform in sign (negative) but grows significantly in magnitude (more negative) with the increase of quantiles, suggesting that EPU lowers LENDING in banks at all levels of LENDING. We plot the estimated effect of EPU from 9 separate quantile regressions for the quantiles ranging from 0.10 to 0.90 in Figure 1.

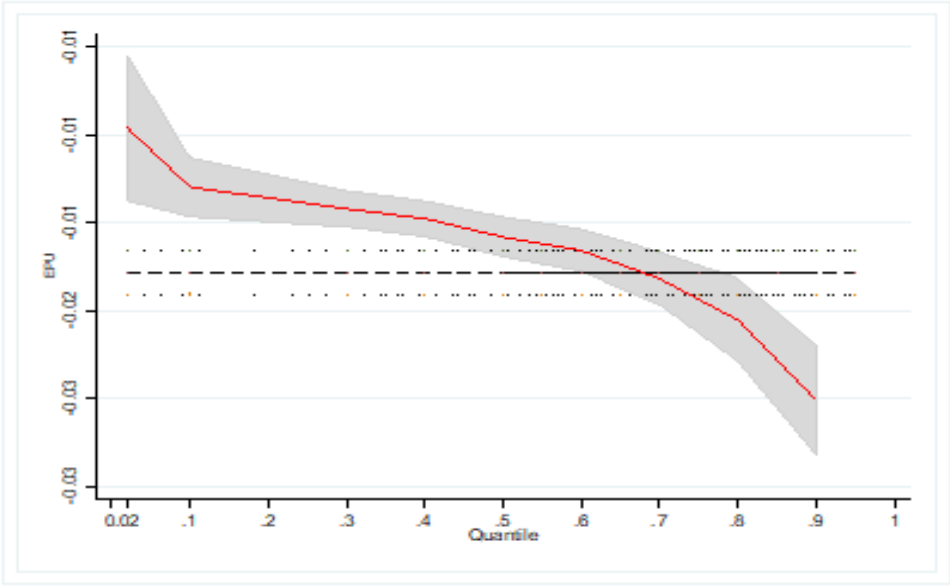

Figure 1: Policy uncertainty and bank lending - Quantile Analysis Estimates
Y-axis is the policy uncertainty. X-axis is the quantile levels of LENDING.

In summary, the results in this analysis indicate that EPU not only affects the conditional average LENDING, but also exerts influence on the LENDING dispersion. This also suggests that banks that lend more (high LENDING), leveraged by higher EPU environment, are more likely to decrease their loan originations. In other words, the impact of EPU appears to be more profound for banks that lend more.

4.4 How bank size influence the impact of policy uncertainty on bank lending?

In this section, we examine the impact of size on the relation between policy uncertainty and bank lending. The results are reported in Table (5).

In Model (1), to reduce autocorrelation effect, following De Jonghe (2010), we decom-pose banks size into two components by regressing bank size on other variables: (i) an organic growth component measured by the fitted value, (ii) a historical size component, which is tantamount to the residual. Accordingly, the size is orthogonalized with respect to the other variables and therefore allows us to derive the size's actual impact (Tran and Nguyen (2019)). In Model (2), following Ellul and Yerramilli (2013), we include size-decile fixed-effects in our baseline model. Next, we exclude the top ten largest banks in Model (3) to alleviate the concern of outliners. In Model (4), following Berger et al. (2016), we exclude all too-big-to-fail (TBTF) banks, which are banks with gross total assets higher than $100 billion. In all specifications, we obtain similar results.

In Models (5)-(7), we re-perform our baseline models with different range of bank size: (i) small banks with gross total assets bellow $1 billion, (ii) medium banks with gross total assets bellow $3 billion, and (iii) large banks with gross total assets above $3 billion. We do observe the coefficients of EPU are still negative and statistically significant in all these three specifications, but are increasing (less negative) with the increase of bank size. The evidence suggests that in the presence of high policy uncertainty, small banks are more likely to decrease their loan growth than larger banks. The results support the evidence of a negative association between EPU and LENDING, meaning that banks at all sizes decrease their loan growth in a high economic policy uncertainty environment, but with different amplitudes.

Table 5. The effects of the EPU on bank lending by bank size classes

This table presents regression estimates of the relationship between EPU and LENDING. All financial variables are winsorized at the 1% and 99% levels. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. Numbers in parentheses are t-statistics. Standard errors are clustered at the bank level.

	Residual size	*Size decile*	*Exclude Top 10th size*	*Exclude TBTF*	*Small*	*Medium*	*Large*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
EPU	-0.015***	-0.014***	-0.014***	-0.014***	-0.015***	-0.013***	-0.010***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.004)
Size	0.006***		-0.029***	-0.028***	-0.035***	-0.047***	-0.033***
	(0.001)		(0.002)	(0.001)	(0.002)	(0.004)	(0.007)
Capital	0.157***	0.172***	0.202***	0.194***	0.171***	0.270***	0.149*
	(0.026)	(0.026)	(0.027)	(0.025)	(0.028)	(0.063)	(0.082)
Earnings	-0.133***	-0.266***	-0.292***	-0.260***	-0.413***	-0.034	-0.157
	(0.048)	(0.048)	(0.048)	(0.045)	(0.056)	(0.082)	(0.121)
Npl	-0.663***	-0.660***	-0.568***	-0.567***	-0.578***	-0.579***	-0.558***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.025)	(0.052)	(0.094)
Dummy Loss	-0.013***	-0.014***	-0.013***	-0.013***	-0.012***	-0.011***	-0.018***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
NII	0.035***	0.016***	0.009*	0.008*	0.007	0.008	0.012
	(0.006)	(0.004)	(0.005)	(0.004)	(0.005)	(0.009)	(0.014)
Constant	0.082***	0.073***	0.466***	0.464***	0.544***	0.740***	0.613***
	(0.005)	(0.005)	(0.021)	(0.020)	(0.024)	(0.051)	(0.122)
Observations	59,085	60,919	55,779	60,919	41,568	14,543	4,808
R-squared	0.123	0.123	0.150	0.143	0.133	0.189	0.096
Number of rssd9001	2,555	2,572	2,468	2,572	2,197	629	173
BFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N_clust	2555	2572	2468	2572	2197	629	173

4.5 The effects of EPU components on bank lending

We go further to examine the effects of each component of EPU on bank lending, which allows us to have a better understanding on what type of uncertainty would affect bank behavior. The results are shown in Table (6).

Models (1) to (4) indicate that each component of EPU has different impact on bank lending. The news-based element EPU (EPU_NEW) and the EPU related to government spending (EPU_GOV) negatively affect the bank lending whereas the tax code expiration (EPU_TAX) has positive impact on bank lending. We do not find any evidence of the inflation risk EPU (EPU_CPI).

Table 6. Effects of the components of EPU on bank lending

This table presents estimation of first derivative of LENDING on each component of EPU. Robust standard errors are in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	EPU_NEW	*EPU_GOV*	*EPU_TAX*	*EPU_CPI*
	(1)	(2)	(3)	(4)
EPU	-0.011***	-0.010***	0.002***	-0.001
	(0.001)	(0.001)	(0.000)	(0.001)
Size	-0.031***	-0.027***	-0.033***	-0.029***
	(0.001)	(0.001)	(0.002)	(0.001)
Capital	0.187***	0.190***	0.151***	0.165***
	(0.025)	(0.025)	(0.026)	(0.026)
Earnings	-0.241***	-0.245***	-0.207***	-0.250***
	(0.045)	(0.045)	(0.046)	(0.046)
Npl	-0.597***	-0.576***	-0.704***	-0.669***
	(0.023)	(0.024)	(0.024)	(0.023)
Dummy Loss	-0.014***	-0.013***	-0.014***	-0.014***
	(0.001)	(0.001)	(0.001)	(0.001)
NII	0.008*	0.009**	0.006	0.008*
	(0.004)	(0.004)	(0.005)	(0.004)
Constant	0.482***	0.430***	0.465***	0.421***
	(0.021)	(0.020)	(0.022)	(0.020)
Observations	60,919	60,919	60,919	60,919
R-squared	0.144	0.142	0.139	0.137
Number of rssd9001	2,572	2,572	2,572	2,572
BFE	Yes	Yes	Yes	Yes
N_clust	2572	2572	2572	2572

5 Additional tests

5.1 Endogeneity concerns

Our investigation may be subject to endogeneity among variables. Policy uncertainty tends to be countercyclical (Bloom et al. (2018)). A potential concern for this is that the periods of high EPU may coincide with poor economic conditions inducing low profitability, and low capitali-zation, which in turn lower the demand for loans (Tran and Nguyen (2019)). That leads to the fact that the policy uncertainty and bank lending could be negatively correlated even in the absence of any direct relation between them. Additionally, both policy uncertainty and bank lending can be jointly correlated with unobservable dimension of economic uncertainty, inducing the concern factors causing concerns on endogeneity which potentially biases our coefficient estimates of EPU.

We first use the instrumental variables (IV) approach to address this issue. Even though in each of the prior estimations, we add the fixed-effects, and use lag of explanatory variables in order to mitigate endogeneity concerns, it is no longer effective when unobservable attrib-utes are time-variant. The results are shown in Table (7).

In the first stage, following Azzimonti (2018), Bonaime, Gulen, and Ion (2018), Tran and Nguyen (2019), we use the partisan confict index from the Federal Reserve Bank of Philadelphia, which is based on a frequency count of newspaper articles containing terms related to lawmakers' policy disagreement. The results obtained from the first-stage of the IV estimation reported in Model (1) show that the coefficient on the instrument is positive (0.004) at the 1% significance level, confirming its relevance. The Anderson LM statistic for under-identification test and the Cragg–Donald statistic for weak identification test are well above the critical values written in Stock and Yogo (2002), further indicating that our selected instru-ment is relevant.

In the second stage, we use the fitted EPU from the 1rst stage, and re-run our main base-line model. The coefficient on fitted EPU is negative at the 1% level, indicating that our findings are robust to endogeneity correction.

Table 7. Endogeneity

This table presents regression estimates of the relationship between EPU and LENDING. Model (1)-(2) report results using instrumental variable (IV) approach. Models (3)-(8) report results with additional variables. All financial variables are winsorized at 1% level on top and bottom of the distribution. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. Numbers in parentheses are t-statistics. Standard errors are clustered at the bank level.

	IV 1rst stage	*IV 2nd stage*	*CS_SIGMA*	*JURADO*	*VXO*	*SD_PROFIT*	*ALL*	*PCA*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PCI	0.00445***							
	(4.28e-05)							
EPU		-0.0143***	-0.011***	-0.013***	-0.013***	-0.016***	-0.013***	-0.013***
		(0.00165)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Size	0.00968***	1.07e-05	-0.029***	-0.029***	-0.029***	-0.027***	-0.027***	-0.029***
	(0.000886)	(0.000156)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
Capital	0.359***	-0.0443***	0.192***	0.192***	0.194***	0.204***	0.190***	0.194***
	(0.0372)	(0.00649)	(0.025)	(0.026)	(0.026)	(0.025)	(0.025)	(0.026)
Earnings	-0.0920	0.0174	-0.265***	-0.270***	-0.258***	-0.263***	-0.257***	-0.258***
	(0.142)	(0.0244)	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)
Npl	3.672***	-0.546***	-0.581***	-0.578***	-0.573***	-0.582***	-0.609***	-0.573***
	(0.0632)	(0.0140)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Dummy Loss	0.0815***	-0.0126***	-0.013***	-0.013***	-0.013***	-0.012***	-0.011***	-0.013***
	(0.00460)	(0.000786)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
NII	0.0548***	-0.00348**	0.009**	0.009**	0.008*	0.011**	0.011**	0.008*
	(0.00838)	(0.00145)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
CS_SIGMA			-0.004***				-0.003***	
			(0.001)				(0.001)	
JURADO				-0.014***			-0.019***	
				(0.003)			(0.003)	
VXO					-0.000***		-0.000***	
					(0.000)		(0.000)	
SD_PRODIT						0.011***	0.012***	
						(0.001)	(0.001)	
PCA								-0.001***
								(0.000)
Constant	4.001***	0.0998***	0.463***	0.477***	0.473***	0.417***	0.429***	0.471***
	(0.0119)	(0.00726)	(0.020)	(0.020)	(0.021)	(0.021)	(0.021)	(0.021)
Observations	60,919	60,919	60,251	60,251	60,251	60,251	60,251	60,251
R-squared		0.107	0.145	0.145	0.144	0.154	0.156	0.144
Number of rssd9001			2,567	2,567	2,567	2,567	2,567	2,567
BFE			Yes	Yes	Yes	Yes	Yes	Yes
N_clust			2567	2567	2567	2567	2567	2567
Weak identification test (Cragg-Donald Wald F statistic)	1.1e+04***							
Underidentification test (Anderson canon. corr. LM statistic)	9190.147***							

On the other hand, it is possible that EPU may capture the effects of macroeconomic uncertainty that potentially confounds our finding of a negative link between policy uncertainty and bank lending. To ensure our main finding is related to policy uncertainty, not driven by economic uncertainty, following Nguyen and Phan (2017), Bonaime, Gulen, and Ion (2018), Tran and Nguyen (2019), we include additional proxies for macroeconomic uncertainty: (i) the VXO implied volatility index (VXO), released by the Chicago Board Options Exchange; (ii) the cross-sectional standard deviations of profit growth (PROFIT GROWTH SD); (iii) the cross-sectional standard deviations of monthly returns from CRSP (CS_SIGMA); and (iv) the Jurado, Ludvigson, and Ng (2015) macroeconomic uncertainty (JURADO). We first augment one-by-one (Models (3)-(6)), and then all the above-mentioned variables (Model (7)) to our baseline model.

In Model (8), to avoid multicollinearity issues, we remove these three proxies for eco-nomic uncertainty above and add the Jurado, Ludvigson, and Ng (2015) monthly index of macroeconomic uncertainty to their first principal component. In all specifications, we still find significantly negative effect of EPU on LENDING.

5.2 Alternatives of bank lending

In this subsection, we use alternative measures of bank lending to test whether our results are still robust. The results are reported in Table (8).

First, we use the gross loan growth rate instead of our loan growth rate in Model (1). Following Cornett et al. (2011), in Model (2), we use credit growth when taking in consideration the commitments in the off-balance sheet. In all specifications, we obtain similar results.

Since credit risk plays a critical role in bank operation (Jiménez, Lopez and Saurina (2013)), we then use different proxies reflecting risk arising from lending activities, such as the ratio of non-performing loans (NPL), ratio of loans losses provisions (LLP), and ratio of loans losses allowances (ALW) (all normalized by total loans). Our results in Model (4)–(6) show that bank credit risks increase during the high policy uncertainty times.

Table 8. Alternative Measures of Lending

This table presents regression estimates of the relationship between different measures of lending. Standard errors are clustered at the bank level. All financial variables are winsorized at 1% level on top and bottom of the distribution. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. Robust standard errors are in parentheses.

	Gross loan growth	*Credit growth*	*NPL*	*LLP*	*ALW*	*NIM*
	(1)	(2)	(3)	(4)	(5)	(6)
EPU	-0.014***	-0.013***	0.019***	0.007***	0.005***	-0.001***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Size	-0.028***	-0.031***	0.013***	0.004***	0.001***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Capital	0.194***	0.184***	-0.080***	-0.031***	-0.004	0.027***
	(0.025)	(0.025)	(0.018)	(0.005)	(0.005)	(0.003)
Earnings	-0.261***	-0.250***	-0.354***	0.071***	-0.066***	0.290***
	(0.045)	(0.045)	(0.030)	(0.012)	(0.008)	(0.010)
Npl	-0.568***	-0.565***				
	(0.024)	(0.025)				
Dummy Loss	-0.013***	-0.016***	0.017***	0.011***	0.004***	0.001***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
NII	0.009*	0.012***	0.019***	-0.001	0.003***	-0.008***
	(0.004)	(0.004)	(0.003)	(0.001)	(0.001)	(0.001)
Constant	0.464***	0.488***	-0.235***	-0.079***	-0.025***	0.065***
	(0.020)	(0.021)	(0.012)	(0.004)	(0.003)	(0.003)
Observations	60,919	60,251	60,649	70,711	70,711	70,708
R-squared	0.143	0.154	0.386	0.167	0.246	0.035
Number of rssd9001	2,572	2,567	2,574	2,964	2,964	2,964
BFE	Yes	Yes	Yes	Yes	Yes	Yes
N_clust	2572	2567	2574	2964	2964	2964

6 Conclusions

In this study, we examine the impacts of economic policy uncertainty on bank lending behavior using a large sample of US banks during the period of 2000:Q1 to 2017:Q4.

We document a negative relationship between EPU and LENDING during the examined period. This implies that banks are less likely to originate loans during the time of economic policy uncertainty, which is consistent with our *Uncertainty-Credit Crunches Hypothesis*. We also find that the impact of EPU on LENDING appears to be strengthened for banks that originate more loans. When focusing on the effects of each component of EPU, we find that the news-based element EPU and the EPU related to government spending induce banks to reduce loans whereas the tax code expiration induces banks to increase loans. When it comes to bank size, our findings reveal that in the presence of high policy uncertainty, small banks are more likely to decrease their loan growth than larger banks. Our results are robust by using different proxies of lending and economic policy uncertainty. We obtain similar results when using a number of methods to control for potential endogeneity, alternative sub-samples, etc. The study enriches the literature on uncertainty and banks operations and have implications for various investors, managers and policy makers, especially when being confronted with and making decisions during high economic policy uncertainty.

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