Do Macroprudential Policies Lower Firms' Financial Leverage? Firm-level Evidence from China

Dr Thanos Andrikopoulos

University of Hull

July 2023

Conference on Research on Economic Theory and Econometrics

Together with Zhongfei Chen and Kexin Li

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Motivation

- The mitigation of systemic risk through the implementation of macroprudential policies (MPs) is a widely accepted practice
- MPs minimize disruptions in the provision of key financial services
- The effectiveness of MPs is measured by their impact on bank credit supply
- A decrease in credit supply, such as the implementation of tight MPs, would result in a decrease in the firm's financial leverage
- Therefore, MPs should lead to a reduction in a firm's leverage through the banking system (Ayyagari et al., 2018)

Motivation

- The importance of MPs lies in their ability to positively impact the real economy, beyond the banking sector
- There is limited empirical research that analyses the micro-level effects of MPs on nonfinancial firms
- A few studies, such as those by Ayyagari et al. (2018), and Yarba & Guner (2020), have shed light on the topic
- China places a great emphasis on mitigating banking systemic risk, due to the rapid growth of credit
- Bank loans are a primary source of funding for businesses
- China has implemented a series of MP measures, and has built up a significant macroprudential capacity

Contributions

- There is evidence of China's MPs success in reducing bank loan growth (Klingelhofer & Sun, 2019)
- However, there is limited understanding of the impact of these measures on the reduction of financial leverage among nonfinancial firms
- We examine the effects of MPs (tightening/loosening), following Richter et al. (2019), on nonfinancial firms in China
- Previous studies focus on the effect of MPs on macroeconomic factors, or on the banking system

Contributions

- We aim to find evidence of heterogeneity at the micro-level
- We use a dataset that includes both state-owned and non-state-owned firms
- We explore variations between firms of different sizes and listing boards
- We highlight the differences in the effects of MPs on small and large firms

Contributions

- Finally, we emphasize the importance of studying the ownership effects of MPs
- The inclusion of non-state-owned firms in the dataset enables a deeper exploration of the heterogeneity of the effects of MPs
- Our study of the impact on financial leverage in terms of short- and long-term objectives, aims to differentiate the role of MPs from other economic shocks
- To accomplish this, we classify MPs based on whether instruments are tight or loose, using a “tight” indicator

Related Literature

- Several studies have examined the macro-level effectiveness of MPs across economies
- With a focus on their impact on macroeconomic variables such as output, inflation, credit growth, and housing prices
- Their interactions with monetary policies
- Domestic borrower-based instruments, especially in emerging markets, are particularly effective in smoothing credit cycles (Fendoğlu, 2017)

Related Literature

- There is a general agreement that MPs can reduce:
  - Banking vulnerabilities (Claessens et al., 2013)
  - Credit growth (Mirzaei & Samet, 2022; Richter et al., 2019)
  - Housing prices (Akinci & Olmstead-Rumsey, 2018)
  - Fluctuations in real exchange rates (Ouyang & Guo, 2019)
- Issues such as the selection of optimal strategies, time-inconsistency
- Coordination with monetary policy (Forbes, 2020; Mendoza, 2016)
- Regulation of foreign exchanges (Ahnert et al., 2021)
- Effectiveness of MPs on domestic banks vs. foreign banks (Kim & Lee; 2017)
- Literature on the importance of proper institutional arrangements

Research Hypothesis

- MPs restrict credit growth through different channels
- One channel is through the tightening of reserve requirements and loan-to-value limits, which in turn decreases the supply of bank credit
- These measures lower firms' financial leverage, especially in cases where banks serve as the primary financial intermediaries for firms
- This lending channel is particularly significant for Chinese firms
- China lacks mature public stock and bond markets
- China depends heavily on banking credit for corporate financing
- Such policy measures result in increased financing costs for firms

Research Hypothesis

- Leading to a decrease in the demand for bank loans
- Resulting in a decrease in firms' financial leverage (Gulen & Ion, 2015)
- Hence, MPs should have a negative impact on firms' financial leverage
- Mainly for Chinese firms that are heavily reliant on bank loans
- Through the theory of financial constraints, we formulate the following hypothesis
- **Hypothesis 1**: Tight macroprudential policies have a negative impact on the leverage of nonfinancial firms

Sample and Methodology

- We employ a combination of country-level and firm-level data
- We use quarterly data from 2,442 listed non-financial firms in China over the period 2002Q1−2020Q4
- An unbalanced panel
- Our sample's total market value accounts of 61.661% of China's GDP
- The top and bottom 1% of all firm-level variables are winsorized

Sample and Methodology

- To test our hypothesis, we run the following regression:
- $Lev_{iq} = \alpha_1 + \lambda_{1i} + \eta_{1t} + \beta_{11} mp_{q-1} + \gamma_{11} X_{iq-1} + \gamma_{12} ind_{iq-1} + \gamma_{13} Z_{q-1} + \varepsilon_{1iq}$ Eq.(1)
- We expect β_{11} to be negative, according to H1

$$Lev_{iq} = \alpha_2 + \lambda_{2i} + \eta_{2t} + \beta_{21} mp_{q-1} + \beta_{22} T_{q-1} + \beta_{23} mp_{q-1} * T_{q-1} + +\gamma_{21} X_{iq-1} + \gamma_{22} ind_{iq-1} + \gamma_{23} Z_{q-1} + \varepsilon_{2iq}$$ Eq.(2)

- The variable T_q and its interaction with MPs help us to distinguish the different effects of tight and loose policies on financial leverage (see, Richter et al., 2019)

Sample and Methodology

- **Dependent variable:** Financial leverage
- The impact of MPs on firm financial leverage is primarily through bank loans
- We define financial leverage as total loans divided by total assets (Chen et al., 2013)
- We use three measures: short-term, long-term, and overall financial leverage ratio, which are based on the maturity of loans (Jin et al., 2022)
  - Short-term financial leverage to total assets (slev)
  - Long-term financial leverage to total assets (llev)
  - Overall financial leverage to total assets (lev), where lev=slev+llev
- We also use the scale of financial loans; the logarithm of financial loans as a dependent variable

Sample and Methodology

- **Independent variable**: The sum of 17 macroprudential policy instruments
- The variable mp represents the sum of 17 macroprudential policy instruments
- We use the 17 macroprudential policy instruments from Alam et al. (2019) database
- These policy instruments can be used in either tightening or loosening actions
- For each country-quarter, each instrument is represented as an index variable
- The value of the macroprudential policy instruments is determined as follows: 1 if tightened, 0 if not used, and -1 if loosened in each quarter
- The level of macroprudential policy is also determined as the sum of the 17 macroprudential policy instruments at time *t*

Sample and Methodology

- **Control Variables- firm-level variables:**
- Following previous studies such as Liu & Tian (2012), Alter & Elekdag (2020), and Jin et al. (2022)
- Logarithm of total assets (asset) → proxy for firm size
- Earnings before interest and taxes per asset (ebit) → proxy for profitability
- Financial constraints (finc), (Hadlock & Pierce, 2010)
- Fixed asset ratio (fix) (Huang & Shang, 2019)
- Firm growth (saleg) is calculated as the growth rate of operating revenues
- Tax (tax), measured by total tax divided by total profits (Liu & Tian, 2012)

Sample and Methodology

- **Control Variables- country-level variables:**
- The quarterly growth rate of China's GDP (*gdpg*)
- Monetary policy (bmgdp) → The quarterly growth rate of broad money (*bmg*)
- The lending rate (*lend*)
- The quarterly growth rate of real effective exchange rate (*reerg*)
- The inflation rate (*cpig*)
- The variable *Ind* represents the median leverage ratios specific to each industry, which vary with the dependent variables under consideration

Empirical Results

Table 2. Financial leverage and macroprudential policies.

	slev	*llev*	*lev*	*slev1*	*llev1*	*lev1*
	(1)	(2)	(3)	(4)	(5)	(6)
L.mp	-0.124***	-0.038***	-0.139***	-0.010***	0.003	-0.004***
	(-6.25)	(-3.96)	(-10.36)	(-4.63)	(1.48)	(-3.14)
Firm-level variables						
L.asset	0.883	2.231***	3.249***	0.952***	1.236***	1.140***
	(1.23)	(5.40)	(4.93)	(9.53)	(20.80)	(29.75)
L.ebit	-0.407***	-0.150***	-0.569***	-0.042***	-0.028***	-0.042***
	(-11.64)	(-6.21)	(-15.62)	(-13.08)	(-8.23)	(-17.70)
L.finc	0.843	2.044**	2.946	0.550**	1.192***	0.719***
	(0.39)	(2.51)	(1.42)	(2.63)	(5.13)	(4.01)
L.fix	0.074***	0.039**	0.110***	0.010***	0.006**	0.010***
	(3.90)	(2.15)	(7.11)	(4.44)	(2.58)	(4.47)
L.saleg	0.003	0.009***	0.012***	0.001**	0.001**	0.002***
	(1.61)	(5.46)	(4.07)	(2.70)	(2.52)	(4.34)
L.tax	0.003	0.002	0.005	0.001**	0.001***	0.001**
	(1.28)	(0.47)	(1.15)	(2.44)	(3.61)	(2.16)
Country-level variables						
L.gdpg	0.105***	0.076***	0.155***	0.008**	-0.001	0.007**
	(7.22)	(6.21)	(8.44)	(2.32)	(-0.13)	(2.14)
L.bmg	0.035	0.152***	0.158***	0.002	0.020***	0.008***
	(1.65)	(16.00)	(6.98)	(1.42)	(8.73)	(3.48)
L.lend	0.634***	0.290***	0.888***	0.019*	-0.006	-0.001
	(9.68)	(4.15)	(15.85)	(1.93)	(-0.34)	(-0.21)
L.reerg	-0.342	1.724***	0.710	0.061	0.411**	0.193
	(-0.33)	(3.41)	(0.56)	(0.46)	(2.20)	(1.73)
L.cpig	2.722**	-1.804	2.525	0.835***	0.860***	0.835***
	(2.50)	(-1.32)	(1.27)	(3.54)	(4.08)	(4.49)
L.ind	0.465***	0.474***	0.415***	0.209***	0.182*	0.244***
	(5.46)	(17.07)	(16.87)	(4.61)	(1.95)	(2.96)
_cons	-13.188	-42.136***	-57.565***	-3.701	-8.049***	-7.527***
	(-1.57)	(-5.73)	(-7.85)	(-1.64)	(-7.44)	(-5.09)
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Quarter	Yes	Yes	Yes	Yes	Yes	Yes
# of firms	2,442	2,442	2,442	2,341	2,140	2,352
Adj R2	0.093	0.103	0.124	0.404	0.353	0.528
N	90,406	90,406	90,406	77,333	60,902	79,987

Empirical Results

- To study the different effects of tight and loose MPs, we disaggregated the overall MPs (mp) into two categories: tight MPs (tmp) and loose MPs (lmp)
- Tight MPs (tmp) represent the sum of 17 macroprudential instruments if tightened
- Loose MPs (lmp) represent the sum of 17 macroprudential instruments if loosened
- Tight MPs have a negative effect, while loose MPs have a positive effect

Empirical Results

Table 3. Tightening versus Loosening Macroprudential Policies.

	slev (1)	*llev* (2)	*lev* (3)	*slev* (4)	*llev* (5)	*lev* (6)	*slev* (7)	*llev* (8)	*lev* (9)
L.mp	-0.050	-0.019	0.010						
	(-1.24)	(-0.69)	(0.25)						
L.mp#L.T	-0.119***	-0.028	-0.223***						
	(-3.71)	(-0.92)	(-3.97)						
L.tmp				-0.133***	-0.042***	-0.171***			
				(-6.38)	(-3.38)	(-7.71)			
L.lmp							0.144***	0.036	0.068*
							(4.15)	(1.28)	(2.01)
L.T	0.112***	0.017	0.156***						
	(2.99)	(0.54)	(4.97)						
				Firm-level variables					
L.asset	0.884	2.232***	3.253***	0.877	2.232***	3.250***	0.854	2.223***	3.210***
	(1.23)	(5.40)	(4.95)	(1.22)	(5.41)	(4.96)	(1.18)	(5.38)	(4.81)
L.ebit	-0.408***	-0.150***	-0.569***	-0.407***	-0.150***	-0.568***	-0.408***	-0.150***	-0.569***
	(-11.68)	(-6.22)	(-15.66)	(-11.61)	(-6.21)	(-15.61)	(-11.56)	(-6.22)	(-15.52)
L.finc	0.819	2.035**	2.893	0.835	2.029**	2.891	1.054	2.114**	3.208
	(0.38)	(2.50)	(1.38)	(0.39)	(2.48)	(1.38)	(0.49)	(2.60)	(1.54)
L.fix	0.073***	0.039**	0.109***	0.074***	0.038**	0.109***	0.074***	0.039**	0.111***
	(3.90)	(2.14)	(7.08)	(3.90)	(2.14)	(7.06)	(3.92)	(2.16)	(7.13)
L.saleg	0.003	0.009***	0.012***	0.003	0.009***	0.012***	0.003	0.009***	0.012***
	(1.62)	(5.47)	(4.08)	(1.63)	(5.47)	(4.09)	(1.55)	(5.46)	(4.07)
L.tax	0.003	0.002	0.005	0.003	0.002	0.005	0.003	0.002	0.005
	(1.26)	(0.47)	(1.13)	(1.24)	(0.47)	(1.12)	(1.34)	(0.48)	(1.17)

Heterogeneity Analysis

- State-owned enterprises have easier access to bank financing
- Binary variable "state", 1 if the firm is state-owned and 0 otherwise
- Larger firms tend to face fewer financing constraints compared to smaller firms (Hadlock & Pierce, 2010)
- Impact of MPs on large firms is smaller
- We measure size using the variable asset, and the variable fix
- We assume that mainboard-listed firms are less affected by MPs than firms listed on other boards
- Binary variable “board”, 1 if the firm is listed on the mainboard and 0 otherwise

Heterogeneity Analysis

Table 4. Macroprudential policies, financial leverage of state-owned firms.

	slev	*llev*	*lev*
	(1)	(2)	(3)
L.mp	-0.157***	-0.058***	-0.198***
	(-6.32)	(-4.61)	(-13.63)
L.mp#L.state	0.073***	0.044	0.128***
	(3.69)	(1.54)	(5.76)
	Firm-level variables		
L.asset	0.881	2.230***	3.246***
	(1.23)	(5.39)	(4.92)
L.ebit	-0.408***	-0.150***	-0.569***
	(-11.64)	(-6.23)	(-15.62)
L.finc	0.877	2.063**	3.004
	(0.41)	(2.55)	(1.44)
L.fix	0.073***	0.038**	0.109***
	(3.89)	(2.13)	(7.11)
L.saleg	0.003	0.009***	0.012***
	(1.60)	(5.45)	(4.06)
L.tax	0.003	0.002	0.005
	(1.27)	(0.47)	(1.14)

Heterogeneity Analysis

Table 5. Macroprudential policies, financial leverage, and firm's size.

	slev (1)	*llev* (2)	*lev* (3)	*slev* (4)	*llev* (5)	*lev* (6)
L.mp	-0.685***	-0.549*	-1.316***	-0.190***	-0.063*	-0.250***
	(-4.21)	(-2.05)	(-8.80)	(-8.68)	(-1.83)	(-4.86)
L.mp#L.asset	0.025***	0.023*	0.053***			
	(3.75)	(1.90)	(8.09)			
L.mp#L.fix				0.284*	0.109	0.472*
				(1.95)	(0.80)	(2.05)
			Firm-level variables			
L.asset	0.865	2.215***	3.211***	0.878	2.230***	3.242***
	(1.20)	(5.26)	(4.87)	(1.23)	(5.38)	(4.92)
L.ebit	-0.407***	-0.150***	-0.569***	-0.408***	-0.150***	-0.570***
	(-11.61)	(-6.20)	(-15.58)	(-11.56)	(-6.24)	(-15.54)
L.finc	0.864	2.063**	2.989	0.868	2.051**	2.984
	(0.40)	(2.55)	(1.44)	(0.40)	(2.52)	(1.42)
L.fix	0.073***	0.038**	0.109***	0.071***	0.037*	0.105***
	(3.89)	(2.13)	(7.09)	(3.91)	(2.04)	(7.30)
L.saleg	0.003	0.009***	0.012***	0.003	0.009***	0.012***
	(1.59)	(5.42)	(4.05)	(1.61)	(5.45)	(4.08)
L.tax	0.003	0.002	0.005	0.003	0.002	0.005
	(1.28)	(0.47)	(1.15)	(1.27)	(0.47)	(1.15)

Robustness Checks

- **Alternative independent variables**
- The impact of macroprudential policies may persist over time
- We use the cumulative MPs index, as suggested by Ayyagari et al. (2018), to capture the intensity effect of macroprudential policies
- The cumulative MPs index (cmp) is calculated as the cumulative change in macroprudential policies since the start of our sample period (2002Q1)
- We replace the main explanatory variable with the measure of macroprudential policy intensity (*cmp*) to examine the cumulative effect
- The qualitative results remain unchanged
- The significant effect of cumulative MPs indicates that macroprudential policies have a persistent effect on firms' financial leverage

Robustness Checks

- **Alternative independent variables**
- We replace the main explanatory variable with supply, loan, capital, and general instruments
- The qualitative results remain unchanged
- Given the role that banking finance plays in firms' financing in China (Pan & Tian, 2015)
- Our results suggest that supply instruments are effective in managing firms' financial leverage

Robustness Checks

- **Alternative database**
- We use the database from Cerutti et al. (2016)
- Their data provide a collection of implementations of six macroprudential policy instruments at quarterly intervals, expressed as dummy-type indices
- We use:
  - The sum of these six instruments per quarter as a proxy variable (mpc)
  - The cumulative sum of mpc to measure the intensity of macroprudential policies (cmpc)
- The qualitative results remain unchanged

Robustness Checks

- **Alternative dependent variable**
- The debt to asset ratio (*dta)* is employed as dependent variable
- The independent variables include the MPs and cumulative MPs from both Alam et al. (2019) (*mp* and *cmp*) and Cerutti et al. (2016) (*mpc* and *cmpc*)
- The qualitative results remain unchanged

Robustness Checks

- **Substitution Effects on Other Credit**
- Firms have various options to obtain funding
- The MPs have a relatively minor impact on firms' long-term financial decisions
- We use bonds payable to total assets (bond) as the dependent variable
- In addition to banking leverage, commercial credit plays an important role in financing through commercial transactions
- Zhou et al. (2021) suggest that firms can defer their expenses or receive funds in advance to secure financing
- Tight MPs may result in a reduced supply of banking loans, encouraging firms to seek commercial credit as an alternative

Robustness Checks

- This "substitution effect" of MPs can transfer risks from banks to firms, causing an increase in commercial credit
- We measure commercial credit (*com*) as the sum of accounts payable, bills payable, and advances received
- We use commercial credit to total assets as the dependent variable
- The implementation of tight MPs limits the bank credit available to firms
- We further examine the impact of MPs on firms' financing costs
- Financing costs (cost) are measured as financial expenses to financial leverage

Robustness Checks

- There is no significant evidence that MPs influence bonds payable
- This result reinforces the notion that MPs affect bank credit, rather than other financing channel such as bond or equity financing
- The negative and significant coefficient of MPs on commercial credit suggests that the tightening of MPs reduces the commercial credit available to firms
- This indicates a liquidity shortage as a result of tight MPs
- Highlighting that MPs do not transfer credit risks from banks to firms
- There is a significant and positive effect of tight MPs on firms' financing costs

Robustness Checks

- **The global financial crisis**
- The adverse effects of the GFC may have interacted with the implementation of MPs
- To control for shocks, like the GFC, we incorporated year fixed effects
- We use the data from 2011 to 2020 to isolate the positive shock of the stimulus plan on firm's financial leverage
- The qualitative results remain unchanged

Policy Implications

- The negative relationship between strict macroprudential policies and leverage of nonfinancial firms holds significant implications for policymakers
- This link implies that tight macroprudential policies should be implemented by authorities seeking to limit firms' financial leverage
- Regarding specific policy tools, our findings advocate for the short-term use of tight supply-side measures

Policy Implications

- In the long term, firms will adjust their capital structure to align with a macroeconomic environment and sustainable development
- Long-term leverage as a result is less affected by macroprudential policies
- The deleveraging effects of macroprudential policies appear to be especially effective for non-state-owned, small, and non-mainboard listed firms
- This structural effect amplifies the financing difficulties faced by small firms

Conclusions

- Impact of macroprudential policies on firms' financial leverage
- 2,442 listed nonfinancial firms in China
- Sample spans from 2002Q1 to 2020Q4; quarterly data
- MPs have a negative impact on financial leverage
- Tight MPs lead to a reduction in financial leverage
- Non-state-owned, small, and non-mainboard listed firms are more susceptible to regulation effects
- MPs do not shift risks from banks to firms as commercial credit is reduced