

Macroprudential Policy, Credit booms, and Banks' Systemic Risk

Peter Karlström
CEMLA

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This paper aims to answer the following 3 questions:

- 1 Can macroprudential policies deal with booms in bank credit?
- 2 Can macroprudential policies address credit booms followed by systemic banking crises (and booms in household credit)?
- 3 Is the macroprudential policy stance associated with the level of systemic risk for banks?

Credit booms as predictors of financial crises

"Credit Booms Gone Bust" - Schularick & Taylor (AER, 2012)

Dell'Ariccia et al. (2016) find in their study that:

- 1/3 of credit booms are followed by financial crises.
- 2/3 of booms are followed by crises or subpar GDP growth.

What characterizes credit booms that lead to financial crises?

- ① Larger in size
- ② Last for a longer period
- ③ Start from a higher level of credit-to-GDP ratio
- ④ Household credit (not credit to firms) is the driving factor
- ⑤ Strongly linked with house price booms
- ⑥ Associated with strong growth in mortgage credit

Definition of macroprudential policy:

“macroprudential policies are designed to identify and mitigate risks to systemic stability, in turn reducing the cost to the economy from a disruption in financial services that underpin the workings of financial markets (FSB/IMF/BIS, 2009)”.

Specifically, policies that can achieve:

“the broader macro-prudential goal of protecting the banking sector from periods of excess credit growth” (Basel Committee on Banking Supervision, 2010)”

Macroprudential policy instruments

- 1 Loan-to-Value Caps (LTV_CAP)
- 2 Interbank exposure limits (IBEX)
- 3 Concentration limits (CONCRAT)
- 4 Reserve requirements on accounts in domestic currency (RR_D)
- 5 Reserve requirements on accounts in foreign currency (RR_FX)

Aggregate macroprudential policy indexes

- **MAPP** (includes all 5 macroprudential instruments)
- **MAPP_B_FI** (includes LTV_CAP, IBEX, and CONCRAT)
- **MAPP_RR** (includes RR_D and RR_FX)

The macroprudential indexes measure the cumulative sum of tightenings (+1) and easings (-1) over the period 2000Q1-2014Q4.

Studies with credit growth and macroprudential policy

- Cerutti et al. (2017)
- Akinci and Olmstead-Rumsey (2017)
- Bruno et al. (2017)
- Buch and Goldberg (2017)
- Garcia Revelo et al. (2020)

Studies with credit booms and macroprudential policy

- Dell’Ariccia et al. (2016)

Studies with similar index for macroprudential policy

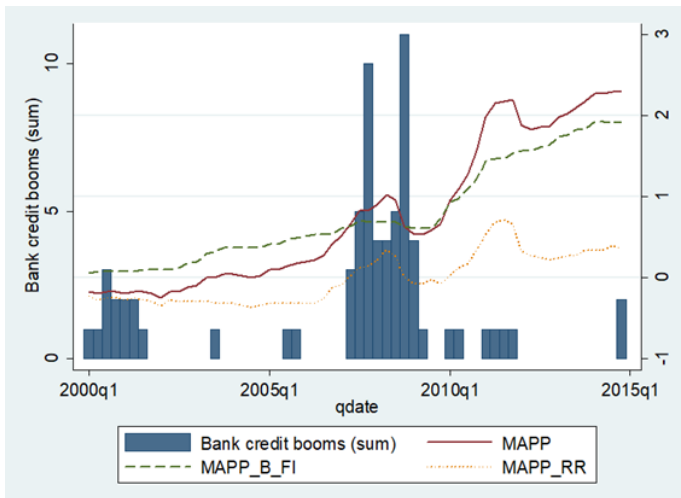
- Chari et al. (2022)
- Bergant et al. (2020)
- Akinci and Olmstead-Rumsey (2017)

Identification method of booms (Mendoza & Terrones, 2008)

- Hodrick-Prescott (HP) filter
- Log of real bank credit per capita
- The deviation from the long-run trend of credit variable is f_{it}
- The country-specific standard deviation of f_{it} is $\sigma(f_{it})$
- A credit boom is identified when $f_{it} \geq \varphi\sigma(f_{it})$ for one or several quarters, where φ is the threshold factor (multiple of the standard deviation)

Evolution of macroprudential indexes and booms

Figure 1: Aggregate macroprudential indexes and credit booms (1.75 s.d.)



GMM estimations with macroprudential index

Variables	(1)	(2)	(3)	(4)	(5)
Control variables	YES	YES	YES	YES	YES
Real bank credit growth	0.1813* (0.0933)	0.1769* (0.0947)	0.1121 (0.1058)	0.1433 (0.0920)	0.1970 (0.1512)
MAPP	0.0010** (0.0004)	0.0016** (0.0008)	0.0012 (0.0011)	0.0005 (0.0005)	0.0008 (0.0007)
MAPP * Top 25%	-0.0014*** (0.0003)				-0.0016** (0.0008)
MAPP * Top 50%		-0.0018* (0.0009)			
MAPP * Bottom 50%			-0.0017 (0.0027)		
MAPP * Bottom 25%				0.0014 (0.0026)	0.0003 (0.0031)
Observations	2123	2123	2123	2123	2123
Countries	40	40	40	40	40
Instruments	37	37	37	37	37

Why credit booms instead of credit growth?

- A negative and significant coefficient of the macroprudential index could be due to reverse causation if policies are tightened at the peak (or after the peak) of the credit cycle.
- It is possible to investigate specifically those credit booms that are followed by financial crises.

Empirical specification for credit booms

- The data covers quarterly data for 41 countries between 2000Q1-2014Q4.
- Logit, Linear Probability Models (LPM), and Firth logit regressions are estimated.
- Dependent variable: A dummy variable that takes value 1 if a credit boom episode is observed, and 0 otherwise.
- Control variables: $\log(\text{VIX})$, real GDP growth, change in central bank policy rate, inflation, $\log(\text{real exchange rate})$, bank credit (% of GDP), and $\log(\text{GDP per capita})$.

Macroprudential index (MAPP) & bank credit booms

Variables	Logit (1)	Logit (2)	Logit (3)	Logit (4)	LPM (5)	Firth logit (6)
Control variables	YES	YES	YES	YES	YES	YES
MAPP	-0.229*** (0.078)	-0.489*** (0.129)	-0.182** (0.087)	-0.270** (0.130)	-0.005** (0.002)	-0.220** (0.089)
Country FE	NO	YES	NO	YES	YES	NO
Year FE	NO	NO	YES	YES	YES	NO
Observations	2171	1370	1284	1370	2171	2171
Credit booms	61	61	61	61	61	61
Countries	41	24	41	24	41	41
Prob > chi-sq (LPM: F-test)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Macroprudential sub-indexes & bank credit booms

Variables	Logit (1)	Logit (2)	Firth logit (3)	Logit (4)	Logit (5)	Firth logit (6)
Control variables	YES	YES	YES	YES	YES	YES
MAPP_B_FI	-0.306** (0.128)	-0.582*** (0.208)	-0.290** (0.127)			
MAPP_RR				-0.220* (0.131)	-0.537*** (0.192)	-0.205 (0.135)
Country FE	NO	YES	NO	NO	YES	NO
Year FE	NO	NO	NO	NO	NO	NO
Observations	2171	1370	2171	2171	1370	2171
Credit booms	61	61	61	61	61	61
Countries	41	24	41	41	24	41
Prob > chi-sq	0.0000	0.0000	0.0000	0.0002	0.0000	0.0002

Bad credit boom

- A bank credit boom is defined as "bad" if a systemic banking crisis occurs during the credit boom or within 3 years after the end of the boom.

Good credit boom

- All bank credit booms that are not "bad" are defined as "good".

A systemic banking crisis meets the following 2 criterias:

- 1 Significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and/or bank liquidations).
- 2 Significant banking policy intervention measures in response to significant losses in the banking system.

Evolution of bank credit around booms

Figure 2: Good credit booms

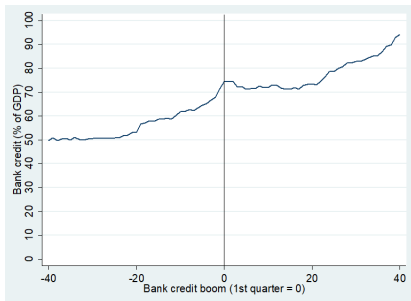
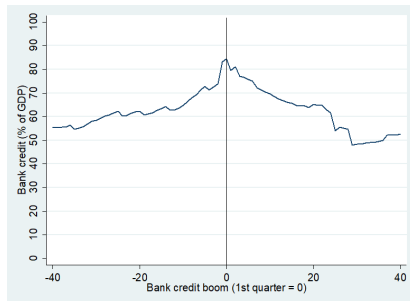


Figure 3: Bad credit booms



Good and bad credit booms

Variables	Good credit boom			Bad credit boom		
	Logit (1)	LPM (2)	Firth logit (3)	Logit (4)	LPM (5)	Firth logit (6)
Control variables	YES	YES	YES	YES	YES	YES
MAPP	-0.166** (0.081)	-0.004** (0.002)	-0.141 (0.098)	-0.515** (0.203)	-0.000 (0.001)	-0.502*** (0.157)
Country FE	NO	YES	NO	NO	YES	NO
Year FE	NO	YES	NO	NO	YES	NO
Observations	2145	2145	2145	2131	2131	2131
Credit booms	35	35	35	21	21	21
Countries	41	41	41	41	41	41
Prob > chi-sq	0.0000	0.0000	0.0091	0.0002	0.0000	0.0001

“Economic disasters are almost always preceded by a large increase in household debt. In fact, the correlation is so robust that it is as close it gets to an empirical law in macroeconomics (Mian and Sufi, 2014).”

Studies showing a link between household credit and financial crises and/or growth slowdown:

- Mian et al. (2017)
- Jordá et al. (2020)
- Müller & Verner (2022)

Evolution of household credit around booms

Figure 4: Good credit booms

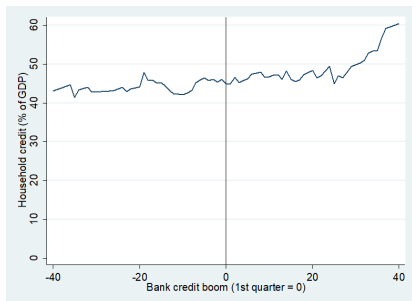
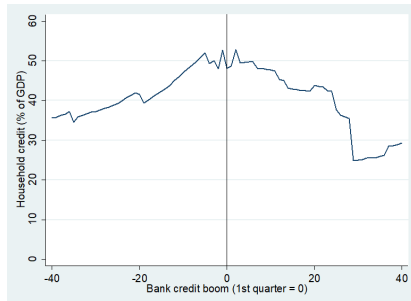


Figure 5: Bad credit booms



Macroprudential index (MAPP) & HH credit booms

Variables	Logit (1)	Logit (2)	Logit (3)	Logit (4)	LPM (5)	Firth logit (6)
Control variables	YES	YES	YES	YES	YES	YES
MAPP	-0.304*** (0.099)	-0.708*** (0.170)	-0.304** (0.146)	-0.475* (0.250)	-0.004* (0.003)	-0.294*** (0.089)
Country FE	NO	YES	NO	YES	YES	NO
Year FE	NO	NO	YES	YES	YES	NO
Observations	1990	1031	1276	1031	1990	1990
Credit booms	49	49	49	49	49	49
Countries	37	19	35	19	37	37
Prob > chi-sq (LPM: F-test)	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000

Bank credit boom 1.75 s.d.

- Average Marginal Effects: -0.0061
- Standard deviation: 1.261
- A one standard deviation increase in the MAPP index reduces the likelihood of bank credit booms by 0.77 percentage points.
- Sample frequency: 2.81% (61/2171)

MAPP	-0.006*** (0.002)
Observations	2171
Countries	41
Credit booms	61
Std. Dev.	1.261

Economic interpretation

- The effect of increasing the MAPP index by 1 s.d. on the likelihood of credit booms is relatively large in economic terms.
- MAPP_B_FI has a larger impact on credit booms compared to MAPP_RR.
- The impact of increasing the MAPP index seems to be bigger for larger booms compared to for smaller booms.
- MAPP_B_FI seems to be significantly more effective to deal with household credit booms compared to bank credit booms.

Robustness tests

- 1 Different thresholds for credit booms (1.5, 1.75, and 2 s.d.)
- 2 Different time periods (2000Q1-2006Q4 & 2007Q1-2014Q4)
- 3 Different country samples (advanced & developing countries)
- 4 Alternative method to identify credit booms (Hamilton filter)
- 5 Other policies (capital requirements & capital buffers)
- 6 Lagging the MAPP index several quarters

"[The] purpose of macroprudential regulation is to focus on the financial system as a whole, with the ultimate objective of limiting systemic risk (De Nicólo et al., 2012)."

Definition of SRISK

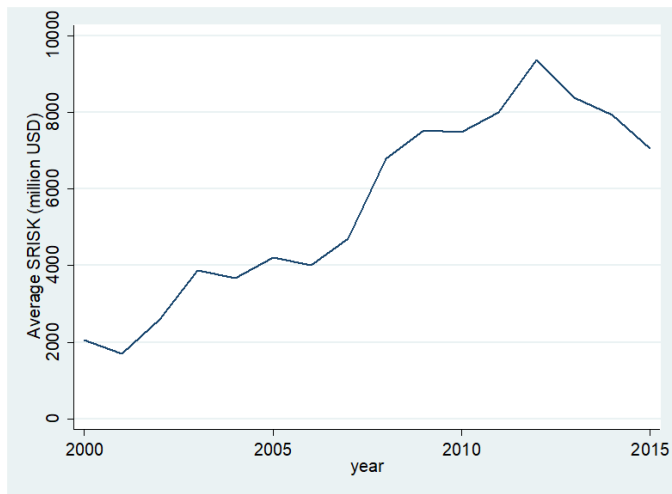
- Systemic risk "SRISK" measures the capital shortfall of a bank conditional on a severe market decline.

SRISK can be defined as follows (Acharya et al., 2012):

$$SRISK_{it} = \max \left[0; \overbrace{k(D_{it} + (1 - LRMES_{it})W_{it})}^{\text{Required Capital}} - \overbrace{(1 - LRMES_{it})W_{it}}^{\text{Available Capital}} \right]$$

- k : prudential capital ratio
- D_{it} : book value of total liabilities
- W_{it} : market capitalization
- $LRMES_{it}$: Long-Run Marginal Expected Shortfall

Figure 6: Average positive SRISK 2000-2015



Empirical specification for systemic risk

- The data covers yearly data for 460 banks in 54 countries between 2000-2015.
- Quantile regressions are estimated at the 25th, 50th, and 75th percentile.
- Dependent variable: SRISK scaled by GDP.
- Control variables: size, leverage, real GDP growth, market return, volatility, non-interest income, and concentration.

Quantile regressions with MAPP and SRISK-to-GDP

Variables	(1) Q.0.25	(2) Q.0.50	(3) Q.0.75
Control variables	YES	YES	YES
MAPP	-0.023 (0.016)	-0.156*** (0.037)	-0.293*** (0.096)
Year effects	YES	YES	YES
Country effects	YES	YES	YES
Observations	2958	2958	2958
Countries	54	54	54
Banks	387	387	387
R-squared	0.1843	0.2000	0.1942

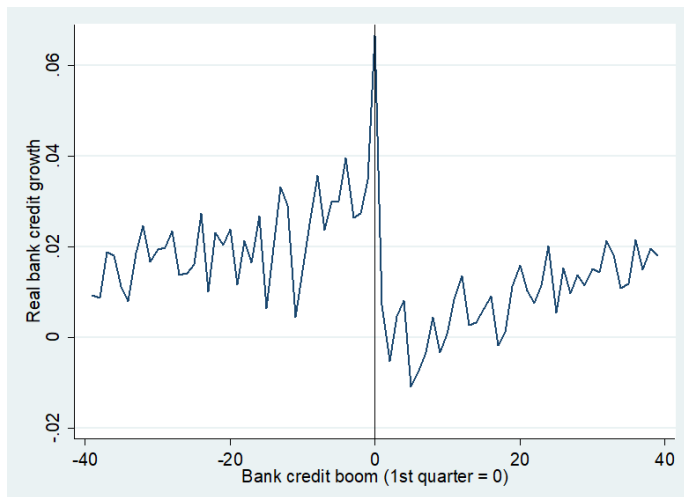
Conclusion

- This study suggests that macroprudential policies are effective to deal with booms in both bank and household credit.
- The results also show that macroprudential policies seem to be effective to address booms followed by a systemic banking crisis.
- The results hold for several robustness tests (different thresholds, time periods, country samples etc.).
- Macroprudential policies could also be effective to address banks' systemic risk.

Appendix

Identification of credit booms

Figure 7: Real bank credit growth around booms



Evolution of GDP around booms

Figure 8: Good credit booms

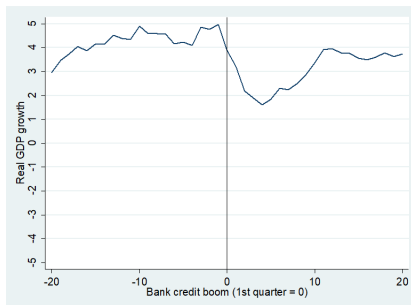
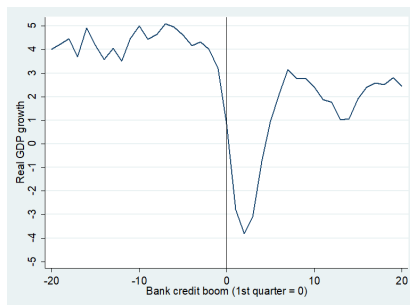


Figure 9: Bad credit booms



Evolution of HH and firm credit around booms

Figure 10: Good credit booms

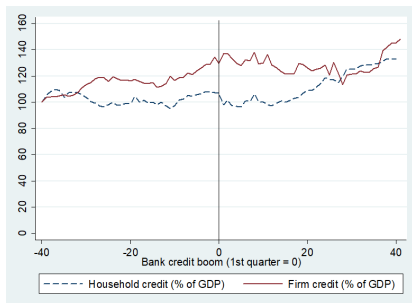


Figure 11: Bad credit booms

