Effectiveness of macroprudential regulations and capital controls in India

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Disclaimer: Views expressed in this paper are personal and do not necessarily reflect the official viewpoint of RBI or RBI staff

Motivation

- Primary logic of prudential regulation in India — Countercyclicality
- Macroprudential regulations have consequences on banks, firms (cross-country evidence)
- Heterogeneity in effectiveness of prudential measures

Mechanism: For macroprudential regulation to be effective in controlling the aggregate supply of bank lending, it must be the case that:

  i. banks reallocate their loan portfolio; and/or,

  ii. banks tap into their capital base in response to mandatory regulation.

What are the consequences of macroprudential regulation on bank and firm-level?

This paper...

Effectiveness of intensity vs discrete measures of macroprudential regulations

- Bank level: Patterns in aggregate bank lending to regulation
- Policy interactions: Substitutes or complements? Evidence from interest rate channel.
- Sectoral level: Case of real estate sector in India (most active)

Where is the credit going?

- Firm-level outcomes: What type of borrowers are impacted?

Determinants of MPM effectiveness

- Role of capitalization: Discern patterns in bank lending of different capital levels
- Do levels matter?: Evidence from real estate sector loans

Role of capital flow measures:

- Foreign capital inflow: How do capital controls impact bank lending patterns?

Review of Findings

- Intensity-measures: More pronounced than discrete/unweighted measures.
- Bank level: Policy effectiveness is ownership-agnostic, role of capitalization overrides.
  - ▸ Lending portfolios of well-capitalized and large banks are not impacted by aggregate macroprudential regulations.
- Policy interactions: Interactive effects of macroprudential regulation and (interest rate channel of) monetary policy not significant.
- Where is credit going?: Weakly capitalized banks increase lending to poor quality borrower firms, unintended consequence.
- Sectoral level: Level of lending exposure matters in policy responsiveness, levels matter.
- Foreign capital: Easing capital flow from abroad potentially replaces bank credit as a funding source (credit growth declines).
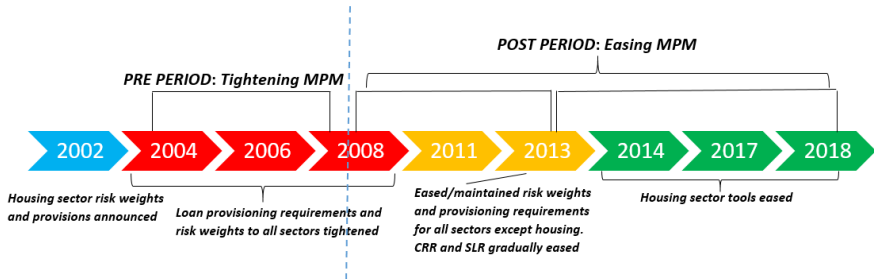
Contributions of the Paper

1. Systematically document time-varying macroprudential toolkit in India
2. Policy evaluation of discrete versus intensity-based measures over a long time horizon
3. Bank, sector and firm-level outcomes
4. Policy interaction effects in India - departure from common literature
5. Bank responsiveness to foreign capital controls

Regulatory Details: MPM and CFM

Timeline of macroprudential policy announcements

Sectors: Real estate, Commercial Real Estate, Retail, NBFC and Capital Market

PRE PERIOD: Tightening MPM

POST PERIOD: Easing MPM

2002 → 2004 → 2006 → 2008 → 2011 → 2013 → 2014 → 2017 → 2018

Housing sector risk weights and provisions announced

Loan provisioning requirements and risk weights to all sectors tightened

Eased/maintained risk weights and provisioning requirements for all sectors except housing. CRR and SLR gradually eased

Housing sector tools eased

Unique nature of macroprudential regulations in India

Unique nature of macroprudential regulations in India

Provisions over time
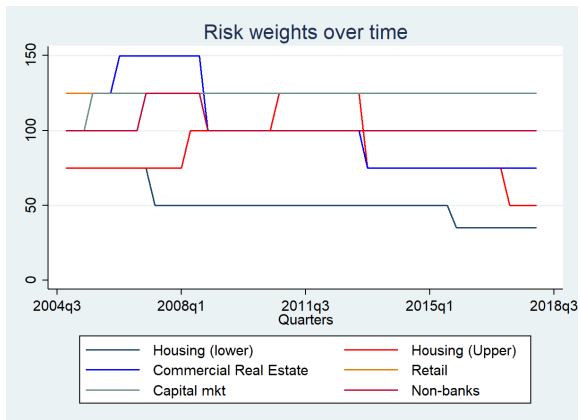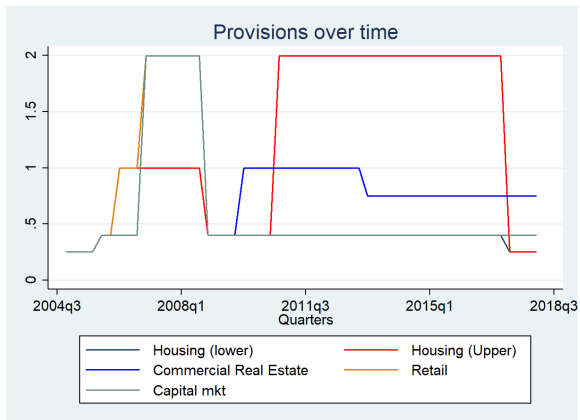
Data and Measures

Data

1. **Bank-level:** Sample of individual banks
   - ▶ **OSMOS**: RBI's **O**ff-**S**ite **M**onitoring and **S**urveillance **S**ystem.
   - ▶ Variables from standalone balance sheets; Identity - Bank classification
   - ▶ Time Period: 2002-2018, quarterly (68 bank-quarters)

2. **Regulatory-level:** We choose policy announcements from RBI circulars between 2002-2018
   - ▶ Sample covers entire time period during which macroprudential tools have been actively deployed in India
   - ▶ Macroprudential tools extracted from individual Master Circulars (to create a continuous series) and matched with bank-level information

- **Firm-level:** Non-financial borrowers (Prowessdx), matched with their lead banker information (2008-18)

Bank Level Measures

1. We define 'Loan Growth' as the quarterly growth of 'Gross Loans and Advances' in any given period (deseasonalized).
2. Construct the MPM and CFM indices using PCA (explained ahead)
3. Calculate 'Liquid Assets'=$(\frac{Securities+LiquidAssets}{TotalAssets})$
4. Calculate Capital Adequacy Ratio 'CRAR'

Use distribution of 'CRAR' through the sample period into four quartile groups of capitalization. (1 is weakly capitalized and 4 is strongly capitalized)

Firm Level Measures

We need measures to indicate low-quality of borrowers based on solvency and liquidity criteria (using Chari et al.)

1. **Solvency:** We sort firms based on 'Debt-Equity Ratio' every year, firms with above median ratio in a year t is tagged as a '**Low Solvency**' firm.

2. **Liquidity:** We sort firms based on 'Cash Ratio' every year, firms with below median ratio in a year t is tagged as a '**Low Liquidity**' firm.

Policy Measures

We need measures to indicate aggregate macroprudential and capital inflow to guage the policy environment.
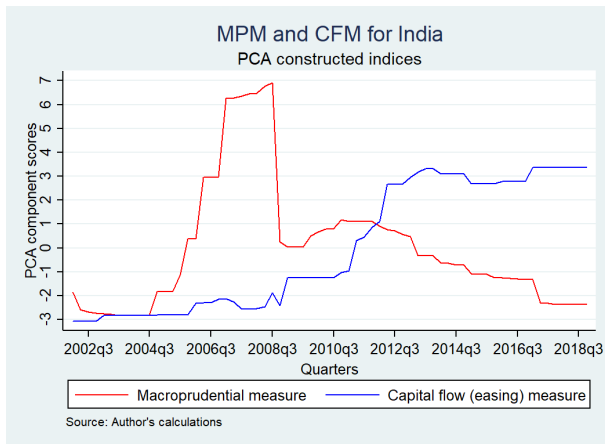
- Macroprudential Measures:
  - Risk weights (5 sectors)
  - Provisioning requirements (5 sectors)
  - Reserve requirements (Tier1, Tier2, SLR and CRR)

- Capital Flow Measures:
  - Limits in FPI in government securities
  - Limits in FPI in corporate bonds
  - FDI restrictiveness index (Source: OECD)
  - FCNRB limits
  - External Commercial borrowings
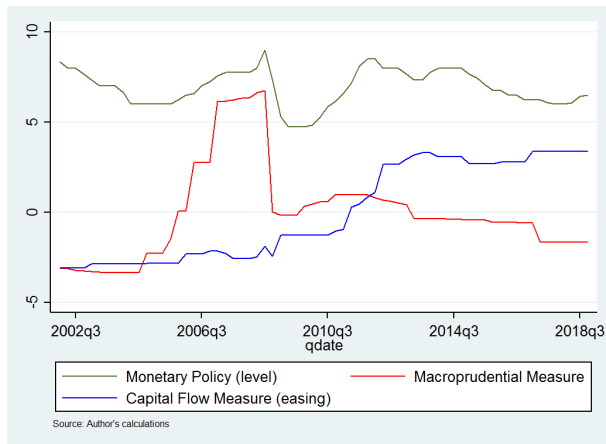
Constructing Policy Measures

We capture intensity-based measures of regulatory tools using Principal Component Analysis (PCA). This allows different weights to instruments, which is more indicative of practical application. All indicators are normalized.

- MPM: First component explains 58.26 percent of sample variation
- CFM: First component explains 59.2 percent of sample variation

Aggregate Policy Measures

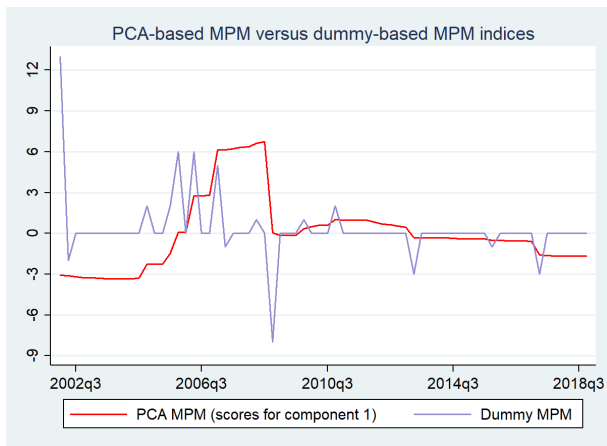MPM and CFM for India
PCA constructed indices

Source: Author's calculations

Comparing with monetary policy

Source: Author's calculations

Intensity vs discrete measure

PCA-based MPM versus dummy-based MPM indices

Policy effects: Bank level

1. Effectiveness of aggregate macroprudential tools on bank loan growth

$$Y_{b,t} = \alpha_o + \sum_0^k \alpha_{1,k} \triangle MPM_{t-k} + \sum_0^k \alpha_{2,k} \triangle MoPo_{t-k} + \sum_0^k \alpha_{3,k}(\triangle MPM_{t-k} * \triangle MoPo_{t-k}) + \sum_0^k \alpha_{4,k} X_{b,t-k} + f_b + f_t + \epsilon_{b,t}$$

- $Y_{b,t}$ — aggregate growth in bank-lending (q-o-q)
- $\triangle MPM_{t-k}$ — aggregate macroprudential measure constructed using PCA
- $\triangle MoPo_{t-k}$ — change in repo rate (monetary policy tool)
- $X_{b,t-k}$ — size (log assets), capital-asset ratio, liquidity (liquid assets/total assets) and return on assets

Effectiveness of aggregated macroprudential tools on bank level lending growth (no channel)

| DepVar: Aggregate loan growth	(1)	(2)	(3)	(4)	(5)
$\sum_0^3 \triangle MPM$	-6.22***	-4.82***	-8.399***	-9.58***	-9.35***
	(0.99)	(1.02)	(2.33)	(0.451)	(0.452)
$\sum_0^3 \triangle Repo$	.382	-1.03	-2.02	-2.13	-1.80
	(1.62)	(1.608)	(0.903)	(0.923)	(0.931)
$\sum_0^3 \triangle (MPM * Repo)$			-1.86*	-1.15	-.980
			(1.43)	(0.344)	(0.347)
$\sum_0^3 \triangle CFM$				-12.16***	-12.37***
				(2.786)	(2.793)
Year FE	Y	Y	Y	Y	Y
Quarter FE	N	N	N	N	N
Bank FE	Y	Y	Y	Y	Y
Bank controls	Y	Y	Y	Y	Y
Observations	1067	935	935	935	915
R-squared	0.135	0.176	0.202	0.236	0.238

Same exercise using discrete index

- The same exercise using a dummy-based macroprudential index yields estimates between 1.24 percent to 1.8 percent.
- Indicative that weighted approach to implementing prudential instruments could potentially alter loan growth by a margin of 4 to 7 percent (i.e. a range of 4.82-9.35 versus a range of 1.24-2.3 percent).

Splitting into capitalisation quartiles

DepVar: Aggregate loan growth	(Weak K)	(Weak K)	(Strong K)	(Strong K)
$\sum_0^3 \triangle MPM$	-15.39***	-8.89	-1.33	-5.49
	(5.915)	(7.142)	(5.164)	(4.403)
$\sum_0^3 \triangle Repo$	4.98	-3.49	-4.13	-4.709*
	(5.520)	(4.102)	(3.097)	(1.536)
$\sum_0^3 \triangle(MPM * Repo)$	-3.19	1.09	1.32	-2.43
	(3.752)	(3.928)	(0.927)	(0.870)
Year FE	Y	Y	Y	Y
Quarter FE	N	N	N	N
Bank FE	Y	Y	Y	Y
Bank controls	Y	Y	Y	Y
Observations	202	174	209	330
R-squared	0.412	0.504	0.386	0.268

Results are ownership-agnostic

Significant CFM indicates bank credit substitution

Aggregate country-cross border flows to India
All instruments, Sector-wise stocks
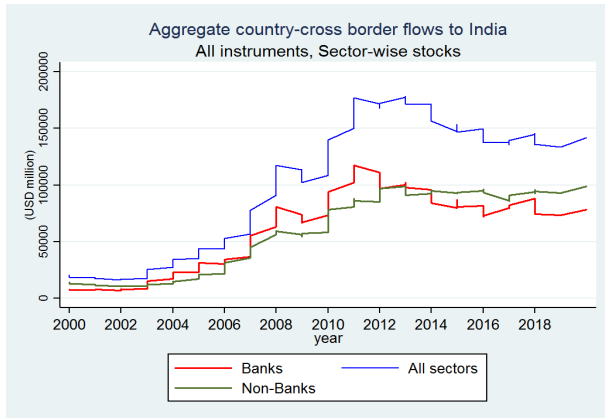
- Source: International Banking Statistics (LBS, BIS).
- Quarterly outstanding positions in various instruments by all countries reporting to BIS on their cross-border claims to India.

Where is credit going?: Firm level

Firm debt by quality

Firm Debt (Borrowings)
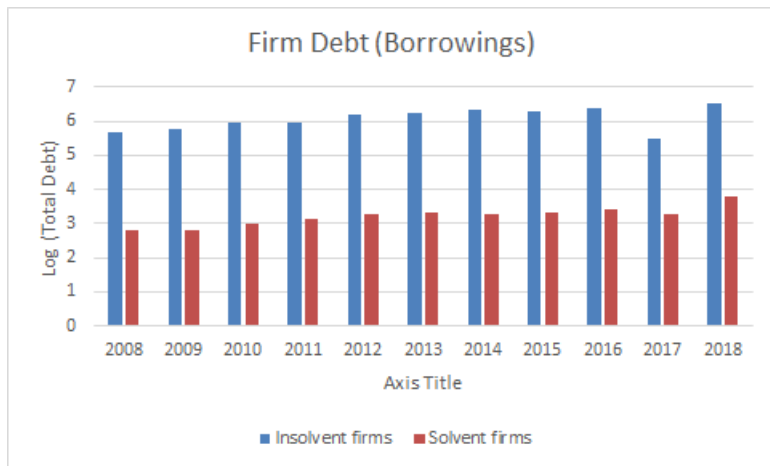
Summary stats of firm quality

	Solvency		Liquidity	
	solvent firms	insolvent firms	liquid firms	illiquid firms
Cash ratio	43.12	5.10	75.15	0.40
Solvency (Debt-to-Asset)	0.09	2.10	0.78	1.36
Total debt (log)	3.23	6.04	3.74	6.05
Profits (PBIT/TA)	7.18	5.90	5.33	7.44
Leverage (Debt-to-Equity)	1.27	3.09	2.45	2.54
ICR	32.86	3.79	15.19	12.56
Observations	20,703	32,566	28,802	24,467

Empirical Framework

$$Y_{b,t} = \alpha_o + \gamma_j + \alpha_1 * BankCap_b * LowQuality_{j,t} +$$

$$\alpha_2 * BankCap_b * MPM_t + \alpha_3 * BankCap_b * LowQuality_{j,t} * MPM_t + \epsilon_{b,t}$$

where,

- $Y_{b,t}$ — aggregate growth in bank-lending (annual)
- Low Quality$_{j,t}$ = Low Solvency$_{j,t}$, Low Liquidity$_{j,t}$

# Poor quality firms borrow more from weaker capitalised banks

		Weakly K banks			Adequately K banks
	(Insolvent firm)	(Illiquid firm)	(Insolvent firm)	(Illiquid firm)
Bankcap$_b$ * $LowSolvency_{j,t}$* MPM$_t$	1.993***			
	(0.084)			
Bankcap$_b$ * $LowLiquidity_{j,t}$* MPM$_t$		1.327***		
		(0.082)		
Bankcap$_b$ * $LowSolvency_{j,t}$* MPM$_t$			0.173***	
			(0.014)	
Bankcap$_b$ * $LowLiquidity_{j,t}$* MPM$_t$				0.151***
				(0.014)
Observations	34,335	34,335	34,335	34,335
Firm FE	Y	Y	Y	Y
Banker FE	Y	Y	Y	Y
Year FE	N	N	N	N

Standard errors are clustered at the firm level. All specifications include time varying controls.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Sectoral level: Real estate sector in India

Risk weights in real estate over time

Housing credit growth difference from total credit growth
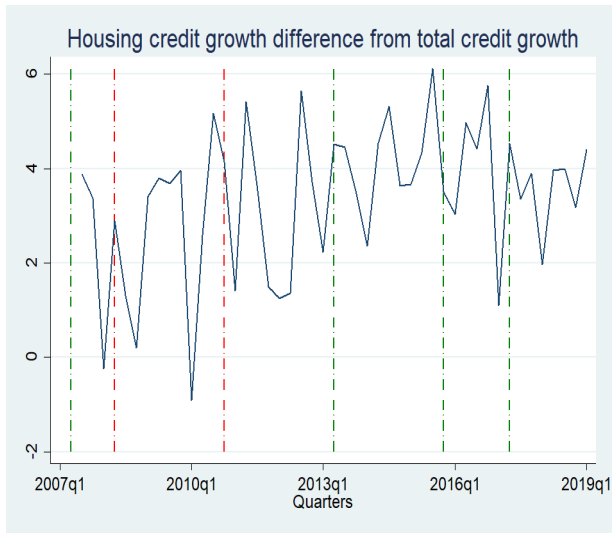
Effectiveness of intensity measures at sectoral level (sectoral share is channel)

$$Y_{b,t} = \alpha_o + \sum_0^k \alpha_{1,k} \triangle MPM_{s,t-k} * \triangle Share_{s,b,t-k} + \sum_0^k \alpha_{2,k} \triangle MoPo_{t-k} * \triangle Share_{s,b,t-k} + \sum_0^k \alpha_{3,k} (\triangle MPM_{s,t-k} * \triangle MoPo_{t-k} * \triangle Share_{s,b,t-k}) + \sum_0^k \alpha_{4,k} X_{b,t-k} + f_b + f_t + f_q + \epsilon_{b,t}$$

- $Y_{b,t}$ — aggregate loan growth by banks
- $\triangle MPM_{s,t-k}$ — change in individual risk weight to real estate sector, in this case
- $\triangle Share_{s,b,t-k}$ — change in sectoral share of real estate in total lending

Effect of housing risk weights on aggregate loan growth

DepVar: Aggregate loan growth	(1)	(2)	(3)	(4)
$\sum_0^3 \triangle(Riskweight * ShareHousing)$	-.0227	-.002	0.0121	-0.0095***
	(0.0173)	(0.019)	(0.00442)	(0.00233)
$\sum_0^3 \triangle(Repo * ShareHousing)$	-0.180	-0.025	0.0188	0.142***
	(0.230)	(0.0628)	(0.0614)	(0.0560)
$\sum_0^3 \triangle(Riskweight * Repo * ShareHousing)$	-0.033	0.0316	0.0011	-.028*
	(0.0571)	(0.0168)	(0.0164)	(0.0173)
Year FE	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y
Bank controls	Y	Y	Y	Y
Observations	520	598	598	589
R-squared	0.555	0.566	0.586	0.419

- Ten percent increase in risk weights to housing reduces real estate loan growth by 1.82 percent [1.82=0.0095356*19.74649*10].
- Triple interaction: Reduction in housing sector loan growth of 5.6 percent [5.6=-0.0286856*19.74649*10]

Effect of housing risk weights on loan growth through adjustment in PSL loans

Aggreagte loan growth	(1)	(2)	(3)	(4)
$\sum_0^3 \triangle (Riskweight * SharePSL)$	0.029***	-0.0289***	-0.0067	-0.0075
	(0.012)	(0.00331)	(0.00992)	(0.0183)
$\sum_0^3 \triangle (Repo * SharePSL)$	-0.065	0.088	-0.0304	0.0035
	(0.101)	(0.0559)	(0.0919)	(0.0759)
$\sum_0^3 \triangle (Riskweight * Repo * SharePSL)$	0.029	-0.0289***	-0.0067	-0.0075
	(0.012)	(0.0281)	(0.0563)	(0.0591)
Year FE	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y
Bank controls	Y	Y	Y	Y
Observations	526	598	575	590
R-squared	0.560	0.603	0.529	0.418

Concluding Remarks

1. Intensity-measures are more pronounced than discrete/unweighted measures in explaining effectiveness.

2. Capital, rather than loan portfolio reallocation, predominantly influences bank's responsiveness to macroprudential regulatory tools. Findings are ownership-agnostic, and driven by capitalisation and size.

3. Interactive effects of macroprudential and (interest rate of) monetary policies do not appear significant.

4. Weakly capitalized banks increase lending to low quality borrower firms – zombie loans (interest rate channel).

5. At the sectoral level, change in regulations are better absorbed by banks with adequate capital and greater lending exposure.

6. Reduced capital controls cause decline in bank credit growth.

Thank you!

Sectoral share in total bank loans
By bank capitalisation