The transmission mechanisms of macroprudential policies on bank risk

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Motivation

- Necessity of MPs: monetary policy not sufficient to smooth consumption/cycles, externalities and market failures
- Emerging economies use MPs most frequently (esp. foreign-based) than advanced economies (esp. borrower-based) (Cerutti et al., 2017)
- MPs distort behaviors and can worse some resource allocations, increasing systemic risk (Claessens, 2014)
- The dark side of MPs: reduce access to finance, obligate banks to use equity instead of debt, one-size-fits-all policies (Martinez and Remolina, 2019)

Motivation

- Improve focus of regulation and policies
- Understand main mechanisms and mitigate unintended consequences
- We address heterogeneity and casual mechanisms while assessing the effect of MPs on bank risk

Objectives

- Evaluate the effect of the implementation of 12 macroprudential policies on risk-taking of banks for several countries
- Measure how the effect changes depending on concentration, size of banks, liquidity and leverage
- Find which MPs are most effective for banks with excessive risk-taking
- Break down the impact of MPs into the leverage or risk-return channels
- Propose a novel identification approach to study the effects of MPs

Contributions and literature

- Recent but growing literature: new databases and evaluation methods
- Cerutti et al. (2017) built a database of MPs and evaluated the effect on credit growth using macroeconomic data
- Altunbas et al. (2018) evaluates the effect of MPs on bank risk
- We propose a better identification approach, measure the impact on banks with excessive risk and perform the decomposition of the risk measure
- Other contributions: Bruno et al. (2017), Akinci and Olmstead-Rumsey (2018), etc

Macroprudential Policies

- We use a set of 12 instruments present in Cerutti's database
- Capital-based instruments are based on capital requirements and provisioning (CTC, SIFI, DP and LEV)
- Asset-based instruments impose restriction on balance sheets (CG, FC and RR)
- Borrower-based instruments impose restrictions related to borrowers (LTV_CAP and DTI)
- Structural instruments aim at addressing vulnerabilities from interconnectedness and contagion (CONC and INTER)
- TAX is a instrument that imposes taxes on the revenues of financial institutions

Data

- Data from Bankscope, Cerutti et al. (2017), World Bank and Heritage Foundation from 1995 to 2014
- Sample of 16.255 banks in 45 different countries
- Z-score as a measure of risk-taking:

$$\text{Z-score}_{ikt} = \frac{ROA_{ikt} + \text{Equity Ratio}_{ikt}}{\sigma_{ikt}(ROA)}, \tag{1}$$

- We use a 5-year rolling window estimates for the Z-score

Table: Descriptive statistics of accounting and macroeconomic variables

Variables	Mean	Standard Deviation	Minimum	Maximum
Ln(Zscore)	3.3831	1.1233	0.4094	6.4180
ROA	0.0115	0.0293	-0.6212	3.4020
Equity Ratio	0.1043	0.0575	0.0247	0.4112
Size	12.9912	1.7273	5.9253	21.8631
Liquid Ratio	0.1399	0.1376	0.0107	0.7369
Leverage	11.0052	6.1933	1.4321	39.5555
Deposit Ratio	0.8201	0.1275	0.2630	0.9547
Cost Ratio	0.0546	0.0483	0.0113	0.3655
Loan/Assets	0.6221	0.1775	0.0773	0.9367
GDP per capita growth	1.2287	2.4777	-14.7863	16.2257
Trade/GDP	46.1057	34.3753	19.7981	382.2915
HHI Loans	0.0637	0.0507	0.0186	0.3209
Country Equity/Assets	0.0774	0.0235	-0.0793	0.2387
Country Loan/Deposits	1.1010	0.5105	0.2345	4.1706
Property Rights Index	79.6113	19.0952	0	95

Table: Mean values of selected variables by country

Countries	No. of banks	Ln(Zscore)	Size	Liquid Ratio	Leverage	HHI Loans	No. of MPs
ARGENTINA	79	2.082	12.947	0.263	6.892	0.084	5
AUSTRIA	251	3.373	13.591	0.239	14.053	0.129	4
BANGLADESH	31	2.541	13.539	0.167	15.085	0.070	4
BELGIUM	51	2.960	14.983	0.221	18.193	0.202	2
BRAZIL	150	2.273	14.059	0.305	7.938	0.103	5
BULGARIA	27	2.648	13.430	0.323	8.379	0.098	4
CHILE	36	3.155	14.556	0.210	8.744	0.119	7
CHINA	160	3.344	16.200	0.262	15.964	0.154	8
COLOMBIA	35	2.557	13.737	0.209	7.875	0.085	7
CROATIA	43	2.914	13.029	0.269	8.258	0.134	2
CZECH REPUBLIC	26	2.950	14.956	0.302	14.081	0.129	3
DENMARK	119	3.031	13.200	0.175	8.228	0.257	2
DOMINICAN REP.	62	2.838	11.199	0.224	6.773	0.207	3
EGYPT	28	3.038	14.767	0.335	11.460	0.145	0
FRANCE	328	3.558	15.364	0.254	14.212	0.078	3
GERMANY	1,910	3.697	13.682	0.140	15.724	0.033	3
HUNGARY	33	2.532	14.244	0.295	11.155	0.110	4
INDIA	84	3.015	15.360	0.099	15.507	0.055	3
INDONESIA	77	2.758	13.903	0.280	9.145	0.076	3
ITALY	701	3.451	13.403	0.188	9.397	0.049	3
JAPAN	606	2.993	15.132	0.196	20.139	0.037	2
KAZAKHSTAN	30	2.371	13.647	0.276	6.969	0.143	3

Table: Mean values of selected variables by country

Countries	No. of banks	Ln(Zscore)	Size	Liquid Ratio	Leverage	HHI Loans	No. of MPs
KENYA	36	2.974	12.102	0.249	6.024	0.106	1
LATVIA	22	1.951	13.350	0.403	10.742	0.177	3
LEBANON	45	3.455	14.225	0.338	12.160	0.093	5
LUXEMBOURG	115	3.047	14.979	0.506	21.232	0.064	1
MEXICO	50	2.425	14.540	0.316	8.699	0.120	3
NORWAY	142	3.592	13.502	0.071	10.683	0.146	4
PANAMA	76	2.979	13.163	0.238	10.673	0.084	2
POLAND	55	2.796	14.590	0.188	9.995	0.090	3
ROMANIA	28	2.219	13.752	0.302	7.577	0.140	5
RUSSIA	900	3.094	11.559	0.308	5.811	0.138	1
SLOVAKIA	17	2.815	14.619	0.239	10.642	0.147	2
SLOVENIA	23	2.986	14.311	0.175	12.106	0.144	2
SPAIN	199	3.562	14.940	0.166	13.870	0.086	4
SWEDEN	100	3.283	12.910	0.137	7.902	0.239	4
SWITZERLAND	379	3.987	13.096	0.206	19.432	0.149	4
THAILAND	26	2.505	15.905	0.130	10.931	0.093	3
TUNISIA	16	3.277	14.162	0.229	10.703	0.107	2
UKRAINE	58	2.324	13.375	0.216	7.856	0.081	4
EMIRATES	17	3.658	15.600	0.229	5.508	0.138	4
UK	113	3.024	14.317	0.415	10.318	0.152	1
USA	8, 888	3.433	12.369	0.086	9.168	0.048	3
VENEZUELA	42	2.307	14.105	0.249	9.077	0.098	0
VIETNAM	41	3.235	14.097	0.305	10.406	0.159	3
TOTAL	16, 255	3.383	12.991	0.140	11.005	0.064	8

Data

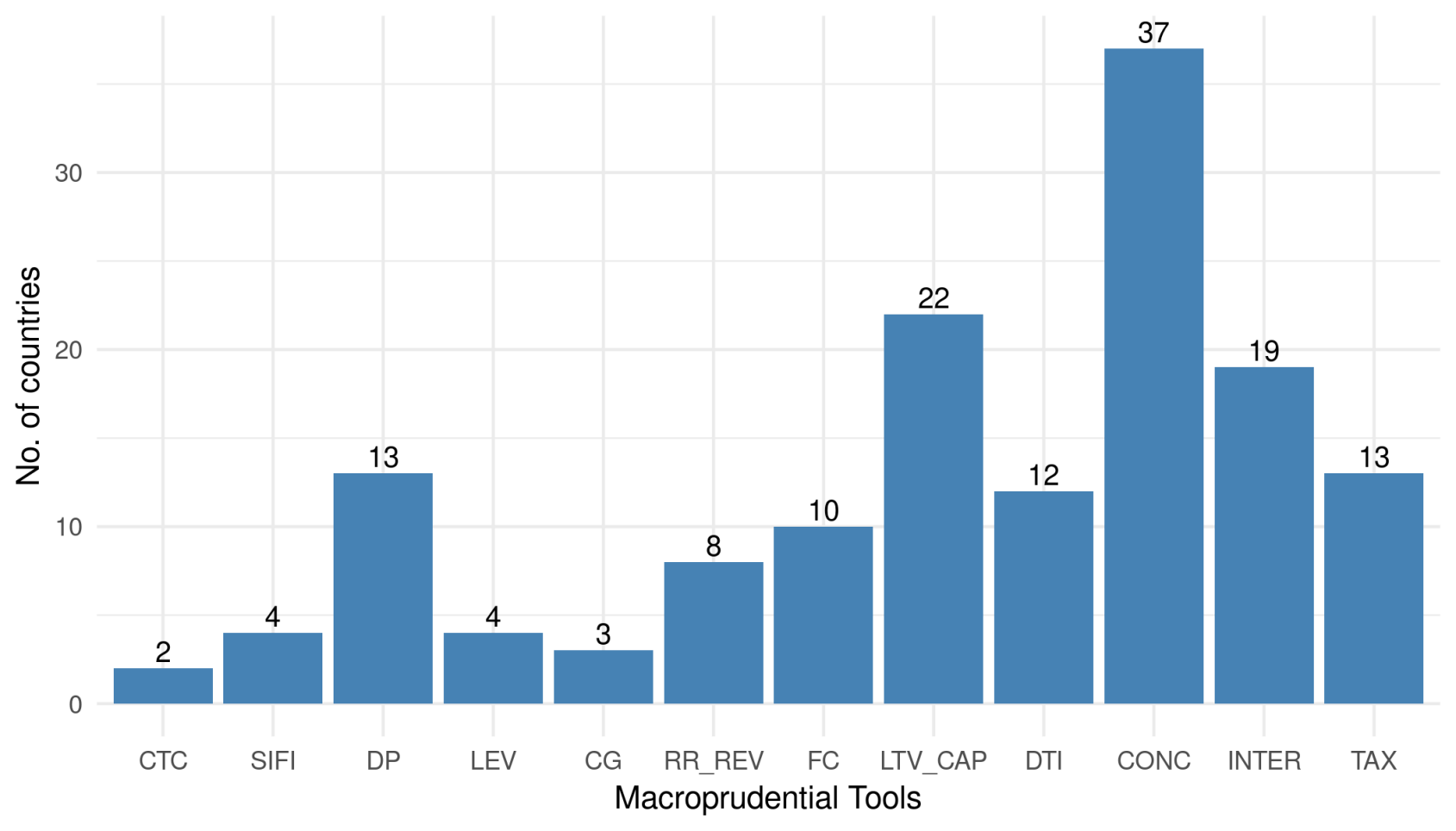

Figure: Number of countries adopting each macroprudential policies

Identification approach

- Two main problems: selection bias and persistence of the risk measure
- We first perform a matching of the countries using nearest neighbor for each macroprudential policy
- Then we estimate a system-GMM model

Method

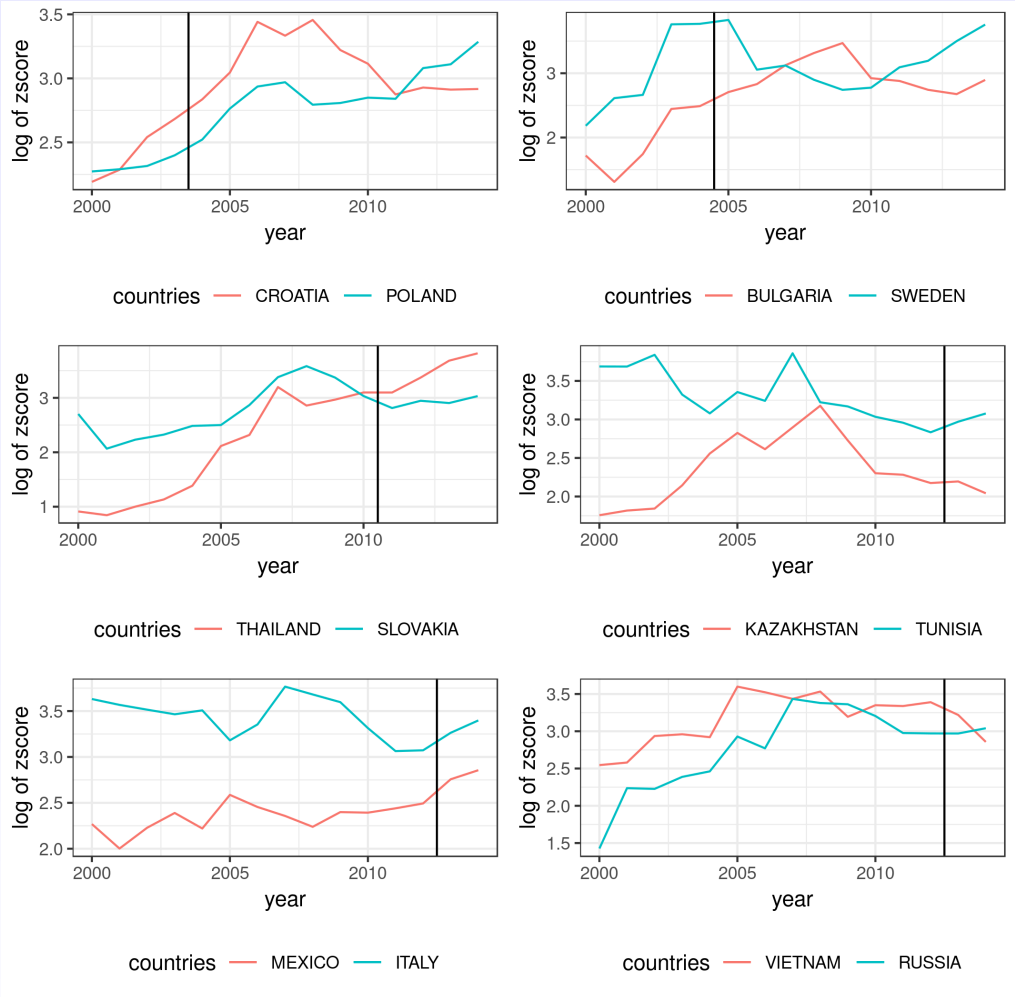

Figure: DP Matching

Regressions

- We estimate dynamic panel data models for each macroprudential policies using bank and macroeconomic/institutional level controls
- We evaluate the impact of each measure on risk taking and interact the dummy of MP with size, liquidity, leverage, HHI and a dummy that identifies excessive risk taking banks
- We also perform the z-score decomposition, using risk adjusted return and leverage as dependent variables
- Finally, we estimate the same regression for 4 distinct groups of MPs: Capital, Asset, Borrower and Structural

Table: Impact of SIFI on banking stability

	Dependent Variable: Ln(Z-score)						*Z-score decomposition*	
	Baseline (1)	Size (2)	Liquidity (3)	Leverage (4)	HHI (5)	Higher risk (6)	ROA (7)	Equity ratio (8)
SIFI	0.218**	0.097	-0.208	-0.108	0.380*	0.252**	-0.053	0.205**
	(0.104)	(0.684)	(0.235)	(0.145)	(0.224)	(0.123)	(0.166)	(0.081)
SIFI · X_t	—	0.008	2.253**	0.014*	-1.039	0.026	—	—
		(0.044)	(1.013)	(0.008)	(1.343)	(0.138)		
SIFI · Higher stability	—	—	—	—	—	-0.279***	—	—
						(0.082)		
Higher risk	—	—	—	—	—	-0.658***	—	—
						(0.200)		
Higher stability	—	—	—	—	—	0.896***	—	—
						(0.149)		
Ln(Y_{t-1})	0.665***	0.676***	0.695***	0.678***	0.689***	0.372**	0.875	0.850***
	(0.193)	(0.191)	(0.220)	(0.202)	(0.196)	(0.188)	(0.637)	(0.222)
Ln(Y_{t-2})	0.160	0.141	-0.052	0.117	0.159	0.149	-0.479	-0.020
	(0.206)	(0.212)	(0.253)	(0.230)	(0.211)	(0.263)	(0.495)	(0.207)
Size	0.030	0.026	0.073	0.027	0.035	0.021	-0.061	0.005
	(0.084)	(0.083)	(0.078)	(0.080)	(0.085)	(0.069)	(0.164)	(0.082)
Liquid Ratio	-2.963	-2.943	-2.679	-4.119	-2.666	-0.850	-10.046	-1.891
	(2.808)	(2.805)	(2.646)	(2.608)	(2.813)	(3.436)	(7.947)	(2.372)
Leverage	-0.064***	-0.063***	-0.068***	-0.057***	-0.063***	-0.034**	0.019	-0.050***
	(0.012)	(0.012)	(0.011)	(0.010)	(0.012)	(0.016)	(0.019)	(0.012)
GDP per capita growth	-0.008	-0.008	0.013	-0.009	-0.009	-0.004	-0.013	-0.021*
	(0.013)	(0.014)	(0.016)	(0.014)	(0.014)	(0.016)	(0.032)	(0.011)
Trade/GDP	0.000	0.001	0.007	0.001	-0.000	-0.001	0.012	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.008)	(0.003)
HHI Loans	0.603	0.540	-0.847	0.614	0.687	2.250	2.636	0.538
	(1.287)	(1.271)	(1.976)	(1.383)	(1.601)	(1.587)	(2.561)	(1.182)
Property Rights Index	0.009	0.009	0.010*	0.005	0.010	0.010	-0.009	0.005
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.008)	(0.013)	(0.006)
Observations	9,710	9,710	9,710	9,710	9,710	9,710	9,710	9,710
Number of banks	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273
Serial correlation AR(1)	0.0979	0.0886	0.0606	0.108	0.0960	0.198	0.207	0.0310
Serial correlation AR(2)	0.218	0.269	0.889	0.340	0.229	0.365	0.536	0.725
Hansen test	0.125	0.124	0.188	0.112	0.133	0.116	0.553	0.0921

Results

Baseline regressions:

- Structural and borrower policies are the most effective (CONC, INTER, LTV, DTI)
- Capital-based policies have mixed effects (sig. - SIFI and DP, no-sig. - CTC, LEV)
- Asset-based policies may increase risk-taking (CG, FC, RR)
- TAX had no significant effect

Heterogeneous effects:

- Some of the policies are only significant for banks with certain characteristics: DP, DTI and RR
- MPs tend to be more effective for larger and more leveraged banks
- The effects tend to be lower for more stable banks, but not higher for excessive risk-taking banks

Results

Transmissions channels:

- Policies such as SIFI, LTV, RR and FC mainly affect the Z-score through the leverage channel
- CG, CONC and INTER also affect the Z-score through the return on assets channel

Conclusions

- One-size-fits-all solutions are not always effective
- Regulation could focus on excessive risk-taking banks and take into account heterogeneity
- Structural and borrower measures are the most effective in reducing risk-taking
- Some regulation are only effective for certain banks
- The leverage channel tends to be the most important one for effective regulation