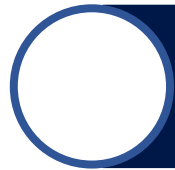# Big data analysis for systemic risk and government interventions in the banking sector
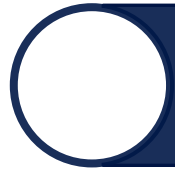
Simona Nistor
Ioana Georgiana Fărcaș
Andreea Maura Bobiceanu
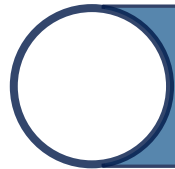Babeş-Bolyai University of Cluj-Napoca, FSEGA

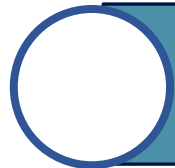December, 2024

Agenda

Motivation & Background information

Previous findings

Data & Methodology

Main results
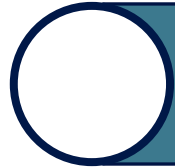
Conclusions

Motivation

The importance of the topic is based on:

- the high variety of macroprudential policies implemented by regulatory authorities in response to financial crises
- not all of the effects and connections of these measures were studied (e.g. cultural factors)

The research questions:

- How does the national culture influence the macroprudential policy actions' tightness across the banking sector?
- Which are the channels through which culture affects macroprudential policies?

Background information (systemic events)

Systemic risk

Amplification mechanisms

Contagion phenomena

Negative spillovers

Collapse of confidence

Asset bubbles

From micro to macroprudential regulation

From bail-ins to bailouts

Previous studies

Findings – macroprudential policy actions

A large strand of the literature investigates their effects on **financial stability** (Claessens, Ghosh, and Mihet, 2013; Ghosh and Kumar, 2022), **lending** (Cerutti, Claessens, and Laeven, 2017), **spread of negative spillovers of monetary policies within financial system** (Coman, and Lloyd, 2022) or **credit growth** (Drehmann and Gambacorta, 2012).

Macroprudential policy tightening is associated with **lower bank credit growth**, **housing credit growth**, and **house price appreciation** (Akinci & Olmstead-Rumsey, 2018).

The main determinants of macroprudential interventions are considered the **monetary policy** (Lim et al., 2013; Boar et al., 2017) or **electoral cycles** (Sever and Yücel, 2022).

Findings – national culture

Previous studies showed that a higher level of individualism results in a **higher level of risk taking by banks** (Berger, 2020) and **a lower level of deposits attracted**, while trust and hierarchy are positively related to **the level of deposits** (Damtsa, 2019).

Credit provision is also affected by the national culture, being higher in countries with higher collectivism, power distance, uncertainty avoidance, and masculinity scores (El Ghoul & Zheng, 2016).

Banks have the tendence to offer the borrowers smaller loans at a higher interest rate especially **when they are culturally distant** (Giannetti & Yafeh, 2012).

Data & Methodology

Data

A worldwide sample of 57 countries (six continents) over 2000-2020.

Data on **macroprudential policy interventions** are from the International Monetary Fund's (IMF) Integrated Macroprudential Policy Database (iMaPP), originally constructed by Alam et al. (2019).
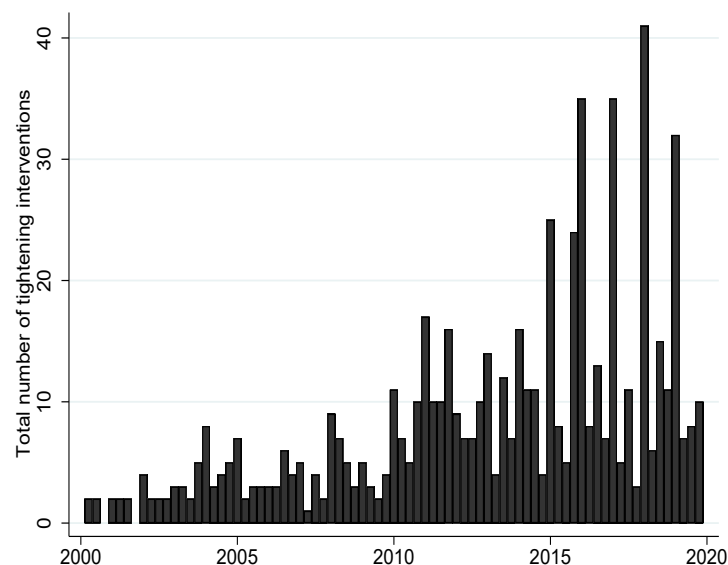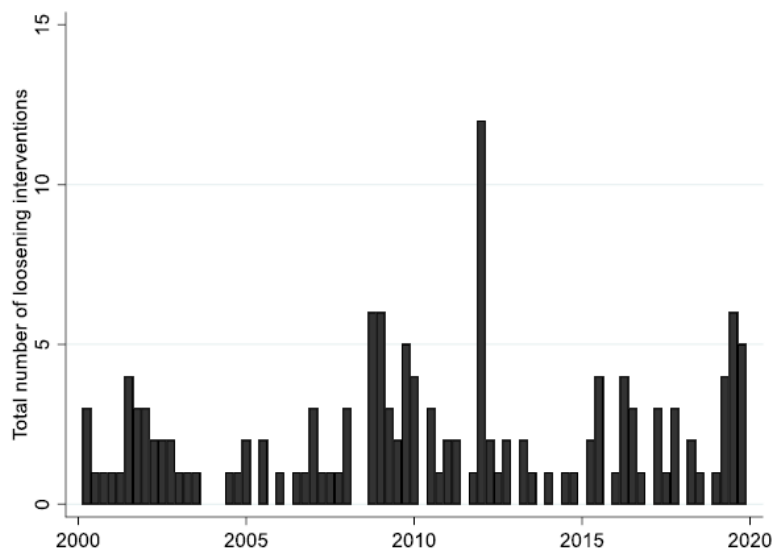
MPPI Index

- The database incorporates a large spectrum of policy instruments classified into **23 categories** including capital, liquidity, activity-based, and borrower-based measures.

Computation method of the MPPI Index:

- The components can take the following monthly values: -1 for **loosening**, 0 for **maintenance**, and 1 for **tightening;**
- sum of all component indices in each category, by **country** and **quarter**;
- computation of a **cumulative index** that aggregates the changes in policies over time (i.e., the MPPI index rises by one unit after a tightening event, maintains when no policy action is taken, and falls by one unit after a loosening event);

Determinants

- **Cultural values of Hofstede**
  - Power distance
  - Individualism
  - Masculinity
  - Uncertainty avoidance
  - Long term orientation
  - Indulgence

- **Controls**
  - Banking market characteristics
  - Macroeconomic characteristics

Methodology

- The **tightness/looseness** is estimated through a GLS model:

$$Y_{c,t} = \alpha + \sum_{i=1}^{6} \beta_i Culture_{i,c} + \gamma * Bank \text{ controls}_{c,t-1} + \delta * Macro\ controls_{c,t-1} + \vartheta_t + \varepsilon_{c,t}$$

- $Y_{c,t}$ - the macroprudential policy index in country c in a given quarter (higher values = tighter policy)
- $Culture_{i,c}$ - the values of the six national culture indices (power distance, individualism, masculinity, uncertainty avoidance, long-term orientation, and indulgence).
- $Bank\ controls_{c,t-1}$ - banking sector controls which consist of Bank non-performing loans to Gross loans, Bank deposits to GDP, Bank Z-score, Bank return on assets, Government owned banks share, and the variation of Bank return on assets, Domestic credit to the private sector, Total assets to GDP.
- $Macro\ controls_{c,t-1}$ - macroeconomic controls which consist of GDP growth, Inflation, share of debt to GDP and a dummy variable for advanced vs. emergent countries.
- ϑ_t - region fixed effects
- $\varepsilon_{c,t}$ - standard error term clustered at country level

Results

Main results: The impact of culture on macroprudential tightness

Method used: random effects generalized least squares (GLS)

$$MPPI_{c,t} = \alpha + \sum_{i=1}^{6} \beta_i * Culture_{i,c}$$

$$+\gamma * Banking\ controls_{c,t-1}$$

$$+ \delta * Macroeconomic\ controls_{c,t-1} + \partial_r + \varepsilon_{c,t}$$

Dependent variable: Macroprudential policy index

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Culture							
Power distance	-38.004***	4.319					
	(9.943)	(9.449)					
Individualism	-19.478***		-29.961***				
	(6.132)		(7.312)				
Masculinity	-27.298***			-22.249**			
	(10.374)			(8.695)			
Uncertainty avoidance	32.540***				31.021**		
	(11.727)				(13.643)		
Long-term orientation	27.146***					29.651***	
	(7.543)					(9.716)	
Indulgence	-1.433						-13.120*
	(7.343)						(7.223)
Constant	22.602*	8.882	11.305*	16.693**	-20.310	15.629***	24.274***
	(13.321)	(8.421)	(6.496)	(6.510)	(16.723)	(5.213)	(5.473)
Banking sector controld	YES	YES	YES	YES	YES	YES	YES
Macroeconomic controls	YES	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES	YES
Cluster	Country	Country	Country	Country	Country	Country	Country
Observations	2,733	2,893	2,893	2,893	2,893	3,154	3,031
No of countries	49	52	52	52	52	57	55
R-squared overall	0.384	0.123	0.221	0.165	0.161	0.146	0.104

Robustness check: alternative methodology, additional controls, alternative macroprudential policy index, alternative cultural measures

Variables	(1) Alternative methodology: Logit	(2) Additional controls: Regulatory and institutional variables	(3) Alternative Y: MPPI Cerutti et al. (2017)	(4) Alternative Y: MPPI static	(5) Alternative cultural measures: GLOBE
Culture					
Power distance	-2.292***	-27.478**	-7.948***	-0.925***	
	(0.810)	(12.045)	(2.698)	(0.201)	
Individualism	0.072	-16.755*	-0.950	-0.095	
	(0.573)	(8.852)	(2.068)	(0.143)	
Masculinity	-1.597**	-24.126**	-5.489***	-0.484***	
	(0.710)	(10.288)	(1.574)	(0.170)	
Uncertainty avoidance	2.500***	33.783***	7.799**	0.713***	
	(0.836)	(13.057)	(3.294)	(0.221)	
Long term orientation	1.659**	20.179**	2.281	0.291	
	(0.787)	(7.961)	(2.698)	(0.177)	
Indulgence	0.081	-7.063	-2.914	0.074	
	(0.796)	(8.852)	(2.677)	(0.170)	
Power distance societal practices					-2.952**
					(1.393)
Collectivism societal practices					3.658**
					(1.509)
Gender egalitarianism societal practices					3.354**
					(1.661)
Uncertainty avoidance societal values					7.866***
					(2.104)
Future orientation societal practice					7.410***
					(2.222)
Other controls					
Overall restrictions		-1.382***			
		(0.336)			
Capital regulatory		-0.105			
		(0.332)			
External rating and credit monitoring		0.810			
		(1.174)			
Private monitoring		0.349			
		(0.659)			
Regulatory quality		6.117			
		(3.946)			
Banking crisis dummy		-3.271***			
		(0.889)			
Constant	0.234	23.332*	3.884	0.419	-72.809***
	(1.059)	(12.884)	(4.486)	(0.273)	(15.461)
Banking sector controls	YES	YES	YES	YES	YES
Macroeconomic controls	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES
Cluster	Country	Country	Country	Country	Country
Observations	2,733	1,728	2,255	2,733	1,937
No of countries	49	43	47	49	35
Pseudo R-squared	0.054				
R-squared overall		0.506	0.347	0.022	0.564

Policy implications (I)

The effects of the supervisory framework on the relation between culture and macroprudential policy tightness: Independence of supervisory authority

Dependent variable: MPPI							
Mitigating factor	Panel A. Independence of supervisory authority						
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mitigating factor	9.128	2.723	-2.896	-1.486	-8.934*	4.425	-6.485
	(12.106)	(5.438)	(6.257)	(4.393)	(4.902)	(3.342)	(4.675)
Culture x Mitigating factor							
Power distance	-15.202	11.039					
	(10.550)	(13.106)					
Power distance x Mitigating factor	-24.993**	-7.521					
	(10.001)	(11.269)					
Individualism	-8.670		-33.720***				
	(6.577)		(10.744)				
Individualism x Mitigating factor	-13.547**		2.713				
	(5.879)		(9.053)				
Masculinity	-30.308***			-23.016**			
	(10.532)			(9.637)			
Masculinity x Mitigating factor	10.428			0.600			
	(7.209)			(8.287)			
Uncertainty avoidance	23.727**				25.378*		
	(11.557)				(14.007)		
Uncertainty avoidance x Mitigating factor	13.771***				12.100**		
	(3.789)				(6.099)		
Long term orientation	34.422***					35.008***	
	(8.350)					(10.455)	
Long term orientation x Mitigating factor	-9.872**					-10.494	
	(4.562)					(6.532)	
Indulgence	-5.230						-20.836**
	(10.694)						(10.391)
Indulgence x Mitigating factor	5.098						12.620
	(8.743)						(8.732)
Banking sector controls	YES	YES	YES	YES	YES	YES	YES
Macroeconomic controls	YES	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES	YES
Cluster	Country	Country	Country	Country	Country	Country	Country
Observations	2,653	2,813	2,813	2,813	2,813	3,074	2,951
No of countries	49	52	52	52	52	57	55
R-squared	0.430	0.116	0.219	0.156	0.190	0.152	0.099

Policy implications (II)

The effects of the supervisory framework on the relation between culture and macroprudential policy tightness: Supervisory forbearance

Dependent variable: MPPI							
Mitigating factor			**Panel C. Supervisory forbearance**				
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mitigating factor	0.260	-0.070	0.512	2.590	6.894***	0.332	-1.341
	(5.014)	(2.076)	(2.706)	(1.842)	(1.431)	(1.942)	(1.134)
Culture x Mitigating factor							
Power distance	-51.000***	2.350					
	(9.946)	(10.928)					
Power distance x Mitigating factor	8.904**	1.277					
	(3.493)	(4.128)					
Individualism	-31.498***		-31.594***				
	(8.810)		(8.693)				
Individualism x Mitigating factor	9.180**		0.324				
	(3.851)		(4.447)				
Masculinity	-21.536*			-15.821			
	(12.469)			(10.961)			
Masculinity x Mitigating factor	-2.786			-3.918			
	(2.636)			(3.138)			
Uncertainty avoidance	49.341***				47.760***		
	(14.772)				(14.323)		
Uncertainty avoidance x Mitigating factor	-10.635***				-9.611***		
	(2.960)				(2.258)		
Long term orientation	20.684**					28.790**	
	(9.855)					(11.858)	
Long term orientation x Mitigating factor	-0.255					0.302	
	(3.557)					(3.123)	
Indulgence	-3.752						-20.602**
	(11.896)						(9.345)
Indulgence x Mitigating factor	-2.025						4.172
	(4.980)						(2.566)
Banking sector controls	YES	YES	YES	YES	YES	YES	YES
Macroeconomic controls	YES	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES	YES
Cluster	Country	Country	Country	Country	Country	Country	Country
Observations	2,733	2,893	2,893	2,893	2,893	3,154	3,031
No of countries	49	52	52	52	52	57	55
R-squared	0.416	0.115	0.217	0.159	0.193	0.141	0.094

Policy implications (III)

The effects of the supervisory framework on the relation between culture and macroprudential policy tightness: Multiple supervisors

Dependent variable: MPPI

Mitigating factor	Panel B. Multiple supervisors						
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mitigating factor	-12.633	1.736	-12.244***	-12.771***	-13.648***	-1.371	-2.071
	(15.253)	(4.419)	(4.722)	(4.417)	(3.322)	(3.708)	(6.104)
Culture x Mitigating factor							
Power distance	-37.086***	2.306					
	(9.630)	(8.818)					
Power distance x Mitigating factor	-1.245	-10.830					
	(11.245)	(8.092)					
Individualism	-21.255***		-30.141***				
	(6.513)		(7.634)				
Individualism x Mitigating factor	9.585		15.784*				
	(12.137)		(8.325)				
Masculinity	-26.185***			-22.642***			
	(10.019)			(8.480)			
Masculinity x Mitigating factor	8.909			15.337**			
	(10.511)			(7.308)			
Uncertainty avoidance	30.241***				28.042**		
	(11.362)				(13.702)		
Uncertainty avoidance x Mitigating factor	8.054				16.685***		
	(8.780)				(6.297)		
Long term orientation	29.161***					29.451***	
	(7.343)					(9.987)	
Long term orientation x Mitigating factor	-8.405					-7.360	
	(6.904)					(8.767)	
Indulgence	1.219						-12.539*
	(7.642)						(7.185)
Indulgence x Mitigating factor	0.560						-8.001
	(20.054)						(10.646)
Banking sector controls	YES	YES	YES	YES	YES	YES	YES
Macroeconomic controls	YES	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES	YES
Cluster	Country	Country	Country	Country	Country	Country	Country
Observations	2,733	2,893	2,893	2,893	2,893	3,154	3,031
No of countries	49	52	52	52	52	57	55
R-squared	0.401	0.141	0.233	0.179	0.172	0.155	0.119

Conclusions

Contributions to the literature

Our results suggest that policymakers should consider cultural heritage when imposing restrictions aiming to increase banks' resilience, or limits that address borrowers' vulnerabilities, and account for supervisory capacity.

As policy recommendation, our findings suggest that the cultural factors should be taken into consideration when the regulatory authorities implement different types of macroprudential policy tools.

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THANK YOU!