

A Tale of Different Capital Ratios: How To Correctly Assess The Impact of Capital Regulation on Lending

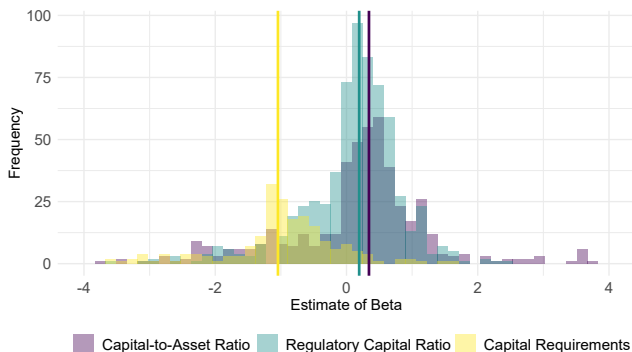
Simona Malovaná, Josej Bajžík, Zuzana Gric, and Martin Hodula

CNB Research Open Day 2022

May 23, 2022

Introduction and motivation

- Rapidly **expanding literature** on the bank capital-lending relationship
 - ▶ Visibly **fragmented** literature
- **Changing** regulatory (Basel III) and economic **environment** (GFC, record low interest rates)
- What is the impact of changes to bank capital and capital requirements on bank lending?
- What explains the fragmentation?



Bank capital-lending relationship at a glance

- The level of capital is central to bank lending decisions
 - ▶ Captured by the so-called **capital ratio** (in simplest form – bank capital over total assets)
- Hard relationship to estimate
 - ▶ “Regulatory” increase in the bank capital ratio may dampen bank lending
 - ▶ Increase in the bank capital (equity) ratio due to bank profit accumulation may increase lending
 - ▶ Likely endogeneity issues, etc.
- Large body of research is focused on bank behavior under capital regulation
 - ▶ Fruitful ground for research given the increasing use of capital-based measures (encompassing capital requirements)
 - ▶ Highly demanded by policymakers

Roadmap of the paper

- Collection process and early view of fragmentation
- Publication bias
 - ▶ Is the reporting selective?
- Heterogeneity drivers
 - ▶ Why do estimates differ?
- Stylized (what if) elasticity
 - ▶ What the mean elasticity would look like if all studies used the same strategy as the one that we prefer?

Selected papers and collected estimates

- Google Scholar search for all empirical studies with bank capital or capital requirements on the RHS and lending on the LHS

“bank capital regulation” OR “capital requirements” OR “bank capital” OR “capital surplus” OR “capital ratio” OR “macroprudential regulation” OR “macroprudential policy” AND “lending” OR “credit” OR “loans”

- Limited to studies published in 2010 and later (to capture changes to capital regulation since the GFC)
- 546 studies screened
 - ▶ 417 excluded based on abstract or title
 - ▶ 83 excluded due to lack of correspondence or data
 - ▶ 46 included (26 journal articles and 20 working papers)
- 1,639 estimates retrieved (app. 36 per study)

Fragmentation

- 85% (1,395) of collected estimates use the same variable transformation, i.e. the semi-elasticities have the same interpretation
- We collect $\hat{\beta}$ (generalized representation):

$$\text{credit growth}_{it} = \hat{\beta} \text{ capital ratio}_{it} + \hat{\gamma} \text{ other variables} + e_{it}$$

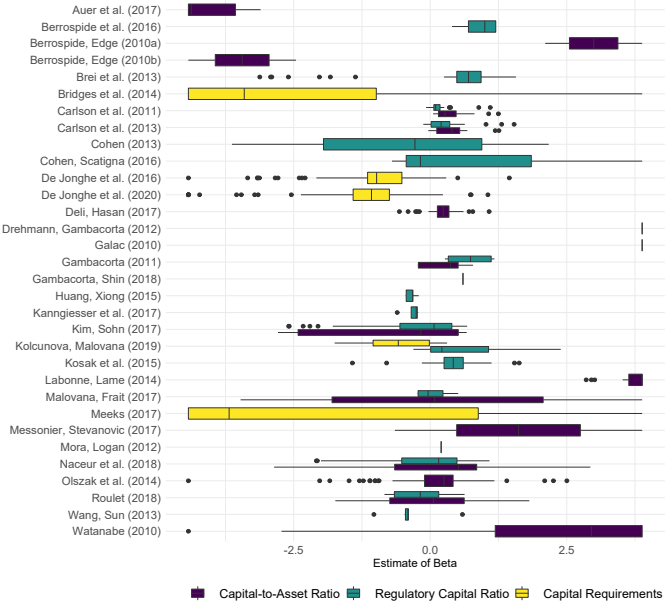
- i can be country or bank
- **3 different capital ratios** in our sample:
 - ▶ Capital-to-asset ratio
 - ▶ Regulatory capital ratio (Tier 1 and Tier 2 over risk-weighted exposures)
 - ▶ Capital requirements (minimum, Pillar 2 add-ons and capital buffers)

Capital vs. capital requirements

- Some heterogeneity well explained by the type of capital ratio used in the estimation
- **Capital-to-asset ratio** associated with a **positive** effect on bank lending
- **Capital requirements** associated with a **negative** effect on bank lending
- **Regulatory capital ratio** is somewhere **in between** – positive mean elasticity, but negatively skewed
 - ▶ Studies using regulatory capital ratio are more likely to capture the effects of changes to bank capital under capital regulation where a negative effect can be expected

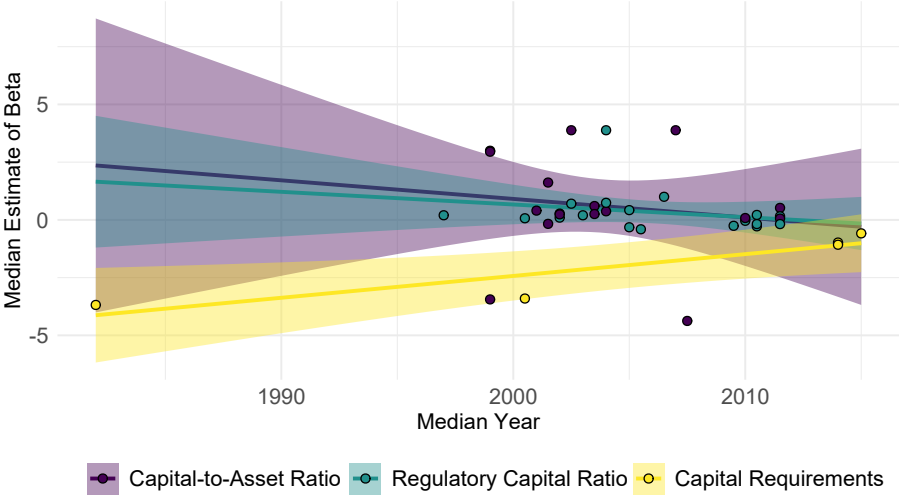
	Obs.	Articles	Mean	5%	95%	Skewness
<i>Total</i>	1,395	32	-0.06	-2.61	1.68	-0.45
Capital-to-asset ratio	514	17	0.30	-2.22	3.79	0.03
Regulatory capital ratio	652	18	0.13	-1.38	1.11	-0.23
Capital requirements	229	5	-1.40	-4.43	0.64	0.02

Estimates vary within and across studies

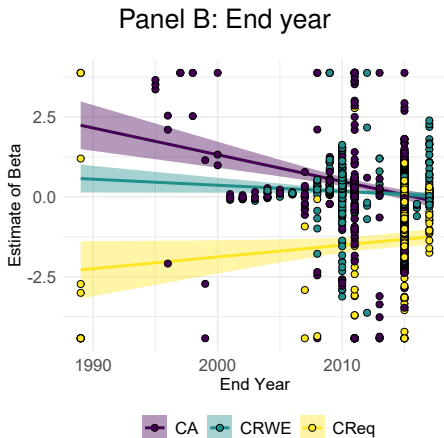
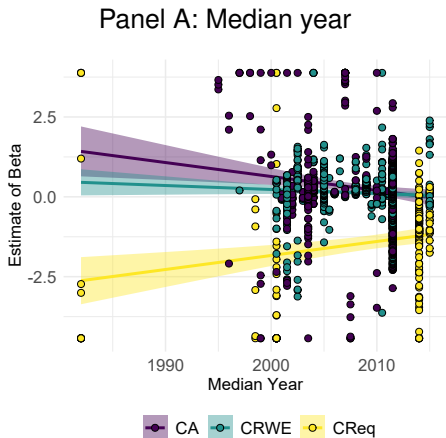


Estimates change over time

- Studies on recent data report estimates closer to zero.

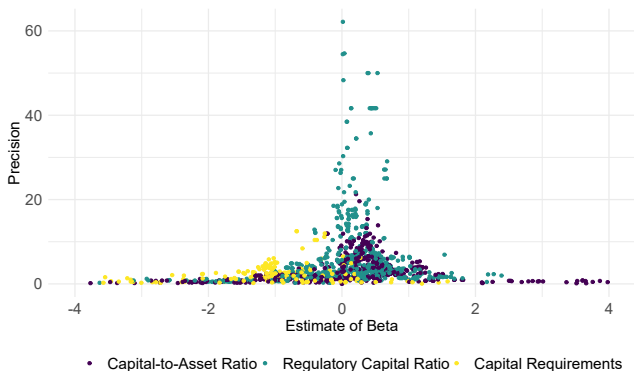


Estimates change over time – individual elasticities



Publication bias

- Are only selected results published (i.e. statistically significant and/or with “correct” sign)?
- Tools:
 - ▶ Graphical inspection – [funnel plot](#)
 - ▶ Empirically – a battery of linear and non-linear tests



Publication bias – empirical tests

- Linear tests:

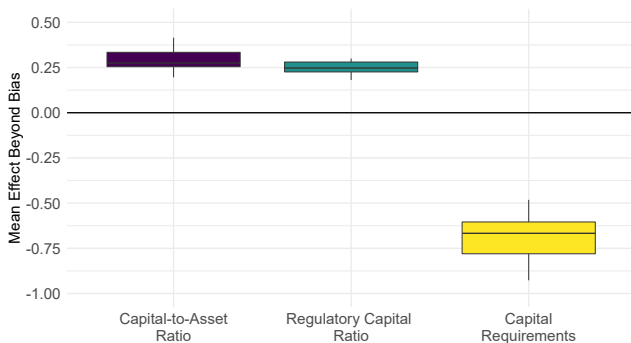
$$\hat{\beta} = \alpha + \gamma \text{ standard error}_{it} + e_{it}$$

- α – effect beyond bias (true effect)
- γ – intensity of the publication bias
- Estimated by, e.g., simple or weighted OLS, fixed-effects or random-effects regression

- Non-linear tests: based on various assumptions
 - ▶ Keeping only adequately powered estimates (Top 10 and WAAP method)
 - ▶ Giving more weight to insignificant underreported estimates (selection method)
 - ▶ Optimizing trade-off between bias and variance (stem-based method)
 - ▶ Searching for a precision threshold above which publication bias is unlikely (kinked method)

Publication bias and true effect – results

- Publication bias:
 - ▶ No or limited for capital-to-assets ratio and regulatory capital ratio
 - ▶ Negative and significant for capital requirements
- True (corrected) effect:
 - ▶ 1 pp increase in capital-to-asset ratio and regulatory capital ratio leads to 0.3 pp and 0.2 pp increase in credit growth
 - ▶ 1 pp increase in capital requirements leads to decrease in credit growth between -0.5 to -1 pp (average app. -0.7 pp)



Drivers of heterogeneity

- How do different **data and estimation methods** influence reported elasticity?
- Do also **publication characteristics** matter?
- What is the role of **structural characteristics** of the economy?
- **40 additional variables** collected to better understand the differences between studies
 - ▶ Type of credit, region, data time span and frequency, data confidentiality
 - ▶ Estimation method, model specification, lags, control variables,
 - ▶ Journal, impact factor, citations, publication year
 - ▶ External variables capturing cross-country or cross-regional differences (macro-financial variables, e.g., interest rates, financial development, credit and house price growth, LIRE)
- **Bayesian model averaging** (baseline), frequentist model averaging and simple OLS (robustness checks)

Which factors drive the heterogeneity?

- **Capital-to-asset ratio and regulatory capital ratio** BMA CA BMA CRWE
 - ▶ Higher positive estimates: single-country studies with longer time span using confidential data, corporate credit
 - ▶ Lower positive or negative estimates: studies shielding against omitted variable bias (FE estimator, control variables included) with more favorable publication characteristics
 - ▶ CA – significant role of a number of structural factors (e.g. LIRE)
 - ▶ CRWE – limited role of structural factors
- **Capital requirements** BMA CReq
 - ▶ Publication bias confirmed
 - ▶ Longer time span used in the estimation weakens the negative effect

Elasticity implied by significant heterogeneity drivers

- “Best practice” – what the mean elasticity would look like if all studies used the same strategy as the one that we prefer
 - ▶ Single-country studies performed on confidential data samples with higher frequency
 - ▶ Dynamic model specification with lagged effect of capital on lending including both bank-level (supply-side) and macroeconomic (demand-side) control variables and estimated with unit fixed effects
 - ▶ More favorable publication characteristics
 - ▶ Selected structural variables
- Economic significance of key variables – type of credit, data and methodology, a prolonged period of low interest rates

Elasticity implied by significant heterogeneity drivers

- True effect accounting for significant heterogeneity drivers is
 - ▶ **Positive** for the capital-to-asset ratio and
 - ▶ **Negative** for the regulatory capital ratio
- **Prolonged period of low interest rates** – the bank capital-lending relationship changes to negative

	Capital-to-Asset Ratio		Regulatory Capital Ratio	
	Estim.	68% CI	Estim.	68% CI
Baseline ("best practice")	1.78	(1.12, 2.52)	-0.74	(-1.00, -0.16)
Corporate credit	1.93	(1.29, 2.67)	-0.78	(-1.03, -0.19)
Household credit	1.71	(1.06, 2.45)	-0.75	(-1.00, -0.17)
Public data & annual frequency	1.62	(0.94, 2.39)	-1.03	(-1.30, -0.47)
Multi-country, public data & annual frequency	0.32	(-0.45, 0.95)	-2.05	(-2.41, -1.55)
Inferior empirical approach	1.55	(0.89, 2.27)	-0.67	(-0.92, 0.00)
Prolonged period of low interest rates*	-1.22	(-1.98, -0.57)	-0.98	(-1.10, -0.22)

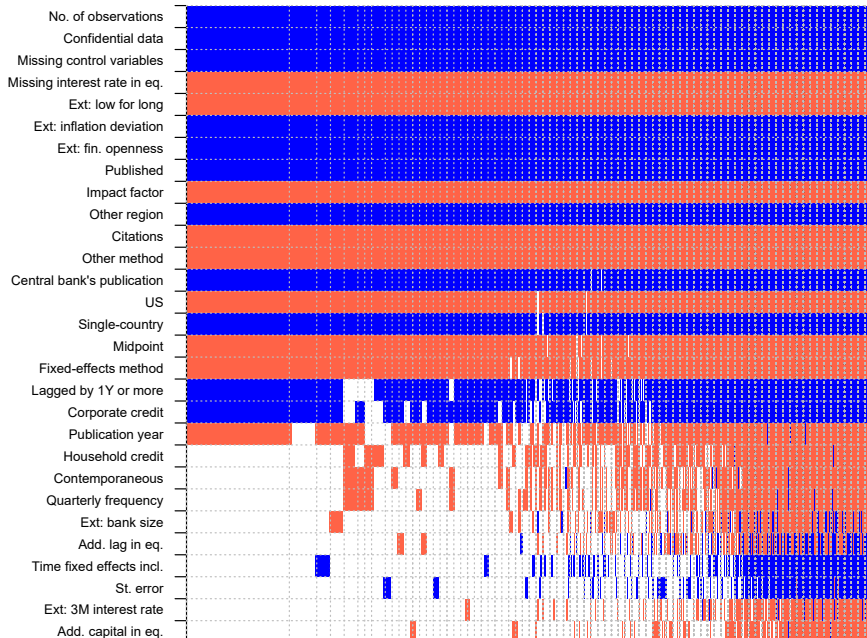
Concluding remarks

- About 1,400 estimates from 32 studies (the narrow sample)
- Significant fragmentation of the collected estimates
- Additional 40 variables collected reflecting the heterogeneity
- Some fragmentation well explained by the type of capital ratio used in the study
- **Publication bias** of estimates on capital requirements (significant negative estimates overreported)
- **Significant heterogeneity drivers** of estimates on capital-to-asset ratio and regulatory capital ratio
- **True effects** corrected for publication bias (accounting for heterogeneity drivers) of 1 pp increase in capital ratio on annual lending growth:
 - ▶ Capital-to-asset ratio: 0.3 pp (1.8 pp implied elasticity)
 - ▶ Regulatory capital ratio: 0.2 pp (-0.7 pp implied elasticity)
 - ▶ Capital requirements: -0.5 to -1.0 pp

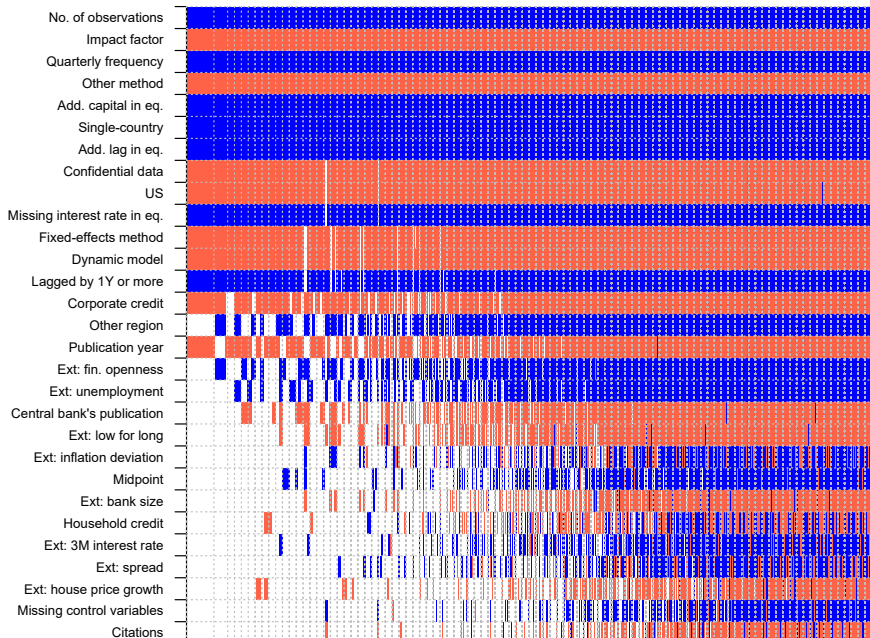
Thank you for your attention!

Back-up slides

BMA results – capital-to-assets ratio

[Back](#)

BMA results – regulatory capital ratio

[Back](#)

BMA results – capital requirements

Back

