The Capital Buffer Calibration for Other Systemically Important Institutions Is there too much Country Heterogeneity?

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7th EBA Policy Research Workshop, November 29, 2018.

Outline

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Systemic Risk is a threat for Financial Stability

- Since the financial crisis, policymakers, market participants and regulators would agree that *systemic risk* thus poses a significant risk to *financial stability*.
- Iori et al. (2006) refers to systemic risk, as the risk to financial systems that **idiosyncratic shocks can easily spread through the entire system**, especially in the context of **interconnected financial institutions**.
- ECB (2009) define financial stability as a *condition in which the financial system - comprising of financial intermediaries, markets and market infrastructures - is capable of withstanding shocks and the unraveling of financial imbalances, thereby mitigating the likelihood of disruptions in the financial intermediation process which are severe enough to significantly impair the allocation of savings to profitable investment opportunities.*

How does the OSII buffer mitigate systemic risk?

- The depth and severity of the financial crisis were clearly amplified by the “market expectation” that certain financial institutions were too big to fail.
- According to Rime (2001); Wheelock and Wilson (2000), capital regulation is motivated principally by the concern that a bank may hold less capital than is socially optimal relative to its riskiness as negative externalities resulting from bank default are not reflected in market capital requirements.
- EBA (2014) claims that the OSII buffer should reduce an institution’s probability of default and therefore reduces the ”caused” (contagion) losses by this institution in the financial system.

Does the market price systemic risk correctly?

Acemoglu et al. (2015) show that in their model of an interbank market:

- **Pricing of *immediate* counterparty risk is sufficient** for a socially optimal outcome in the absence of financial contagion effects.
- **Social efficiency does not hold in the presence of contagion effects** unless banks include these effects in their pricing (through contract covenants, in their model).

Siebenbrunner and Sigmund (2018a) show that in their model these contagion effects are not prices in.
$\Rightarrow$ Identification of a market failure calls for OSII buffers to mitigate risk stemming from systemic risk.

So, do we need an OSII buffer?

- Acemoglu et al. (2015); Siebenbrunner and Sigmund (2018a) demonstrate that **systemic risk is not priced in**.
- Rime (2001); Wheelock and Wilson (2000) demonstrate that **higher capitalization reduces the probability of a bank's default**.
- EBA (2014) **identifies OSIIs**.
- Siebenbrunner et al. (2017); Siebenbrunner and Sigmund (2018b) demonstrate that the indicators of the **OSII score** (see next section) are **good indicators to predict contagion losses**.

$\Rightarrow$ How to assign the the optimal OSII buffer is an open question.
$\Rightarrow$ We take a **decision theory approach** and analyze how regulatory authorities set OSII buffers for their respective banks.

Main results and policy messages

- Although there is a unified approach to identify other systemically important banks (OSIIs), there is a lot of country heterogeneity in the OSII buffer assignment process. Applying the German OSII buffer assignment model would increase capital requirements by 83bn EUR.
- We show this heterogeneity with different models and also provide a theory on how the OSII buffer assignment process might work in practice.
- From a policy point of view, the big-too-fail dilemma is not fully addressed by many countries, as the optimal OSII buffer is not assigned to each bank in Europe.

Outline

Data and OSII Score Methodology

- All data on OSII buffers and OSII scores are based on the publications of the European union member state authorities to the European Systemic Risk Board (ESRB).
- We use 283 observations on OSII scores and buffers, with 186 banks from 2015 to 2017 in 28 countries (observations after March 2018 are not included).

Criterion	Indicators	Weight
Size	Total assets	25%
Importance	Value of domestic payment transaction	8.33%
	Private sector deposits from depositors in the EU	8.33%
	Private sector loans to recipients in the EU	8.33%
Complexity/Cross-border activity	Value of OTC derivatives (notional)	8.33%
	Cross-jurisdictional liabilities	8.33%
	Cross-juridictional claims	8.33%
Interconnectedness	Intra financial system liabilities	8.33%
	Intra financial system assets	8.33%
	Debt securities outstanding	8.33%

OSII Score Calculations I

- The weighted numbers of the scoring process in Table 10 are then used to calculate the OSII score of bank *i* as follows:

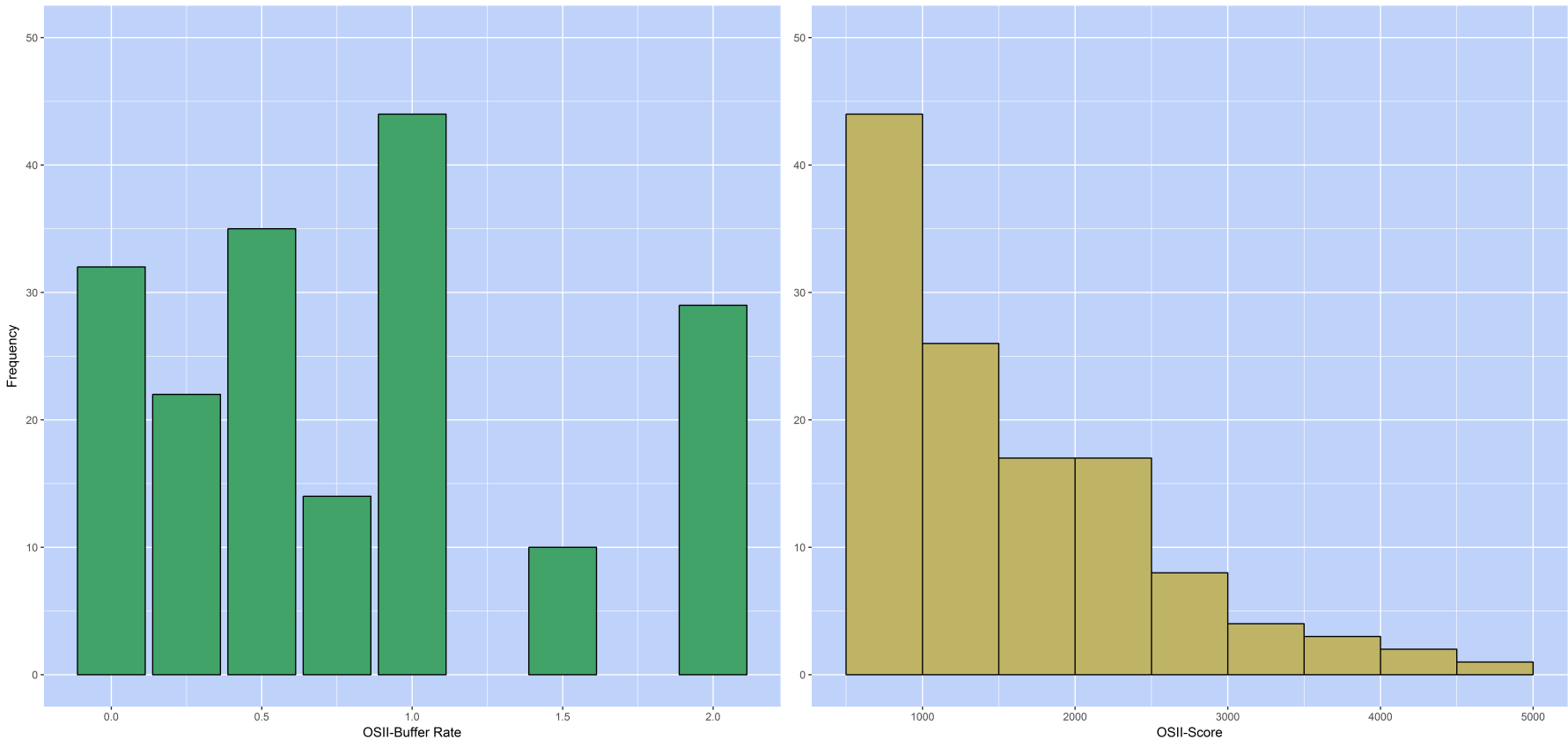
$$\text{OSII-Score}_i = 10,000 * \sum_{Ind. \in \text{OSII-Indicators}} w^{Ind.} \frac{Ind._i}{\sum_{j=1}^{N} Ind._j} \quad (1)$$

- N is the number of banks in a specific country.
- By dividing each weighted criteria by the weighted sum (across all banks in a country) of each criteria, it is possible to compare OSII scores across countries.
- Multiplying the result by 10,000 makes sure that each bank has a score in the open interval $(0, 10,000]$.
- A score of 10,000 would imply that there was only one bank in a specific country. A score of close to 0 would imply that a bank has a balance sheet sum close to 0.
- This score is re-calculated annually by the designated authorities and must be publicly accessible.

OSII Score Calculations II

- Although regulatory authorities could set OSII buffers in the interval from 0 to 2%. They only set their buffers discretely in 0.25% steps.
- The scores are used in a two step procedure to determine OSIIs:
  1. If a specific bank has more than 350 basis points, authorities have to declare this institution as an OSII. The authorities are allowed to increase or decrease the threshold of 350 in a range between 275 and 425 basis points to take into account member states specific characteristics of the banking sector.
  2. If there are further institutions which are relevant, authorities can designate them as OSIIs. However, institutions with a score of 4.5 basis points or lower shall not be designated as OSIIs.

OSII Buffers vs. OSII Score Frequency



Source: ESRB database.
The left histogram shows the frequency of OSII buffers between 0% and 2%. The right histogram shows the frequency of OSII scores between 0 and 5000.

Outline

The OSII Buffer Assignment Process I

- We assume that the OSII buffer assignment process is a bargaining process between the regulatory authority and banks' representatives.
- In some countries, it might be possible that only one of these parties is solely responsible for the OSII buffer decision.
- As a consequence, we first analyze how the OSII buffer assignment process should be implemented within the national macroprudential institutional framework.
- ESRB (2011) states that *"macro-prudential policy can be pursued by either a single institution or a board composed of several institutions, depending on the national institutional frameworks [..]"* and that *"the national central banks should have a leading role in macro-prudential oversight because of their expertise and their existing responsibilities in the area of financial stability."*

The OSII Buffer Assignment Process II

- In each country a **macroprudential authority** should be responsible for setting an OSII buffer.
- The **designated authority** is then responsible for issuing an administrative decision on the OSII buffer to the respective banks.
- In BE, CZ, EE, IE, GR, FR, CY, LT, HU, MT, NL, PT, RO, SK, FI, SE and UK the macroprudential authority and the designated authority are the same.
- In BG, DK, DE, ES, HR, IT, LV, LU, AT, PL and SI, these authorities are separated.
- In ES and IT, no macroprudential authority has been established yet.

The Nash Bargaining Problem I

- We set up a Nash bargaining problem (Nash Jr, 1950) with two players, the regulator and banks' representatives:
- **Definition: OSII buffer assignment bargaining problem:** The OSII buffer assignment bargaining problem is a pair (S, d), where $S \subset R^2$ is compact and convex, $d \in S$, and there exists $s \in S$ such that $s_i > d_i$ for $i = 1, 2$. The set of all bargaining problems is denoted B. A bargaining solution is a function $f^{\alpha} : B \to R^2$ that assigns to each bargaining problem $(S, d) \in B$ a unique element of S.
- The Nash bargaining problem is based on three axioms: (1) invariance to equivalent utility representations, (2) independence of irrelevant alternatives and (3) Pareto efficiency.

The Nash Bargaining Problem II

- Most notably, the Nash bargaining problem has been used in the Nobel Prize winning Diamond–Mortensen–Pissarides theory of equilibrium unemployment (Pissarides, 2000) to determine how to share the output between a productive worker-vacancy match.
- We also define the sets A and S:

$$\begin{aligned} A &= \{(a_1, a_2) \in R^2 : a_1 + a_2 = 2 \text{ and } a_1 \in [0,2], a_2 \in [0,2]\} \\ S &= \{(s_1, s_2) \in R^2 : (s_1, s_2) = (u_1(a_1), u_2(a_2)) \\ &\quad \text{for some } (a_1, a_2) \in A\} \end{aligned} \tag{2}$$

- **Definition: OSII buffer bargaining solution:**

$$\begin{aligned} \mathbb{N} = \; & \text{argmax}_{(d_1,d_2) \leq (u_1(a_1), u_2(1-a_1)) \in S} \\ & (u_1(a_1) - d_1)^{\alpha} (u_2(2 - a_1) - d_2)^{1-\alpha} \end{aligned} \tag{3}$$

The Nash Bargaining Problem III

- From Eq. (2) it is clear that $a_2 = 2 - a_1$.
- $d = (d_1, d_2)$ is called the threat point, which would be the outcome if players do not reach an agreement.
- We make a few simplifying assumptions: (1) u_1 is linearly increasing in a_1, (2) u_2 is linearly decreasing in a_1, (3) d_1 depends on the systemic risk buffer (SyRB) and the OSII score. (4) d_2 depends on the tier 1 capital ratio, the operating income ratio and on the SyRB as well.
- Solving Eq. (3) by taking the derivative with respect to a_1 and setting the resulting FOC to zero yields:

$$\begin{aligned} OSIIB^* = \quad & 2\alpha + \gamma_2(1-\alpha) * OSIIS - \\ & \alpha * \beta_1 T1CR + \alpha\beta_2 OIR + [(1-\alpha)\gamma_1 - \alpha\beta_3] SyRB \end{aligned} \tag{4}$$

The Nash Bargaining Problem IV

- From the theoretical solution in Eq.(4), we see that the bargaining power of the regulator partially defines the coefficients of all variables.
- As a consequence, we would need to estimate an OSII buffer bargaining model for each country based on a very limited number of observations to exactly derive the structural parameters $\alpha, \beta_1, \beta_2, \gamma_1$ and γ_2.
- We, therefore, introduce a country dummy in the set of explanatory variables that should capture parts of the "bargaining power" of the regulator and the banks' representatives. Moreover, we only estimate the average structural parameters of OSIIS, T1CR, OIR and SyRB across all countries.

$$OSIIB_i^* = \delta_0 + X\delta + \epsilon_i \tag{5}$$

Outline

Empirics – Estimation Techniques

1. **Ordered probit model:** Takes into account that there are 9 options to choose from. Used to establish country heterogeneity.
2. **Count data model:** Takes into account that OSII buffers also have a cardinal interpretation (e.g. 2 is bigger than 1.75), but does not take the upper limit into account. Used to establish country heterogeneity.
3. **Ordinary least squares model:** Does not account for the discrete steps nor for the OSII buffers interval, but it is more robustness than the other two models. It is used to calculate the Nash bargaining solution.

$\Rightarrow$ All models lead to very similar results. Strengthening the robustness of our results.

Empirics – Ordered probit model I

	Cum-High ordered probit	Ordered probit	Ordered probit with dummy
Score	0.001	0.001	0.002
	(0.000)	(0.000)	(0.000)
Higher SyRB	0.192		
	(0.091)		
Cum SyRB	0.006		
	(0.073)		
0|0.25	-0.316^{***}	-0.349^{***}	-4.073^{***}
	(0.115)	(0.111)	(0.182)
0.25|0.5	0.057	0.034	-2.656^{***}
	(0.109)	(0.106)	(0.157)
0.5|0.75	0.538	0.521	-1.474^{***}
	(0.111)	(0.108)	(0.158)
0.75|1	0.814	0.798	-0.931^{***}
	(0.115)	(0.112)	(0.169)
1|1.5	1.843	1.813	1.094
	(0.148)	(0.145)	(0.237)
1.5|2	2.303	2.245	2.070
	(0.169)	(0.163)	(0.268)
McFadden R^2	0.100	0.096	0.493
Num. obs.	274	274	274

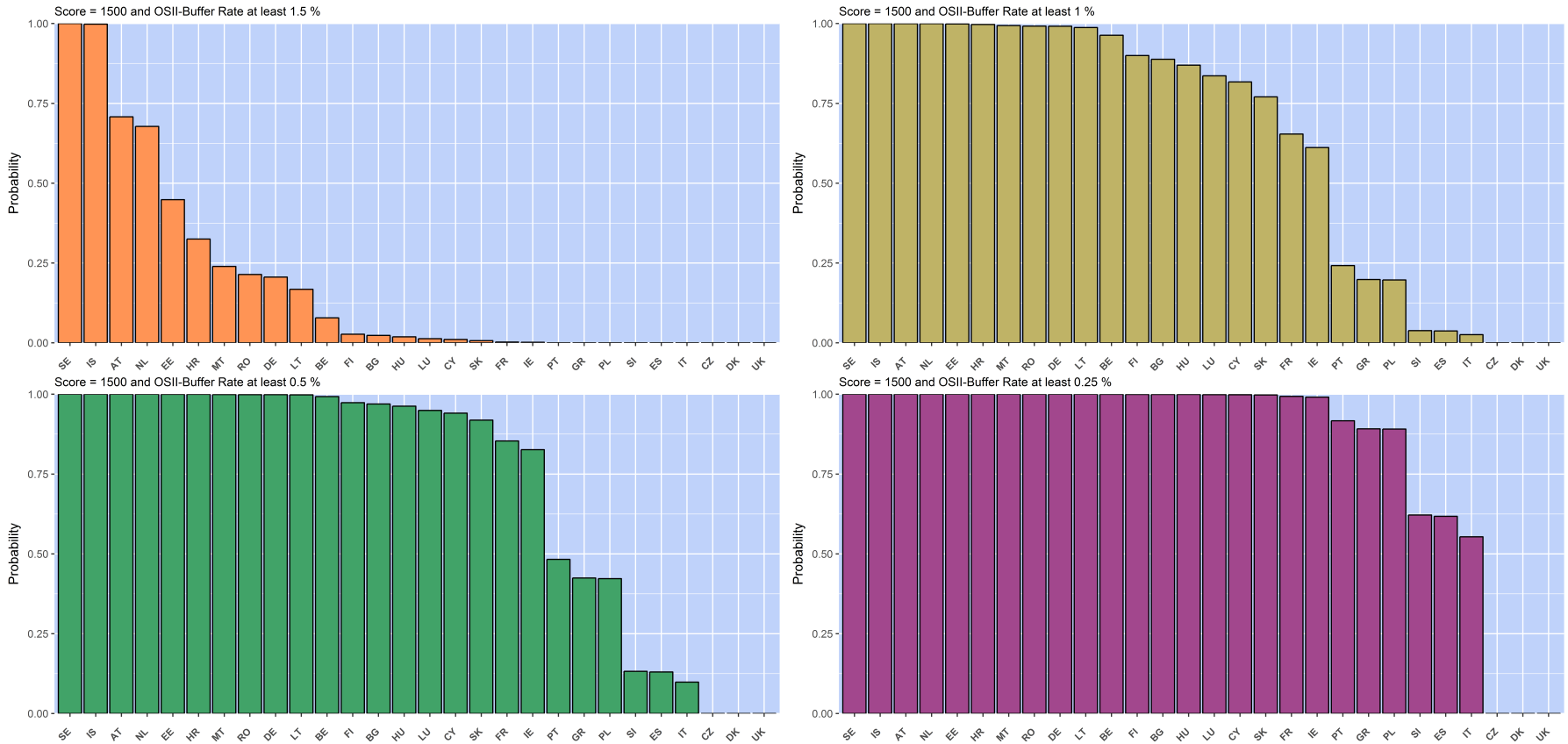
$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Empirics – Ordered probit model II

- We look at the dummy coefficients separately for the *Ordered probit with dummy* model (column 3 from the last table).

DK	-24.187^{***}	HU	-2.391^{***}
CZ	-16.290^{***}	BG	-2.358^{***}
UK	-5.966^{***}	FI	-2.213^{***}
IT	-4.877^{***}	BE	-1.779^{***}
ES	-4.707^{***}	DE	-1.325^{***}
SI	-4.688^{***}	RO	-1.272^{***}
GR	-4.018^{***}	LT	-1.253^{***}
PL	-3.999^{***}	MT	-1.114^{***}
PT	-3.951^{***}	NL	-0.099^{***}
IE	-3.010^{***}	HR	-0.851^{***}
FR	-2.965^{***}	EE	-0.474^{***}
SK	-2.716^{***}	IS	2.475
LU	-2.567^{***}	SE	4.727
CY	-2.508^{***}		

Empirics – Ordered probit model probabilities



The graph shows the probability that a bank with a certain score in a specific country get an OSII buffer of 1.5%, 1%, 0.5% and 0.25%. The calculation of the probabilities is based on Table 1

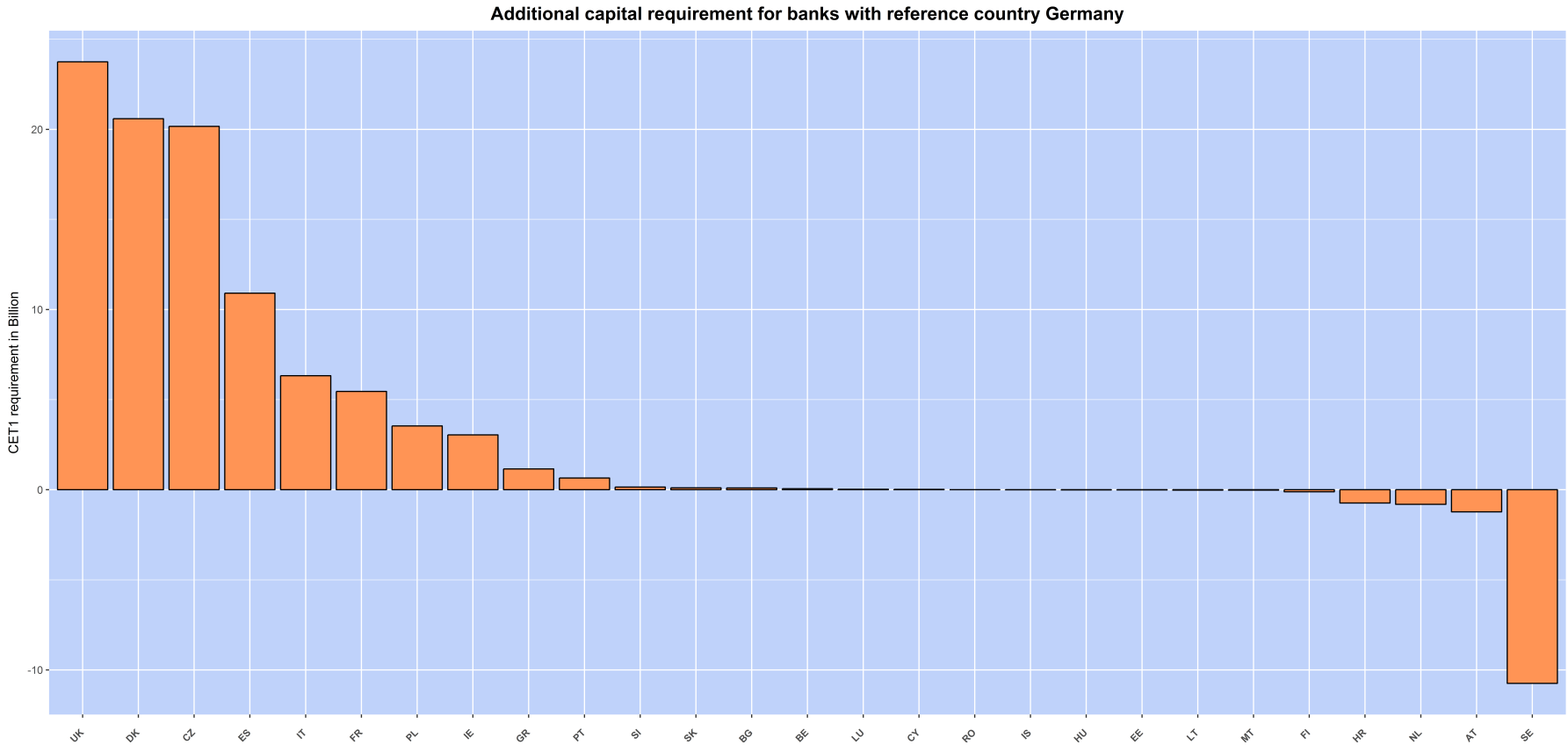
Interpretation – Ordered probit model probabilities

- The results of orderd probit models cannot be directly interpreted, we first need to translate them into conditional probabilities.
- The upper left graph: What is the probability that a regulator would assign an OSII buffer of at least 1.5% to a bank? Only SE, IS, AT, NL, EE, HR, MT, RO, DE, LT and BE would assign an OSII buffer of at this size with a positive probability.
- The upper right graph in Figure 25 shows that already more countries would assign an OSII buffer of at least 1% to a bank with an OSII score of 1500. However, countries like SI, ES, IT, CZ, DK and UK still assign a very low to zero probability.
- The lower left graph in Figure 25 presents the probabilities of an OSII buffer of 0.5% given an OSII score of 1500.
- Finally, the lower right graph identifies those countries such as CZ, DK and UK that do not assign OSII buffers at all, if the OSII score is 1500.

Empirics – Capital Requirement Scheme Simulation

- Cross-country comparison based on the following capital requirement scheme simulation: We predict the OSII buffers for each bank of the sample based on the model of Germany.
- We assume that all banks have to increase or decrease their capital requirements by the calculated OSII buffer, even if a bank holds more capital than the ”new” regulatory requirement. It could be that some banks have a CET1 ratio far beyond the requirements of Basel III, even with the additional OSII buffer requirements.
- However, there is a new draft by the European Parliament that suggests to sum the OSII buffer and the SyRB, instead of applying only the higher of the two.

Empirics – Capital Requirement Scheme Simulation



The graph show the capital requirements and surpluses which is cumulated over all banks in a country in reference to the German OSII buffer estimations. The capital requirements are calculated via the Poisson estimation.

Empirics – Capital Requirement Scheme Simulation

Bank	Country	Capital requirement	CET1 ratio
Dankse Bank	DK	16.30	16.28%
HSBC	UK	10.71	13.60%
Ceska sporitelna	CZ	6.97	16.64%
CSOB	CZ	6.03	17.18%
Santander	ES	5.88	12.53%
Komercni banka	CZ	5.31	18.02%
Unicredit S.p.A	IT	3.87	8.15%
Barclays	UK	3.66	12.36%
BBVA	ES	2.92	12.18%
Citi	IE	2.92	14.35%

This table shows the 10 largest banks with CET1 requirements according to a higher OSII buffer.
The reference country is Germany and the values of the table are predicted via the Poisson estimation results.
The capital requirement and surplus is in Billion Euro. The mean CET1 ratio of European banks was 13.78% in 2016.

Taking DE as a reference country, the heterogeneity in the buffer attribution between countries which accounts to around 83 bn EUR in additional capital requirements.

Empirics – Nash Bargaining Solution

	OLS Nash Bargaining Solution	OLS Country Dummies
(Intercept)	0.4738	1.1558***
Score	0.0114***	0.0320***
Target SyRB	0.5055***	
Tier1ratio (-1)	0.0032	
Regulatory Quality (-1)	0.0473	
Operating Income Ratio (-1)	0.0099	
BE (Mapru, DA by CB)	−0.2034	−0.4315***
BG (Mapru by council, DA by CB)	−1.8496***	−0.6640***
CY (Mapru, DA by CB)	−0.2729	−0.5838**
CZ (Mapru, DA by CB)	−1.4696***	−1.4544***
DE (Mapru by council, DA by FMA)	−0.2443	−0.4191***
DK (Mapru by council, DA by Ministry)	−1.7277***	−1.6962***
EE (Mapru, DA by CB)	−0.5054**	0.0296
ES (No Mapru, DA by CB)	−0.5176*	−1.1529***
FI (Mapru, DA by FMA)	−0.2078	−0.3990
FR (Mapru, DA by Council)	−0.3248	−0.7444***
GR (Mapru, DA by CB)	−0.3580	−0.9721***
HR (Mapru, DA by CB)	−0.6653	−0.2725*
HU (Mapru, DA by CB)	−0.3274	−0.6627***
IE (Mapru, DA by CB)	−0.4769*	−0.8523***
IS	−1.5134***	−0.0801
IT (No Mapru, DA by CB)	−0.4888	−1.1782***
LT (Mapru, DA by CB)	0.0286	−0.1442
LU (Mapru by council, DA by FMA)	−0.1773	−0.7510***
MT (Mapru, DA by CB)	−0.0708	−0.2210
NL (Mapru by council, DA by CB)	−0.2642	−0.1898
PL (Mapru by council, DA by Ministry)	−2.0497***	−1.0559***
PT (Mapru, DA by CB)	−0.4415	−0.9977***
RO (Mapru, DA by Council)	−0.1987	−0.4199***
SE (Mapru, DA by FMA)	−0.4075	0.1531
SI (Mapru by council, DA by CB)	−0.5652	−1.1643***
SK (Mapru, DA by CB)	−0.5751*	−0.7012***

Interpretation – Nash Bargaining Solution

- "Mapru" refers to macroprudential authority. "DA" refers to designated authority. "CB" refers to central bankk. "FMA" refers to financial market authority or similar institutions. "Ministry" refers to ministry of finance. "Council" refers to a financial market committee or similar institutions.
- We see a reduction in the number of significant country dummies and also a reduction in size of most country dummy coefficients.
- We also demonstrate that the "Target SyRB" is part of the OSII buffer assignment process. If there is a "Target SyRB"> 0 in place, this improves the bargaining position of the regulator with respect to the banks' representatives.
- The "Target SyRB" is itself determined by a bargaining process for each bank between the same or similar negotiators.
- The importance of the "Target SyRB" also reduces the size of the OSII score coefficient by around two-third.
- Finally, we control for the tier 1 ratio, regulatory quality and operating income divided by total assets. These variables have the expected positive sign but are not significant.

Outline

Summary and Conclusion

- Given 283 OSII buffer decisions, what status quo did we identify?
  1. We present a first empirical analysis of how European union member states calibrate their buffer rates for other systemically important institutions.
  2. Our results on the OSII buffer calibration are quite surprising $\Rightarrow$ a lot of country heterogeneity, since the OSII score calculation is based on the unified approach.
  3. Implementing the Nash bargaining problem and estimating its solution reveals that some country heterogeneity can be attributed to the SyRB in the bargaining process.
  4. The OSII score has the expected positive coefficient, implying that on average banks with a higher OSII score receive a higher OSII buffer. However, the country dummies and the SyRB are much more important.

Policy Recommendations I

- What are our policy recommendations?
  1. Given the advancement in macroprudential regulation to address the too big too fail dilemma $\Rightarrow$ it is about time to apply these measures and hopefully prevent bank support packages paid by the tax payer during the next crisis.
  2. In our opinion, the OSII buffer should address the risk ”caused losses” (risk stemming from the failure of an OSII bank) more directly. $\Rightarrow$ OSII buffer and SyRB should be additive, as they measure address different problems.
  3. The SyRB should address the risk “received losses” (stemming from turbulences) in the economy (there is a new draft by the European Parliament that suggest to sum the OSII buffer and the SyRB).

Policy Recommendations II

4. We would suggest to quantify the risk more directly as suggested by Siebenbrunner et al. (2017); Siebenbrunner and Sigmund (2018a). In their model, ”caused losses” are calculated based on the interbank network and the hypothetical failure of an OSII. A prudent regulatory would then look at the relationship between capital ratios and probability of a bank failure and calibrate the OSII buffer accordingly.
5. A closer look at the macroprudential institutional framework in each country could help to improve the regulator's bargaining power. In some countries, the influence of central banks and financial market authorities is too small.
6. “Improve” or “increase” d_1, the regulator's threat point, by minimal standards for the OSII buffer assignment model (e.g. OSII score of 1500 $\Rightarrow$ OSII buffer of at least 0.5%).
7. Finally, we make a case for a unified assignment process across all countries to ensure a level playing field for all OSIIs in the European union.

Thank you for your attention!

If you have any questions and/or comments, please contract us under michael.sigmund@oenb.at.

A full version of our paper can be found here:
`https://www.researchgate.net/publication/326467964_The_Capital_Buffer_Calibration_for_Other_Systemically_Important_Institutions_-_Is_There_Too_Much_Country_Heterogeneity`

A short policy version of the paper is available upon request from the authors.

References I

Acemoglu, D., Ozdaglar, A. E., and Tahbaz-Salehi, A. (2015). Systemic risk in endogenous financial networks.

EBA (2014). On the criteria to determine the conditions of application of Article 131(3) of Directive 2013/36/EU (CRD) in relation to the assessment of other systemically important institutions (O-SIIs). Eba guideline, European Banking Authority.

ECB (December 2009). European Central Bank. *Financial Stability Review*.

ESRB (2011). Recommendation of the european systemic risk board of 22 december 2011 on the macro-prudential mandate of national authorities. Technical Report ESRB/2011/3, European Systemic Risk Board. Frankfurt.

Iori, G., Jafarey, S., and Padilla, F. G. (2006). Systemic risk on the interbank market. *Journal of Economic Behavior and Organization*, 61(4):525–542.

References II

Nash Jr, J. F. (1950). The bargaining problem. *Econometrica: Journal of the Econometric Society*, pages 155–162.

Pissarides, C. A. (2000). *Equilibrium unemployment theory*. MIT press.

Rime, B. (2001). Capital requirements and bank behaviour: Empirical evidence for switzerland. *Journal of Banking & Finance*, 25(4):789–805.

Siebenbrunner, C. and Sigmund, M. (2018a). An application of quantile panel estimation to systemic risk. Working paper.

Siebenbrunner, C. and Sigmund, M. (2018b). Do interbank markets price systemic risk? Working paper.

Siebenbrunner, C., Sigmund, M., and Kerbl, S. (2017). Can bank-specific variables predict contagion effects? *Quantitative Finance*, 17(12):1805–1832.

Wheelock, D. and Wilson, P. (2000). Why do banks disappear? the determinants of u.s. bank failures and acquisitions. *The Review of Economics and Statistics*, 82(1):127–138.