The Basel III Leverage Ratio: Unaffected by the Risk Measurement Approach?

Christoph Maidl & Corinna Woyand

Finance Center Münster · Chair of Banking

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„[...] by providing a simple non-risk-based capital requirement, the LR can potentially alleviate issues surrounding model risk in the calculation of risk-weights or even the outright manipulation of risk-weights.“

(ECB, Financial Stability Review, 2015)

Mariathasan & Merrouche (2014), Behn et al. (2016):

- Significant variation of internal risk weights across banks and countries weakens the credibility of the risk-based capital framework

Blum (2008), Wu & Zhao (2016):

- Derive from theoretical model that a non-risk-based capital requirement may lead to truthful risk reporting

BCBS (2009):

- Announcement of the regulatory leverage ratio (LR) in December 2009 as backstop measure

This paper:

⇒ But: LR simultaneously induces certain risk-shift incentive

⇒ *Is the LR adjustment process indeed unaffected by the applied risk measurement approach?*

Multiple capital requirements

$$\text{Tier 1 ratio} = \frac{\text{Tier 1}}{\text{RWA}} \geq 6\% \qquad \text{LR} = \frac{\text{Tier 1}}{\text{Total exposure}} \geq 3\%$$

- Capital Buffer Theory: banks hold capital in excess of the minimum regulatory requirement (Marcus, 1984, Milne & Whalley, 2001)
- Since 2009, LR as additional capital requirement to comply with
  - Increase Tier 1 capital and/or reduce total exposure (or both)
  - May induce banks to shift risks (Kiema and Jokivuolle, 2014; Smith et al., 2017)
    - → RWA shift limited by Tier 1 capital requirement
    - → SA banks with less leeway in determining RWA than IRB banks

⇒ **Are there adverse effects of LR adjustments on banks' balance sheets regard to the risk measurement approach?**

Sample construction

- **Data set:**
  - All countries of EBA stress test: 15 EU- and EEA-countries
  - Observation period: 2007 to 2014 (annual data)
  - Unbalanced panel: 554 IRB and SA banks
    - → 4,244 bank-year observations

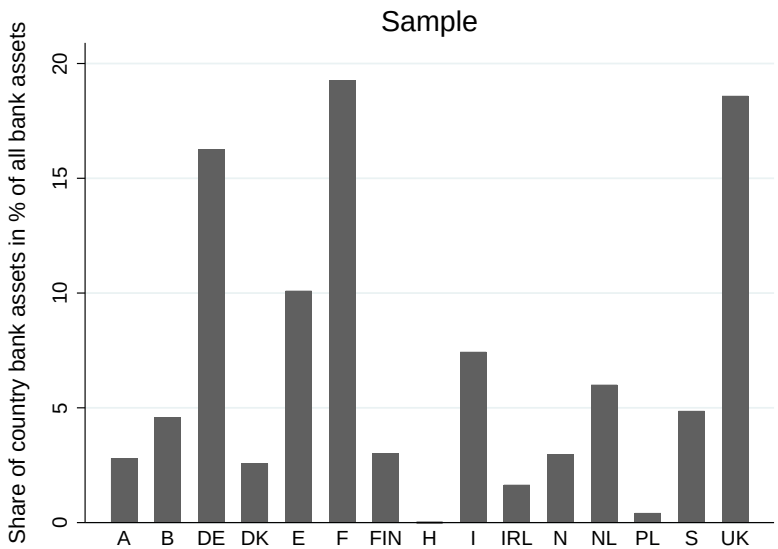
- **Data sources:**
  - IRB application data: collected manually from annual reports and Pillar 3 reports
  - Balance sheet data: Bureau van Dijk's Bankscope Database
  - Macro data: World Bank, Eurostat, ECB
  - Regulatory and supervisory data: Barth et al. (2013)

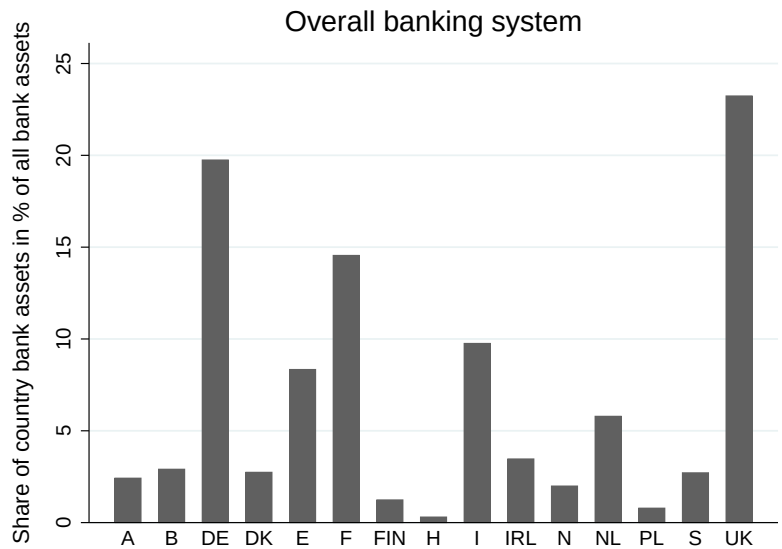
- **Data preparation:**
  - Consolidation status taken into account
  - At least 4 consecutive years of data (no gaps)
  - Winsorizing on 1% and 99% level

Appendix

Sample Overview

- Final sample comprises 554 medium- to large-size European banks
  - → Approx. 60% of total assets in Bankscope
  - → Approx. 80% of systemically important banks





Source: Bankscope (left) ECB Datawarehouse und national central banks (right).

Dataset

Methodology (I/II)

1. Partial Adjustment Model (2007-2014):

   → Internal target LR, which depends on various factors

   → Adjustment costs prevent immediate adjustment

   ⇒ Gap variable quantifies the need for adjustment of the LR

$$LR_{i,t} - LR_{i,t-1} = \lambda(LR^*_{i,t} - LR_{i,t-1}) + \epsilon_{i,t} \tag{1}$$

$$LR^*_{i,t} = \mu_i + \sum_{n=1}^{N} \theta_n \cdot X_{n,i,t} \tag{2}$$

$$LR_{i,t} = (1-\lambda)LR_{i,t-1} + \lambda \left(\mu_i + \sum_{n=1}^{N} \theta_n \cdot X_{n,i,t} \right) + \epsilon_{i,t} \tag{3}$$

$$GAP_{i,t} = \left| 100 \cdot \left(\frac{LR_{i,t-1}}{\hat{LR}^*_{i,t}} - 1 \right) \right| \tag{4}$$

Methodology (II/II)

2. Regression analysis based on results from the first step (2010-2014):

   → Change in balance sheet and risk positions when adjusting the LR

   → Differences in the adjustment process between SA and IRB banks

$$\begin{aligned}\Delta DV_{i,t} = \alpha_i &+ \beta_1 \cdot \Delta DV_{i,t-1} + \beta_2 \cdot GAP_{i,t-1} \\ &+ \beta_4 \cdot D\_IRBA_{i,t} + \beta_5 \cdot GAP_{i,t-1} \times D\_IRBA_{i,t} \\ &+ \gamma' \cdot CONTROLS_{i,t} + \tau' \cdot COUNTRY + \omega' \cdot YEAR + \xi_{i,t}.\end{aligned}$$

⇒ System GMM estimation according to Arellano and Bover (1995) and Blundell and Bond (1998) for both steps

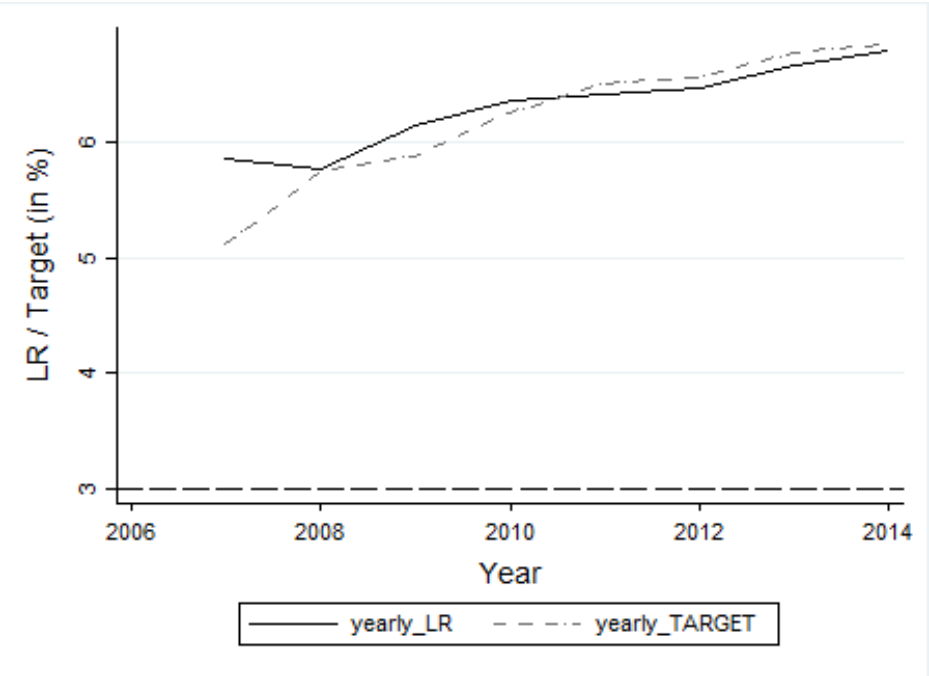
- Presence of unobserved bank-specific effects
- Autoregressive process of dependent variable
- Endogeneity between dependent and bank-specific variables

Summary statistics

Variable	Mean	Std. dev.	p10	p50	p90	N
Partial adjustment model (2007-2014)						
LR (%)	6.27	3.55	2.58	5.52	10.69	3,536
RWATA (%)	51.74	21.02	22.94	52.10	78.94	3,336
EQU_QUAL (%)	84.94	13.68	65.92	86.69	100.00	3,461
ROA (%)	0.31	0.89	-0.20	0.30	1.06	4,243
LLP_TO_TL (%)	0.69	1.08	-0.01	0.40	1.78	4,051
PCT_SIZE	2.50	1.11	1.00	2.50	4.00	4,244
CAP_STR	6.28	1.79	4.00	7.00	8.00	4,164
Regression analysis (2010-2014)						
Δ*T1C* (%)	5.62	16.53	-9.73	4.26	22.45	2,221
Δ*TOT_EXP* (%)	2.97	14.51	-10.57	1.99	16.85	2,687
Δ*RWA* (%)	1.00	16.32	-15.15	0.71	18.06	2,150
CAPITALIZATION (%)	15.33	8.54	8.83	13.45	21.88	2,216
LOANS/TA (%)	62.11	22.97	27.29	66.09	86.68	2,695
DEPOSITS/TA (%)	69.03	20.63	40.52	74.09	90.43	2,687
NII (%)	70.04	27.94	39.63	70.12	94.61	2,703
LIQUIDITY (%)	18.30	17.76	3.02	12.30	42.85	2,704

- LR and target LR above the 3% minimum requirement
- Target LR surpasses the actual LR from 2010 onwards

⇒ Indicates reaction of banks following the LR announcement of the BCBS (December 2009) and/or financial crisis



Regression PAM

	$\Delta T1C_{i,t}$	$\Delta TOT\_EXP_{i,t}$	$\Delta RWA_{i,t}$
$DV_{i,t-1}$	-0.149	0.140***	0.0530
	(0.113)	(0.0465)	(0.0503)
$GAP_{i,t-1}$ (α)	0.697***	-0.256***	0.188**
	(0.212)	(0.0719)	(0.0863)
$SURPLUS_{i,t-1}$	-0.169**	0.0758*	-0.0125
	(0.0766)	(0.0442)	(0.0440)
$D\_IRBA_{i,t}$ (β)	-13.39*	-10.66***	-23.72**
	(7.266)	(3.921)	(10.40)
$D\_IRBA_{i,t} \times GAP_{i,t-1}$ (γ)	-0.346**	0.0172	-0.0493
	(0.175)	(0.102)	(0.148)
Controls	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes
N	1,624	1,624	1,624
N(G)	479	479	479
AR(2)-p	0.528	0.376	0.522
Hansen-p	0.332	0.222	0.675
Wald tests:			
Marginal impact $\alpha + \gamma$	0.3516**	-0.2386***	0.1391
Marginal impact $\beta + \gamma$	-13.7339*	-10.6463***	-23.4908**

→ Banks with gap reduce leverage, while simultaneously increase RWA

→ Need to increase T1C more pronounced for SA banks

	$ZSCORE_{i,t}$	$ZSCORE_{i,t}$	$ZSCORE_{i,t}$
$ZSCORE_{i,t-1}$	0.777***	0.790***	0.784***
	(0.0469)	(0.0509)	(0.0491)
$LR_{i,t}$	0.0522***		
	(0.0118)		
$\Delta LR_{i,t}$ (α')		0.00642**	
		(0.00252)	
$D\_IRBA_{i,t}$ (β')		-0.544*	
		(0.278)	
$D\_IRBA_{i,t} \times \Delta LR_{i,t}$ (γ')		-0.00842**	
		(0.00403)	
$\Delta T1C_{i,t}$			0.00619***
			(0.00197)
$\Delta TOT\_EXP_{i,t}$			0.00184
			(0.00247)
Controls	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes
N	1,809	1,809	1,809
N(G)	505	505	505
AR(2)-p	0.272	0.245	0.281
Hansen-p	0.203	0.361	0.263
Wald tests:			
Marginal impact $\alpha' + \gamma'$		-0.0021	
Marginal impact $\beta' + \gamma'$		-0.4959*	

→ SA banks that deleverage become significantly more stable

Robustness Checks

1. Estimation of partial adjustment model using a different time horizon (2010–2014)
2. Reestimation of regression analysis using different control variables (e.g., log(total assets), macros)
3. Applying simple fixed effects estimation instead of dynamic panel data model
4. Difference-in-difference methodology to ensure not measuring the impact of risk-weighted capital ratio

$\Rightarrow$ None of these robustness checks lead to material changes

Difference-in-Difference

Conclusion

- Banks reduce leverage over time and adjust their internal target LR upwards in the period 2007 to 2014
- Simultaneously, banks raise RWA when adjusting their LR
- Significant differences in balance sheet growth rates for SA and IRB banks
  - → SA banks increasingly enhance their T1C compared to IRB banks
  - → RWA 'tweaking' still beneficial when imposing a LR

⇒ **Higher adjustment leeway of IRB banks leads to adverse impact of the LR adjustment process on banks' balance sheet and financial soundness**

Thank you for your attention!

Regression Results: Partial Adjustment Model

	$LR_{i,t}$
$LR_{i,t-1}$	0.244**
	(0.102)
$RWATA_{i,t}$	0.000551***
	(0.000145)
$EQU\_QUAL_{i,t}$	0.000805***
	(0.000187)
$ROA_{i,t}$	0.00402**
	(0.00180)
$LLP\_TO\_TL_{i,t}$	0.00345**
	(0.00156)
$PCT\_SIZE_{i,t}$	-0.0101***
	(0.00388)
$D\_MODEL_{i,t}$	-0.00333*
	(0.00183)
$CAP\_STR_{i,t}$	0.000171
	(0.000238)
$D\_CRISIS_{i,t}$	0.00306***
	(0.000819)
N	2,726
N(G)	531
AR(2)-p	0.256
Hansen-p	0.181

PAM

Robustness Checks: Difference-in-Difference Estimation

Outcome Variable	ΔT1C$_{i,t}$	ΔTOT_EXP$_{i,t}$	ΔRWA$_{i,t}$	ΔLOANS$_{i,t}$
Baseline: 2007–2009				
Difference (SA–IRB)	-1.934	2.418*	6.891***	2.160
	(1.698)	(1.321)	(1.755)	(1.632)
Follow-up: 2010–2014				
Difference (SA–IRB)	2.099**	2.320***	2.860***	3.219***
	(1.065)	(0.733)	(0.994)	(0.856)
Diff-in-Diff	4.032**	-0.098	-4.031**	1.059
	(1.937)	(1.454)	(1.945)	(1.754)
Time fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
R^2	0.06	0.11	0.10	0.08
N	1,908	2,773	1,748	2,763

Robustness Checks