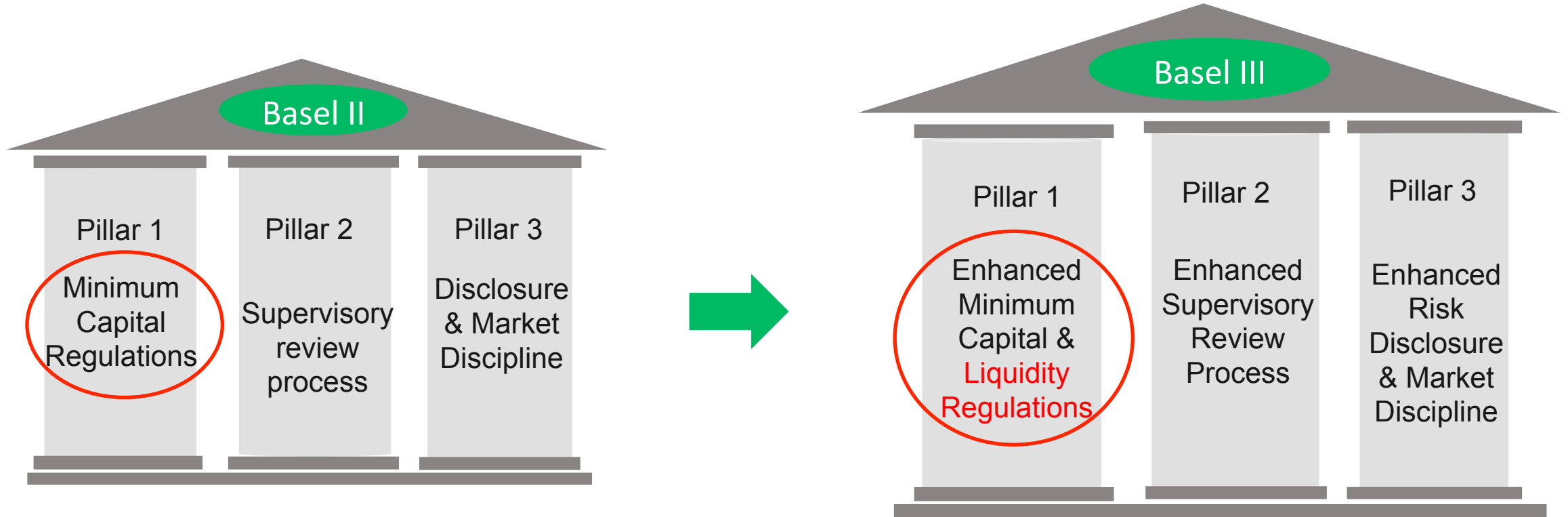# Capital and Liquidity Interaction in Banking

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Motivation

Basel II

Pillar 1 — Minimum Capital Regulations

Pillar 2 — Supervisory review process

Pillar 3 — Disclosure & Market Discipline

Basel III

Pillar 1 — Enhanced Minimum Capital & Liquidity Regulations

Pillar 2 — Enhanced Supervisory Review Process

Pillar 3 — Enhanced Risk Disclosure & Market Discipline

Questions
- How do capital and liquidity requirements interact?
- Where and when are they complement or substitute?

Approach

Question:

How does banks' capital position affect their incentives to engage in liquidity transformation?

Banks' liquidity resilience		Banks' credit risk resilience

????

Liquidity requirements

Capital Requirements
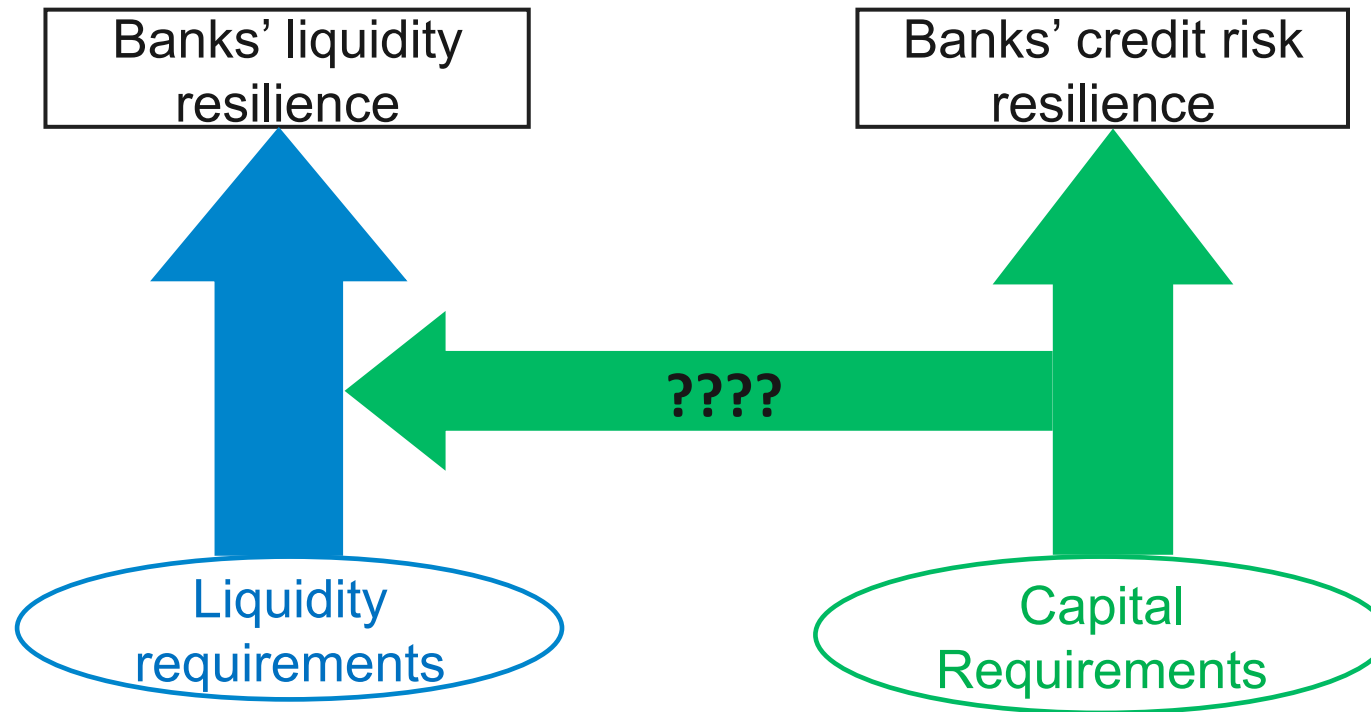
Substitutability: higher capital ratio ⇒ less liquidity transformation

Complementarity: higher capital ratio ⇒ more liquidity transformation

Roadmap and main results

- **Theoretical model to develop hypotheses**
  - The model analyses how banks' choice of liquidity holdings depends on their capital ratio.

- **Empirical analysis**
  - Key dataset is a confidential Bank of England database of bank regulatory reporting requirements with semi-annual frequency, from 1989 to 2013.
  - Includes arguably exogenous changes in bank capital requirement

- **Main results**
  - Inverted U-shaped relationship between bank capital and liquid **asset** holdings
  - BUT **OVERALL** more capital leads banks to engage less in liquidity transformation

Related Literature

- Theory
  - Gomez and Vo (2019)
  - Miller and Sowerbutts (2017)
  - Kara and Ozsoy (2019)

- Empirics
  - Berger and Bouwman (2009)
  - Distinguin et al. (2013)
  - DeYoung et al (2018)
  - Banerjee and Mio (2015)

- Identification strategy
  - Aiyar et al. (2012); De-Ramon et al. (2017); Bahaj and Malherbe (2016)
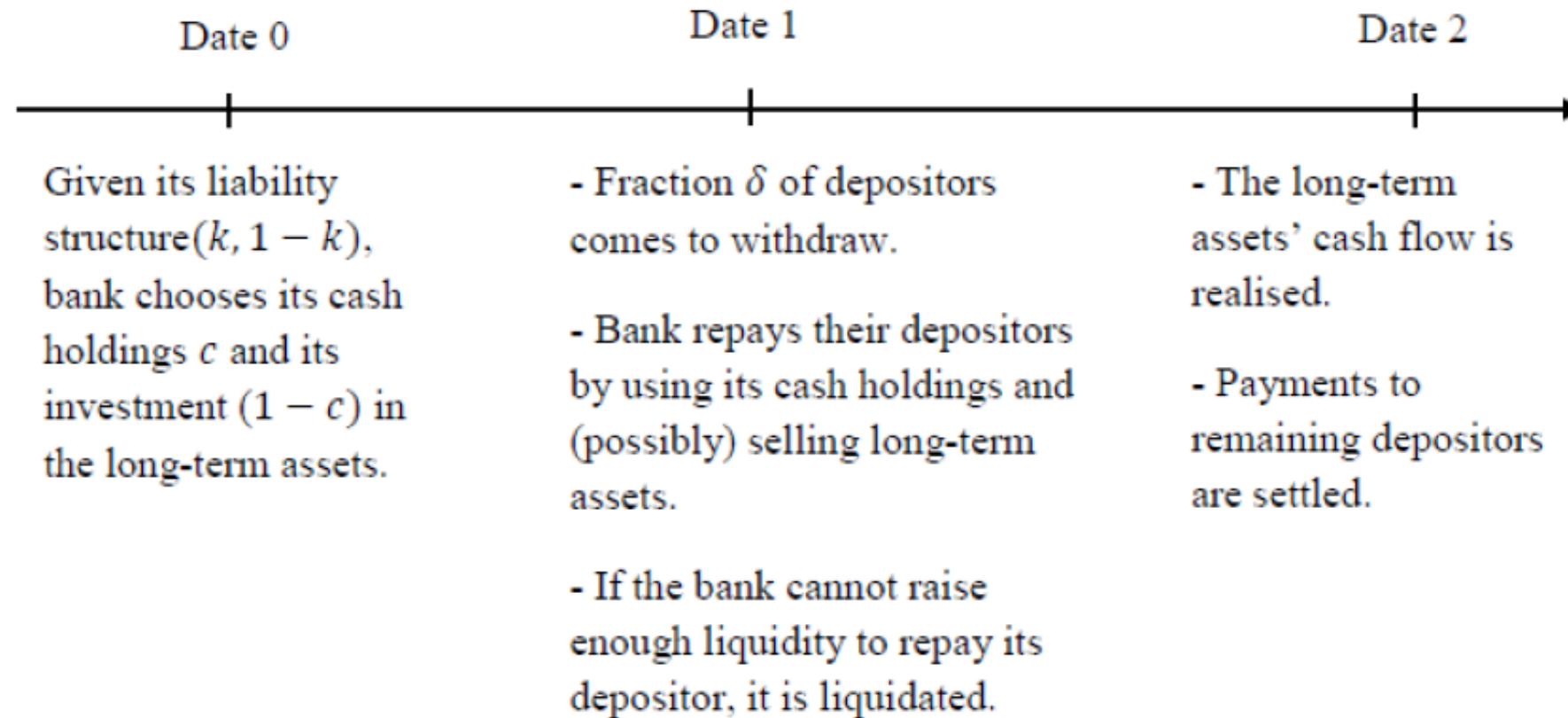
Theoretical model – Set up

- Bank's liabilities:
  - The size of the bank's balance sheet is normalized to 1
  - The bank is funded at date 0 with

Assets	Liabilities
c	1 - k
1 - c	k

    - Equity of amount k
    - Retailed deposits of amount $1-k$

- Two investment opportunities:
  - Liquid assets: return per period equal to 1.
  - Long-term assets: generate a cash flow of $R>1$ at date 2.
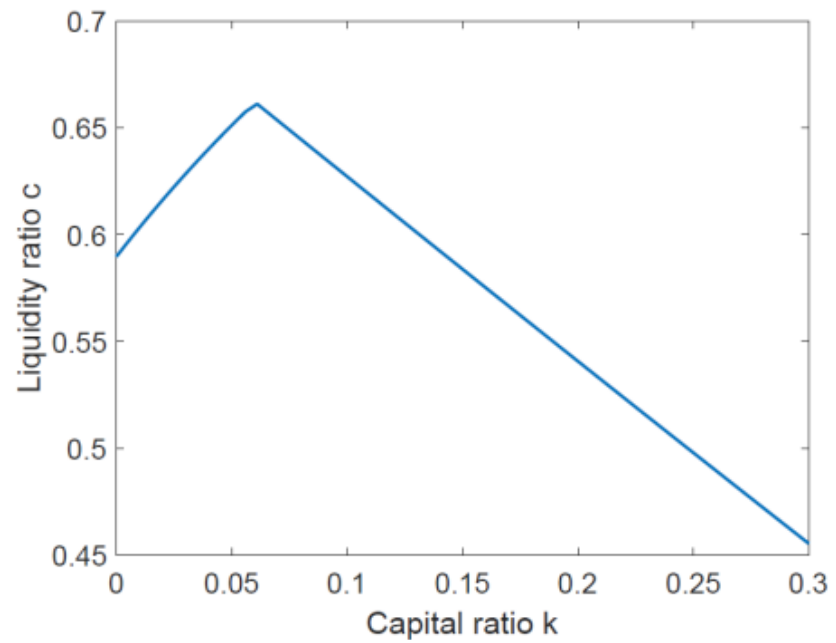
Theoretical model - Timeline

Date 0

Date 1

Date 2

Given its liability structure $(k, 1-k)$, bank chooses its cash holdings c and its investment $(1-c)$ in the long-term assets.

- Fraction δ of depositors comes to withdraw.

- Bank repays their depositors by using its cash holdings and (possibly) selling long-term assets.

- If the bank cannot raise enough liquidity to repay its depositor, it is liquidated.

- The long-term assets' cash flow is realised.

- Payments to remaining depositors are settled.

Theoretical model – Two main channels

- Banks' capital ratio and their liquidity holdings: two competing effects

  - *"Liquidity-demand effect":*

    Higher capital ratio → more stable liabilities → less demand for liquidity holdings → **lower liquidity holdings**

  - *"Skin-in-the game effect":*

    Higher capital ratio → more skin in the game → costlier failure → less incentive to take liquidity risk → **higher liquidity holdings**.

- Banks' capital ratio and their **overall** liquidity transformation
  - Lower liquidity holdings **per se** do **not** mean higher liquidity transformation
  - Liquidity transformation depends on both asset and liability side

Numerical analysis

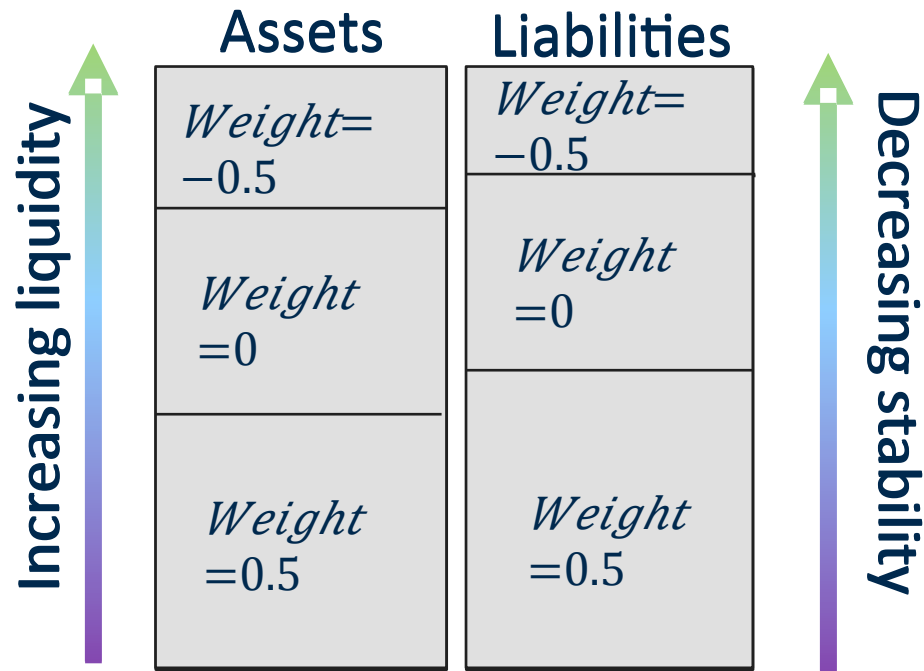| Liquidity holdings as function of bank capital ratio	Survival probability as function of bank capital ratio
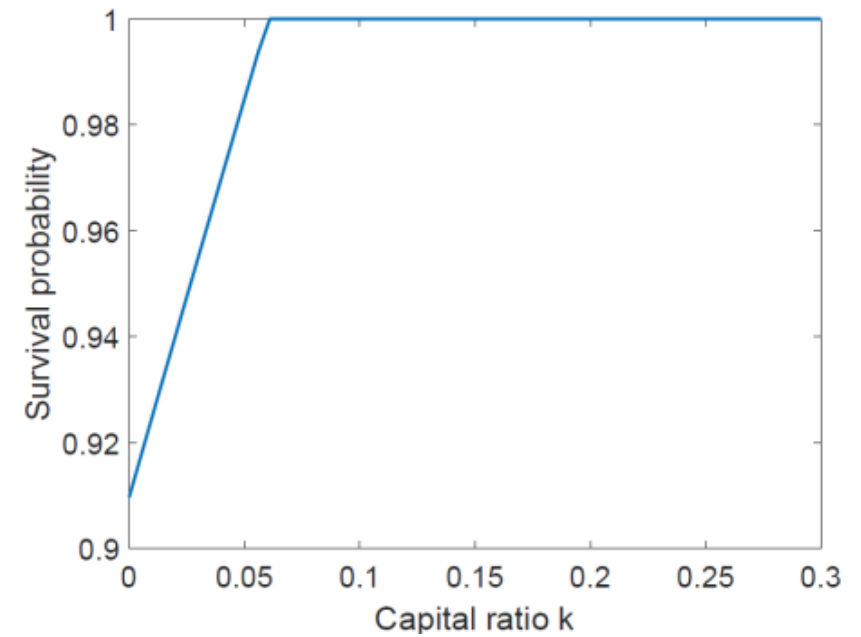
How can we test – Empirical assessment

- Using **arguably exogenous changes** in capital requirements

  ⇒ **less concern for reverse causality** relative to earlier literature

- On top of Basel regulation: Individual capital guidance set by UK supervisors since 1989:

  - **Not based on liquidity or credit risk**, lending volume or business model (Aiyar et al., 2014b,a and Aiyar et al., 2016)

  - **Based on supervisory judgements** on organisational structures, systems and reporting procedures, quality of management (Turner, 2009 and Francis and Osborne, 2012)

Empirical assessment - Data

- Use detailed **regulatory data** on banks' balance sheet, covering all UK banks for the period **1989-2013**, with a **semi-annual** frequency (HBRD)

- We **filter our data** by removing outliers and banks with missing variables and winsorising at 1%.

- In total we have an unbalanced panel of **2514 observations for 154 banks** and **516 changes** in individual capital requirements.

Liquidity transformation measure - Berger and Bouwman (2009)

Increasing liquidity →

Assets	Liabilities
Weight= −0.5	Weight= −0.5
Weight =0	Weight =0
Weight =0.5	Weight =0.5

Balance sheet & off-balance sheet items

Decreasing stability →

Principle:

One unit of <u>unstable</u> liabilities used to <u>finance</u> one unit of <u>illiquid</u> assets $\Rightarrow$ one unit of liquidity transformation is created

BB Liquidity index $= \Sigma_i\ notionalvalue_i \times weight_i\ / Assets + Off\ BS\ commitments\ \&\ Guarantees$

Econometric specifications

Banks' **asset** liquidity:

$$LiquidAssetRatio_{i,t} = \beta_1 + \beta_2\, CapMeasure_{i,t} + \beta_3\, CapMeasure_{i,t}^2 + \beta_4\, Controls_{i,t} + u_i + time_t + \epsilon_{i,t}$$

Banks' **overall** degree of liquidity transformation

$$BB\ Liquidity\ index_{i,t} = \gamma_1 + \gamma_2\, CapMeasure_{i,t} + \gamma_4\, Controls_{i,t} + v_i + time_t + \varepsilon_{i,t}$$

Capital and asset liquidity

VARIABLES	(1) Liquid assets (BB)	(2) Broad	(3) Narrow
Req. capital to TA	2.343*	2.668**	1.212**
	(1.210)	(1.172)	(0.474)
Req. capital to TA, square	-11.86**	-13.63**	-6.205**
	(5.489)	(5.430)	(2.438)
Methodology	FE	FE	FE
Controls	YES	YES	YES
Observations	1,984	1,984	1,984
Adj. R2	0.759	0.726	0.751
Adj. R2 within	0.0466	0.0746	0.0715
Banks	154	154	134

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Capital and OVERALL liquidity transformation

VARIABLES	(1)	(2)	(3)
Req. capital to RWA	**-1.046*****	**-0.804****	
	(0.306)	(0.336)	
Req. capital to RWA (first lag)			**-0.879****
			(0.378)
RWA density (lagged)		0.177***	0.163***
		(0.0509)	(0.0510)
ROA (lagged)	-0.0446	-0.134	-0.219
	(0.241)	(0.253)	(0.312)
Impairment scaled (lagged)	0.233**	0.198**	0.0814
	(0.0964)	(0.0900)	(0.101)
Total assets (lagged and log)	0.00442	0.0178	0.0127
	(0.0134)	(0.0129)	(0.0125)
Constant	0.575***	0.345***	0.405***
	(0.110)	(0.116)	(0.111)
Methodology	FE	FE	FE
Liquidity regimes	YES	YES	YES
Observations	2,000	2,000	1,736
Adj. R2	0.860	0.869	0.875
Adj. R2 within	0.0701	0.130	0.121
Banks	154	154	134

How banks adjust?

VARIABLES	(1) liquid assets	(2) semi-liquid assets	(3) illiquid assets	(4) deposits	(5) wholesale funding	(6) off-balance sheet
Req. capital to RWA	0.587*	0.291	-0.835*	-0.455	0.400	-0.0472
	(0.308)	(0.412)	(0.443)	(0.700)	(0.638)	(0.252)
Methodology	FE	FE	FE	FE	FE	FE
Controls	YES	YES	YES	YES	YES	YES
Observations	2,000	2,000	2,000	2,000	2,000	2,000
Adj. R2	0.751	0.928	0.933	0.891	0.879	0.836
Adj. R2 within	0.0456	0.256	0.291	0.0419	0.0220	0.0242
Banks	154	154	154	154	154	154

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Heterogeneity

VARIABLES	(1) Crisis	(2) 10 largest banks
Req. capital to RWA	-0.767***	-0.956***
	(0.274)	(0.354)
Req. capital to RWA * $I\!\!\downarrow year\!<\!2007$	-0.0799	
	(0.395)	
Req. capital to RWA * $I\!\!\downarrow top\ 10\ banks$		1.853**
		(0.880)
Methodology	FE	FE
Controls	YES	YES
Observations	2,000	2,000
Adj. R2	0.869	0.871
Adj. R2 within	0.130	0.140
Banks	154	154

Robust standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Conclusion

- We find empirically that the relationship between the bank's capital requirement and their liquidity transformation is **negative.**

- We find both theoretically and empirically that the relationship between **banks' asset liquidity and leverage ratio** has a form of an **inverted U-shape**, with a turning point around 10% leverage ratio.

- Policy implications:
  - Capital and liquidity requirements are, at least to some extent, substitutes.
  - This substitution is mainly driven by small banks $\Rightarrow$ insight for the debate on the proportionality of the regulatory requirements for small banks.

Thank you for your attention

APPENDIX

Stylised facts

Liquidity index

Changes in Individual Capital Guidance