The Macroeconomics of Liquidity in Financial Intermediation[a]

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[a]This paper represents our own views, not necessarily those of the European Central Bank or Eurosystem.

Introduction

Model of endogenous runs on financial intermediaries

- within standard macro framework.

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Implications of run risk for (1) bank behaviour and (2) macroeconomic outcomes?

1. Limit leverage, demand liquid assets, pay spread on deposits/bank debt.
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Macroeconomic effects of government-supplied liquid assets (e.g., reserves)?

- It reduces banks' run risk $\implies$ supports lending.
- How and how much liquidity should be supplied?

Bank-funding spreads positively correlated with liquidity premium. (daily US data)

- Bank-funding spread = 3M LIBOR - 3M GC repo rate.
- Liquidity premium = 3M GC repo rate - 3M T-Bill rate.

Figure 1: Global financial crisis. (monthly)

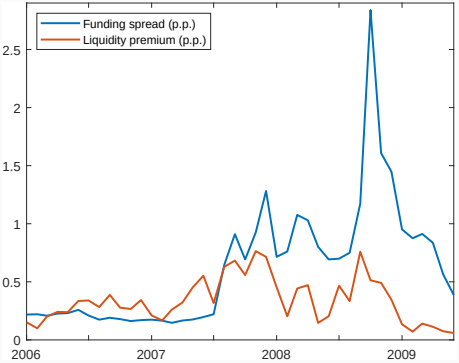
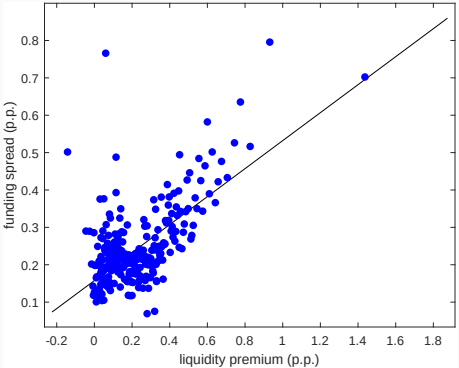


Figure 2: May 1991 – June 2023. (binned)



Literature

Macro-banking: Gertler and Kiyotaki (2010), Gertler and Karadi (2011), Brunnermeier and Sannikov (2014), Gertler, Kiyotaki, and Prestipino (2020), Fernández-Villaverde et al. (2023), Amador and Bianchi (2024).

→ different friction.

Banking theory: Diamond and Dybvig (1983), Goldstein and Pauzner (2005).

→ in general equilibrium.

Demand for reserves/liquid assets: Poole (1968), Drechsler et al. (2018), Bianchi and Bigio (2022), d'Avernas and Vandeweyer (forthcoming), Li (forthcoming).

→ different micro-foundation.

Roadmap

1. Coordination game among bank creditors.
   $\Longrightarrow$ no-run condition.

2. Macro model
   - RBC: firms, households, and government.
   - Banks.

3. Calibration and quantitative exercise.

4. Empirical evidence.

No-run condition

In each period,

1. banks with net worth N choose:
   - liquidity ratio m,
   - capital ratio n.
2. Households choose whether or not to hold the deposits.

Because of illiquid-asset liquidation cost $1 - \lambda$, bank is bankrupt if too few households hold deposits.

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Coordination friction: departure from common knowledge about bank fundamentals.

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No-run condition:

$$\underbrace{j-\rho}_{\text{Funding spread}} \geq \underbrace{\theta}_{\text{LGD}} \underbrace{\left(\frac{1-n}{\lambda+(1-\lambda)m}-1\right)}_{\text{Bank fragility}} \tag{1}$$

Macro model

Illustrate with RBC model, but can also embed in full NK DSGE model.

Agents:

1. Households save in bank debt, supply labour and consume.
2. Competitive firms rent physical capital from banks and hire labour.
3. Government supplies liquid assets (government bonds) with lump-sum taxes/transfers.

Assets:

1. Physical capital with return r.
2. Bank debt with return j.
3. Liquid assets with return i.

- ρ is $\text{MRS}_{t,t+1}$

Bank behaviour

Bank maximizes PDV(dividends) s.t. BCs, no-run condition and minimum dividend payout.

Key trade-off: Return vs funding spread.

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Liquidity demand:

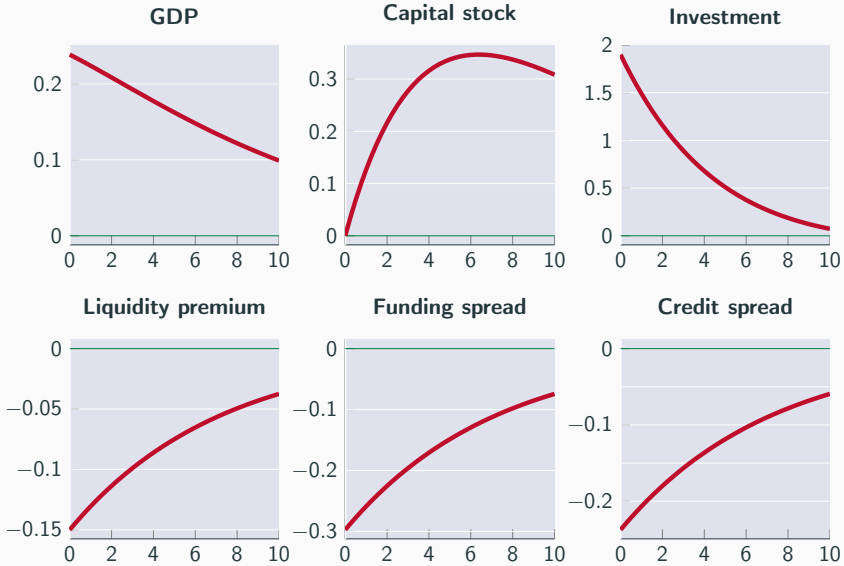
$$\underbrace{j-\rho}_{\text{funding spread}} = \theta^{1/2} \underbrace{(\rho-i)}_{\substack{\text{liquidity}\\ \text{premium}}}^{1/2}. \tag{2}$$

Credit supply:

$$\underbrace{r-i}_{\text{credit spread}} = 4(1-\lambda)\left[\frac{1}{2}\theta^{1/2} + \frac{1}{2}\underbrace{(\rho-i)}_{\substack{\text{liquidity}\\ \text{premium}}}^{1/2}\right]^2. \tag{3}$$

Increase in supply of liquid assets

Calibration | Capital-destruction shock



Empirical test

Model:

$$\mathrm{FS}_t = \alpha + \beta\, \mathrm{LP}_t + \epsilon_t \tag{4}$$

- Theory implies $\beta > 0$.

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Empirical strategy:

- Controls:
  - lags (11 variables for 80 periods),
  - time dummies,
  - linear trend.
- Outstanding US Treasuries as instrument:
  - Relevant [Krishnamurthy and Li (2004)].
  - Predetermined *at daily frequency* $\implies$ valid.

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	Funding spread
Liquidity premium	0.99**
	(0.45)
Lags	Y
Time dummies	Y
Linear trend	Y
R-squared	97%
Observations	4077
1st-stage F statistic	15

Note 1: Heteroskedasticity-cons. SEs.

Note 2: Fund. spr. = 3M LIBOR - 3M repo rate. Liq. prem. = 3M repo rate - 3M T-bill rate.

Conclusion

Macro model + bank fragility.

Coordination game among bank creditors:

1. Fragility is costly because funding costs $\uparrow$.
2. Leverage $\downarrow$ and liquidity $\uparrow$ $\implies$ fragility $\downarrow$.

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Macro model:

1. Demand for liquid assets.
2. Amplification and propagation of shocks via spreads.
   - Capital-destruction shock $\implies$ GDP $\downarrow$ by 40% more and more persistently.
3. Liquidity supports bank lending and economic activity.
   - Liquidity shock that reduces liquidity premium by 15 bps $\implies$ GDP $\uparrow$ by 0.2%.

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Empirical evidence shows supply of liquidity reduces bank-funding spread.

Appendix: Expansions and recessions

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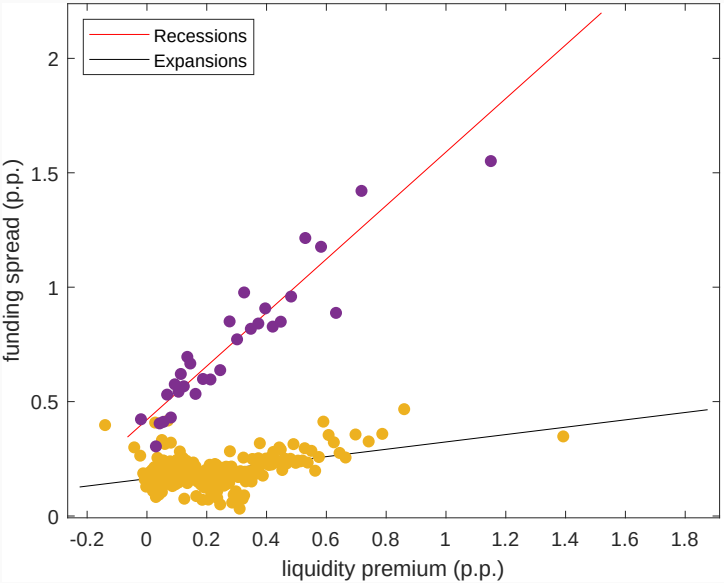

Calibration: targets and parameters

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- A model period is three months. • Data 1991–2008.

Description	Notation	Value
Real Treasury Bill rate	i	1.5%/4
Real return on bank equity	q	8.4%/4
Credit spread	$r - i$	2.2%/4
Liquidity premium	$\rho - i$	0.28%/4
Bank capital ratio	n	8.8%

Description	Notation	Value
Bank-asset liquidity relative to T-bills	λ	0.681
Loss given bank default	θ	4.4%/4
Minimum dividend distribution	γ	8.4%/4
Subjective discount factor	β	$(0.984)^{1/4}$
Elasticity of intertemporal substitution	σ	1
Frisch elasticity of labour supply	ψ	3
Capital elasticity of output	α	1/3
Depreciation rate	δ	7.5%/4

One-off 5% capital destruction shock

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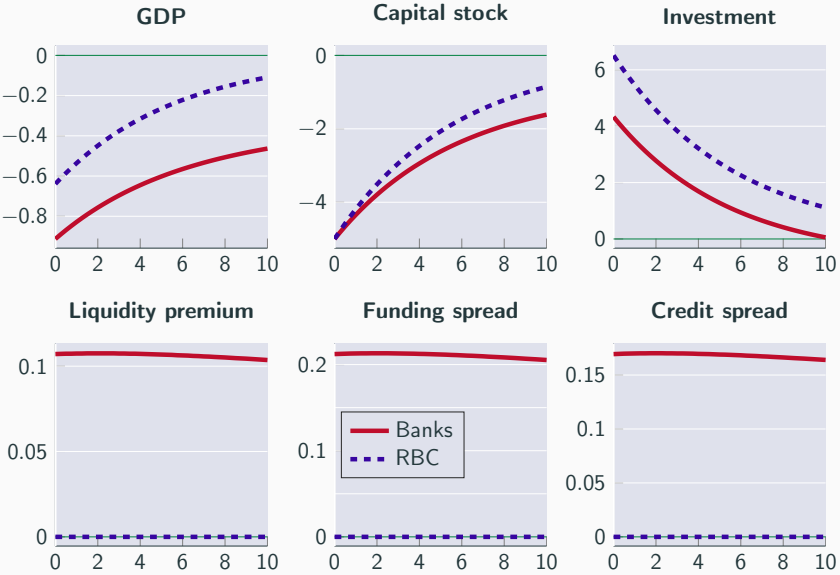

Appendix: Auction timing

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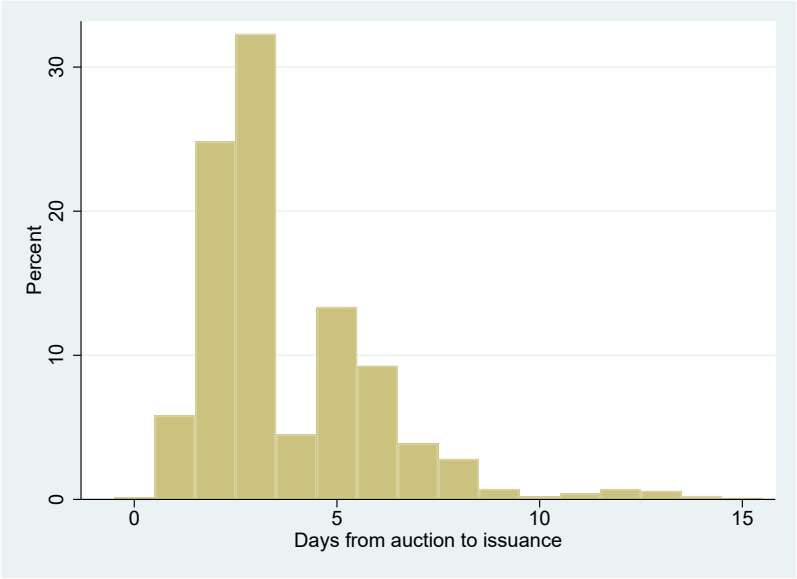

Appendix: Autocorrelation of identified error

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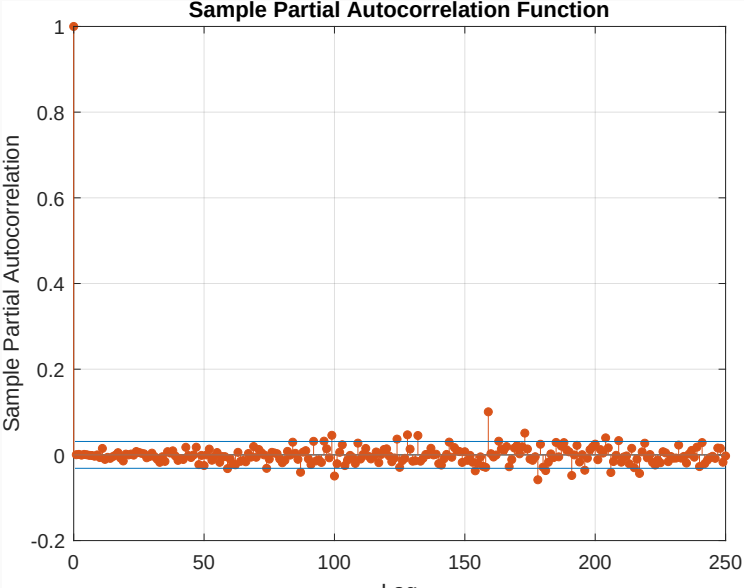

Appendix: Alternative specifications

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Funding spread	IV	IV	IV
Liquidity premium	1.0**	0.31***	1.28***
	(0.48)	(0.04)	(0.06)
Lags	Y	N	N
Time dummies	N	Y	N
Linear trend	Y	Y	Y
R-squared	96%	57%	17%
Observations	4077	4157	4157
1^{st}-stage F statistic	13	1560	1823

Note 1: Outstanding US Treasuries as external instrument.

Note 2: Heteroskedasticity-consistent standard errors in parentheses.

Note 3: Funding spread = 3M LIBOR - 3M repo rate. Liquidity premium = 3M repo rate - 3M T-bill rate.

Appendix: Lag selection – Robustness

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Appendix: OLS

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Funding spread	OLS	OLS	OLS	OLS
Liquidity premium	0.75***	0.40***	-0.30***	-0.30***
	(0.06)	(0.04)	(0.06)	(0.06)
Lags	N	N	Y	Y
Time dummies	N	Y	N	Y
Linear trend	Y	Y	Y	Y
R-squared	23%	57%	99%	99%
Observations	4157	4157	4077	4077

Note 1: Heteroskedasticity-consistent standard errors in parentheses.
Note 2: Funding spread = 3M LIBOR - 3M repo rate. Liquidity premium = 3M repo rate - 3M T-bill rate.