# Discussion of ”Central Bank Liquidity Reallocation and Bank Lending: Evidence from the Tiering System”

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# Do reserves crowd out loans?

**What happens when interest on reserves decreases?**

1. Reserves and loans are substitutes.
   - Reserves crowd out loans.
2. Reserves and loans are complements.
   - More liquidity reduces bank risk.
   - This leads to more lending.

**The paper:** find evidence that low-liquidity banks view reserves and loans as complements.

# The Paper

**Shock and data:** introduction of tiering by ECB.

- Banks with no excess reserves see their deposit rate $\uparrow$.
- Banks with a lot of excess reserves see their deposit rate $\downarrow$.
- Use Anacredit to trace effects on credit supply.

**Outcome variables:** trace out effect on credit supply.

- Small reserve vs. big reserve banks.
- Start with money market - transfer of reserves.
- Then look at relative credit supply.
- End with results on possible misallocation.

# Empirical strategy - credit supply

Main specification of the paper is

$$\begin{aligned}\log \text{Loan}_{f,i,t} = &\beta_1 \times \mathbf{1}\{t \in \text{Interim}\} \times \text{Exposure}_i^{\text{Feb 2019}} \\ &+ \beta_2 \times \mathbf{1}\{t \in \text{Interim}\} \times \text{Exposure}_i^{\text{Feb 2019}} \\ &+ \beta_3 X_{i,t} + \gamma_{f,t} + \delta_{i,f} + \varepsilon_{f,i,t}\end{aligned}$$

- Within-firm results and across banks.
- Look at difference in slopes.
- Announcement vs. implementation.

Model hypothesis: $\mathcal{E}^{\text{small reserves}} > 0 \implies \beta_1 \geq 0, \beta_2 > 0$.

# Result 1: transfer of funds from high- to low-reserve banks

| | Secured | | | Unsecured | | |
|---|---|---|---|---|---|---|
| | Borrowing | Lending | Net | Borrowing | Lending | Net |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Exposure (Feb 2019) x Interim (Mar-Oct 2019) | -0.195 | -0.635 | 0.440 | -0.030 | -0.039 | 0.009 |
| | (0.466) | (0.394) | (0.498) | (0.207) | (0.053) | (0.202) |
| Exposure (Oct 2019) x Implementation (Nov 2019-Feb 2020) | 0.588 | -1.136* | 1.724** | 0.551* | -0.135 | 0.687** |
| | (0.429) | (0.583) | (0.658) | (0.321) | (0.100) | (0.272) |
| CDS | -0.766 | -0.412 | -0.354 | 1.707 | 0.067 | 1.641 |
| | (0.592) | (0.672) | (0.996) | (1.765) | (0.090) | (1.696) |
| Country-MP fixed effects | Y | Y | Y | Y | Y | Y |
| Bank fixed effects | Y | Y | Y | Y | Y | Y |
| Observations | 44,269 | 44,269 | 44,269 | 44,269 | 44,269 | 44,269 |
| No. Banks | 42 | 42 | 42 | 42 | 42 | 42 |
| R2 | 0.920 | 0.910 | 0.878 | 0.802 | 0.939 | 0.837 |
| R2 (within) | 0.002 | 0.002 | 0.004 | 0.006 | 0.001 | 0.005 |

- Banks with unused allowances obtain more funds.
- Mostly through lower lending.

# Result 2: bank lending increases for low-reserve banks

| Dependent Variable: | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Volume of NFC loans | Log | Log | Log | Log |
| Exposure(Feb 2019)*Interim(Mar-Oct 2019) | 0.012 | 0.007 | 0.013 | 0.011 |
| | (0.011) | (0.006) | (0.010) | (0.009) |
| Exposure(Oct 2019)*Implementation(Nov 2019-Feb 2020) | 0.066*** | 0.040*** | 0.074*** | 0.066*** |
| | (0.025) | (0.012) | (0.017) | (0.019) |
| CDS | -0.049 | -0.021 | -0.034 | -0.045 |
| | (0.040) | (0.020) | (0.032) | (0.033) |
| Excess liquidity | 0.010** | 0.002 | 0.009** | 0.006 |
| | (0.005) | (0.002) | (0.005) | (0.004) |
| Holdings of government securities | 0.055*** | 0.026*** | 0.047*** | 0.038** |
| | (0.016) | (0.009) | (0.016) | (0.016) |
| Deposit ratio | 0.000 | -0.000 | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| TLTRO funds | 0.005* | 0.002* | 0.004** | 0.003** |
| | (0.002) | (0.001) | (0.002) | (0.001) |
| Bank FE | Yes | Yes | Yes | - |
| Country-Month FE | Yes | - | - | - |
| Industry-Location-Size-Month FE | - | Yes | - | - |
| Firm-Month FE | - | - | Yes | Yes |
| Bank-Firm FE | - | - | - | Yes |
| Observations | 35,356,355 | 34,338,371 | 10,353,666 | 10,256,326 |
| R-squared | 0.084 | 0.719 | 0.697 | 0.935 |

- Economically significant: loan volumes increase by 4.7%.

Comment 1: what is the control group?

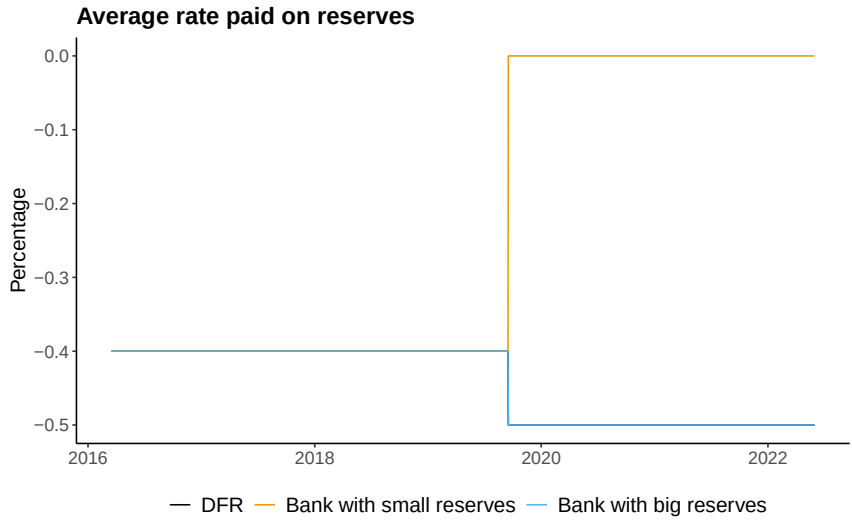
# How does tiering work?

- In September 2019, ECB cuts DFR to -0.5%.
- They also introduce a tiering system.

$$\text{Average rate on reserves} = 0 \times \frac{\text{Exempt}}{\text{Reserves}} - 0.5 \times \frac{\max\{\text{Exempt} - \text{Reserves}, 0\}}{\text{Reserves}}$$

- Exempt reserves = $6 \times \underbrace{0.01 \times \text{Liabilities}}_{\text{minimum reserve requirements}}$.

# How do returns on reserves change?



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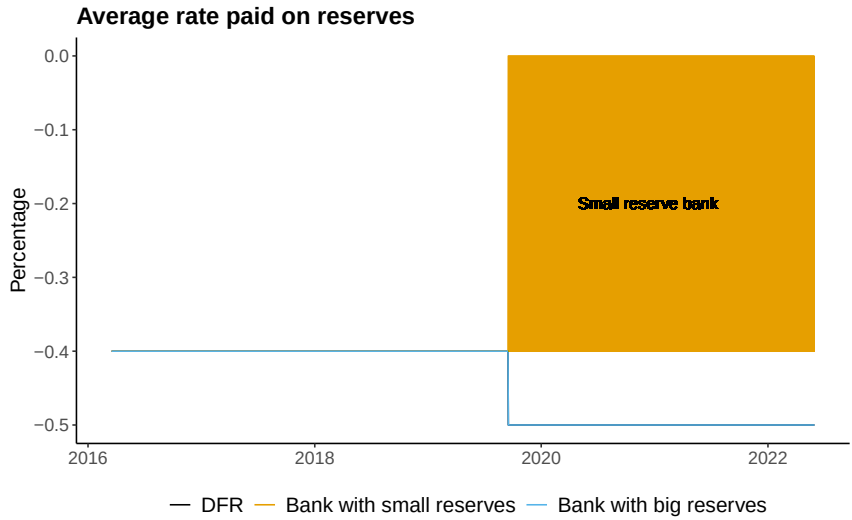

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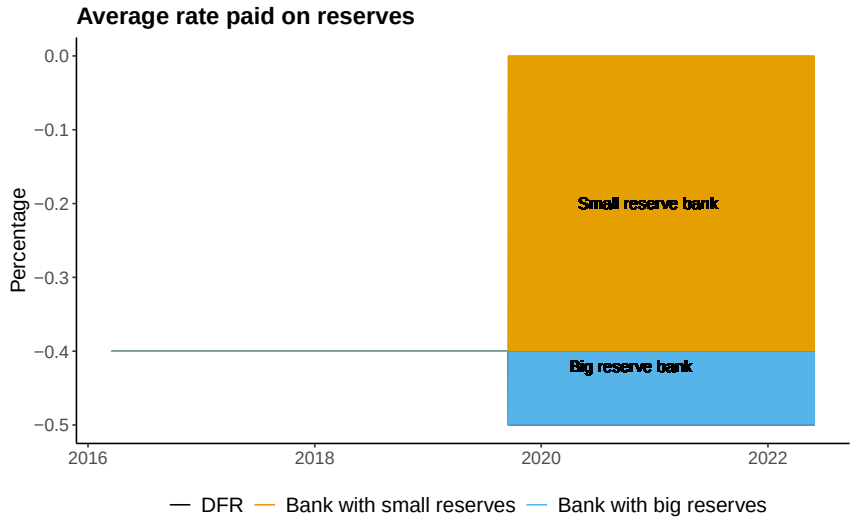

# Does the response of the control group matter here?

$$\text{ATT}_{\text{slopes}} = \mathcal{E}^{\text{small reserves}} \times \underbrace{\text{Shock}^{\text{small}}}_{>0} - \mathcal{E}^{\text{big reserves}} \times \underbrace{\text{Shock}^{\text{big}}}_{<0}$$

$$\mathcal{E} \equiv \frac{d \log \text{Credit}}{d \log \text{Rate on reserves}}$$

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When do we get falsification?

- Falsification = $\mathcal{E}^{\text{small reserves}} < 0$ and ATT$> 0$.
- Problem only exists if $\mathcal{E}^{\text{big reserves}} > 0$.
- Does not seem to be a likely scenario.

# Does the response of the control group matter here?

$$\text{ATT}_{\text{slopes}} = \mathcal{E}^{\text{small reserves}} \times \underbrace{\text{Shock}^{\text{small}}}_{>0} - \mathcal{E}^{\text{big reserves}} \times \underbrace{\text{Shock}^{\text{big}}}_{<0}$$

$$\mathcal{E} \equiv \frac{d \log \text{Credit}}{d \log \text{Rate on reserves}}$$

Can we get dampening?

- Can we underestimate $\mathcal{E}^{\text{small reserves}} > 0$?
- Yes, if $\mathcal{E}^{\text{big reserves}} < 0$.
- Then, finding ATT $> 0$ must mean $\mathcal{E}^{\text{small reserves}} > 0$!

# Still can get finer identification

Authors use a DiD setting with varying slopes.

- Why not a simple DiD?

My recommendation: split banks into bins.

- All units are treated.
- Exposure is heterogeneous.
- Banks with reserves $>$ exemption are the control group.
- Split all other banks into bins of exposure.

Comment 2: what are the implications for QT?

# What are the implications for quantitative tightening?

What happens to credit if the ECB changes the DFR?

$$d \log \text{Credit} = \sum_b s_b \times \underbrace{\frac{d \log \text{Credit}_b}{d \log \text{Reserves}_b}}_{\mathcal{E}_b} \times \underbrace{\frac{d \log \text{Reserves}_b}{d \log \text{DFR}}}_{\chi > 0} \times d \log \text{DFR}$$

$$= \chi \cdot d \log \text{DFR} \cdot \sum_b s_b \times \mathcal{E}_b$$

- Joint distribution of elasticities and shares matters.
- If elasticities are driven by level of reserves, then $F(\text{Reserves}, s)$ is the crucial object!
- Can use results in paper to think about impact conditional on distribution.

# Quantitative tightening

Compare case with $\mathcal{E}_b = \bar{\mathcal{E}}$ with heterogeneous elasticities.

$$d \log \text{Credit}^{\text{het}} - d \log \text{Credit}^{\text{hom}} = \chi \times d \log \text{DRF} \times \left[ \mathcal{E}^{\text{high}} + s_{\text{low}} \times \left( \mathcal{E}^{\text{low}} - \mathcal{E}^{\text{high}} \right) - \bar{\mathcal{E}} \right]$$

$$\approx \chi \times d \log \text{DFR} \times s_{\text{low}} \times \underbrace{\left( \mathcal{E}^{\text{low}} - \mathcal{E}^{\text{high}} \right)}_{\text{identified in paper} > 0}$$

What if $d \log DFR > 0$?

- $d \log \text{Credit}^{\text{het}} - d \log \text{Credit}^{\text{hom}} > 0$.
- Expect $\text{Credit}^{\text{hom}} < 0$.
- Decline in credit with heterogeneous elasticities is less severe.

# Quantitative tightening

Compare case with $\mathcal{E}_b = \bar{\mathcal{E}}$ with heterogeneous elasticities.

$$d \log \text{Credit}^{\text{het}} - d \log \text{Credit}^{\text{hom}} = \chi \times d \log \text{DRF} \times \left[ \mathcal{E}^{\text{high}} + s_{\text{low}} \times \left( \mathcal{E}^{\text{low}} - \mathcal{E}^{\text{high}} \right) - \bar{\mathcal{E}} \right]$$
$$\approx \chi \times d \log \text{DFR} \times s_{\text{low}} \times \underbrace{\left( \mathcal{E}^{\text{low}} - \mathcal{E}^{\text{high}} \right)}_{\text{identified in paper} > 0}$$

What if $d \log DFR < 0$?

- $d \log \text{Credit}^{\text{het}} - d \log \text{Credit}^{\text{hom}} < 0$.
- Then, it must mean that expansion in credit is less pronounced.

# Comment 3: firm selection

# Do bad firms borrow from multiple banks?

**Result:** loans to bad borrowers do not behave differently from loans to good borrowers.

- Firm-time FE means regression only includes firms that borrow from two different banks.
- In fact, require one treated and one control bank.
- Are these firms very different?
- What is the distribution of quality within these firms?
- Is it different from distribution across all firms?

My recommendation: run regression with and without firm-year FE.

- All firms and firms with multiple banks.

# Concluding remarks

**I really like this paper!**

- Super important question in the even of quantitative tightening.
- Very hard to get causal evidence but authors do a great job.
- I think a back-of-the-envelope calculation can elevate the paper.
- What do we learn about elasticities?