

Banks' Reluctance to Intermediate: credit and liquidity provision

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Research questions

Motivating evidence / Tension

- ❑ Influential strand of economic literature:
 - banks' tendency to **overextend** and occasionally fuel financial booms that end badly.

- ❑ At the same time, evidence on:
 - banks are **reluctance** to borrow from the central bank and lend on the borrowed liquidity

Empirical and theoretical questions

- ❑ **Is there a nexus between (scant) central bank borrowing and (insufficient) lending?**
 - No consensus on whether central bank liquidity matter for bank intermediation capacity

- ❑ **What is the role played by central bank balance sheet policies – Credit Easing and QE?**
 - Are all these instruments (e.g. MRO, LTRO, TLTRO, QE) equally affecting bank intermediation?

What we find

□ Theory

Banks' failure to internalise social objectives leads to deficient bank intermediation and under-investment in aggregate. Three results:

- **LOLR:** If a standard, conventionally-priced refinancing operation (LOLR) is the only source of liquidity, banks are reluctant to borrow and lend on.
- **CE:** Liquidity offered in a refinancing operation on concessionary terms (Credit Easing, CE) can bring the economy to the social optimum in the absence of production externalities across sectors
- **QE:** With production externalities, Quantitative Easing (QE) can bring the economy to the social optimum.

□ Empirics

- **LOLR:** lack of connection between reserves borrowed under a standard refinancing operation and loans supports the **Reluctance Hypothesis**.
- **CE and QE:** The strong positive connection between loans and reserved borrowed under TLTRO or the non-borrowed reserves give support to the results on CE and QE.
- The **extra credit spurred by CE and QE is productive:** it's conducive to more investment and income

Literature

Reluctance to Borrow central bank funds

- ❑ Bernanke (2009): “In August 2007,.. banks were reluctant to rely on discount window credit to address their funding needs”
- ❑ Peristiani (1998), ReStat; Furfine (2001), EL; Armantier, Ghysels, Sarkar, Shrader (2015), JFE; Anbil (2018), JFE

Bank credit cycles and unstable banking

- ❑ Bernanke and Gertler (1989), Kiyotaki and Moore (1997), Rajan (2006), Adrian and Shin (2008), Lorenzoni (2008), Shleifer and Vishny (2009), Stein (2012) and Acharya and Rajan (2022).

Central bank reserves and bank lending

- ❑ Banks that increased their reserve holdings, following the FED QE3, **increased lending** (Rodnyansky and Darmouni, 2017; Kandrac and Schlusche, 2021).
- ❑ Banks with higher excess reserve holdings **grant more credit lines** and take more risk (Acharya et al. 2023; Acharya and Rajan, 2022).
- ❑ The reallocation of central bank reserves towards banks with higher liquidity needs **fosters credit supply** (Altavilla, Boucinha, Burlon, Giannetti, and Schumacher, 2022)
- ❑ Reserve-rich banks’ credit **supply is less sensitive** to the monetary policy tightening compared to other banks (Fricke, Greppmair, and Paludkiewicz, 2023)
- ❑ An increase in excess reserve holdings **crowds out bank lending** (Diamond, Jiang and Ma, 2023)
- ❑ Liquidity factors contribution to the decline in credit (Bianchi and Bigio, 2022)

A model of reluctant banks

Two-period economy, four sectors: households, bank-financed manufacturing (“banks” in short), non-bank-financed manufacturing (“non-banks”), and a policy authority. Policy authority can advance liquidity to the banks.

□ Three equilibria

1. **Lender of Last Resort (LOLR)**. When the bad state hits, LOLR equilibrium improves over the non-interventionist equilibrium (NI) with fire-sales. But, in a LOLR equilibrium banks still don’t borrow enough, there is a loan shortfall, and the economy suffers from under-investment.
2. **Credit Easing (CE)** does a good job of promoting welfare. The policy authority lends liberally as in LOLR, but calibrates the collateral haircut to encourage as much bank borrowing. We prove that the terms and conditions of the loans to the banks can be made sufficiently attractive to bring private allocations into complete alignment with those that the policy authority itself would select.
3. **Quantitative Easing (QE)** can reinstate the convergence of private and public goals. Here, the central bank offers to buy up a pre-set amount of the banks’ assets, threatening that if the banks chose not to sell that amount in the adverse contingency, there would be no CE operation and the equilibrium would revert to LOLR.

□ Main results

- Banks’ failure to internalise social objectives leads to deficient bank intermediation and under-investment in aggregate
- Credit easing only aligns the private equilibrium allocations with those prescribed by the social optimum only in the absence of production externalities.
- QE brings the economy to its social optimum even in the presence of externalities.

[Important: the model is stigma-free. What explains deficient intermediation is a structural misalignment between banks’ individual profit-maximising perspective and the policy authority’s goal of enhancing collective welfare.]

A model of reluctant banks

Four testable predictions

- H1.** Banks are generally **reluctant to borrow** from standard conventionally-priced backup facilities;
- H2.** If the standard facility is the only source of central bank liquidity:
any increase in borrowing to address an **adverse shock** will **not lead to a loan expansion**;
- H3.** **CE and QE** stimulate bank borrowing and can **encourage banks to lend**;
- H4.** The **credit** spurred by CE and QE is **productive**: it's conducive to more investment and income.

Outline

❑ Stylised facts

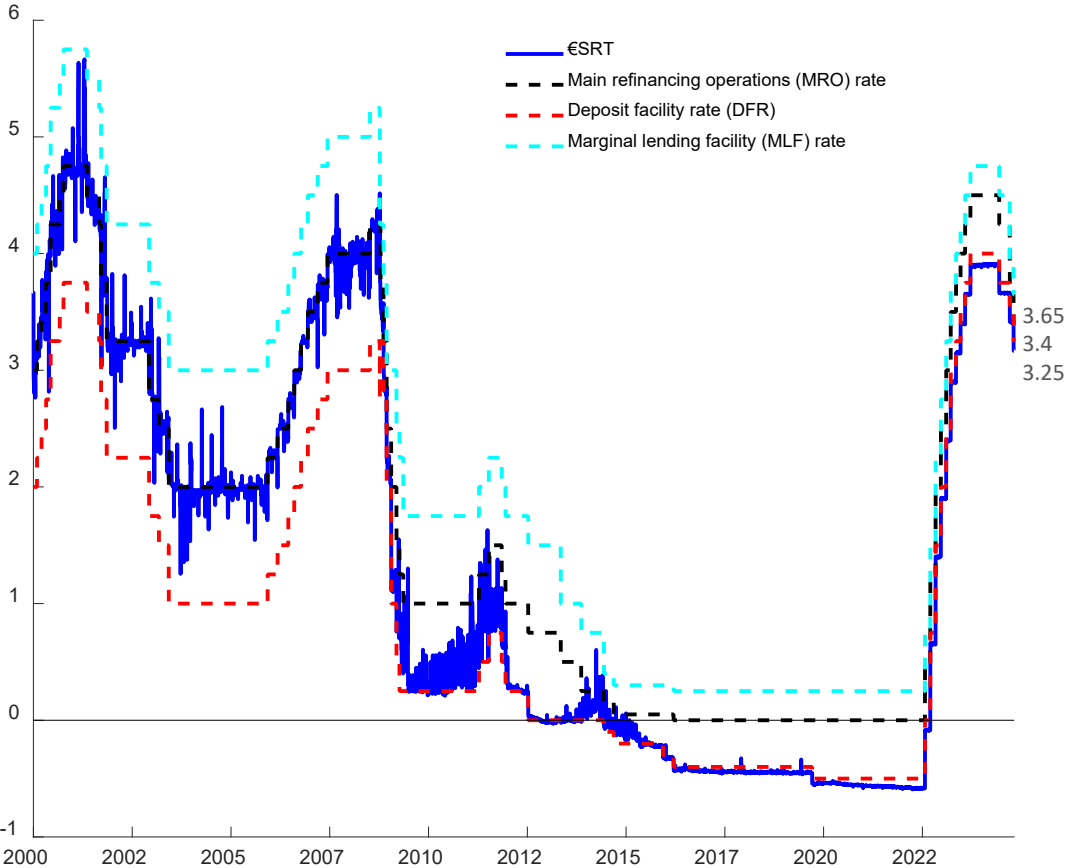
❑ Empirical Analysis

- Banks' reluctance to borrow (H1)
- Bank lending and liquidity provision in a LOLR regime (H2)
- Bank lending and regimes of liquidity provision (H3)
- The real effects of liquidity provision (H4)

❑ Conclusions

Stylised Facts

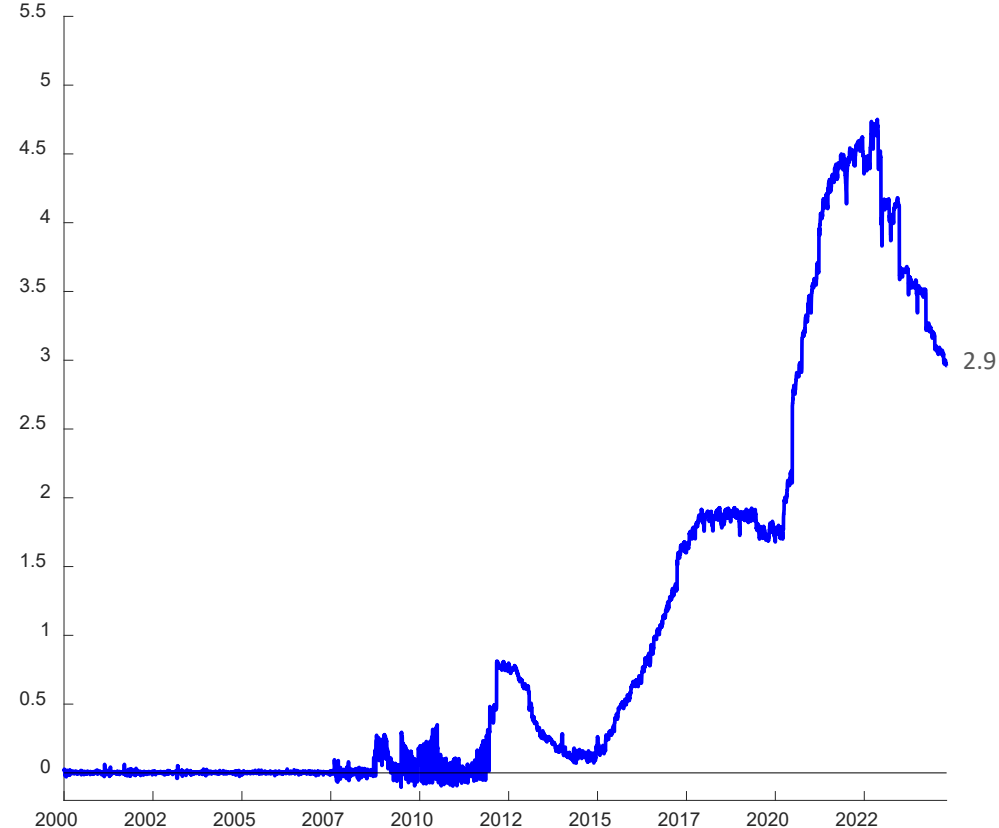
Interest rates



Last observation: 29 October 2024.

Excess Liquidity

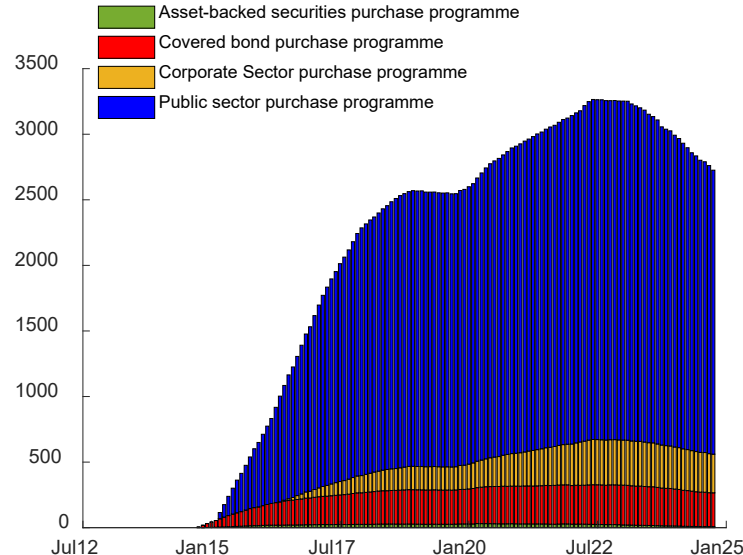
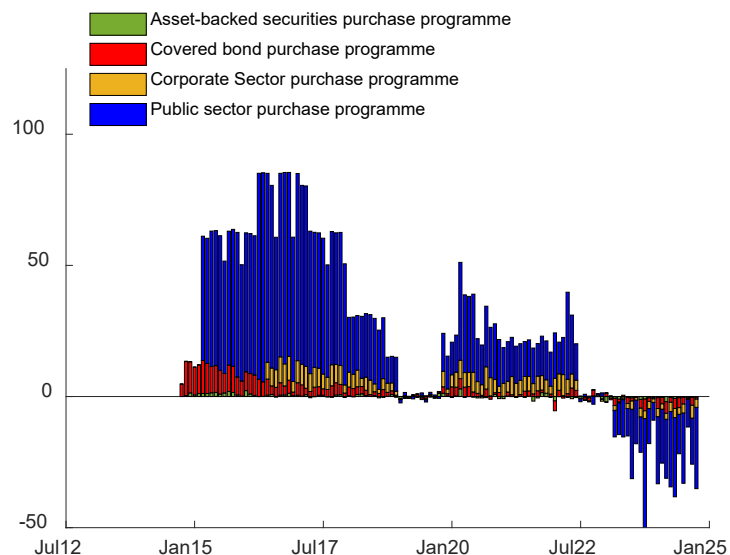
Current Account - Reserve requirements + Deposit Facilities (in euro trillion)



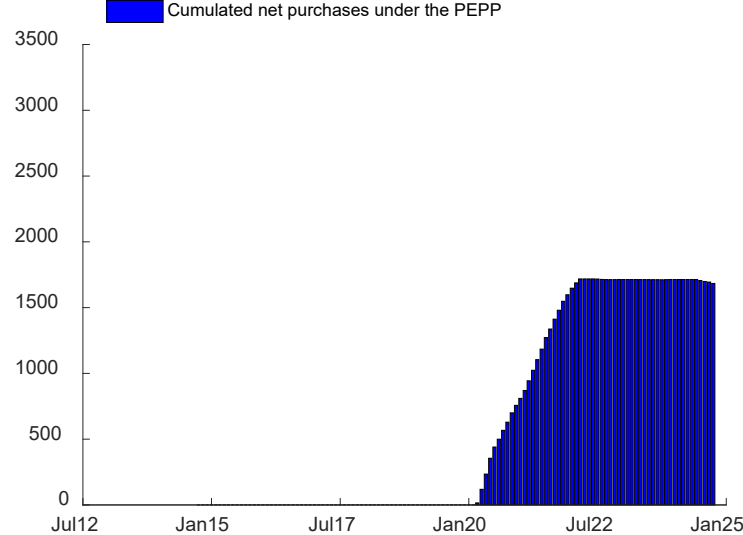
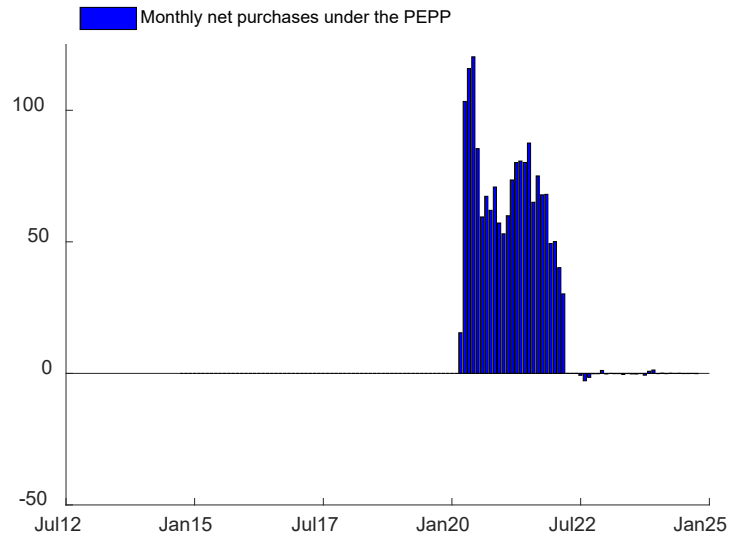
Last observation: 29 October 2024.

Quantitative Easing

APP



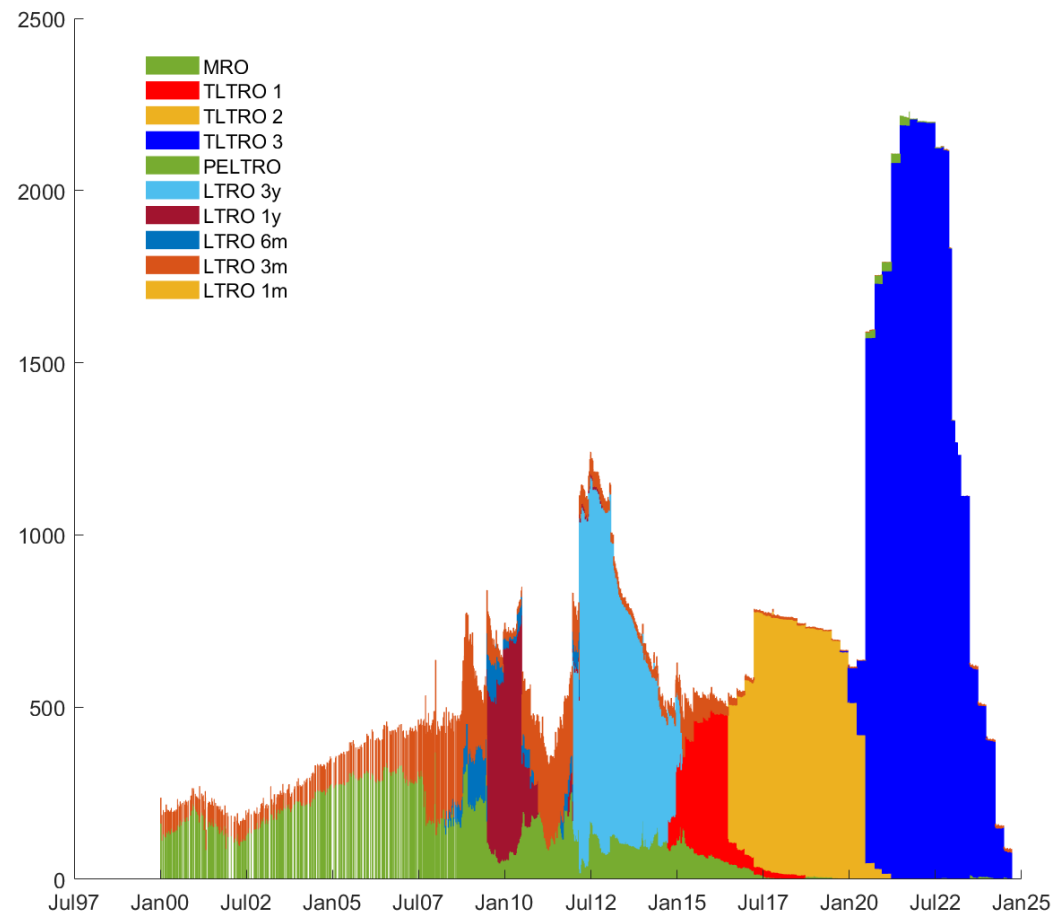
PEPP



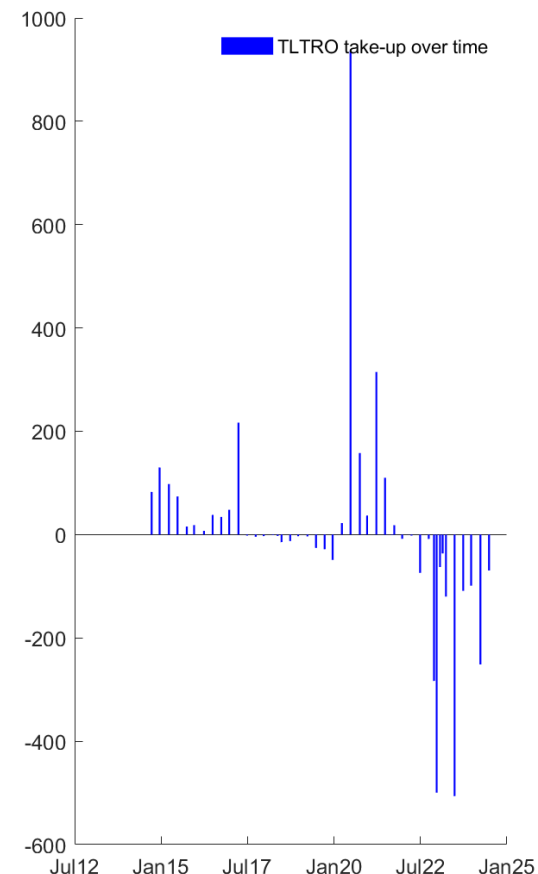
Note: the chart shows monthly and cumulative net purchases under the asset purchase programme (APP), decomposed into the various components (corporate sector purchase programme (CSPP), public sector purchase programme (PSPP), asset-backed securities purchase programme (ABSPP), third covered bond purchase programme (CBPP3)), and since March 2020, the net purchases of debt securities under Pandemic emergency purchase programme (PEPP). Last observation: October 2024.

Standard Refinancing Operations and Credit Easing

Eurosystem Borrowing



Targeted longer-term refinancing operations (TLTROs)



Note: the chart shows monthly and cumulative net purchases under the asset purchase programme (APP), decomposed into the various components [corporate sector purchase programme (CSPP), public sector purchase programme (PSPP), asset-backed securities purchase programme (ABSPP), third covered bond purchase programme (CBPP3)], and since March 2020, the net purchases of debt securities under Pandemic emergency purchase programme (PEPP). Last observation: October 2024.

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❑ Conclusions

Banks' reluctance to borrow (H1)

Already in the 1920s, Federal Reserve (Fed) economists Riefler and Burgess noticed that banks' reluctance to borrow from the discount window gave the Fed's open market operations an extra leverage over credit conditions, especially in a tightening phase (Brunner and Meltzer, 1964; and Meltzer, 1976 and 2003).

Same behaviour detected ever since across a variety of cyclical/market conditions and regulatory environments:

- **Great Depression.** Banks remained hesitant to borrow from the discount window (Friedman and Schwartz, 1963).
- **After 1982**, the unwillingness of banks to borrow when borrowed reserves were used as an operating target by FOMC weakened interest rate control to the point that the Fed saw a return to an interest-rate-targeting framework as desirable (Meulendyke, 1998, Peristiani, 1998)
- **Great Financial Crisis (GFC):** many banks faced with a drain of cash would often eschew refinancing with the central bank and rather refuse to make markets, dump assets at deep discounts and cut back credit to restock their liquidity reservoirs (Bernanke, 2009; Armantier *et al* 2015).
- **2013-2014:** banks' widescale reimbursement of central bank liquidity in the euro area came into conflict with the central bank's objective to kickstart lending and reflate the economy (Rostagno *et al.*, 2021).

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- Banks' reluctance to borrow in the data (H1)
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❑ Conclusions

Bank lending and liquidity provision in a LOLR regime (H2)

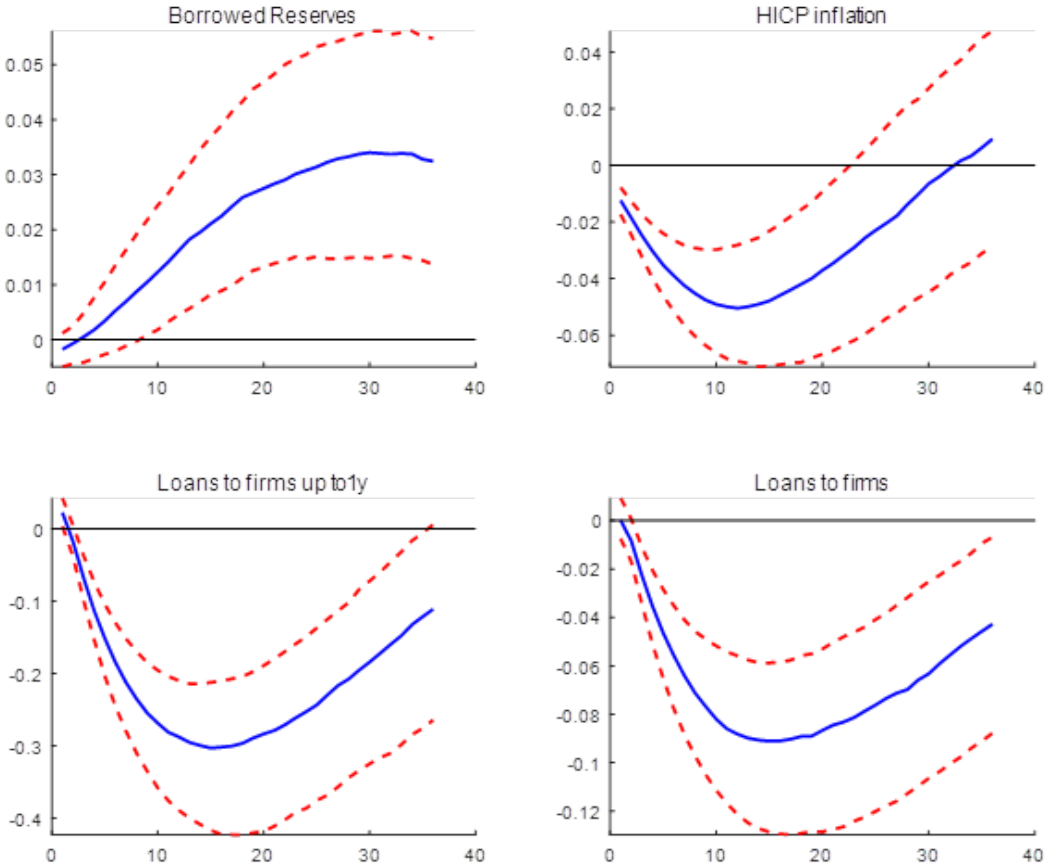
BVAR:

$$\begin{pmatrix} I & 0 \\ A_{0,yz} & I \end{pmatrix} \begin{pmatrix} z_t \\ y_t \end{pmatrix} = A(L) \begin{pmatrix} z_{t-1} \\ y_{t-1} \end{pmatrix} + \begin{pmatrix} e_{t,z} \\ u_t \end{pmatrix}$$

Y =
Industrial Production
 Borrowed reserves
 Interest rate
 Inflation
 Loans to firms
 Bank capital ratio
 Security over asstes

Sample: July 2007-July 2024

An increase in borrowing to address an adverse shock will not result in higher loan issuance



Note: The figure presents the response of the variables to an unanticipated temporary shock that decreases industrial production by 1 pp and leaves the policy rate unchanged over the entire simulation horizon. The solid line is the median, the red dotted lines represent the 16th and 84th percentiles of the posterior distribution.

Bank lending and liquidity provision in a LOLR regime (H2)

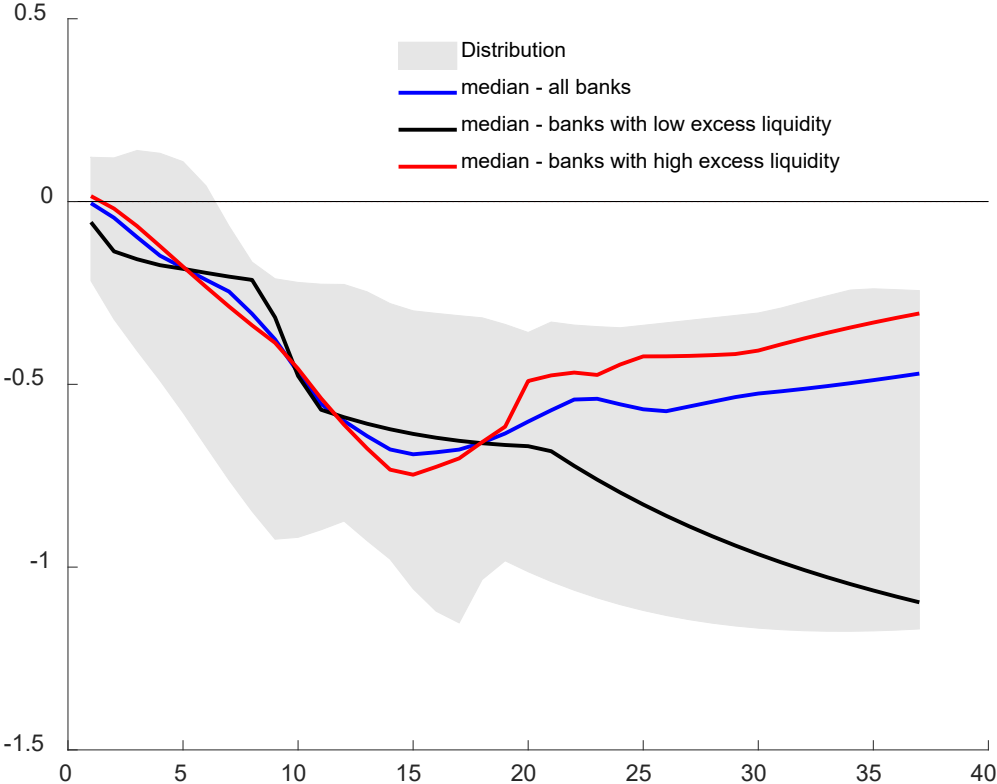
P-BVAR:

$$\begin{pmatrix} I & 0 \\ A_{0,yz} & I \end{pmatrix} \begin{pmatrix} z_{i,j,t} \\ y_{i,j,t} \end{pmatrix} = A(L) \begin{pmatrix} z_{i,j,t-1} \\ y_{i,j,t-1} \end{pmatrix} + \begin{pmatrix} e_{i,j,t} \\ u_{i,j,t} \end{pmatrix}$$

Y =
Industrial Production
 Borrowed reserves
 Interest rate
 Inflation
 Loans to firms
 Bank capital ratio
 Security over asstes

Sample: July 2007-July 2024

Lending growth responses to liquidity shocks



Note: Response to an unanticipated shock that increases liquidity (borrowed, non-borrowed and TLTRO) over assets by 1 pp and leaves the policy rate unchanged over the entire simulation horizon. The solid line is the median, the red dotted lines represent the 16th and 84th percentiles of the posterior distribution.

Outline

❑ Stylised facts

❑ Empirical Analysis

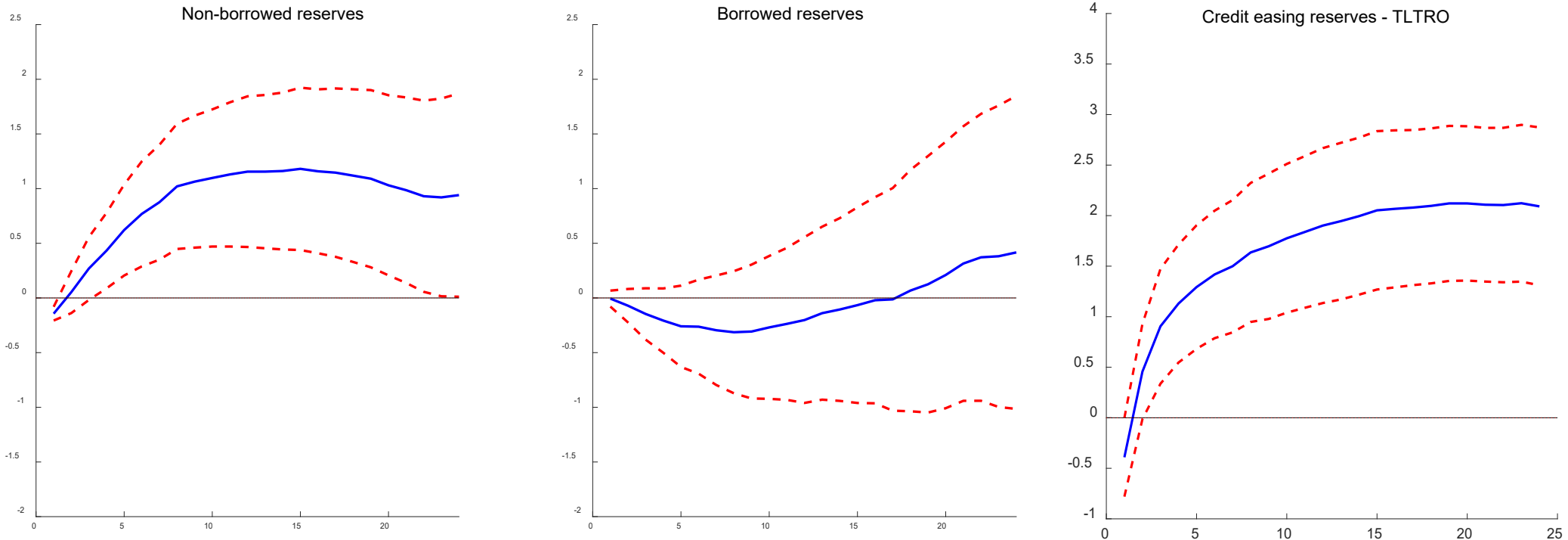
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Bank lending and regimes of liquidity provision (H3)

$$\Delta L_{i,t+h} = \alpha_{i,h} + \beta_h NBR_{i,t} + \delta_h BR_{i,t} + \Gamma_h X_{i,t-1} + \epsilon_{i,t+h} \text{ for } h = 1, \dots, 30$$

Response of bank loans after a 1pp increase in borrowed and non-borrowed reserves



Note: The figure reports the cumulated response of banks' loan growth up to time $t+h$ to an increase in TLTRO, non-borrowed and borrowed reserves ratio at time t . The solid line are retrieved from the coefficients β_h , δ_h , and λ_h from the regression $\Delta L_{i,t+h} = \alpha_{i,h} + \beta_h \Delta NBR_{i,t} + \delta_h \Delta BR_{i,t} + \lambda_h \Delta CER_{i,t} + \Gamma_h X_{i,t-1} + \epsilon_{i,t+h}$, $h = 1, \dots, 24$. $\Delta L_{i,t+h}$ is the cumulated change in loans to firms of bank i between t and $t+h$; the variable $\Delta NBR_{i,t}$ and $\Delta BR_{i,t}$ represents the change in the ratio of borrowed and non-borrowed reserves over assets. $\Delta CER_{i,t}$ is instead the ratio of credit easing reserves, i.e. TLTRO funds, over assets. $X_{i,t-1}$ includes the non-performing loan ratio, the return on assets, bank-specific credit demand conditions from the BLS, the share of government and corporate securities in the bank's assets, the level of excess liquidity over assets and the share of deposit of assets. The dashed lines report the 95% confidence intervals for each horizon h with standard errors clustered at the country*time and bank level.

Does non-random selection of banks introduce a bias into our empirical analysis?

- As there is no proper randomization, the **participation in liquidity operations** (i.e., the treatment) is not independent of the expected outcomes (i.e., lending behaviour).
- The **impact** of a change in liquidity may be **biased downward** if the banks that **borrowed more** from the refinancing operations had **worse lending prospects**.
- To alleviate concerns on potential endogeneity issues related to banks' participation in ECB liquidity operations we use a local projection instrumental variable (LP-IV)

Bartik-like “shift-share” instrument

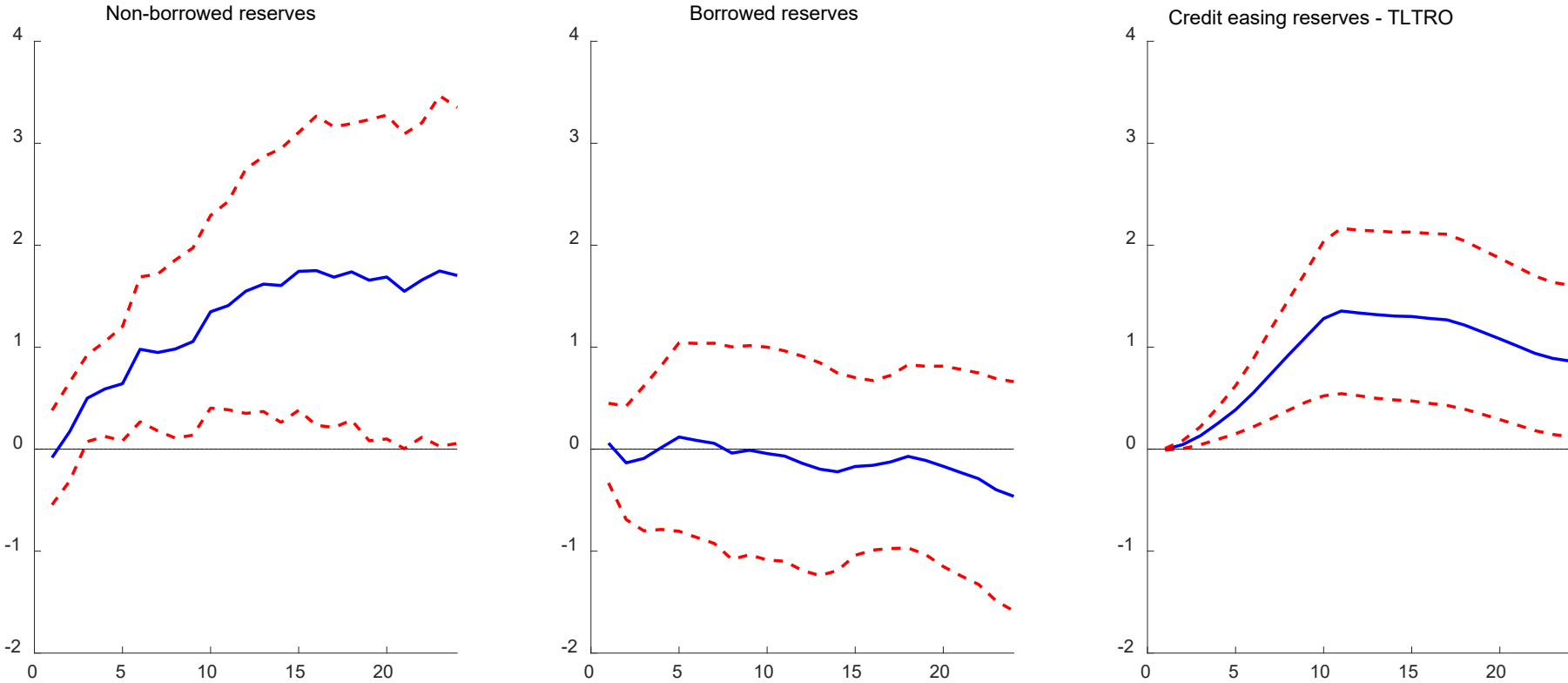
$$Z_{i,t}^{NBR} = \underbrace{\ln \left(\frac{NBR_t}{NBR_{t-3}} \right)}_{\text{Shift}} \times \underbrace{Share_{i,t}^{NBR}}_{\text{Share}}$$

Quarterly growth rate of the aggregate non-borrowed reserve (NBR), i.e. a quantity that an individual bank cannot influence (i.e. the **shift**, or the shock).

Share of each bank's non-borrowed reserves over the total reserves (i.e. the **share**). To ensure that this second term is less depended on specific events, we take the 12 months average as $\frac{1}{12} \sum_{k=1}^{12} NBR_{i,t-k}$.

Bank lending and regimes of liquidity provision (H3)

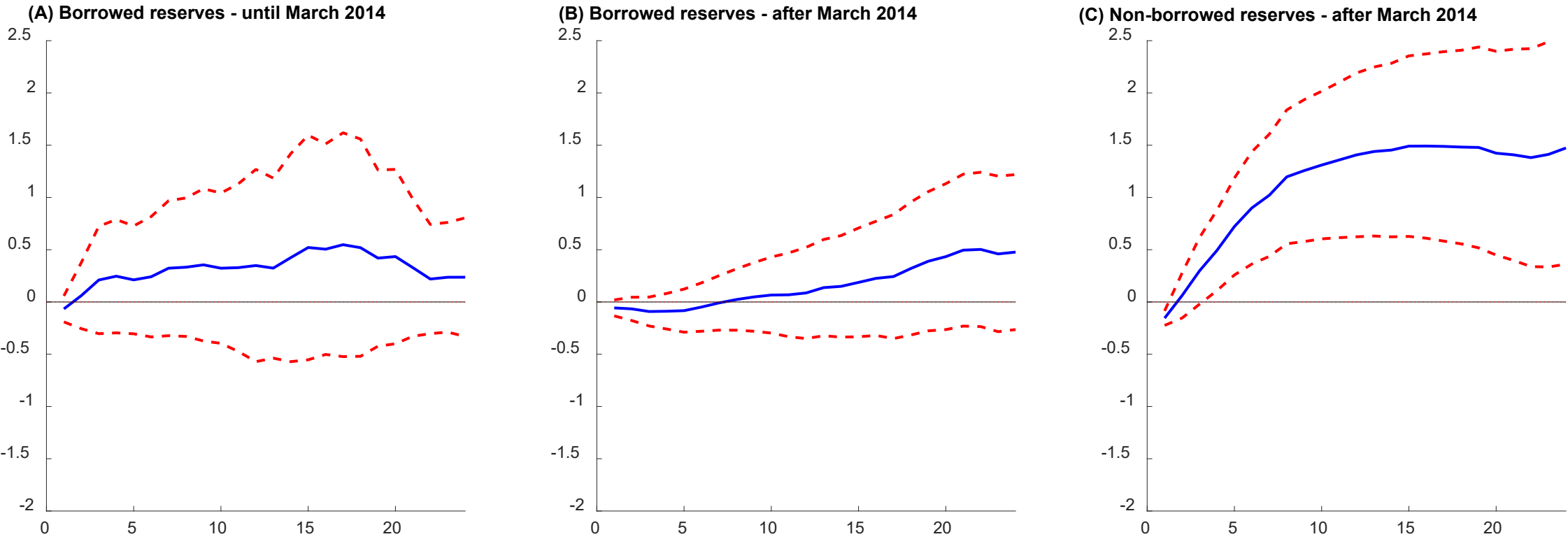
Response of bank loans after a 1pp increase in central bank reserves



Note: The figure reports the cumulated response of banks' loan growth up to time $t+h$ to a drop in TLTRO, non-borrowed and borrowed reserves ratio at time t . The solid line are retrieved from the coefficients β_h , δ_h , and λ_h from the regression $\Delta L_{i,t+h} = \alpha_{i,h} + \beta_h \Delta NBR_{i,t} + \delta_h \Delta BR_{i,t} + \lambda_h \Delta TLTRO_{i,t} + \Gamma_h X_{i,t-1} + \epsilon_{i,t+h}$, for $h = 1, \dots, 24$. $\Delta L_{i,t+h}$ is the cumulated change in loans to firms of bank i between t and $t+h$; the variable $\Delta NBR_{i,t}$ and $\Delta BR_{i,t}$ represents the change in the ratio of borrowed and non-borrowed reserves over assets. These variables are instrumented. The instrument for the non-borrowed reserves is $Z_{i,t}^{NBR} = \ln\left(\frac{NBR_t}{NBR_{t-3}}\right) \times Share_{i,t}^{NBR}$. The instrument for the borrowed reserves is calculated in a similar way. The variable $\Delta TLTRO_{i,t}$ represents the high frequency changes in bank-specific bond yields around TLTRO announcements. Additional lagged observable characteristics at the bank level are included in the vector $X_{i,t-1}$. These variables are the non-performing loan (NPL) ratio, the return on assets (ROA), bank-specific credit demand conditions from the BLS, the share of government of government and corporate securities in the bank's assets, the level of excess liquidity over asses and the share of deposit of assets. The dashed lines report the 95% confidence intervals for each horizon h with standard errors clustered at the country*time and bank level.

Response of bank loans before and after the unconventional monetary measures

Response of bank loans over subsamples



Note: The figure reports the cumulated response of banks' loan growth up to time $t+h$ to a drop in non-borrowed and borrowed reserves ratio at time t . The solid line are retrieved from the coefficients β_h and δ_h from the regression of the regression $\Delta L_{i,t+h} = \alpha_{i,h} + \beta_h \Delta NBR_{i,t} + \delta_h \Delta BR_{i,t} + \Gamma_h X_{i,t-1} + \epsilon_{i,t+h}$, for $h = 1, \dots, 24$. $\Delta L_{i,t+h}$ is the cumulated change in loans to firms of bank i between t and $t+h$; the variable $\Delta BR_{i,t}$ and $\Delta NBR_{i,t}$ represents the change in the ratio of borrowed and non-borrowed reserves over assets; We control for a host of lagged observable characteristics at the bank level $X_{i,t-1}$, which include the non-performing loans (NPL) ratio, the return on assets (ROA), the share of government and corporate securities in the bank's assets, bank-specific credit demand conditions from the BLS, and bank fixed effects $\alpha_{i,h}$. In addition to the benchmark specification, we also control for the level of excess liquidity over assets and the share of deposit of assets. The shaded areas report the 68% and 95% confidence intervals for each horizon h with standard errors clustered at the country*time and bank level.

Summary statistics

Variable name	Units	Obs.	Mean	St. Dev.
Loan	log(EUR mln)	66,858,446	-2.86	2.32
Excess Liquidity	% of main assets	65,682,715	10.2	5.87
Non-borrowed reserves	% of main assets	65,682,715	3.34	4.33
Borrowed reserves	% of main assets	65,682,715	0.11	0.69
TLTRO	% of main assets	65,682,715	7.97	6.5
Security holdings	% of main assets	65,682,715	8.3	5.5
Return on assets (ROA)	% of main assets	65,682,715	0.36	0.61
Non-performing loans (NPL)	% of loans	65,682,715	4.38	2.77

Note: loans (credit lines) are defined as logarithm of outstanding amounts (in EUR million) of loans (credit lines) between a bank and a firm in a given month. Excess liquidity is the ratio of excess liquidity (current account + deposit facility – minimum reserve requirements) over assets. Borrowed reserves are the ratio of borrowed reserve (MRO+LTRO) over main assets. Non-borrowed reserves are the ratio of non-borrowed reserves (excess liquidity-MRO-LTRO-TLTRO) over assets. The variable TLTRO represents the ratio of funds borrowed under TLTROs over assets.

Loan growth and Reserves – Bank-firm panel

	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta BR_{b,t-1}$	-0.591 (0.575)	0.213 (0.685)	0.570 (0.642)	0.528 (0.567)	0.200 (0.673)	-0.103 (0.417)
$\Delta CER_{b,t-1}$	0.441*** (0.131)	1.114*** (0.256)	1.147*** (0.238)	0.174 (0.201)	0.822*** (0.240)	0.577*** (0.126)
$\Delta NBR_{b,t-1}$	1.537*** (0.276)	1.027*** (0.319)	1.069*** (0.296)	0.773*** (0.221)	0.990*** (0.316)	0.889*** (0.191)
Share of securities held $_{b,t-1}$	0.311 (0.325)	0.650** (0.314)	0.442 (0.293)	0.0385 (0.257)	0.687** (0.329)	0.312 (0.295)
ROA $_{b,t-1}$	16.55*** (1.927)	12.36*** (1.785)	11.74*** (1.635)	6.009*** (1.067)	10.72*** (1.720)	6.418*** (1.054)
NPL $_{b,t-1}$	-0.428 (0.343)	-1.910*** (0.385)	-1.718*** (0.352)	-0.869*** (0.318)	-1.914*** (0.382)	-1.318*** (0.310)
Fixed effects:						
Bank	Yes	Yes	Yes	Yes	Yes	Yes
Time	-	Yes	Yes	-	Yes	-
ILS	-	-	Yes	-	-	-
ILS*Time	-	-	-	Yes	-	-
Firm	-	-	-	-	Yes	-
Firm*Time	-	-	-	-	-	Yes
Observations	63085929	63085929	63085928	63084924	63007675	40985546
R-squared	0.006	0.008	0.151	0.372	0.384	0.753

1. The coefficient on BR is positive and **NOT** statistically significant across all specifications.
2. The coefficient on CER (TLTRO) is positive and statistically significant across all specifications. In more saturates specifications the CER coefficient is smaller than the one on NBR.
3. The coefficient on NBR is positive and statistically significant across all specifications.
 - Elasticity of 1 means that an increase in NBR of 350 bn (1% of TA) is associated with an increase in credit by 45 bn (1% of Loans). In other words: the increase of one euro of non-borrowed reserves results in an increase in credit of about 15-cent.

Note: the dependent variable is the annual growth rate of loans to firms f by bank i at time t . The model includes other control variables. Excess liquidity is the change in the excess liquidity (current account + deposit facility - minimum reserve requirements) over main assets. Borrowed reserves represent the change in borrowed reserves (MRO+LTRO) over main assets. Non-borrowed reserves are the change in non-borrowed reserves (excess liquidity-MRO-LTRO) over main assets. The variable TLTRO represents the ratio of TLTRO funds over assets. The model includes share of security held, ROA and NPL ratio as additional control variables as well as the set of fixed effects as reported in the table. ILS stands for industry-location-size fixed effects. Standard errors are clustered at bank and time level. * $p < .1$, ** $p < .05$, *** $p < .01$.

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❑ Empirical Analysis

- Banks' reluctance to borrow (H1)
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❑ Conclusions

The real effects of liquidity provision (H4)

$$\Delta Y_{f,t} = \alpha^{FE} + \Gamma L_{f,t-1} + \lambda PD_{f,t-1} + \Omega \left(L_{f,t-1} \times PD_{f,t-1} \right) + \Delta X_{f,t-1} + \epsilon_{i,f,t}$$

Y={Sales, Employment, Investment}

L={NBR, BR, TLTRO}

X = {Age, Size, Leverage}

□ Preview of the results

- 1. CE and QE lending is productive:** more exposed firms increase sales, employment and investment.
- 2. Risk-taking channel of monetary policy:** QE and CE allow banks to expand lending to riskier firms.
- 3. No zombie lending:** no evidence of QE and CE credit tilted toward zombie firms

Summary statistics

Variable Name	Units	Obs.	Mean	St. Dev.	Median
Sales	yoy	2,818,018	4.528058	54.76027	4.897205
Employment	yoy - No. employees	2,818,018	2.016814	37.03723	0
Investments	yoy	2,818,018	6.297684	65.28107	-2.19092
Firm Age	log - years	2,818,018	2.171098	.7489531	2.397895
Total Assets	log -EUR million	2,818,018	14.05745	1.693925	13.8559
Leverage	% of total assets	2,818,018	0.2435623	0.2313024	0.1946399
Non-borrowed reserves	% of main assets	2,818,018	3.662971	4.259802	2.298898
Borrowed reserves	% of main assets	2,818,018	0.0327158	0.2499879	0
Credit easing reserve	% of main assets	2,818,018	7.465933	6.539388	8.830747
Debtor probability of default (PD)	%	2,818,018	3.80	8.41	1.05%
Zombie	dummy	2,818,018	0.0129	0.1131	0

Notes: The unit of observation is the firm. All bank variables are averages across counterpart banks, with bank assets used as weights. To control for outliers, variables are winsorized at the top and bottom 1 percent of the sample. Investment is defined as tangible fixed assets. Debtor probability of default (PD) is the Moody's expected default frequency (EDF). Zombie is a dummy variable that takes value 1 if a firm has experienced an interest coverage ratio persistently below 1 over the three previous years and has been operating in the market for at least a decade. Data from 2018 to 2023.

The real effects of liquidity provision (H4)

	Sales			Employment			Investment		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Delta BR_{f,t-1}$	3.450*** (0.198)	-0.122 (0.194)	-0.0825 (0.195)	0.597*** (0.140)	0.0233 (0.141)	0.0394 (0.141)	0.0277 (0.287)	-0.00437 (0.290)	-0.0249 (0.291)
$\Delta CER_{f,t-1}$	0.0931*** (0.0117)	0.0752*** (0.0255)	0.0587** (0.0256)	0.105*** (0.00830)	0.0407** (0.0177)	0.0458** (0.0178)	0.0580*** (0.0140)	0.0832*** (0.0300)	0.0834*** (0.0301)
$\Delta NBR_{f,t-1}$	2.057*** (0.0219)	0.438*** (0.0261)	0.417*** (0.0262)	0.586*** (0.0148)	0.319*** (0.0179)	0.315*** (0.0180)	0.140*** (0.0249)	0.354*** (0.0307)	0.356*** (0.0308)
$PD_{f,t-1}$	-0.0184 (0.0217)	-0.0285** (0.0130)	-0.0446** (0.0213)	-0.0920*** (0.0142)	-0.101*** (0.0142)	-0.0986*** (0.0142)	-0.272*** (0.0217)	-0.267*** (0.0217)	-0.266*** (0.0217)
$PD_{f,t-1} \times \Delta BR_{f,t-1}$	0.0177 (0.0318)	0.00323 (0.0310)	0.00622 (0.0311)	-0.0266 (0.0192)	-0.0301 (0.0192)	-0.0296 (0.0192)	-0.0271 (0.0300)	-0.0261 (0.0301)	-0.0276 (0.0301)
$PD_{f,t-1} \times \Delta CER_{f,t-1}$	0.00259* (0.00157)	0.00499*** (0.00154)	0.00474*** (0.00154)	0.0000556 (0.000967)	0.000302 (0.000965)	0.000282 (0.000966)	0.0112*** (0.00142)	0.0109*** (0.00142)	0.0109*** (0.00142)
$PD_{f,t-1} \times \Delta NBR_{f,t-1}$	0.0189*** (0.00249)	0.0254*** (0.00242)	0.0251*** (0.00243)	0.00526*** (0.00152)	0.00638*** (0.00151)	0.00639*** (0.00152)	0.00689*** (0.00224)	0.00636*** (0.00225)	0.00626*** (0.00225)
Fixed Effects:									
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	-	Yes	Yes	-	Yes	Yes	-	Yes	Yes
ILS	-	-	Yes	-	-	Yes	-	-	Yes
Observations	2000021	2000021	1999864	2000021	2000021	1999864	1928872	1928872	1928715
R-squared	0.290	0.343	0.345	0.288	0.291	0.293	0.360	0.360	0.362

Exposure to central bank liquidity, risk-taking and firm outcomes

1. An increase in NBR is associated with an increase in sales, investment, and employment growth. (BR does not appear to impact firm outcomes)
2. Firms with a higher PD exhibit poorer economic performance.
3. The significance of the interaction term aligns with the risk-taking channel of monetary policy:
 - Following an increase in NBR, less creditworthiness firms tend to increase employment and investment
 - If TLTRO on Employment is 0.1 = if TLTRO/Assets increase by 1pp, Employment increase by 0.1pp.

Do central bank funds incentivize banks to direct credit towards unproductive firms?

	Sales			Employment			Investment		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Delta BR_{f,t-1}$	2.869*** (0.167)	-0.165 (0.166)	-0.0839 (0.166)	0.163 (0.122)	-0.273** (0.123)	-0.243** (0.124)	-0.395 (0.247)	-0.430* (0.250)	-0.470 (0.350)
$\Delta CER_{f,t-1}$	0.0159** (0.00809)	0.0192** (0.00974)	0.0197** (0.01001)	0.154*** (0.00708)	0.0693*** (0.0144)	0.0702*** (0.0145)	0.0242** (0.0123)	0.153*** (0.0250)	0.148*** (0.0251)
$\Delta NBR_{f,t-1}$	1.774*** (0.0179)	0.361*** (0.0203)	0.365*** (0.0203)	0.459*** (0.0119)	0.214*** (0.0139)	0.214*** (0.0139)	0.126*** (0.0209)	0.283*** (0.0246)	0.275*** (0.0247)
Zombie _{f,t-1}	-16.79*** (1.640)	-13.19*** (1.576)	-12.93*** (1.580)	-4.966*** (0.960)	-4.262*** (0.958)	-4.163*** (0.959)	-6.221*** (1.444)	-6.540*** (1.445)	-6.628*** (1.448)
Zombie _{f,t-1} x $\Delta BR_{f,t-1}$	0.277 (2.908)	0.457 (2.866)	0.540 (2.874)	-1.350 (1.150)	-1.319 (1.150)	-1.357 (1.153)	3.164 (2.264)	3.154 (2.264)	3.344 (2.267)
Zombie _{f,t-1} x $\Delta CER_{f,t-1}$	0.119 (0.108)	-0.0772 (0.105)	-0.0757 (0.106)	0.0723 (0.0651)	0.0322 (0.0650)	0.0316 (0.0650)	0.253 (0.251)	0.280 (0.251)	0.283 (0.255)
Zombie _{f,t-1} x $\Delta NBR_{f,t-1}$	-0.303 (2.315)	1.453 (2.285)	1.581 (2.286)	0.170** (0.0860)	0.103 (0.0857)	0.110 (0.0864)	0.0950 (0.130)	0.115 (0.130)	0.132 (0.129)
Fixed Effects:									
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	-	Yes	Yes	-	Yes	Yes	-	Yes	Yes
ILS	-	-	Yes	-	-	Yes	-	-	Yes
Observations	2427517	2427517	2427365	2427517	2427517	2427365	2261077	2261077	2260911
R-squared	0.283	0.331	0.335	0.288	0.292	0.294	0.360	0.360	0.362

Zombie =
 $\begin{cases} 1 & \text{if } ICR < 1 \text{ for } 3y \text{ and } Age > 10y \\ 0 & \text{otherwise} \end{cases}$

- Firms with higher exposure to non-borrowed and TLTRO reserves tend to exhibit better economic performance in terms of employment, sales, and investment
- Although zombie firms generally perform worse economically, their exposure to banks with higher non-borrowed reserves does not influence this outcome. This aligns with the notion that the increase in bank credit supply followed by a rise in central bank reserves is not associated with excessive risk-taking or zombie lending.

Refined estimate on the link between bank credit supply and firm outcomes

1st Stage: first regress loans on BR,NBR and CE reserves in the **bank-firm panel** to isolate the portion of lending driven by changes in central bank reserves. ($dLoans/dRes$)

2nd Stage: use the fitted values into the **firm-level regressions** to capture the impact of bank loans associated with central bank reserves on firm outcomes.

	Sales			Employment			Investment		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$E(\Delta NBR_{f,t-1})$	3.547*** (0.0378)	0.755*** (0.0450)	0.719*** (0.0452)	1.011*** (0.0256)	0.551*** (0.0309)	0.542*** (0.0311)	0.242*** (0.0428)	0.611*** (0.0529)	0.613*** (0.0532)
$E(\Delta BR_{f,t-1})$	8.541*** (0.489)	-0.303 (0.481)	-0.204 (0.483)	1.479*** (0.346)	0.0577 (0.349)	0.0974 (0.349)	0.0684 (0.711)	-0.0108 (0.719)	-0.0616 (0.720)
$E(\Delta TLTRO_{f,t-1})$	0.0931*** (0.0117)	0.0752*** (0.0255)	0.0587** (0.0256)	0.105*** (0.00830)	0.0407** (0.0177)	0.0458** (0.0178)	0.0580*** (0.0140)	0.0832*** (0.0300)	0.0834*** (0.0301)
Fixed Effects:									
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	-	Yes	Yes	-	Yes	Yes	-	Yes	Yes
ILS	-	-	Yes	-	-	Yes	-	-	Yes
Observations	2000037	2000037	1999880	2000037	2000037	1999880	1928883	1928883	1928726
R-squared	0.290	0.339	0.343	0.291	0.294	0.297	0.360	0.360	0.362

Outline

❑ **Stylised facts**

❑ **Empirical Analysis**

- Banks' reluctance to borrow (H1)
- Bank lending and liquidity provision in a LOLR regime (H2)
- Bank lending and regimes of liquidity provision (H3)
- The real effects of liquidity provision (H4)

❑ **Conclusions**

Conclusions

□ Theory

Banks' failure to internalise social objectives leads to deficient bank intermediation and under-investment in aggregate. Three results:

- **LOLR:** If a standard **refinancing operation** is the only source of liquidity, banks are reluctant to borrow and lend on.
- **CE:** Credit Easing can bring the economy to the social optimum in absence of production externalities.
- **QE:** With production externalities, Quantitative Easing (QE) can bring the economy to the social optimum.

□ Empirics

- **LOLR:** lack of connection between reserves borrowed under a standard refinancing operation and loans supports the **reluctance hypothesis**.
- **CE and QE:** The strong positive connection between loans and reserved borrowed under TLTRO or the non-borrowed reserves give support to the results on CE and QE
- The **extra credit spurred by CE and QE is productive:** it's conducive to more investment and income

THANK YOU