Bank Funding Structure and
Interest Rate Pass-Through in the Euro Area

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- Frictions reduce the effectiveness of monetary policy and contribute to fragmentation
  → Mandler et al. (2022), Gagnon and Gimet (2023)

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Literature

Specification

$$\text{Impulse response:} \quad IRF_h^{(Y,R,Z)} = \beta^{(Y,h)}/\beta^{(R)}$$

$$\text{First stage:} \quad R_t = \alpha + \beta^{(R)} Z_t + \Gamma X_{t-1} + \varepsilon_{t+h}^{(R)}$$

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- Controls X_{t-1}: 12 lags of the dependent variables, industrial production, prices, overnight interest rate, stock market index, corporate bond spreads, sovereign bond yields, financial distress (Kremer et al. (2012))

Bank-level Dataset

- Data from July 2007 to April 2023
- 266 banks with data for more than two years
- 103 banks for a balanced panel
- Individual version of two datasets available in aggregate:
  - Main Interest Rates
  - Balance Sheet Items
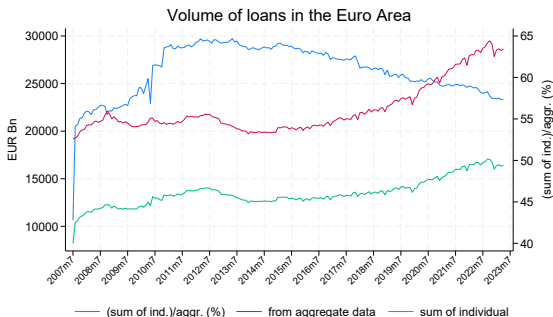
Figure: Bank-level dataset coverage. Balance Sheet

Aggregate/Average Effect

- Fixed effect specification for the average effect $\beta^{(Y,h)}$:
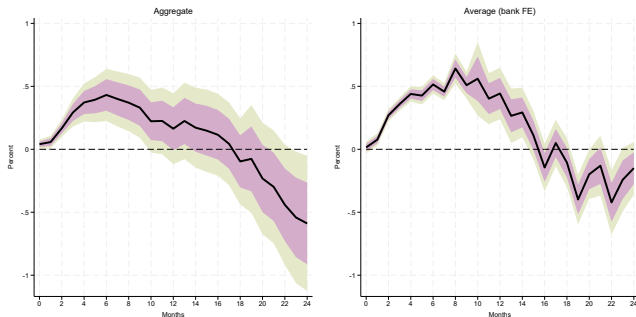
$$Y_{i,t+h} = \alpha_i + \beta^{(Y,h)}\hat{R}_t + \Gamma X_{t-1} + \varepsilon_{i,t+h}^{(Y)}.$$

Figure: Response of lending rates to a monetary policy shock. clustering deposits

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- Aggregate/Average effect indicates a similar response to monetary policy, but are all banks alike?
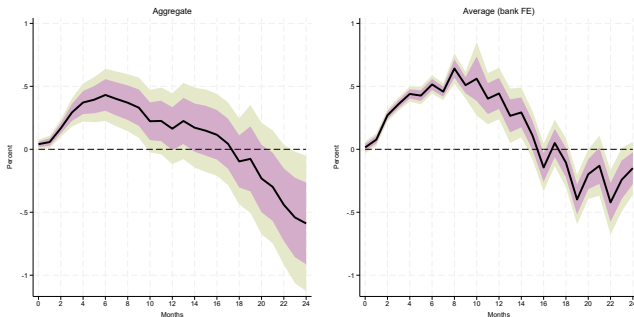
Figure: Response of lending rates to a monetary policy shock. (clustering) (deposits)

IV-LP Heterogeneous Effect Model

Asses heterogeneity using the approach of Cloyne et al. (2023):

$$Y_{i,t+h} = \alpha_i + \sum_{g=1}^{G} \beta_g^{(h)} I_{[X_{i,t-1} \in g]} \hat{R}_t$$

$$+ \sum_{g=1}^{G} \alpha_g^{(h)} I_{[X_{i,t-1} \in g]} + \Gamma X_{t-1} + \varepsilon_{i,t+h}$$

- $\hat{R}_t$: Policy rate instrumented with the swap market surprises

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- $g = 1, \ldots, G$: Categories (e.g. quantiles of $X_{i,t-1}$)

Lending Rate by Money Market Participation

Figure: Response of lending rates to a monetary policy shock, conditioned on money market debt, bottom and top quartiles. Shaded areas represent 68% and 90% confidence bands.

h=24   Deposits   Shares per country

Lending rate by bond issuance
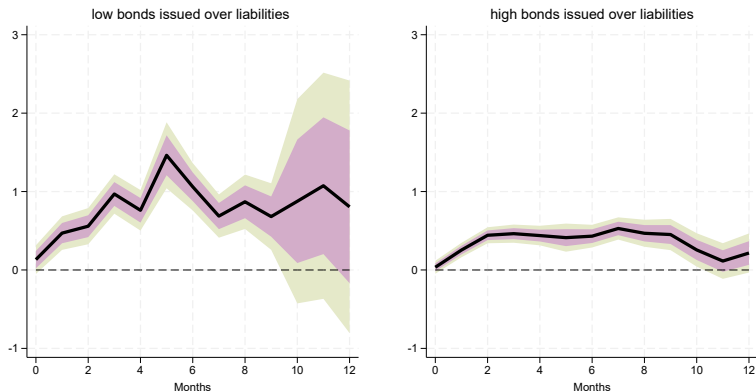
Figure: Response of lending rates to a monetary policy shock, conditioned on bond issuance, bottom and top quartiles. Shaded areas represent 68% and 90% confidence bands.

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Bond Issuance and Fixed-Rate Loans
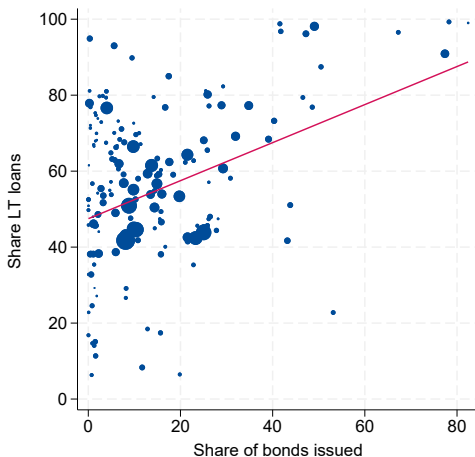
Figure: Mean share of bonds issued and mean share of loans with fixed rate for more than five years, per bank, weighted by size. (by year) (by country)

Lending Rate by Share of Fixed Loans
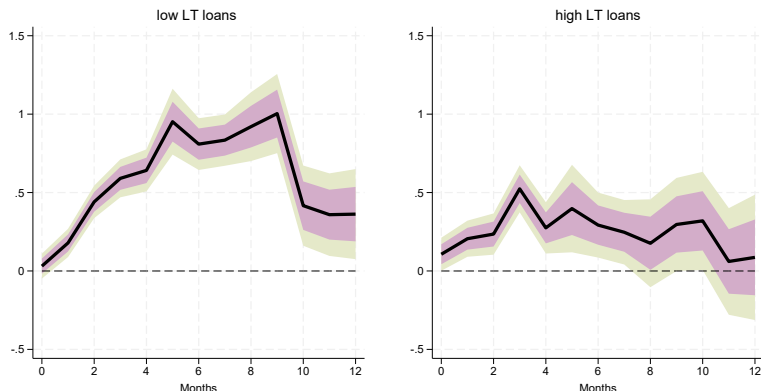
Figure: Response of lending rates to a monetary policy shock, conditioned on interest rate fixation (cut-off 5 years) of new issuances, bottom and top quartiles. Shaded areas represent 68% and 90% confidence bands.

h=24   by asset   cut-off 1 year

Long-term Oriented Banks Transmit Less
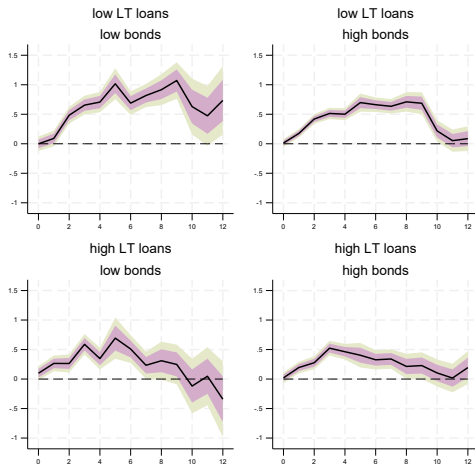
Figure: Long term assets vs liabilities above and below the median. Balanced sample
Fixed groups

Further Analysis and Robustness

- Considering deposit rates (households) $\rightarrow$ pass-trough varies depending on wholesale funding structure (money market vs bond issuance)

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  - Clustering standard errors Driscoll and Kraay (1998)

Adding these Frictions to a Standard Model

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- Adding monopolistically competitive financial intermediaries **adjust rates à la Calvo**

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- Taylor Rule: $i_t = \rho_i i_{t-1} + \delta_x x_t + \delta_\pi \pi_t + z_t$

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Estimation
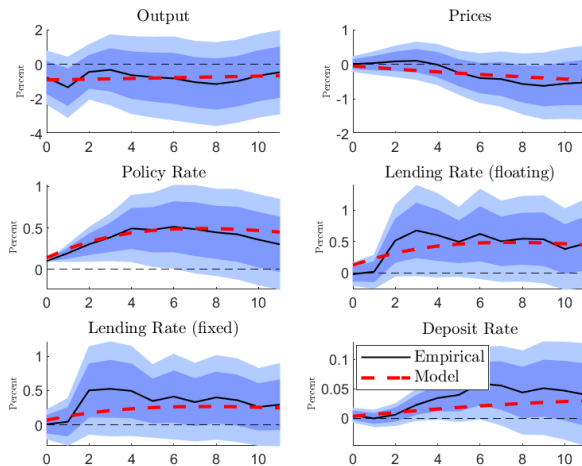
Figure: Responses to a 10bp monetary policy shock, Internal Instrument VAR and model   Pass-through   Calibration

Monetary Policy under Different Frictions
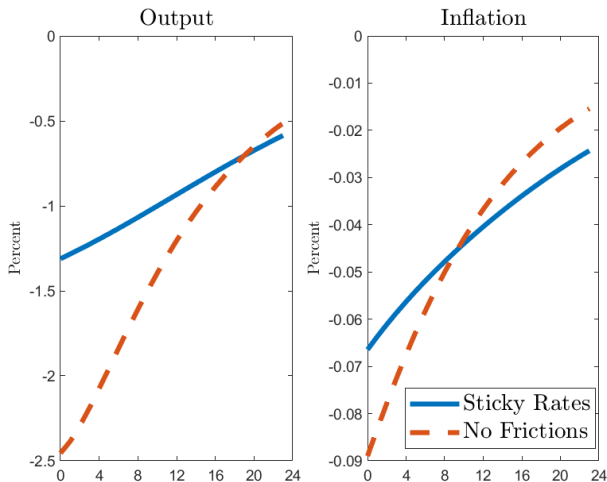
Figure: Simulation with and without frictions. Imposing a perfect pass-through overestimates the impact on output and inflation.

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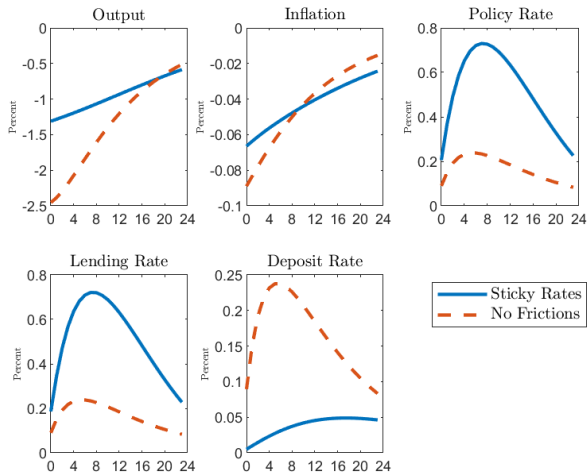
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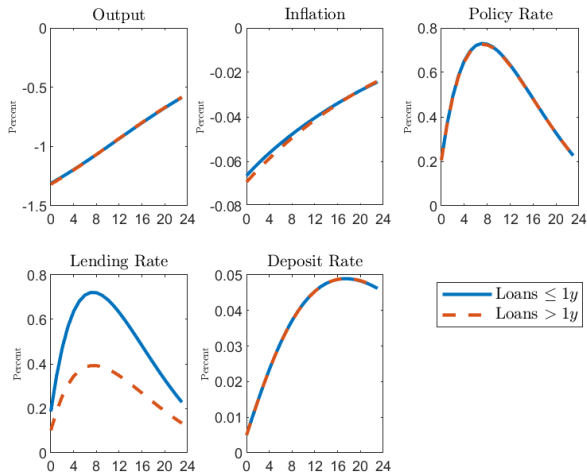
Figure: Simulation with frictions, fixed vs floating-rate loans. Only inflation is affected, through the Phillips Curve.

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  - Include these features in a model that can explain heterogeneous funding structures (e.g. Corbae and D'Erasmo (2021), Bianchi and Bigio (2022))

Thank you!

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- On **maturity transformation and monetary policy**, Drechsler et al. (2021) "maturity transformation does not expose banks to interest rate risk—it hedges it. [...] **banks closely match the interest rate sensitivities of their interest income and expense**"

Back

Responses to a Monetary Policy Shock

- ECB's Main Interest Rates dataset provides average bank rates for the Euro Area and by country.

Responses to a Monetary Policy Shock

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- Instrument:
  - Swap market surprises around monetary policy announcements.
  - First principal component of surprises around the ECB's press release as a "Target" component, Altavilla et al. (2019).

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- Local Projections to address:
  - non-invertibility of the shocks, Plagborg-Møller and Wolf (2021) ,
  - non-linearities and bank-level heterogeneity, Boeckx et al. (2017).

Back

Asset Volumes

Asset	Volume May 2023	Growth from July 2007
Loans to Hh	6,586	3%
Current Accounts Hh	5,276	78%
Loans to Firms	4,997	-10%
Current Accounts Firms	2,369	76%
Term Deposits Hh	1,315	-37%
Term Deposits Firms	645	5%
Short Term Credit to Firms	565	-28%
Short Term Credit to Hh	194	-26%

Table: Loans and deposit volumes at Euro Area commercial banks. ECB Balance Sheet Items for May of each year. Volumes in current EUR Billions, growth rates in real terms.

real volumes

EA banking sector balance sheet
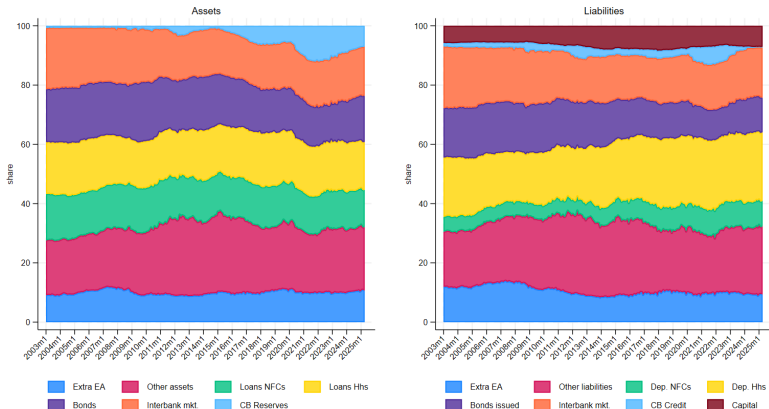
Figure: Aggregate balance sheet of the Euro Area banking sector (BSI data)

Germany, banking sector balance sheet

Banking sector balance sheet for country: DE
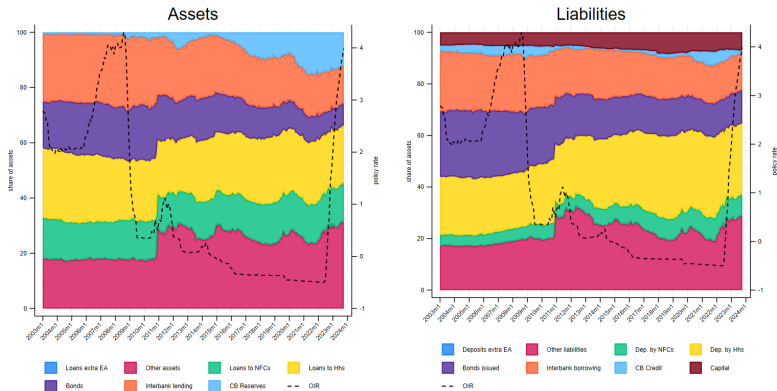
Spain, banking sector balance sheet

Banking sector balance sheet for country: ES
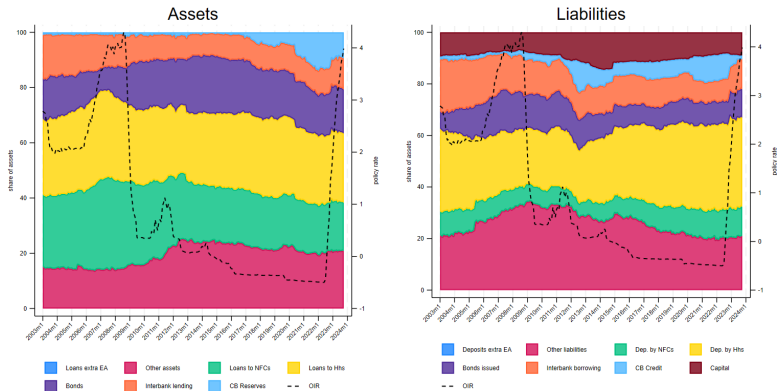
France, banking sector balance sheet

Banking sector balance sheet for country: FR
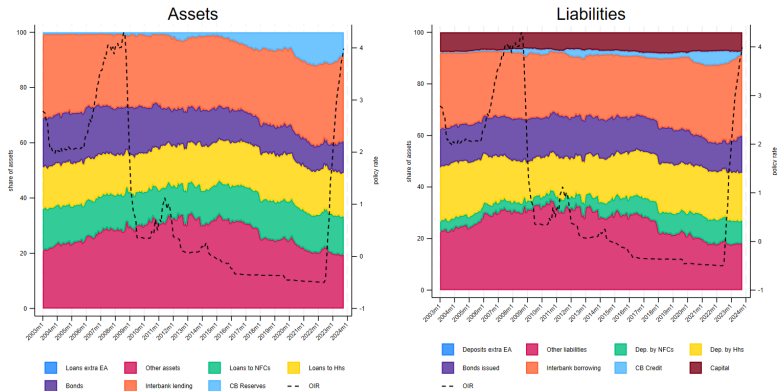
Italy, banking sector balance sheet

Banking sector balance sheet for country: IT
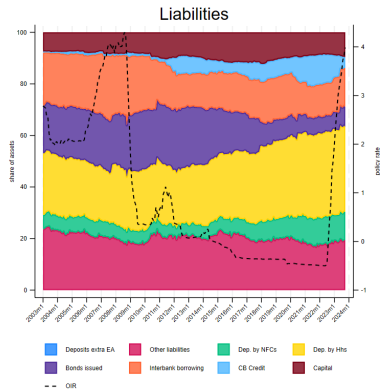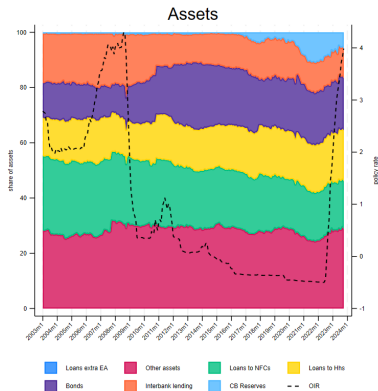
Netherlands, banking sector balance sheet

Banking sector balance sheet for country: NL

IMIR / IBSI Datasets
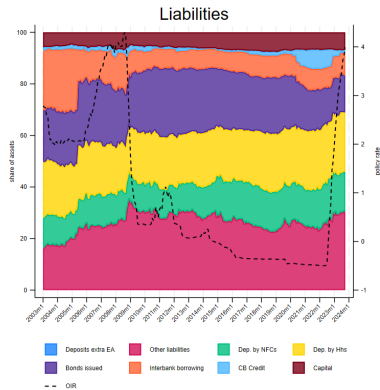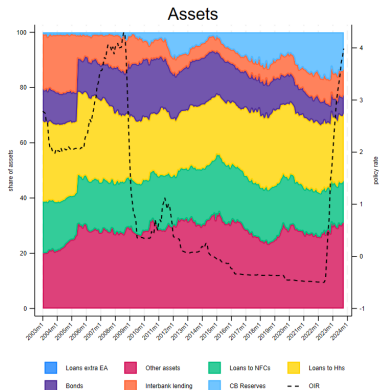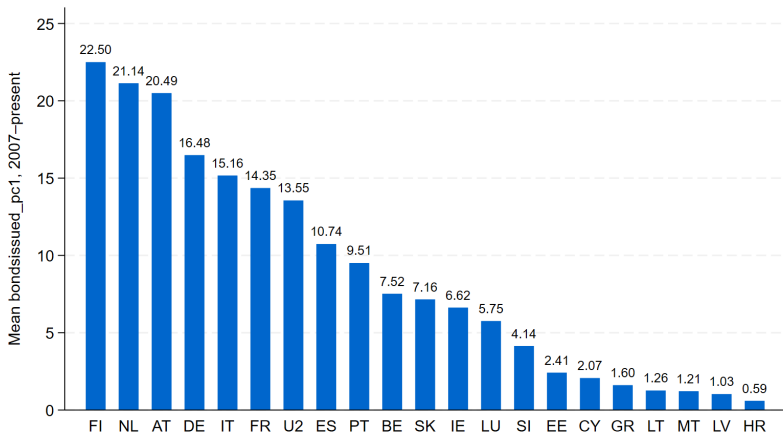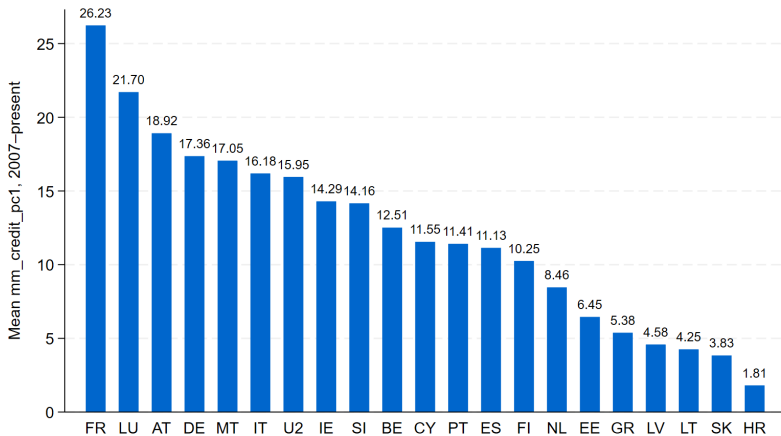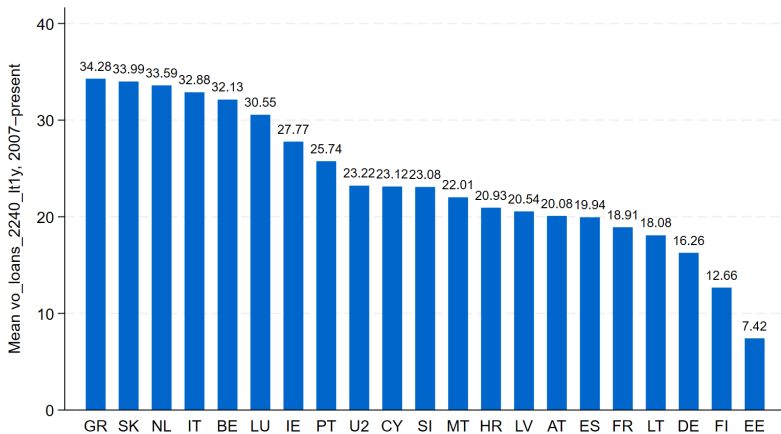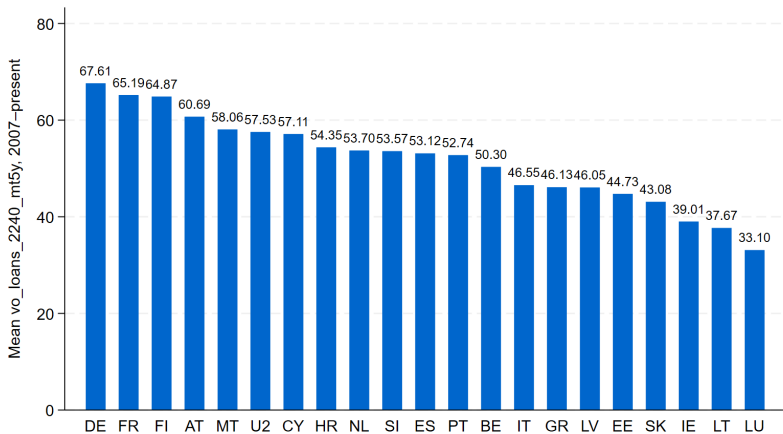
- Data from July 2007
- 266 banks with data for more than two years (loan volume 50% of aggregate)
- 103 banks for a balanced panel (loan volume 50% of whole sample)
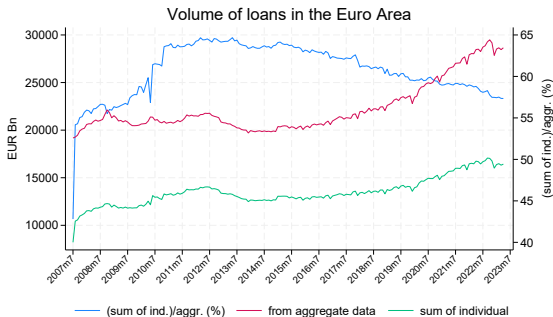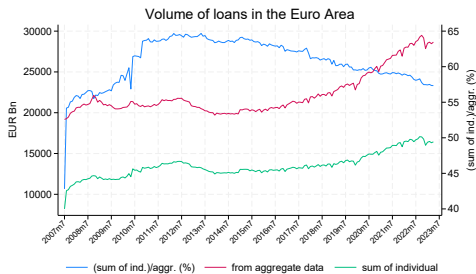
Volume of loans in the Euro Area

Individual data sample representativeness

Volume of loans in the Euro Area

Individual data sample representativeness

Volume of deposits in the Euro Area

New loans to firms, real volumes

Loans to households, real volumes

New loans to households, real volumes

Loans to households, real volumes

Legend:
- with fixation > 10y
- 5y < fixation < 10y
- 1y < fixation < 5y
- fixation < 1y
- All
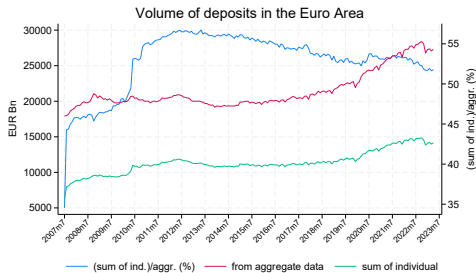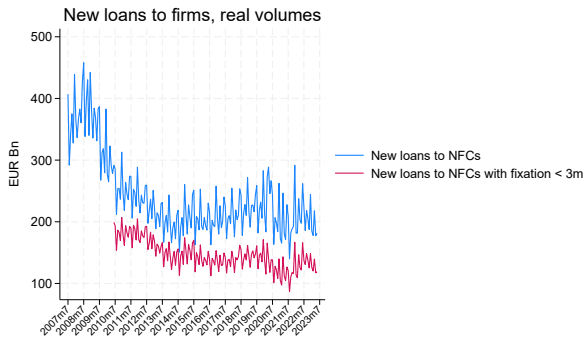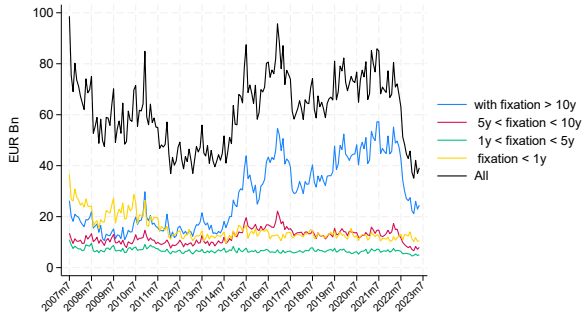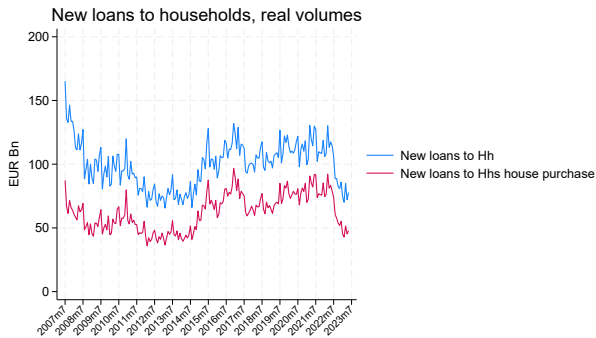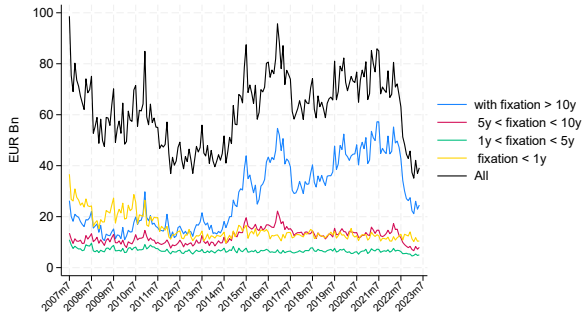
Lending Rate by Share of Fixed Loans
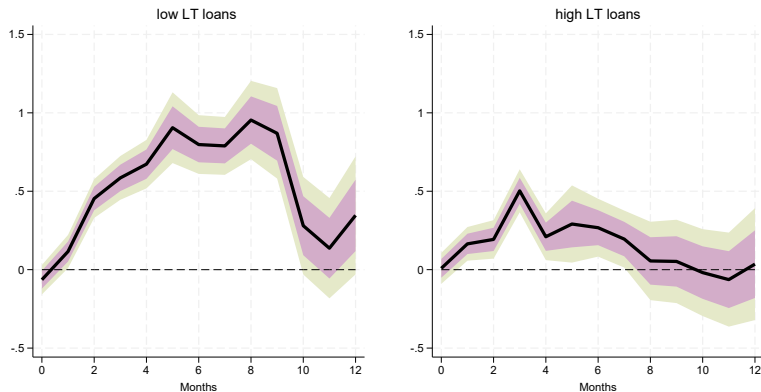
Figure: Response of lending rates to a monetary policy shock, conditioned on interest rate fixation (cut-off 1 year) of new issuances.

h=24   by asset   cut-off 5 years

Clustering Standard Errors, lending rate
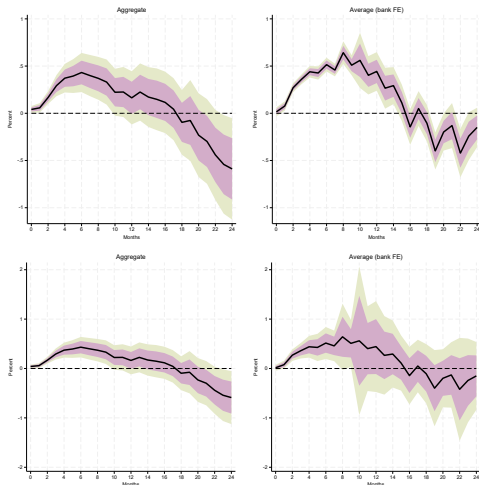
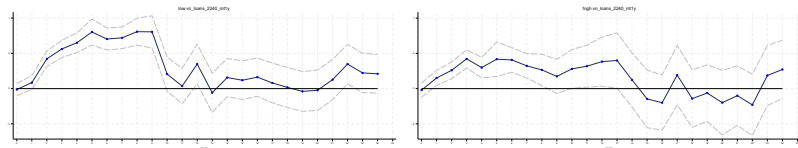Figure: Response of lending rates to a monetary policy shock. Top panel without clustering standard errors, bottom panel clustering standard errors for bank and date. back

Clustering Standard Errors, deposit rate
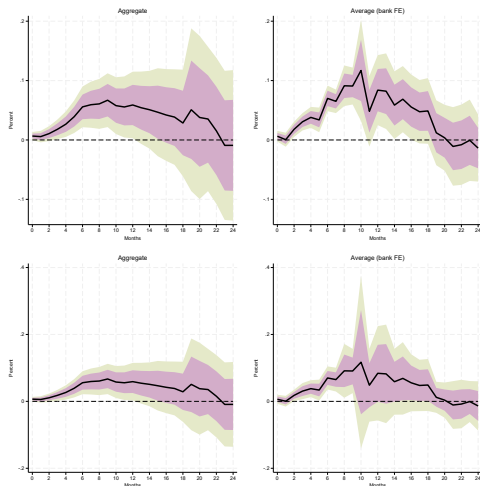
Figure: Response of deposit rates to a monetary policy shock. Top panel without clustering standard errors, bottom panel clustering standard errors for bank and date. back

Lending Rate by Funding Structure - Money Market Participation
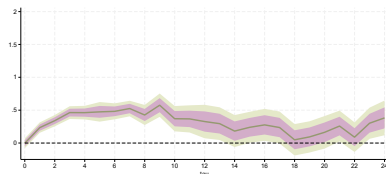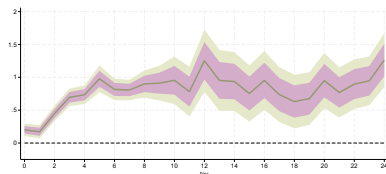
Figure: Response of lending rates to a monetary policy shock, conditioned on money market debt.

Deposit rates   Back

Lending Rate by Funding Structure - Bond Issuance
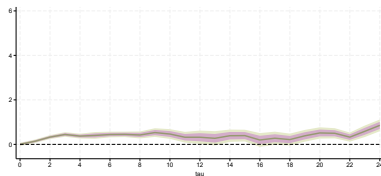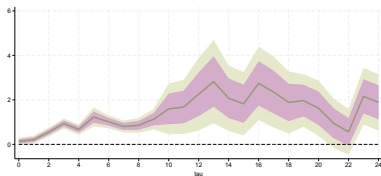
Figure: Response of lending rates to a monetary policy shock, conditioned on bond issuance.

Deposit rates   Back

Deposit Rate by Funding Structure - Money Market Participation
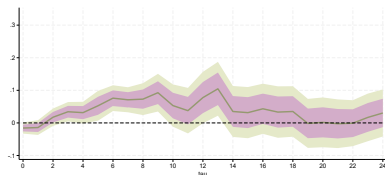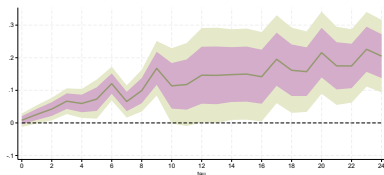
Figure: Response of deposit rates to a monetary policy shock, interacted with net money market debt as a share of total liabilities.

Back

Deposit Rate by Funding Structure - Bond Issuance
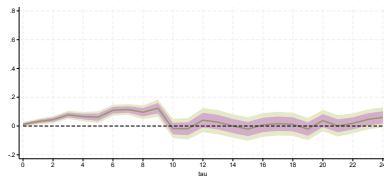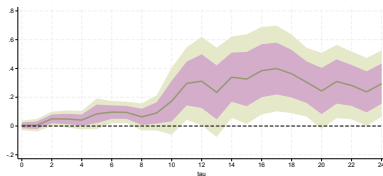
Figure: Response of deposit rates to a monetary policy shock, interacted with quartiles of bonds issued as a share of total liabilities.

Back
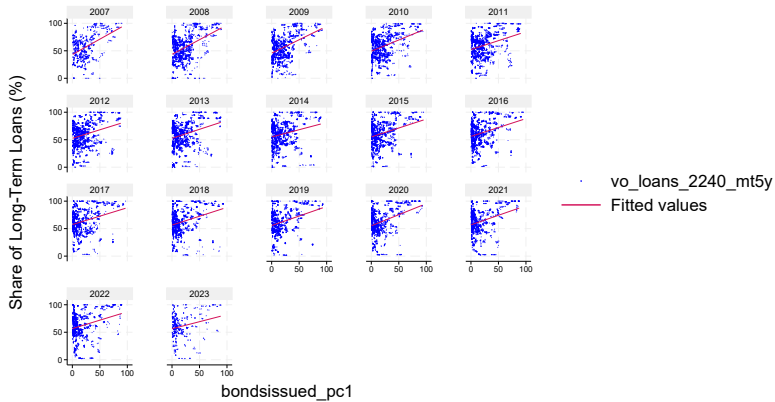
Figure

Interest Rate Fixation
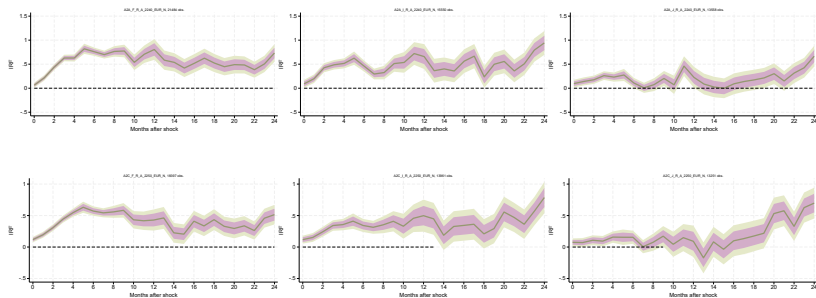
Figure: Response of lending rates to a monetary policy shock, fixed rates up to one year (lhs), between one and five years (middle) and over five years (rhs). Loans to firms in the top panels and loans to households in the bottom one.
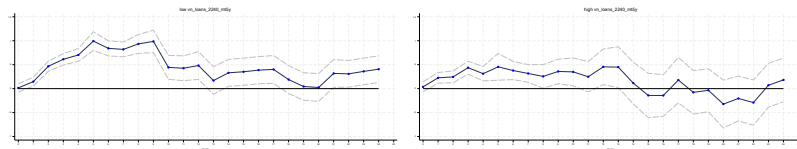
Lending Rate by share of fixed loans

Figure: Response of lending rates to a monetary policy shock, conditioned on interest rate fixation (cut-off 5 years) of new issuances.

by asset   back

Lending Rate by share of fixed loans

Figure: Response of lending rates to a monetary policy shock, conditioned on interest rate fixation (cut-off 1 year) of new issuances.

by asset   back

Aggregate vs avgerage effect

- Fixed effect specification for the average effect $\beta^{(Y,h)}$

$$Y_{i,t+h} = \alpha_i + \beta^{(Y,h)} R_t + \Gamma X_{t-1} + \varepsilon_{i,t+h}^{(Y)}.$$

- Average effect from bank-level data is very close to the estimates with aggregate data
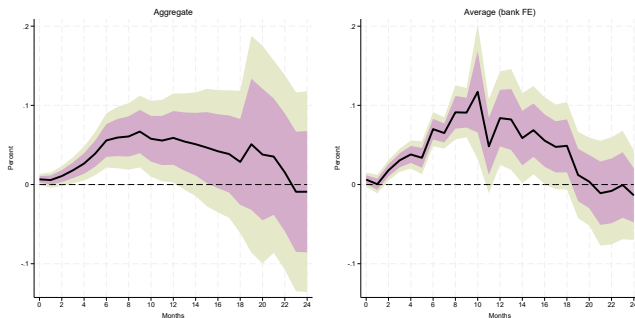
Figure: Response of deposit rates to a monetary policy shock. clustering loans

Pass-through to firms' lending rates
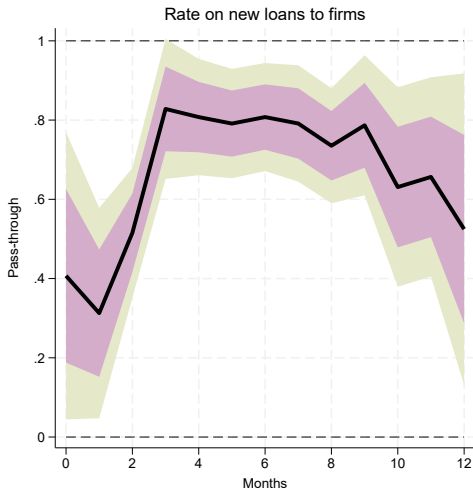
Figure: Interest rate pass-through from the policy rate to firms' lending rate following a monetary policy shock. $PT_h^{(Y,R,Z)} = IRF_h^{(Y,R,Z)}/IRF_h^{(R,R,Z)}$. back

Pass-through to households' lending rates
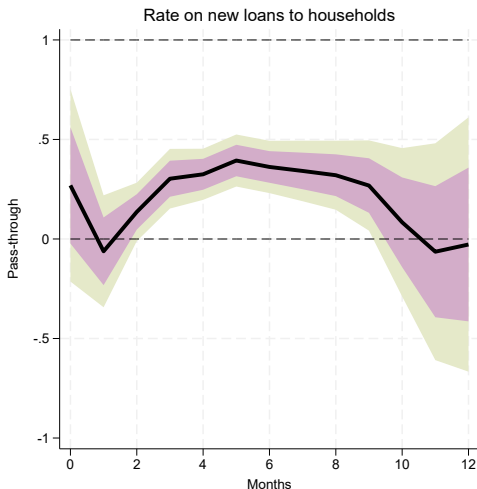
Figure: Interest rate pass-through from the policy rate to household lending rate following a monetary policy shock. $PT_h^{(Y,R,Z)} = IRF_h^{(Y,R,Z)}/IRF_h^{(R,R,Z)}$.
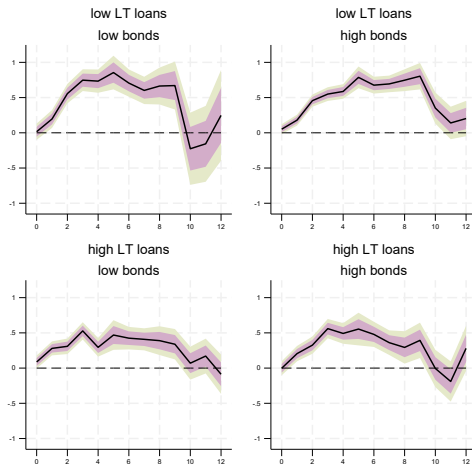
Pass-through to firms' deposit rates
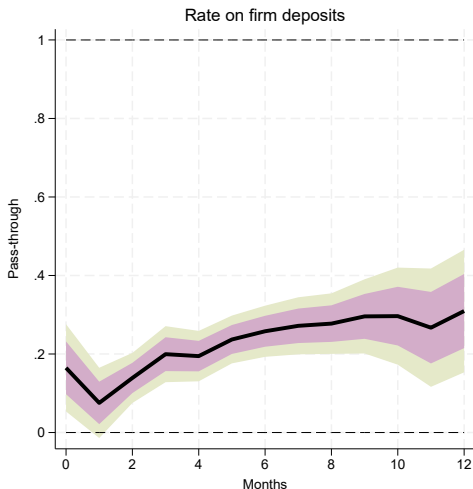
Figure: Interest rate pass-through from the policy rate to firms' deposit rate following a monetary policy shock. $PT_h^{(Y,R,Z)} = IRF_h^{(Y,R,Z)}/IRF_h^{(R,R,Z)}$.

Pass-through to households' deposit rate
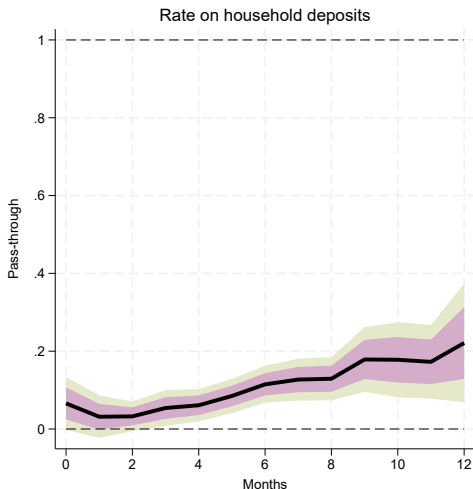
Figure: Interest rate pass-through from the policy rate to household deposit rate following a monetary policy shock. $PT_h^{(Y,R,Z)} = IRF_h^{(Y,R,Z)}/IRF_h^{(R,R,Z)}$.

Long-term oriented banks transmit less (balanced panel)
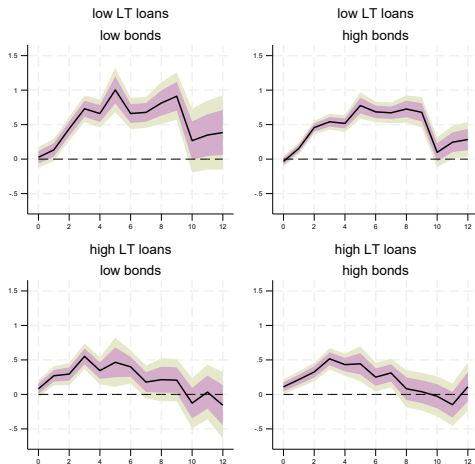
Figure: Long term assets vs liabilities above and below the median. Estimates from the balanced sample of 106 banks. (back)

Long-term oriented banks transmit less (fixed groups)

Figure: Long term assets vs liabilities above and below the median. Estimates from the full sample, assigning banks to groups based on the average characteristics through time. back
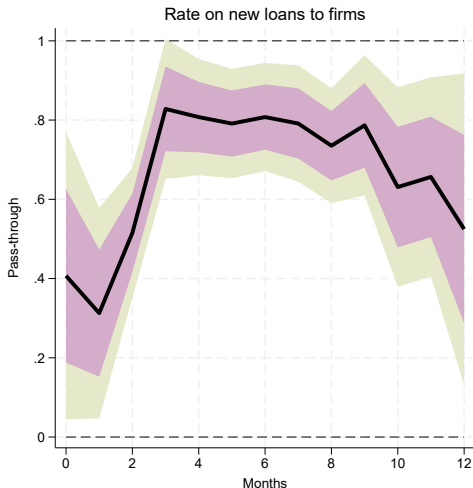
Aggregate responses
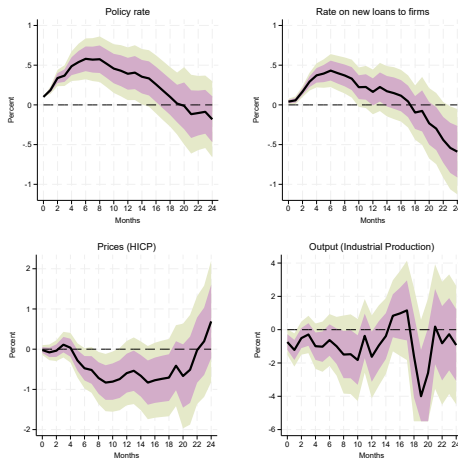
Figure: Response to a monetary policy shock. The shaded areas represent 68% and 90% confidence bands. Pass-Through Back

Pass-through for lending rates to firms

Figure: Interest rate pass-through of a monetary policy shock from the policy rate to lending rate. $PT_h^{(Y,R,Z)} = IRF_h^{(Y,R,Z)}/IRF_h^{(R,R,Z)}$ Deposits Back
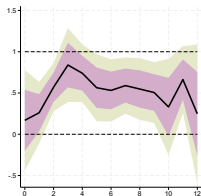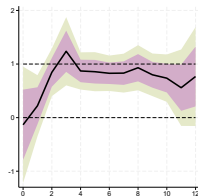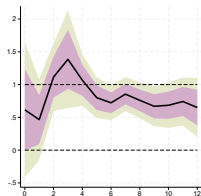
Pass-through by country

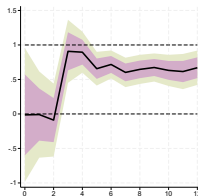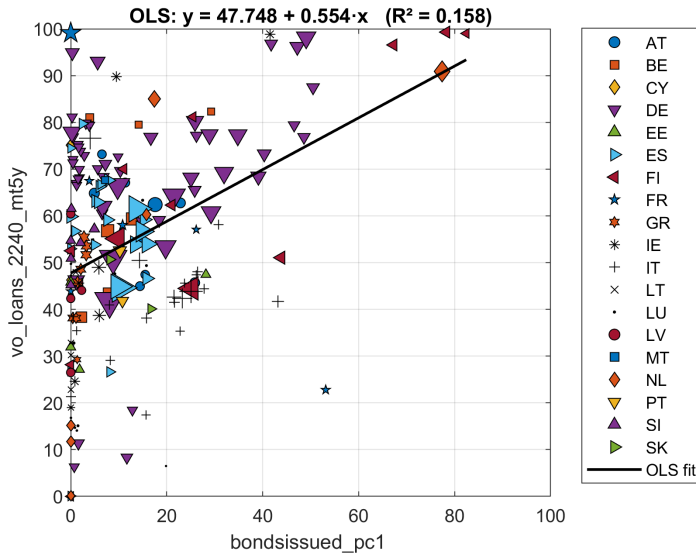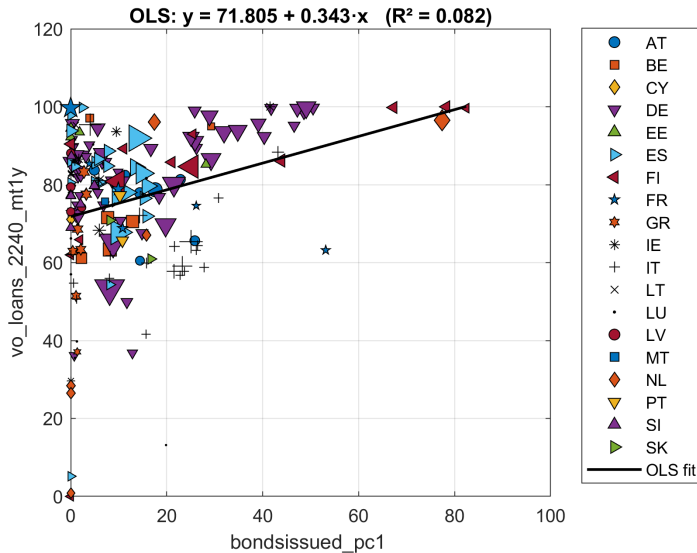
Figure: Germany

Figure: Italy

Figure: Spain

Figure: France

Long term assets vs liabilities ●

Long term assets vs liabilities ●

OLS: y = 71.805 + 0.343·x   (R² = 0.082)

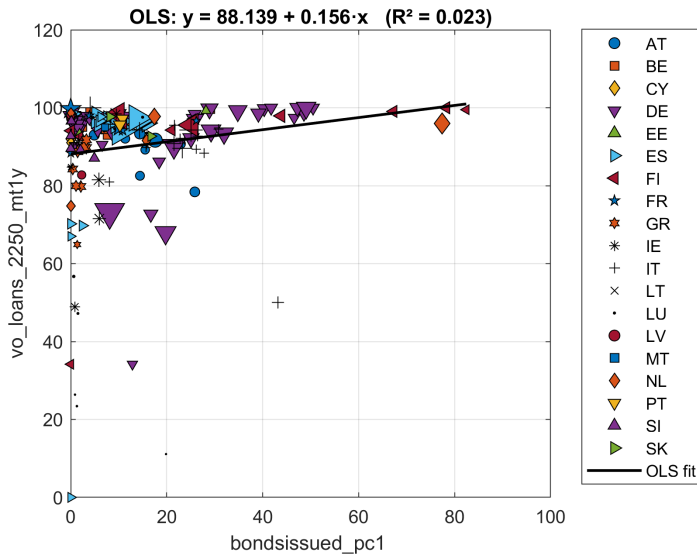# Long term assets vs liabilities ●
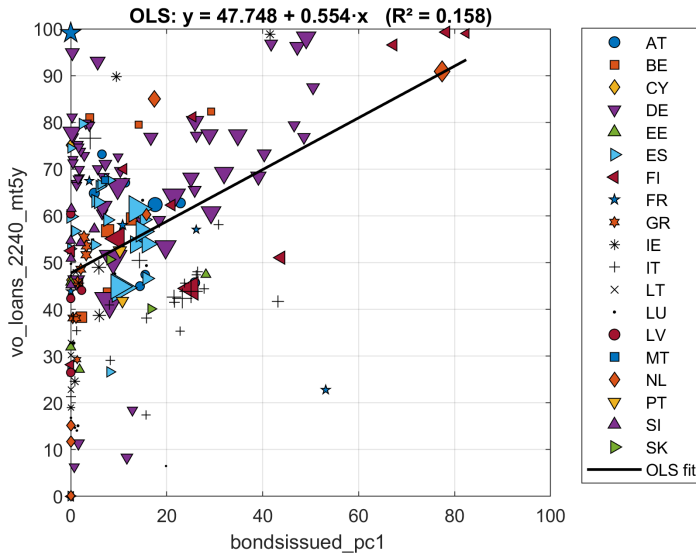
Long term assets vs liabilities ●
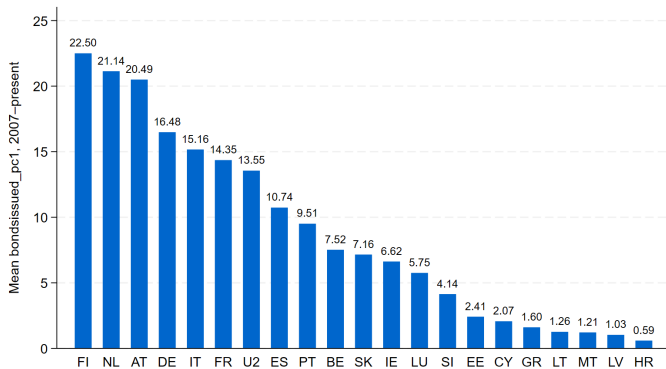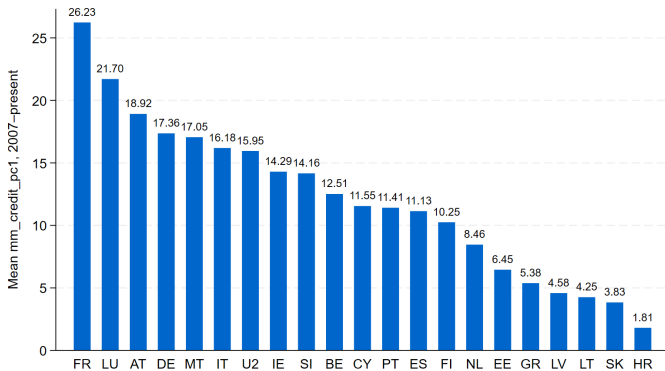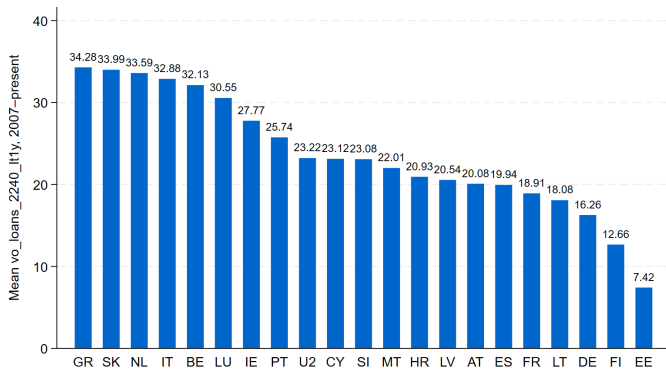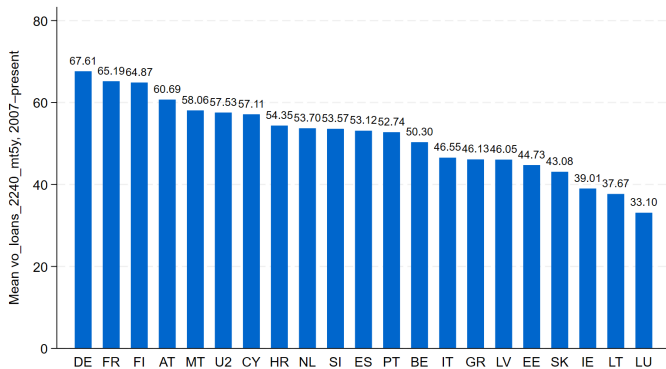
Cost channel, Ravenna and Walsh (2006)

- Households saving problem is unchanged and so the IS curve is

$$x_t = \mathbb{E}_t x_{t+1} - \frac{1}{\sigma}\left(\hat{i}_t - \mathbb{E}_t \pi_{t+1}\right) + u_t, \qquad (1)$$

- While since firms borrow to pay wages in advance, the interest rate enters the marginal costs and the Phillips curve

$$\pi_t = \beta \mathbb{E}_t \pi_{t+1} + \kappa(\sigma + \eta)x_t + \kappa \hat{i}_t, \qquad (2)$$

- This way **monetary policy transmits through both** deposits and loans. back

Cost channel, Ravenna and Walsh (2006)

Adding a Taylor rule for monetary policy and defining the shocks, the economy is described by the system of equations:

$$\begin{cases} z_t &= \rho_z z_{t-1} + \varepsilon_t^z \\ x_t &= \mathbb{E}_t x_{t+1} - \frac{1}{\sigma}\left(\hat{i}_t - \mathbb{E}_t \pi_{t+1}\right) + u_t \\ \pi_t &= \beta \mathbb{E}_t \pi_{t+1} + \kappa(\sigma + \eta)x_t + \kappa \hat{i}_t \\ \hat{i}_t &= \rho_i \hat{i}_{t-1} + \delta_x x_t + \delta_\pi \pi_t + z_t \end{cases} \tag{3}$$

With $u_t = \mathbb{E}_t Y_{t+1}^f - Y_t^f = \frac{1+\eta}{\sigma+\eta}(\rho_z - 1)z_t$ and $k = (1 - \beta\omega)\frac{1-\omega}{\omega}$.

Sticky rates

Banks are monopolistically competitive, with a degree of substitutability θ.

- Households deposit $D_t = \left[\int_0^1 d_{j,t}^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}}$ at gross interest rate $R_t^D \equiv \left[\int_0^1 r_{j,t}^{D\ 1-\theta} \right]^{\frac{1}{1-\theta}}$,

- Firms borrow $L_t = \left[\int_0^1 l_{j,t}^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}}$ at gross interest rate $R_t^L \equiv \left[\int_0^1 r_{j,t}^{L\ 1-\theta} \right]^{\frac{1}{1-\theta}}$,

- Bank-specific demand is $d_{j,t} = \left(r_{j,t}^D / R_t^D \right)^{-\theta} D_t$ and $l_{j,t} = \left(r_{j,t}^L / R_t^L \right)^{-\theta} L_t$.

The financial intermediary's problem

Banks can borrow from the central bank and, subject to the demand schedule, set the lending rate to maximise profits as:

$$\max_{\{r^L_{j,t}\}} \mathbb{E}_t \sum_{i=0}^{\infty} \omega_L^i \Delta_{i,t+i} \frac{1}{P_{t+i}} \left(r^L_{j,t} l_{j,t+i} - r^D_{j,t+i} d_{j,t+i} - i_{t+i}(l_{j,t+i} - d_{j,t+i}) \right), \tag{4}$$

With solution:

$$r^{L*}_{j,t} = \frac{\theta}{\theta - 1} \frac{\mathbb{E}_t \sum_{i=0}^{\infty} \omega_L^i \Delta_{i,t+i} i_{t+i} R^L_{t+i}{}^\theta L_{t+i}/P_{t+i}}{\mathbb{E}_t \sum_{i=0}^{\infty} \omega_L^i \Delta_{i,t+i} R^L_{t+i}{}^\theta L_{t+i}/P_{t+i}}, \tag{5}$$

And equivalently for the deposit rate.

The financial intermediary's problem

Considering the aggregate rate indexes in deviations from the steady state:

$$\begin{cases} \hat{R^L}_t & = \frac{1}{1+k_L+\beta}\left(\hat{R^L}_{t-1} + k_L\hat{i}_t + \beta\mathbb{E}_t\hat{R^L}_{t+1}\right) \\ \hat{R^D}_t & = \frac{1}{1+k_D+\beta}\left(\hat{R^D}_{t-1} + k_D\hat{i}_t + \beta\mathbb{E}_t\hat{R^D}_{t+1}\right) \end{cases} \tag{6}$$

Pass-through
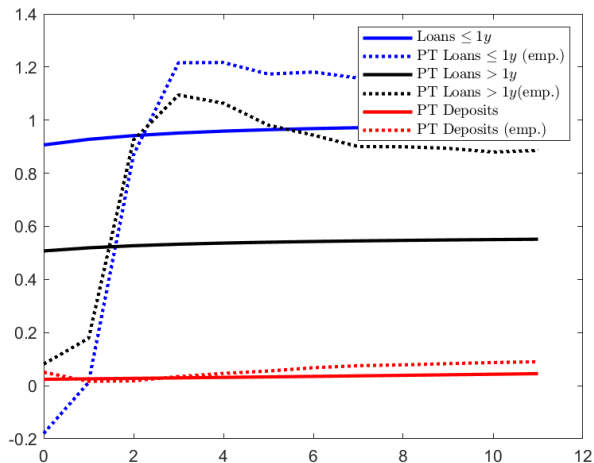
Figure: Pass-through as ratio of impulse response functions from the data and from the model IRF

Model with Fixed-Rate Loans

Loans with geometrically decaying payments as in Greenwald (2016)

$$
\begin{cases}
z_t & = \rho_z z_{t-1} + \varepsilon_t^z \\
x_t & = \mathbb{E}_t x_{t+1} - \frac{1}{\sigma}\left(\hat{R}^D_t - \mathbb{E}_t \pi_{t+1} \right) + u_t \\
\pi_t & = \beta \mathbb{E}_t \pi_{t+1} + \kappa(\sigma + \eta)x_t + \kappa \hat{R}^L_t \\
\hat{R}^L_t & = \frac{1}{1+k_L+\beta}\left(\hat{R}^L_{t-1} + \left(\hat{i}_t - \sigma \hat{C}_t - \hat{\psi}_t \right) + \beta \mathbb{E}_t \hat{R}^L_{t+1} \right) \\
\hat{\psi}_t & = -\sigma(1-\phi\beta)\hat{C}_t - \phi\beta \mathbb{E}_t \pi_{t+1} + \phi\beta \mathbb{E}_t \hat{\psi}_{t+1} \\
\hat{R}^D_t & = \frac{1}{1+k_D+\beta}\left(\hat{R}^D_{t-1} + k_D \hat{i}_t + \beta \mathbb{E}_t \hat{R}^D_{t+1} \right) \\
\hat{i}_t & = \rho_i \hat{i}_{t-1} + \delta_x x_t + \delta_\pi \pi_t + z_t
\end{cases}
\tag{7}
$$

With $k = (1-\beta\theta)(1-\theta)/\theta$, and $\phi = 1 - 1/\tau$. Back

Calibration

	Initial value	Range min	Range max	Estimate
β	0.976836195	0.8	0.99	0.99
σ	2.5	1	2.5	2.5
η	2.175515673	1	10	2.224745587
ω	0.981800861	0.2	0.99	0.980885177
ω^D	0.980765695	0	0.99	0.981208663
ρ^I	0.9	0.7	0.9	0.9
δ_π	1.366333435	1.01	5	1.518657871
δ_x	0.99	0.01	0.99	0.99
σ^v	0.002282017	0.00001	1	0.002347975
ρ^v	0.917096843	0	0.99	0.923575676
τ	12.00800731	36	60	36.0026667
ω^L	0.386095799	0	0.99	0.311732209
ρ^v	0.5	0	0.75	0.75
τ	12	1	24	12.36170543
ω^L	0	0	0.99	0.677715692

Response magnitude in the first 12 months

	Scale	JK2020 (US)	JK2020 (EA)	BS2023(EA)	GK2015(US)	I.I. VAR 2002-2023
Policy Rate	bp	10	10	10	10	10
Output	bp	-20	-30	-64	-20	-77
Prices	bp	-10	-10	-20	-5	-25

		JK2020 (US)	JK2020 (EA)	BS2023(EA)	GK2015(US)	I.I. VAR 2002-2023
Policy Rate	%	0.1	0.1	0.1	0.1	0.1
Output	%	-0.2	-0.3	-0.64	-0.2	-0.77
Prices	%	-0.1	-0.1	-0.2	-0.05	-0.25

back