Corporate Debt Structure, Access to Credit, and Monetary Policy

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Work in progress

Roadmap

Roadmap

Corporate bond-to-loan ratio in the US and the euro area

Sources: ECB (Quarterly Sector Accounts), Federal Reserve (Flow of Funds), authors' calculations.

Cyclicality of corporate debt structure in the euro area

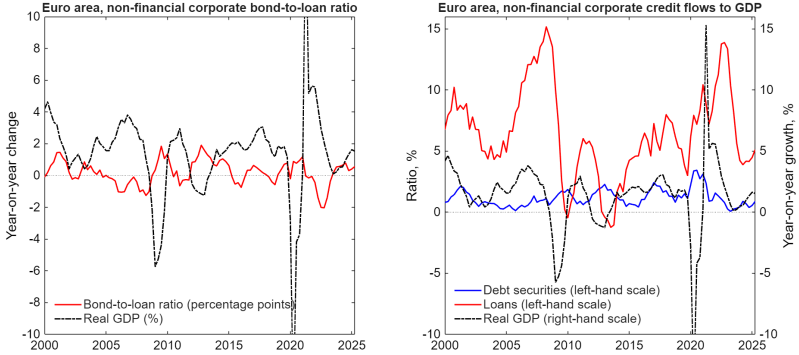

Figure: *Source:* Eurostat, ECB, authors' calculations.

$corr(\text{B/L ratio}, \text{GDP}) = -0.45$, $corr(\text{B flows}, \text{GDP}) = -0.12$, $corr(\text{L flows}, \text{GDP}) = 0.38$

Previous literature

- **Bank lending vs. broad credit channels** of MP transmission, starting with Bernanke and Gertler (1989), Kashyap and Stein (1994), Oliner and Rudebusch (1996), ...
- **Bond-loan substitution following MP shocks** in firm-level and aggregate data: Becker and Ivashina (2014), Holm-Hadulla and Thürwächter (2021), Lhuissier and Szczerbowicz (2022)
- **Aggregate dynamic models with corporate bond/loan debt structure**: De Fiore and Uhlig (2011, 2015), Verona et al. (2013), Chang et al. (2017), Zivanovic (2019)

This paper

Our contribution: a dynamic New Keynesian model with endogenous corporate debt structure with:

- **optimal debt structure:** firms' access to credit and optimal choice between direct and intermediated finance is endogenous to the state of the economy
- **bank lending channel:** bank equity matters and is not a perfect substitute for deposits or debt
- **operational bank leverage:** bank assets are subject to undiversifiable aggregate risk, which they need to absorb with their equity (covering for depositors)
- firms operate within an otherwise standard New Keynesian environment

Key takeaways

- We develop a **model that rationalizes empirical dynamics** of key variables conditional on MP shocks, obtained from a monetary SVAR model estimated on euro area data

Empirical results

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- Following a contractionary MP shock:
  - Bank loans become **more expensive** relative to bonds
  - **Rebalancing from bank loans towards bonds** by low-risk firms (intensive margin)
  - **Tighter access to bank credit** for high-risk firms (extensive margin)

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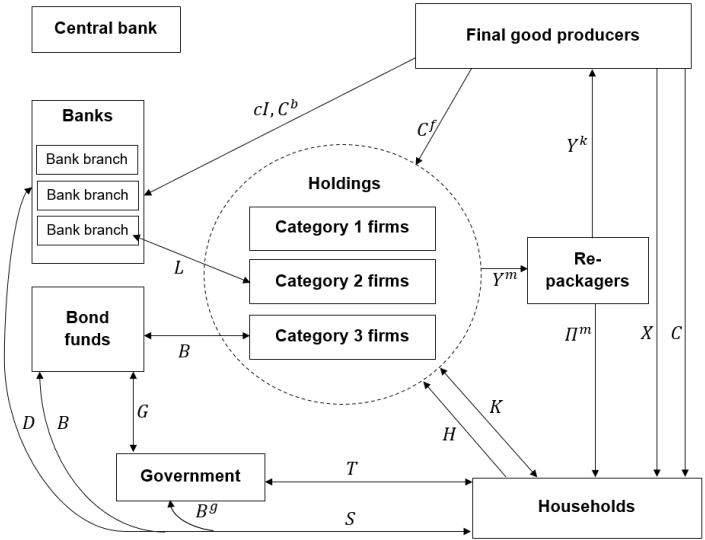
  - **Rebalancing from bank loans towards bonds** by low-risk firms (intensive margin)
  - **Tighter access to bank credit** for high-risk firms (extensive margin)
- Counterfactual analysis: **how is monetary policy transmission affected when the bond-loan ratio is higher?** (bank-based vs. bond-based economy)

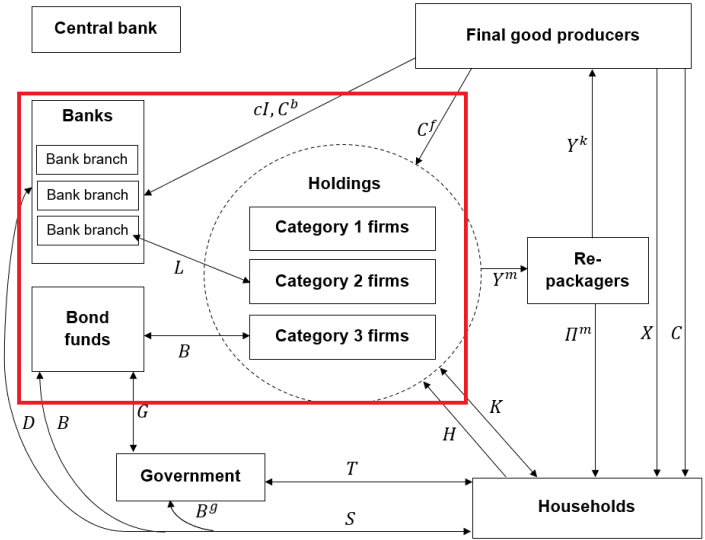
Empirical results

Roadmap

Overview of the model economy



Overview of the model economy

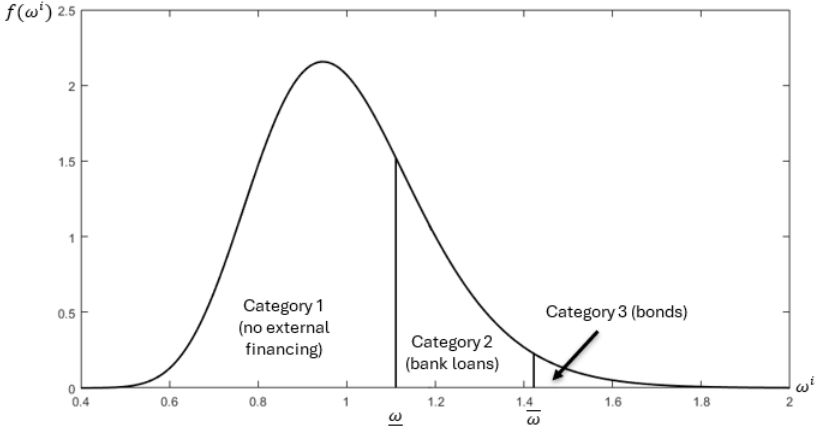


Financial frictions in the model: three key ingredients

1. Intermediate good firms face a **cash-in-advance constraint** to fund their production More
2. **Imperfectly observable idiosyncratic productivity** of borrowers *ex ante* creates default risk *ex post*, the cost of which is borne by banks More
3. Ability to raise external funding is limited by a **moral hazard problem** following Holmström and Tirole (1997); banks act as monitors and can alleviate the information friction More

Financial market equilibrium: distribution of financing mode by productivity signal

Equilibrium cut-offs: $\bar{\omega}_t = \bar{\omega}(\underset{+}{i_t}, \underset{-}{K_t^f}, \underset{-}{E_t R_{t+1}})$, $\underline{\omega}_t = \underline{\omega}(\underset{+}{i_t}, \underset{+}{i_t^b}, \underset{-}{K_t^f}, \underset{-}{E_t R_{t+1}})$

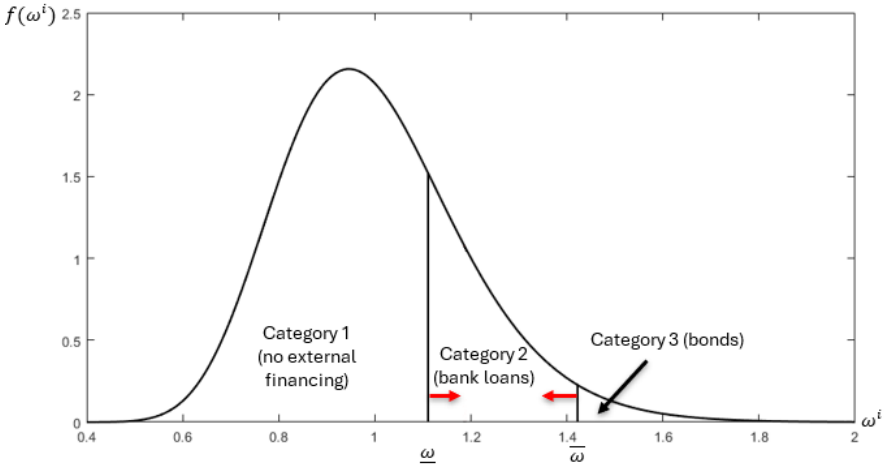


Calibration of the financial block and model fit

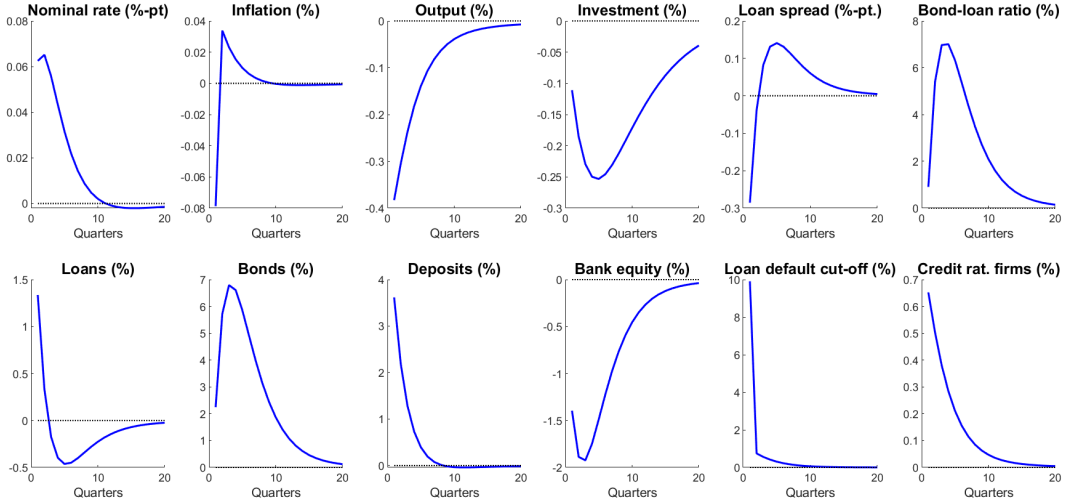
	EA	*Model*
Ratios matched directly		
NFC bond-to-loan ratio	0.12	0.12
Bank operating costs to bank assets (%)	0.34	0.34
Bank NFC loans to bank equity	2.20	2.20
Firm assets to equity	1.94	1.94
Firm net savings to equity	−0.20	−0.20
Bank return on equity (%)	1.31	1.31
Targets matched in moment matching exercise		
Default rate on bonds (%)	0.008	0.008
Default rate on loans (%)	0.18	0.19
Firm (1-) dividends to equity	0.98	0.96
Key implied ratios		
Firm return on equity (%)	5.37	4.04
Firm return on assets (%)	1.89	0.87
NFC loans to output	3.51	0.55
NFC bonds to output	0.41	0.07

Roadmap

Aggregate bond-loan substitution following MP contraction



Model simulation: a 25 bp contractionary MP shock

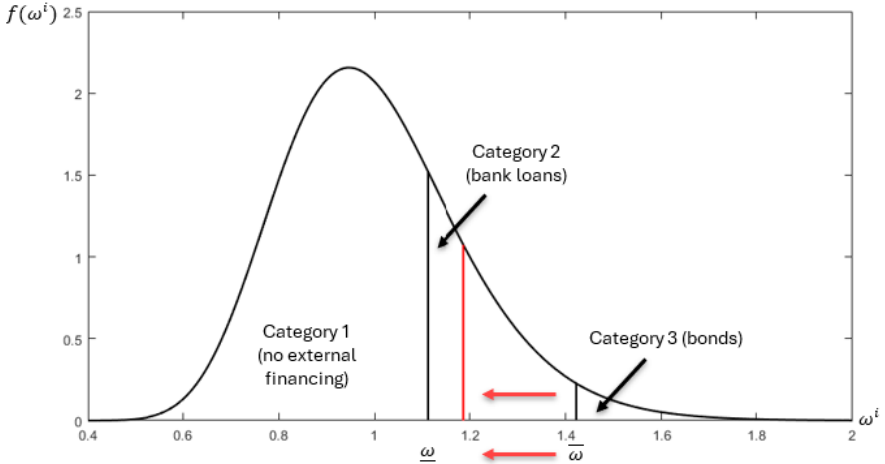


More

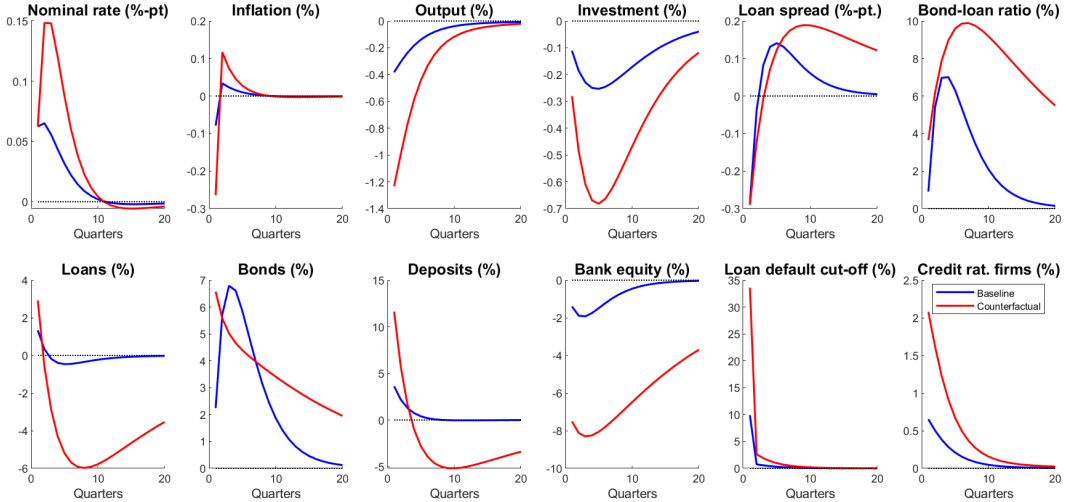
Roadmap

Counterfactual: EA with US bond-loan ratio

US counterfactual bond-to-loan ratio 1.66 (vs. EA baseline ratio 0.12) obtained by reducing b_H



Counterfactual: MP shock with higher BL ratio



Roadmap

Conclusions

- We develop a tractable New Keynesian DSGE model with **endogenous and optimal determination** of the corporate debt structure and credit access
- It allows to **rationalize the observed cyclical patterns in corporate debt** following MP shocks
- Operationalizes the **bank lending channel**, where MP contraction leads to a squeeze in bank equity and loan supply, but where some firms can switch to market finance
- Counterfactual analysis: **corporate debt structure affects MP transmission**
- Expanding access to bond finance amplifies transmission, if it makes average borrower less creditworthy (through pecking order mechanism)

Thank you!

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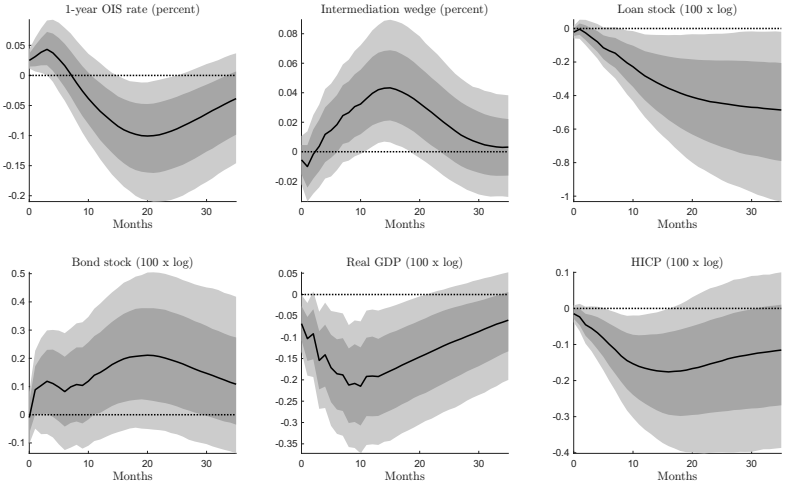
Additional slides

Aggregate evidence from the euro area: A Monetary SVAR

- A Bayesian SVAR following the approach in Jarocinski and Karadi (2020)
- Monthly data over sample 2001M1–2025M4 (omitting the initial COVID crisis period 2020M3–2020M6) with:
  - 6 macro variables: euro area real GDP, HICP, 1-year OIS rate, stock of corporate loans, stock of corporate bonds, the "intermediation wedge" (corporate loan spread – bond spread)
  - 2 high-frequency financial series: 1st principal component of changes in OIS rates at various maturities, changes in the STOXX50 index within narrow (30 min) windows around ECB monetary policy announcements

- Identify structural MP shock through:
  - **High-frequency identification**: the high-frequency surprises are only affected by the central bank announcements within the narrow time window, and not by any other shocks
  - **Sign restrictions**: following an MP shock, market interest rates and stock prices move in **opposite** directions

Aggregate dynamics following a 1SD contractionary MP shock



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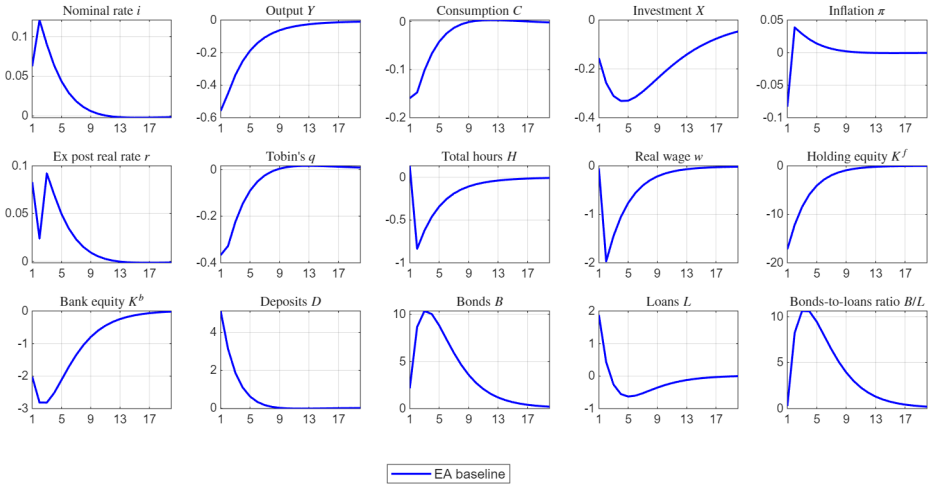
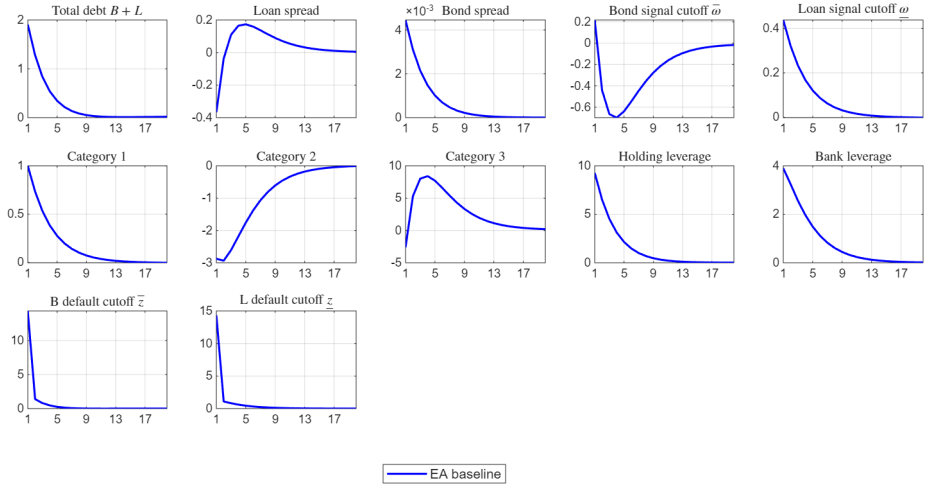
Baseline IRFs



Baseline IRFs (cntd)



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Financial frictions 1/3: External funding constraint of firms

- Intermediate good firms i are constrained by a **cash-in-advance constraint** in financing their working capital:

$$I \geq Wh^i + R^K k^i \tag{1}$$

- To produce in period $t+1$, need to raise external funding $I - K^f$ in period t using either direct market finance (bonds), I^u:

$$I \leq K^f + I^{u,i} \qquad \text{(Financing constraint B)}$$

$$z^i R \geq R^{f,i} + R^{u,i} \qquad \text{(Ex-post pie-sharing, B)}$$

- or intermediated finance (loans), $I^b + I^d$:

$$I \leq K^f + I^{b,j} + I^{d,j} \qquad \text{(Financing constraint L)}$$

$$z^j R \geq R^{f,j} + R^{b,j} + R^{d,j} \qquad \text{(Ex-post pie-sharing L)}$$

- Firms that cannot obtain any external financing remain inactive

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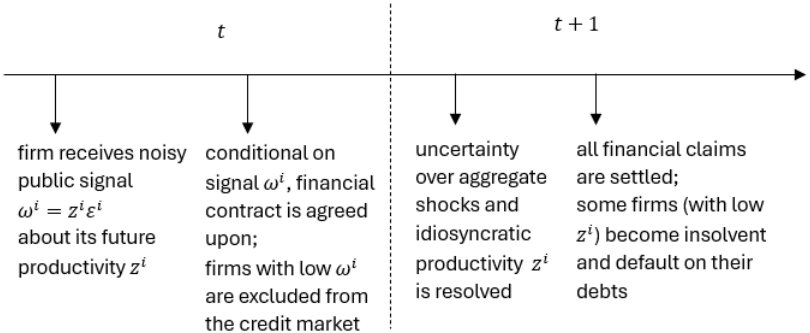
Financial friction 2/3: Noisy signals – Contract timing



Financial friction 2/3: Noisy signals – Idiosyncratic default risk

- Each firm obtains a noisy public signal about its future productivity z^i before signing the financing contract:

$$\omega^i = z^i \epsilon^i \,, \quad z^i \perp \epsilon^i \,, \quad \ln z^i \overset{i.i.d}{\sim} N\left(\mu_z, \sigma_z^2\right) \,, \quad \ln \epsilon^i \overset{i.i.d}{\sim} N\left(\mu_\epsilon, \sigma_\epsilon^2\right)$$

- Firms are protected by limited liability: $R^{f,i} \geq 0$
- Then, a debtor firm is **insolvent** and unable to repay its creditors *ex post* even though it appeared solvent *ex ante* (high signal ω^i) iff

$$z^i \leq \frac{R^{u,i}}{R} = \bar{z}^i \,, \qquad z^j \leq \frac{R^{b,j} + R^{d,j}}{R} = \underline{z}^j$$

- Unexpected losses from loan defaults are **absorbed by bank equity**; losses from bond defaults are covered by a government transfer scheme

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Financial frictions 3/3: Moral hazard – Choice of external funding mode

- Ability to raise external funding is limited by the classic double moral hazard model of Holmström and Tirole (1997), conditional on the signal ω about future productivity z
- Firms can either behave diligently (**work**) or not (**shirk**); shirking reduces the expected revenue from production by a factor $1 - \Delta$, but entails a private benefit $b_H > 0$ to the firm

- Banks are able to **monitor** firms they lend to at a non-verifiable cost $cI > 0$; this reduces the private benefit from b_H to b_L
- Banks need their own equity stake in the loan to convince depositors that they will monitor the firms

Financial frictions 3/3: Moral hazard – Banks as monitors

- Firms borrowing from banks are monitored; this reduces the private benefit from b_H to b_L
- Banks bear non-verifiable monitoring cost $cI > 0$
- Banks need their own equity stake in loan to convince depositors that they will monitor the firms
- Because monitoring is costly, loan rates are higher than bond rates

Financial frictions 3/3: Moral hazard – Incentive compatibility

- Non-monitored (direct) finance:

$$E_t \int_{\underline{z}^i}^{\infty} R^{f,i} \, \mathrm{d}F_{z|\omega}\left(z^i|\omega^i\right) \geq (1-\Delta) \, E_t \int_{\underline{z}^i}^{\infty} R^{f,i} \, \mathrm{d}F_{z|\omega}\left(z^i|\omega^i\right) + b_H I \, (1+i) \qquad \text{(Firm IC)}$$

$$E_t \int_{\underline{z}^i}^{\infty} R^{u,i} \, \mathrm{d}F_{z|\omega}\left(z^i|\omega^i\right) \geq (1+i) \, I^{u,i} \qquad \text{(Investor PC)}$$

- Monitored (intermediated) finance:

$$E_t \int_{\underline{z}^j}^{\infty} R^{f,j} \, \mathrm{d}F_{z|\omega}\left(z^j|\omega^j\right) \geq (1-\Delta) \, E_t \int_{\underline{z}^j}^{\infty} R^{f,j} \, \mathrm{d}F_{z|\omega}\left(z^j|\omega^j\right) + b_L I \, (1+i) \qquad \text{(Firm IC)}$$

$$E_t \int_{\underline{z}^j}^{\infty} \left(R^{b,j} + R^{d,j}\right) \mathrm{d}F_{z|\omega}\left(z^j|\omega^j\right) - cI \, (1+i) - R^{d,j}$$

$$\geq (1-\Delta) \left[E_t \int_{\underline{z}^j}^{\infty} \left(R^{b,j} + R^{d,j}\right) \mathrm{d}F_{z|\omega}\left(z^j|\omega^j\right) - R^{d,j}\right] \qquad \text{(Bank IC)}$$

$$E_t \int_{\underline{z}^j}^{\infty} \left(R^{b,j} + R^{d,j}\right) \mathrm{d}F_{z|\omega}\left(z^j|\omega^j\right) - R^{d,j} \geq \left(1 + i^{b,j}\right) I^{b,j} \qquad \text{(Bank PC)}$$

$$R^{d,j} \geq (1+i) \, I^{d,j} \qquad \text{(Depositor PC)}$$

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Households

- Preferences are CRRA over consumption and labor:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{(C_t - hC_{t-1})^{1-\sigma}}{1-\sigma} - \frac{H_t^{1+\tau}}{1+\tau} \right]$$

- Real budget constraint:

$$C_t + X_t + \frac{S_t}{P_t} + \frac{T_t}{P_t} = w_t H_t + r_{t-1}^K K_{t-1} + \frac{S_{t-1}}{P_{t-1}} (1 + r_t) + \frac{\Pi_t^m}{P_t}$$

- Households have access to one period, nominally riskless debt which can be allocated in bonds B_{t+1} or bank deposits D_{t+1}. Both modes of saving yield interest r_{t+1} and are perfect substitutes from households' point of view.

Production

- Intermediate goods $y_t^{m,i}$ are produced by monopolistically-competitive firms:

$$y_t^{m,i} = z_t^i R_t = z_t^i A_t \left(k_{t-1}^i\right)^{\alpha} \left(h_t^i\right)^{1-\alpha}$$

  subject to the (real) working capital constraint $\frac{I}{P_t} \geq w_t h_t^i + r_t^K k_{t-1}^i$
- Monopolistically competitive re-packagers buy homogeneous intermediate goods from solvent intermediate good producers. They costlessly differentiate these into varieties y_t^k, and set prices p_t^k for their variety according to the Calvo pricing mechanism.
- Final goods producers purchase varieties y_t^k and combine them into a homogeneous final good y_t using a CES aggregation technology:

$$y_t = \left[\int_0^1 \left\{y_t^k\right\}^{\frac{\theta-1}{\theta}} \mathrm{d}k\right]^{\frac{\theta}{\theta-1}}$$

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