Interest rates, bank liquidity and credit frictions

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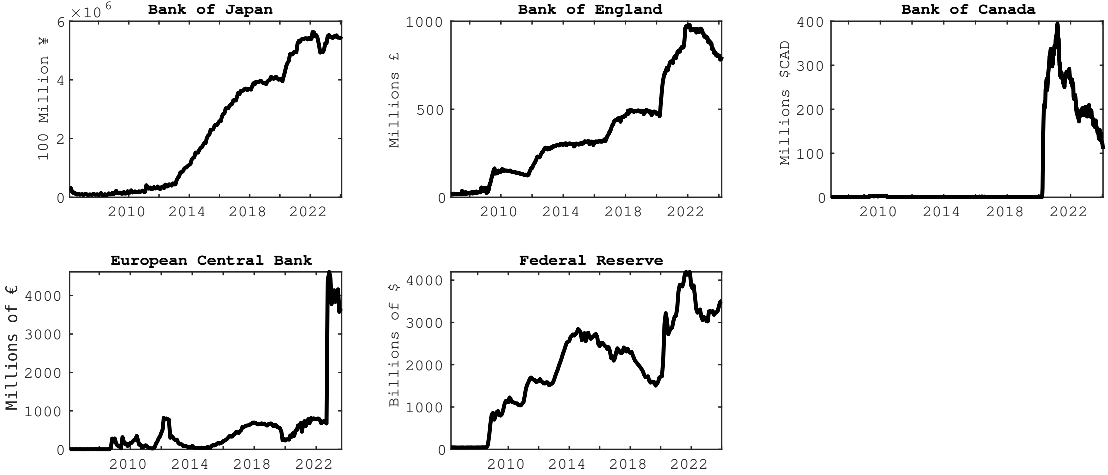
Sky-rocketing banking sector liquidity



Shows central bank reserve balances / deposit facility use

Bank liquidity and the credit channel

Increasing banking sector liquidity and UMPs have had an unclear affect on bank lending

Central banks injected huge amounts of liquidity, but banks often increase excess reserves rather than increase lending:

- 2008–2009 excess reserves in US $\uparrow$ while lending standards were tightened (source: SLOOS)
- 2010–2012 lots of liquidity in eurozone banking sector without increasing lending in stressed economies

Aim of Paper

Build a model to rationalise some of this evidence

- The ambiguous link between liquidity and lending
- Small business lending frictions

Use this to study:

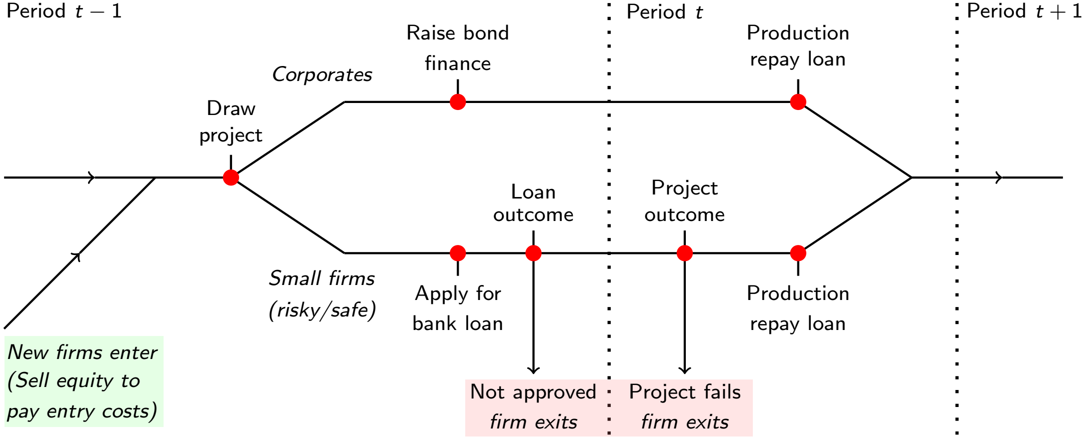
- Role of monetary policy (interest rates, interest rate corridors, and UMPs)
- Interaction between liquidity and credit frictions

Model Overview

New Keynesian (Calvo) model + frictional bank lending:

- Households are standard
- Follow Swarbrick (2023) – Stiglitz & Weiss (1981) information problem (see also, e.g., Ikeda 2020)
- Some firms have private information
- Each period draw either risky/safe projects (risk of productivity ω^i)
- Expected productivity the same $\rightarrow$ $1 = \omega_t^s = p_t \omega_t^r$
- Banks can separate borrowers using loan approval
- When risk is high, banks can ration credit and hold excess reserves (paying CB deposit rate)

Firms



Period $t-1$
Period t
Period $t+1$
Raise bond finance
Production repay loan
Corporates
Draw project
Loan outcome
Project outcome
Small firms (risky/safe)
Apply for bank loan
Production repay loan
New firms enter (Sell equity to pay entry costs)
Not approved firm exits
Project fails firm exits

Banks and lending 1/2

- Separate borrowers using loan approval
  - Abstract from collateral and loan size
  - Loan terms are repayment rate τ_t^i and approval rate x_t^i

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$$R_{t+1}^s - \tau_t^s \geq 0 \tag{1}$$

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- Risky **incentive compatibility** (IC) constraint binds

$$\underbrace{x_t^r p_{t+1}\left(R_{t+1}^r - \tau_t^r\right)}_{\text{Surplus choosing risky loan}} \geq \underbrace{x_t^s p_{t+1}\left(R_{t+1}^r - \tau_t^s\right)}_{\text{Surplus choosing safe loan}} \tag{2}$$

- The other not-always-binding IC/IR constraints imply: $x_t^r \geq x_t^s$

Banks and lending 2/2

- Consider IR and IC with no aggregate uncertainty (and using $p_t R_t^r = R_t^s$):

$$
\begin{aligned}
\tau_t^s &= R_{t+1}^s && (3)\\
x_t^r p_{t+1}\left(R_{t+1}^r - \tau_t^r\right) &= x_t^s p_{t+1}\left(R_{t+1}^r - \tau_t^s\right)\\
\Rightarrow \quad \tau_t^r &= R_{t+1}^r \underbrace{- \frac{x_t^s}{x_t^r}\left(1 - p_{t+1}\right) R_{t+1}^r}_{\text{Information rents}} && (4)
\end{aligned}
$$

Banks and lending 2/2

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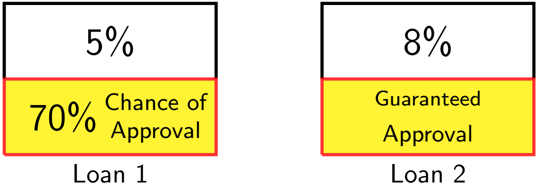
$$\tau^s_t = R^s_{t+1} \tag{3}$$

$$x^r_t p_{t+1}\left(R^r_{t+1} - \tau^r_t\right) = x^s_t p_{t+1}\left(R^r_{t+1} - \tau^s_t\right)$$

$$\Rightarrow \quad \tau^r_t = R^r_{t+1} - \frac{x^s_t}{x^r_t}\left(1 - p_{t+1}\right) R^r_{t+1} \tag{4}$$

- Illustrative numbers – safe projects 5% return, risky projects 15% *when successful*:



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- Illustrative numbers – safe projects 5% return, risky projects 15% *when successful*:

Loan 1	Loan 2
5%	↑ 8%
↓ 70% Chance of Approval	Guaranteed Approval

- When risk is high, banks can ration credit and hold excess reserves (paying CB deposit rate)

Banks first-order conditions

Solution to the problem yields:

$$\mathbb{E}_t \left[\frac{\Lambda_{t,t+1}}{\Pi_{t,t+1}} \left(p_{t+1} R^r_{t+1} - R^{opp}_t \right) \right] = \varphi^r_t \frac{1}{1-\lambda} - \psi_t \frac{1}{1-\lambda} \tag{5}$$

$$\mathbb{E}_t \left[\frac{\Lambda_{t,t+1}}{\Pi_{t,t+1}} \left(\left(\lambda + (1-\lambda) p_{t+1} \right) R^s_{t+1} - R^{opp}_t \right) \right] = \varphi^r_t - \varphi^s_t \tag{6}$$

And

$$\varphi^s_t, \varphi^r_t, \psi_t \geq 0 \tag{7}$$

$$0 \leq x^s_t \leq x^r_t \leq 1 \tag{8}$$

$$\varphi^s_t x^s_t = \varphi^r_t (1 - x^r_t) = \psi_t (x^r_t - x^s_t) = 0 \tag{9}$$

R^{opp}_t is opportunity cost of funds (depends on interbank rate, interest on reserve balances etc)

Credit rationing

Consider the equilibrium with $\varphi_t^s = 0$ ($x_t^s > 0$) and $\varphi_t^r > 0$ ($x_t^r = 1$)

- Credit rationing can occur if $\psi_t = 0$ (no pooling), so $x_t^s < 1$
- First-order conditions become

$$\psi_t = \mathbb{E}_t \left[\frac{\Lambda_{t,t+1}}{\Pi_{t,t+1}} \left(\left[\lambda - (1-\lambda)(1-p_{t+1}) \right] R_{t+1}^s - \lambda R_t^{opp} \right) \right] \geq 0 \qquad (10)$$

Credit rationing more likely if:

- More risk $\quad 1 - p_{t+1} \uparrow$
- Lower return on capital $\quad R_{t+1}^s \downarrow$
- Higher opportunity cost of funds $\quad R_t^{opp} \uparrow$

Implies thresholds beyond which banks ration credit

Monetary policy

Standard Taylor rule

$$r_t^{mro} = \bar{r} + \gamma_\pi \left(\pi_{t-1,t} - \pi^*\right) + \gamma_y \left(y_t - \bar{y}\right) \tag{12}$$

- Think of this as the central bank setting the main refinancing rate at regular full -allotment auctions
- Interest rate on HH deposits $R_t = R_t^{mro}$ in equilbrium

Central bank also has two standing facilities

- Deposit facility paying R_t^{df} (excess reserves)
- Lending facility charging R_t^{lf}

We also allow the bank to conduct QE through purchasing assets from HHs — more on this if time

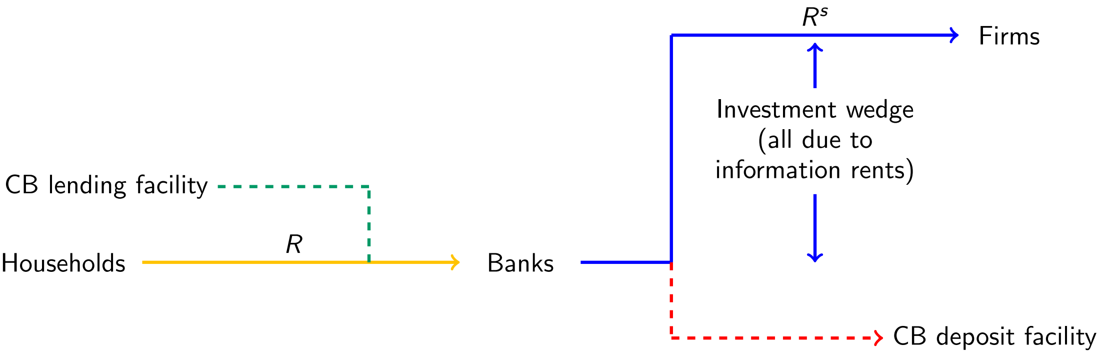
Interest rates

Benchmark – no liquidity risk, efficient financial markets

$$\text{Households} \xrightarrow{\quad R \quad} \text{Banks} \xrightarrow{\quad R^s \quad} \text{Firms}$$

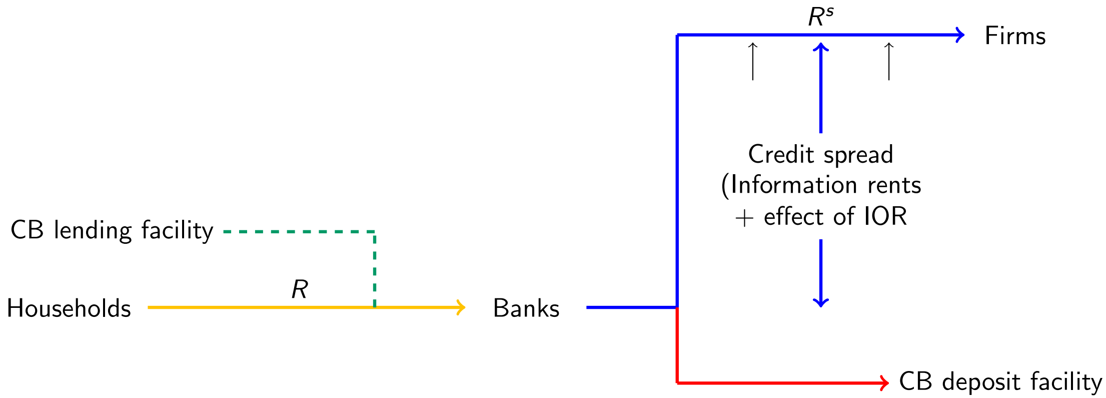
Interest rates

Benchmark – credit frictions, no liquidity risk, no excess liquidity



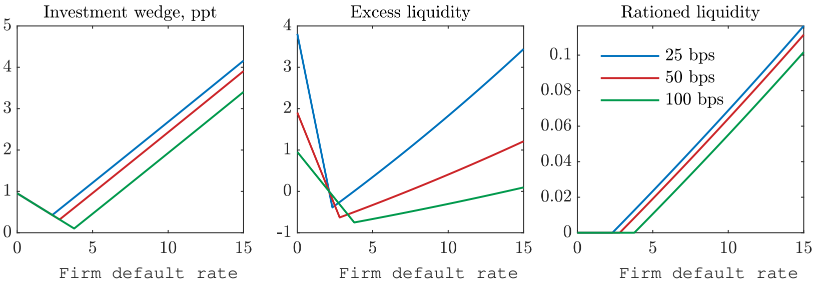
Interest rates

Benchmark – credit frictions, <u>with</u> excess liquidity, no liquidity risk



Note: interest rate corridor only matters when banks hold excess reserves

Comparative statics – role of corridor



Result: changes in interest on reserves only affect economy through the effect on credit rationing.

Constraint on lending

Quantitative Easing

Example implementation:

Central Bank

Liabilities	*Assets*

Bank

Liabilities	*Assets*
Deposits	Loans

e.g., Pension fund

Liabilities	*Assets*
Pension liabilities	Bonds

Quantitative Easing

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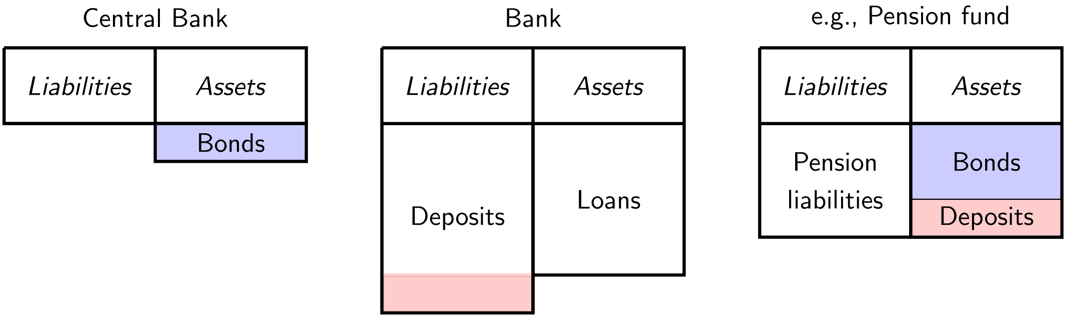

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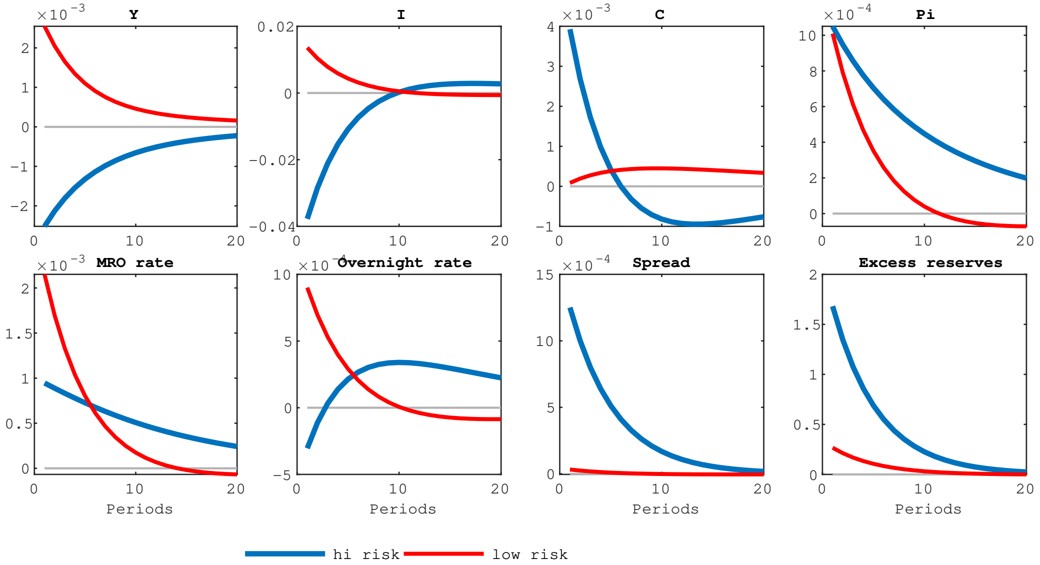
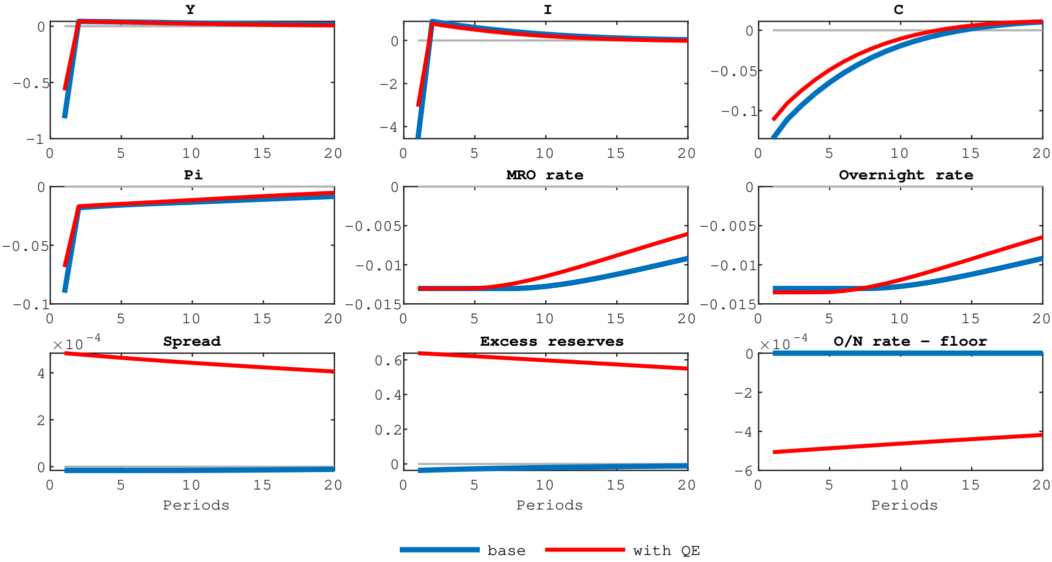
- Lowers the return on bank assets
- $\Rightarrow$ money markets only clear at a lower overnight rate
- Overnight rate moves towards the floor (interest on reserves)

QE programme -- high risk vs. low risk economy



Demand shock with/without QE -- high risk economy



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