Interest rate corridors, liquidity and credit frictions

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Monetary policy implementation has evolved since the Great Moderation

Expanded toolkit – balance sheet policies, more prominent role for forward guidance, credit easing policies etc

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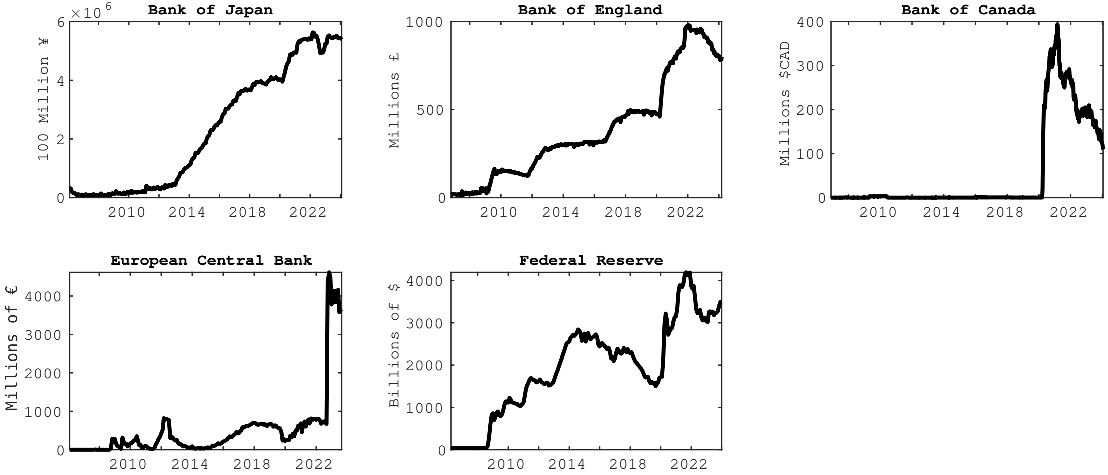
These policies contributed to a big increase in banking sector excess reserves

Banking sector reserves



This paper

- I seek to build a model with endogenous excess reserves
- To study the interaction between QE, policy corridors, and lending conditions
- To study the important trade-offs in a structural model
- To study the impact of the ZLB and the role of negative interest rates
- To explore the role of QE on bank lending
- To study optimal policy

Corridor system 1/2

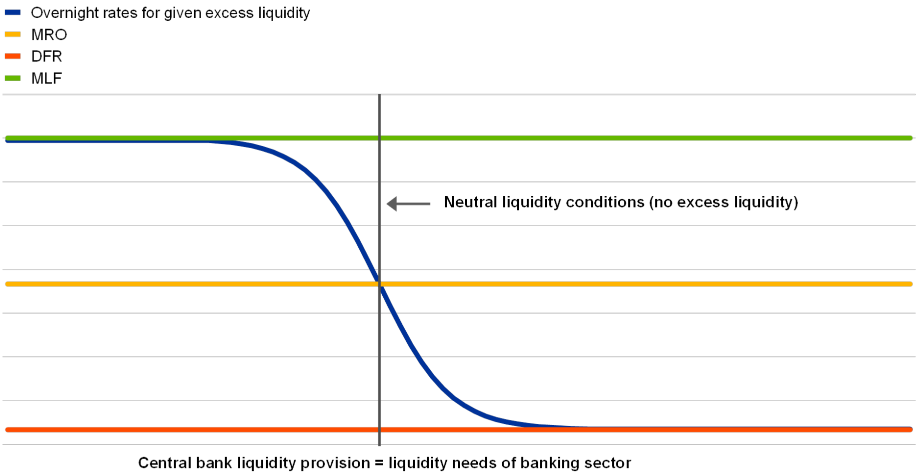
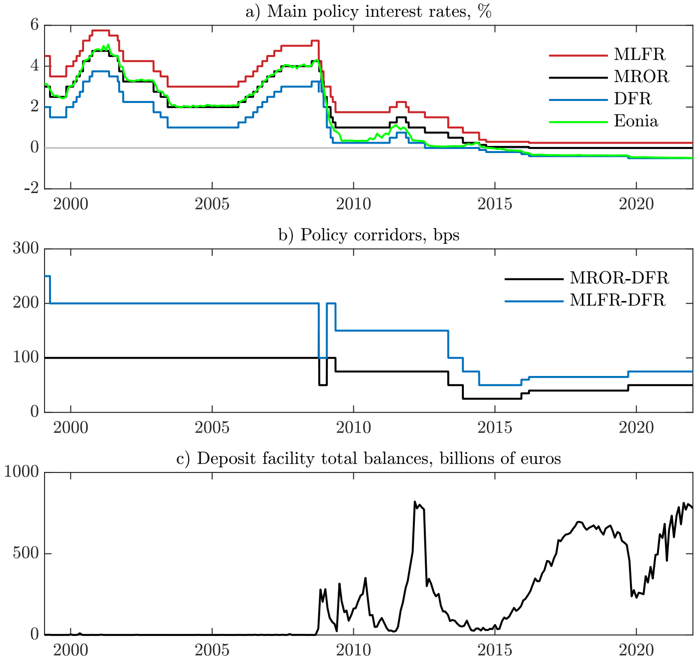


Figure: From Eisenschmidt, Kedan & Tietz (2018) (ECB Economic Bulletin 2018(5))

ECB interest rates



Corridor system 2/2

- Width of interest rate corridor to manage the volatility of overnight rate (Bindseil & Jabłecki 2011)
  - Narrow corridor → low volatility
  - Wide corridor → high interbank market volumes

- High reserve balances → floor becomes more important
  - Floor (CB deposit rate) becomes main policy interest rate
  - Deposit rate lowered to incentivize increased lending to real economy
  - Draghi (2015): "cuts in the rate on the deposit facility vastly improve the transmission of our monetary policy"

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It is very early stage – comments very welcome!

Snapshot of results: model and credit friction

New Keynesian model with:

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Main mechanism:

- Central bank deposit facility is an outside option for banks
- When adverse selection is bad (e.g., high risk), banks can ration credit
- CB deposit rate (IoR) affects incentives
- If IoR relatively high, banks ration credit more

Snapshot of results: initial results

Provisional results:

- If ZLB squeezes corridor $\rightarrow$ more credit rationing
  - additional cost of ZLB
  - importance of negative rates
- QE can be used as an additional tool
  - Can shift monetary policy towards a floor system
- Away from ZLB, two main channels:
  - lowers overnight rate compared to main policy target rate – usual demand channel expansion $\uparrow$
  - increases incentive to ration credit contraction $\downarrow$
  - Which effect dominates depends on financial conditions (firm risk)
- At the ZLB, I find QE can always help

Model Overview

New Keynesian (Calvo) model frictional bank lending:

- Follow Swarbrick (2023) – Stiglitz & Weiss (1981) information problem (see also, e.g., Ikeda 2020)
- 'Small firms' and 'large firms' (proportion exogenous, firm type random)
- Small firms all same size (need 1 unit of external finance)
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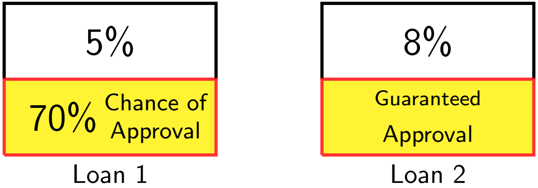

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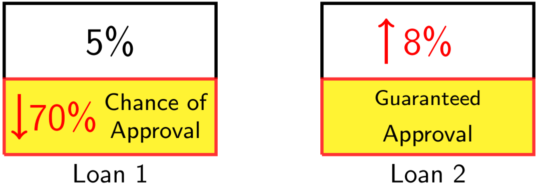
- When risk is high, banks can ration credit and hold excess reserves (paying CB deposit rate)



Banks

Using central banks liquidity and HH deposits:

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- banks post loan contracts specifying **interest rate** τ_t^i and **approval probability** x_t^i
- τ_t^i and x_t^i chosen solve:

$$\max_{\substack{x_t^s, x_t^r \\ \tau_t^s, \tau_t^r}} \mathbb{E}_t \left[\frac{\Lambda_{t,t+1}}{\Pi_{t,t+1}} \left(\lambda x_t^s \left(\tau_t^s - \boxed{R_t^*} \right) + (1-\lambda)\, x_t^r \left(p_{t+1}^r \tau_t^r - \boxed{R_t^*} \right) \right) \right] \tag{1}$$

$$\text{s.t.} \quad \text{IC \& IR constraints} \tag{2}$$

$$\lambda x_t^s + (1-\lambda)\, x_t^r \leq \bar{x}_t \tag{3}$$

$$0 \leq x_t^s \leq x_t^r \leq 1 \tag{4}$$

- IR constraint binds for safe firms (no expected profits)
- IC constraint binds for risky firms (earn expected profits to reveal type)
- IC, IR also $\Rightarrow \tau_t^r \geq \tau_t^s$, $x_t^r \geq x_t^s$
- R_t^* is opportunity cost of funds (e.g., interest on reserve balances)

Monetary policy

Standard Taylor rule

$$r_t^{mro} = \bar{r} + \gamma_\pi \left(\pi_{t-1,t} - \pi^*\right) + \gamma_y \left(y_t - \bar{y}\right) \tag{5}$$

- 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

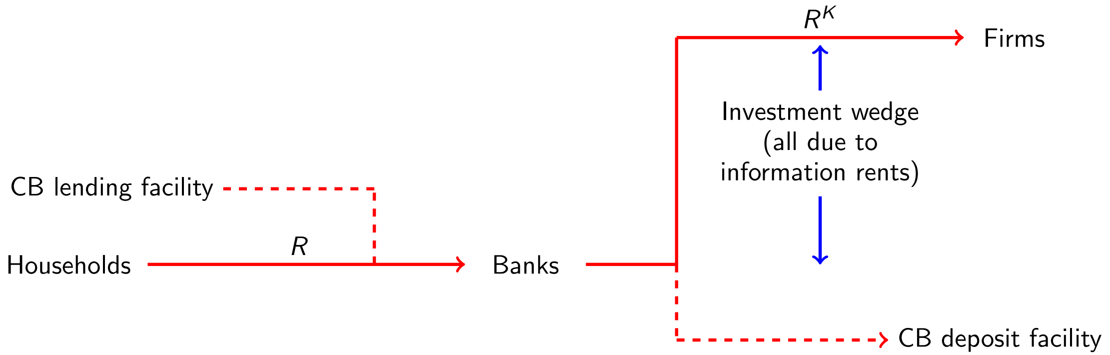
Interest rates

Benchmark – efficient financial markets

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

Interest rates

Benchmark – credit frictions, no excess liquidity



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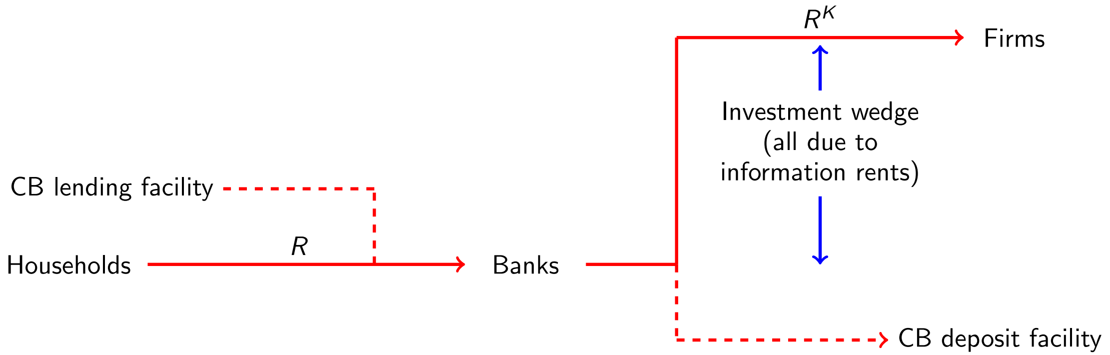
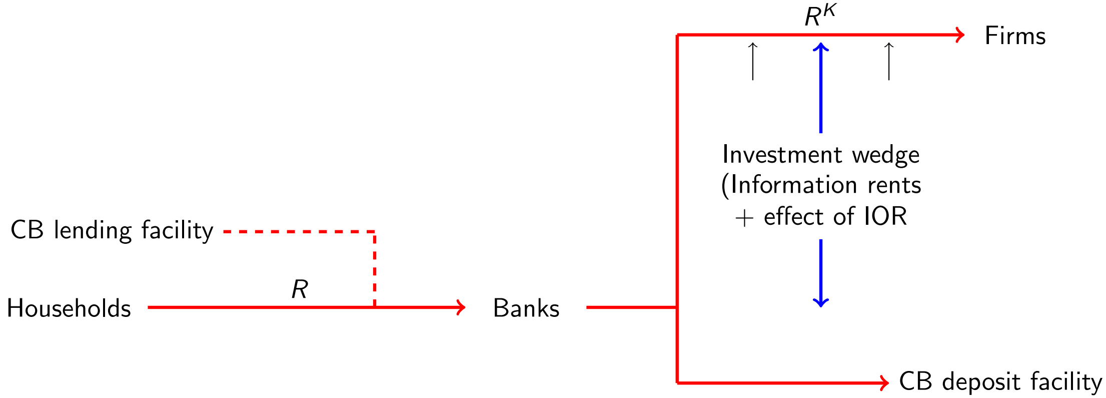


Interest rates

Benchmark – credit frictions, with excess liquidity



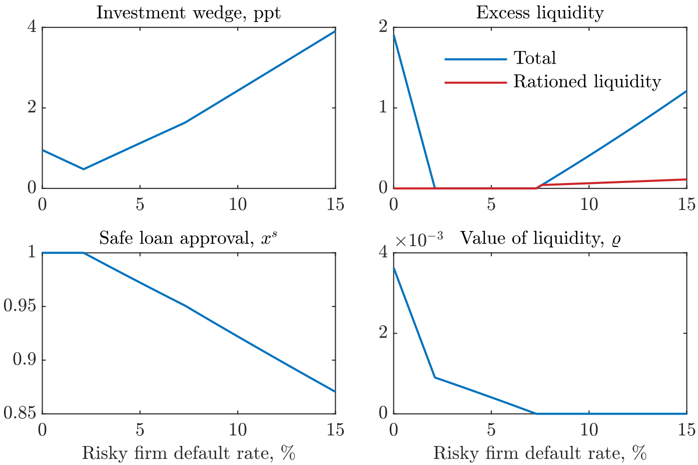
Note: interest rate corridor only matters when banks hold excess reserves

Excess liquidity can arise from two sources

1. More liquidity available than firms looking for loans at equilibrium interest rates
   - Depends on risk and entry costs
   - Lower risk $\rightarrow$ lower firm profits
   - Low profits $+$ high entry costs $=$ few firms
   - Fewer firms $\rightarrow$ less investment $\rightarrow$ higher marginal return on capital
   - Excess liquidity in banking sector and positive spread

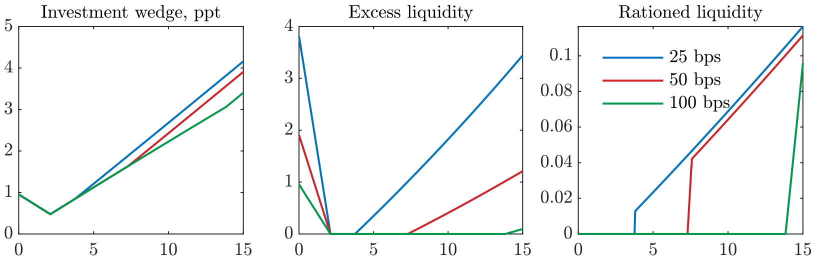
2. Banks ration credit due to high level of risk
   - To raise risky loan interest rates, banks must lower approval of safe loans
   - I.e., cannot only tighten standards on high-interest rate loans
   - Safe borrowers rationed
   - Banks hold excess reserves instead

Comparative statics – effect of risk



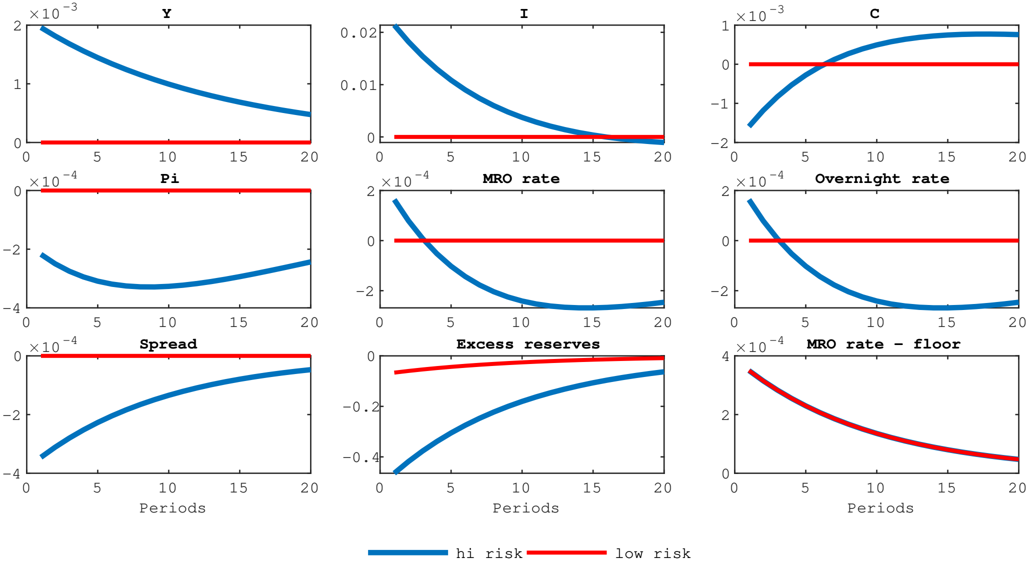
Result: large region with no excess reserves – the interest rate corridor has no role

Comparative statics – role of corridor



Result: changes in deposit rate only affect economy through the effect on credit rationing.

Temporary widening of corridor



Note: shows deviations from SS % or ppt (inflation/interest rates). Excess reserves are reserves/loans ratio

Quantitative Easing

The equilibrium interest rate depends on the volume of banking sector liquidity

- Suppose the CB purchases assets from HHs or injects bank liquidity directly
- Banks will take liquidity as long as expected return = expected funding cost
- Expected bank return (L_t is loans, S_t is Assets = loans + reserves):

$$1 = \mathbb{E}_t \left[\frac{\Lambda_{t,t+1}}{\Pi_{t,t+1}} \left(\underbrace{\left[\lambda x_t^s + (1-\lambda)\left(1 - (1 - p_{t+1}) x_t^s\right) \right] R_t^s \frac{L_t}{S_t}}_{\text{Return on lending}} + \underbrace{\left(1 - \left(\lambda x_t^s + (1-\lambda)\right) \frac{L_t}{S_t}\right) R_t^*}_{\text{Return on reserves}} \right) \right]$$

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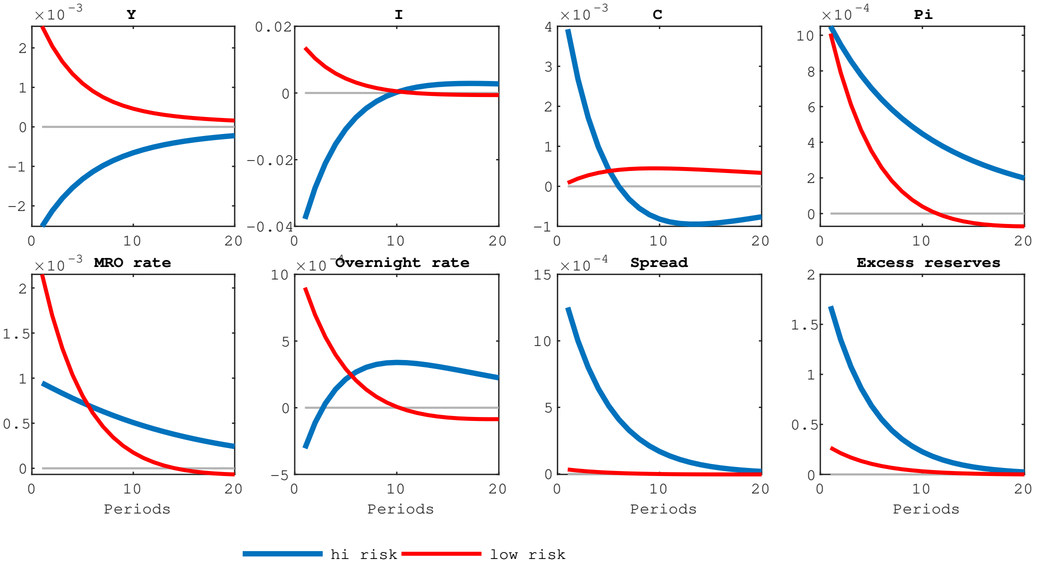
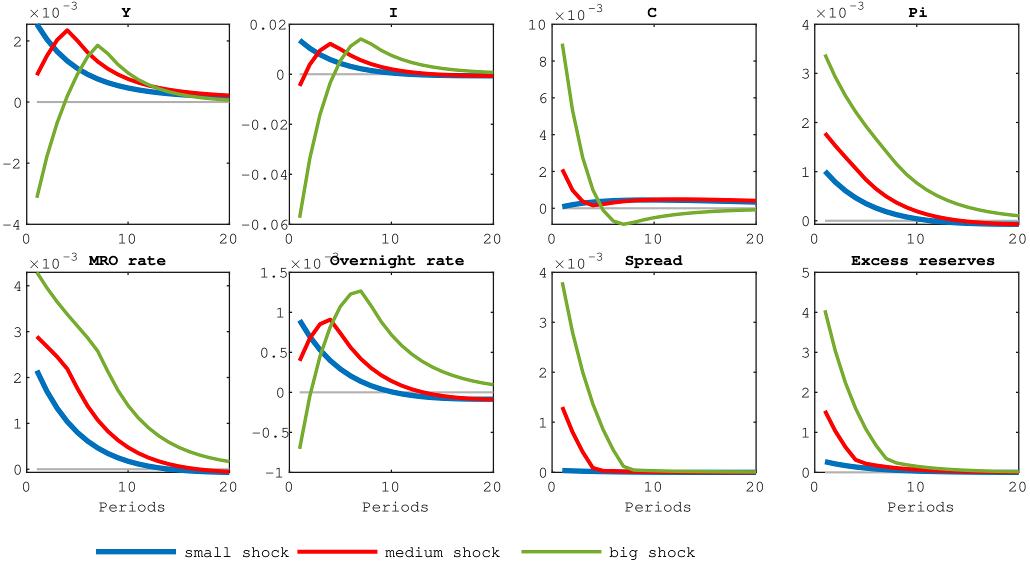
Two competing effects

- With lower interest rates, banks pass on to more favourable lending conditions: lending $\uparrow$
- As equilibrium interest rate $\downarrow$ but CB deposit rate unchanged, incentive to ration credit: lending $\downarrow$

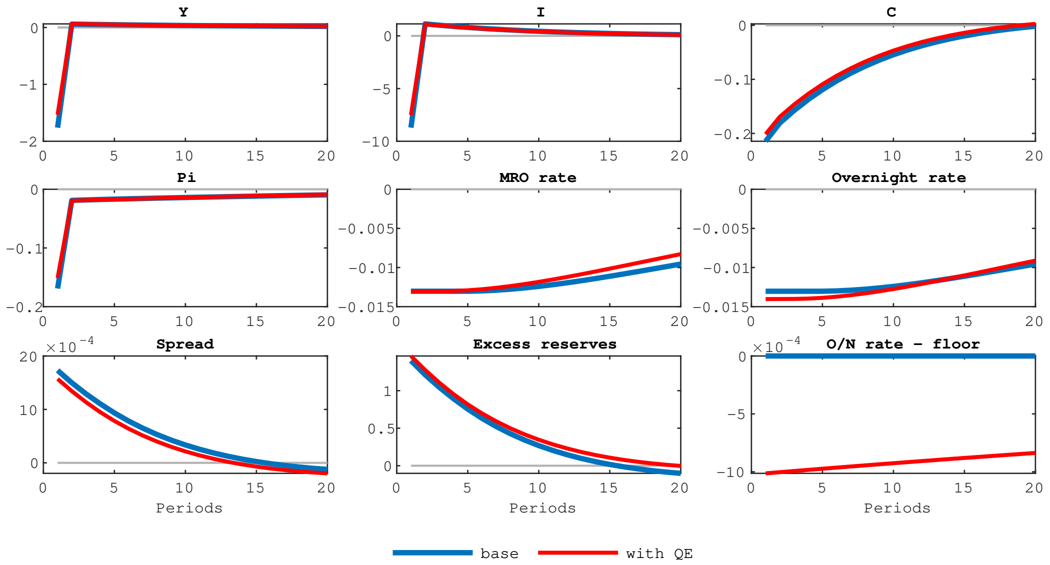
QE programme -- high risk vs. low risk economy



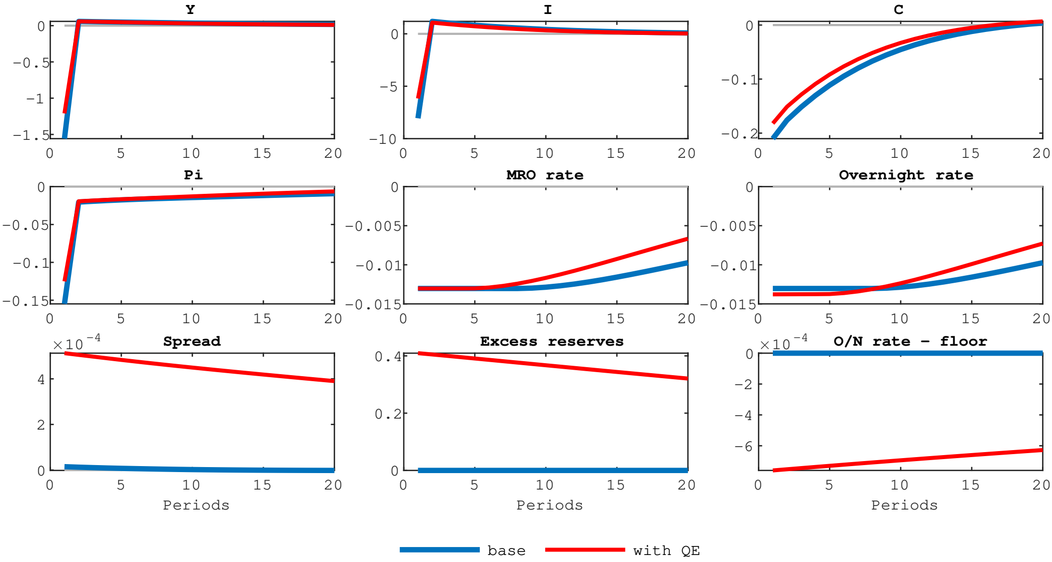
QE -- low risk economy, programme size effect



Demand shock with/without QE -- low risk economy



Demand shock with/without QE -- medium risk economy



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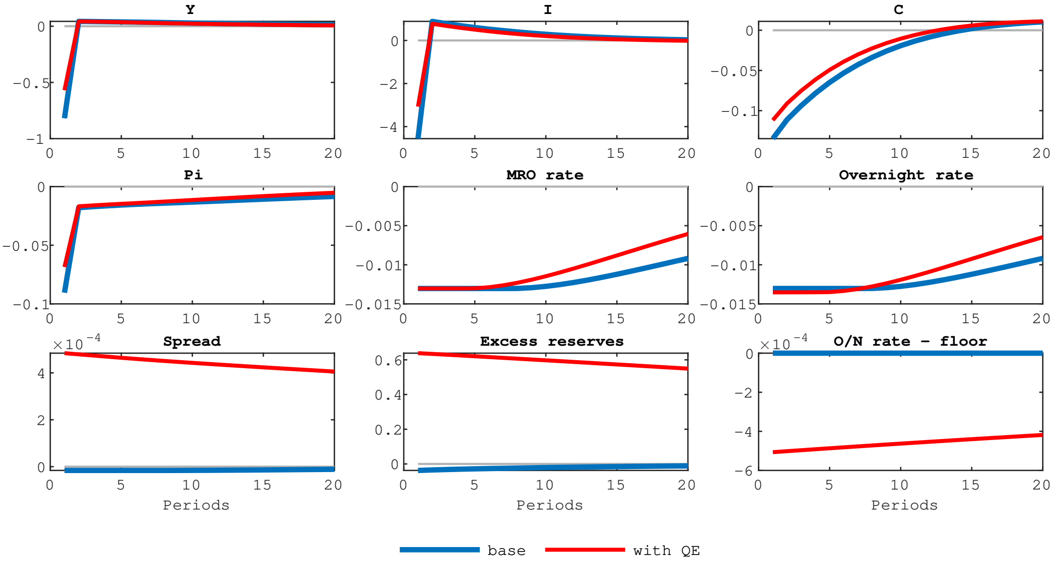

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Firms: large and small firms

- Differentiate between large (observable projects) and small (unobservable projects) firms
- Every period, firms draw their type (large/small) and a project (risky/safe):
  1. λ are **safe** – known return, no risk of default
  2. $1 - \lambda$ are **risky** – uncertain return, risk of default
- Project type doesn't matter for large firms as we'll assume equal NPV
- Entry costs – new firms raise equity finance to enter $\Longrightarrow$ claim on future profits
- Firms must raise outside finance for ongoing investment

Small firms

Firms raise k units of outside finance (loans)

- convert to $\omega_t^i k$ units of capital, $i \in \{s, r\}$
- succeed with probability p_{t+1}^i, otherwise yield zero
- $\omega_t^s = p_t^s = \omega_t^r p_t^r = 1$, $\omega_t^r > 1, p_t^r < 1$

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If funded, choose labour demand to maximise period profits:

$$V_t^i = \max_{h_t\left(\omega_t^i\right)} \left\{ \frac{P_t^W}{P_t} y_t\left(\omega_t^i\right) - \frac{W_t}{P_t} h_t\left(\omega_t^i\right) - \left(\frac{\tau_{t-1}^i}{\Pi_{t-1,t}} q_{t-1} - (1-\delta)\,\omega_t^i q_t \right) k + V_t \right\} \tag{6}$$

where

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Investment wedge and credit rationing

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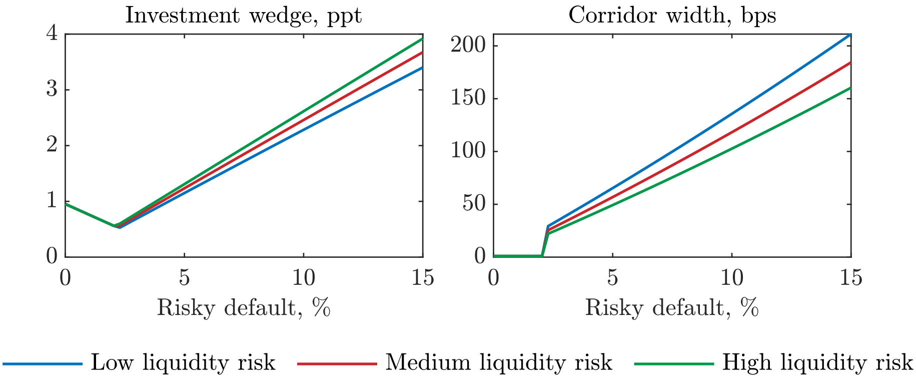
Optimal corridor



Monetary policy shock