Bank Recapitalizations, Credit Supply and the Transmission of Monetary Policy

Mark Mink & Sebastiaan Pool

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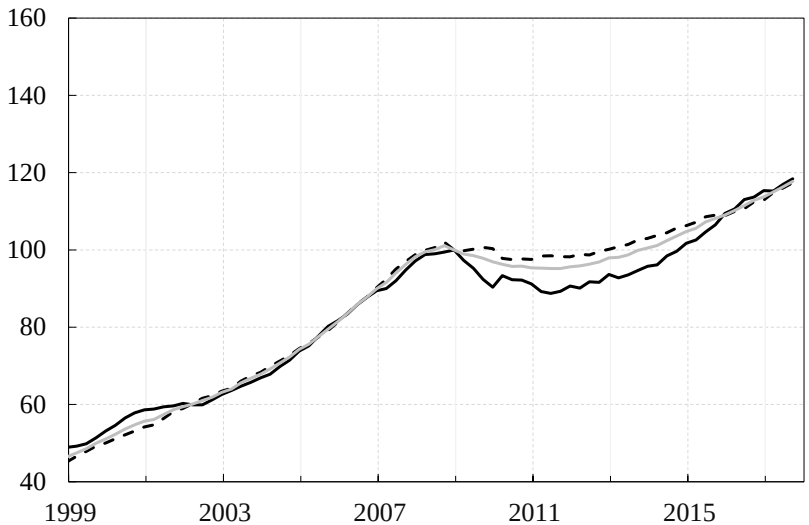
Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

Aim of the paper

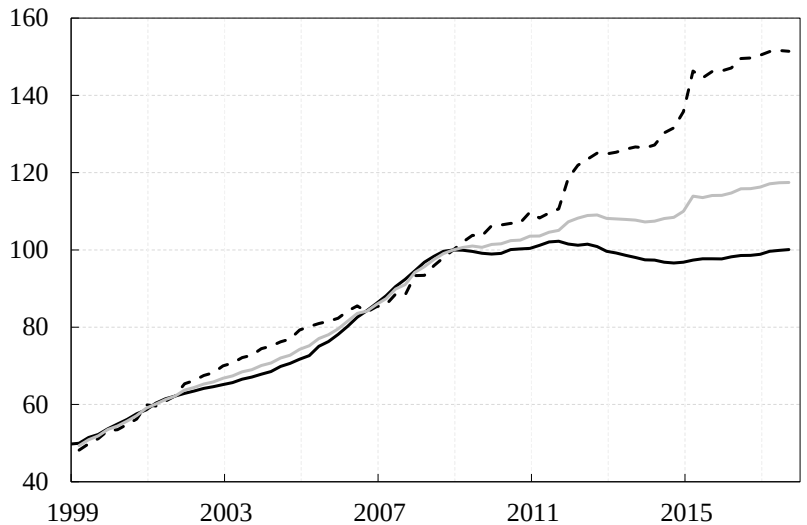
- We examine how banking sector recapitalizations after a crisis affect credit supply and monetary transmission.
- To this end, we integrate a representative bank in a conventional New-Keynesian DSGE model with physical capital.
- The key friction in the model is that the banking sector receives a transfer from the government if loan losses exceed equity buffers.
- The government can provide this transfer immediately after a crisis, or with a delay (this policy choice is exogenous).

Motivation (1)

- Especially in EMU, post-crisis recovery of bank credit was slow:



US

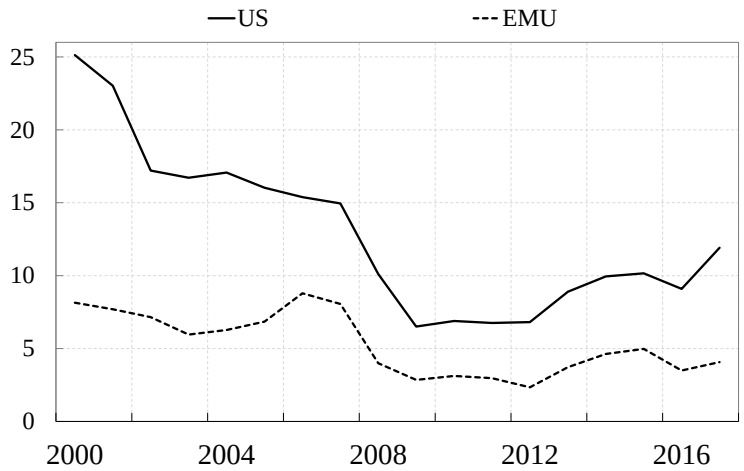


EMU

Bank credit (solid), non-bank credit (dashed) and total credit (gray)

Motivation (2)

- The financial crisis caused a large drop in bank equity ratios...



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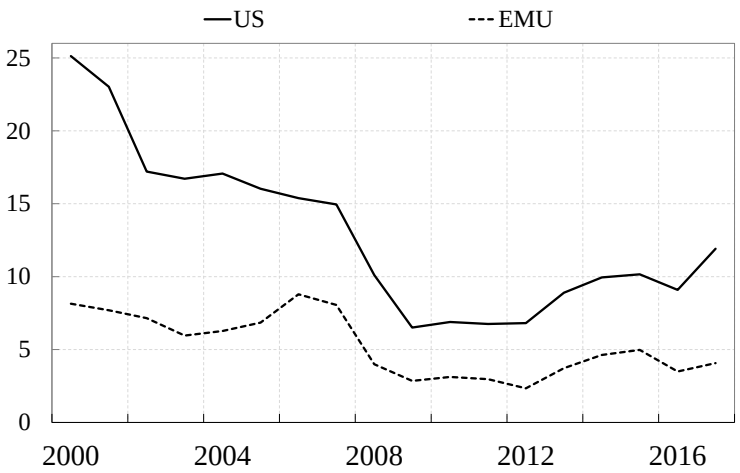

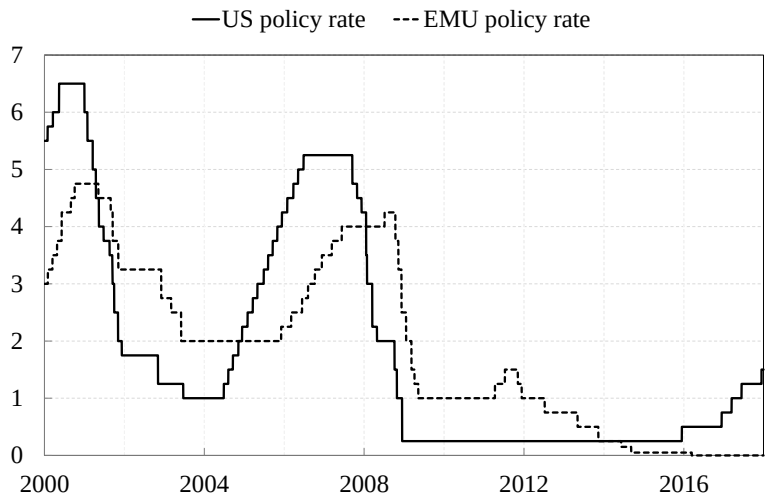

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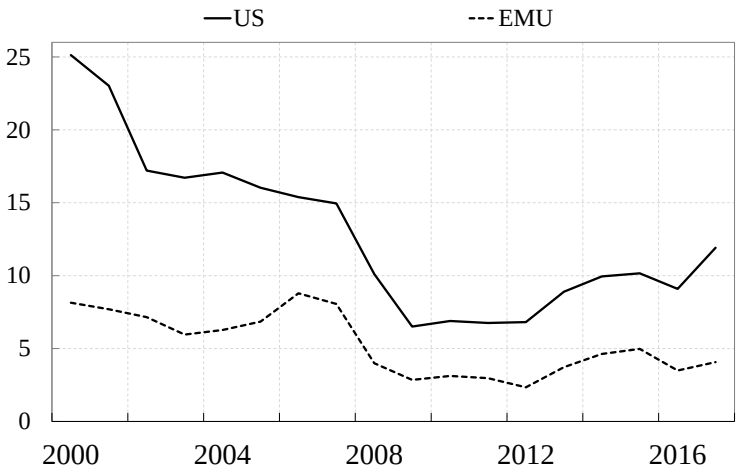

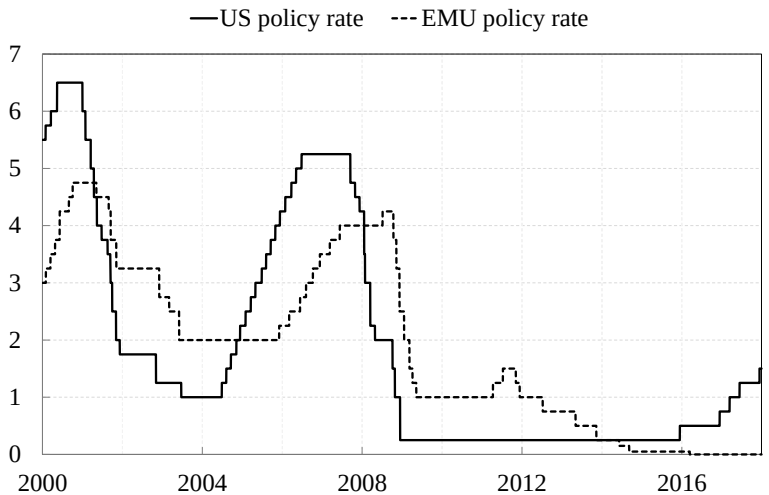

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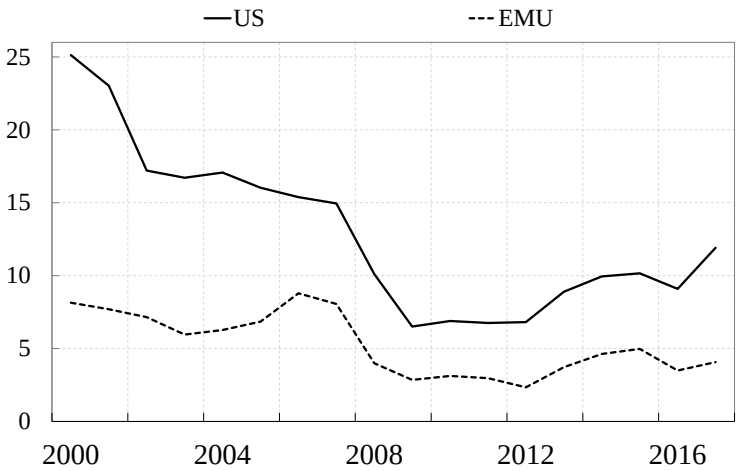

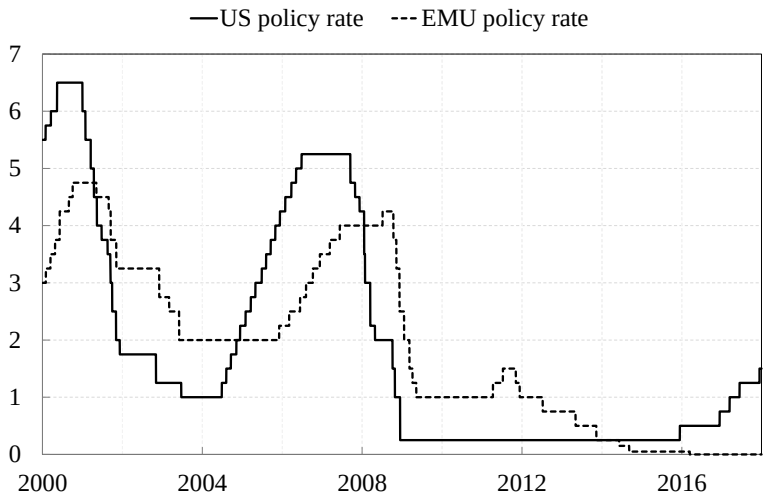

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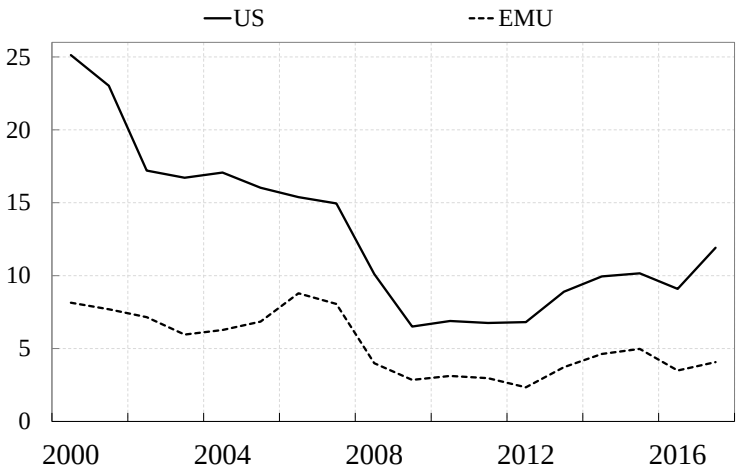

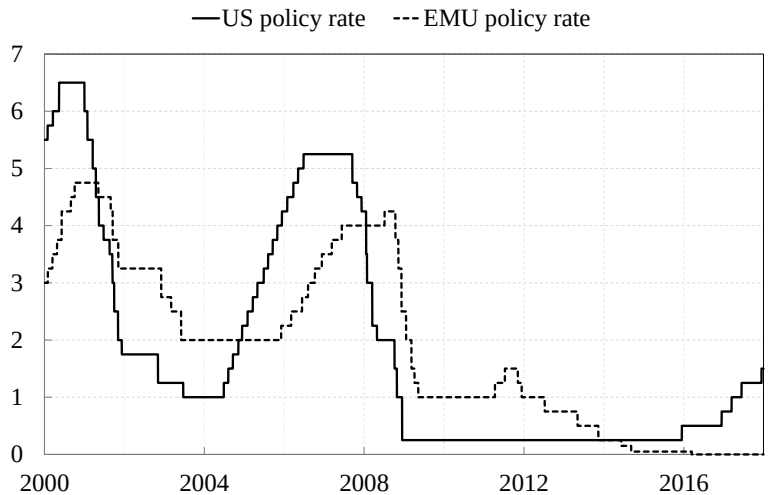

- ... which was followed by a large monetary expansion
- The US banking sector was recapitalized rather swiftly
- The EMU banking sector recapitalization was delayed by the sovereign debt crisis and limited coordination at the European level
- This paper builds a model to examine how recapitalization policies affect bank credit supply

Preview of the results

- Before a crisis, banks anticipate recapitalizations by charging lower lending rates (over-lending).
- This decline in lending rates is larger when recapitalizations are immediate instead of delayed.
- After a crisis, delaying a recapitalization leads to debt-overhang in the banking sector.
- This debt-overhang drives up high lending rates (under-lending) and weakens monetary policy transmission to inflation.

Related literature

- **Government safety nets and bank lending**: Merton (1977), Kareken and Wallace (1987), Dam and Koetter (2012), Farhi and Tirole (2012), Admati et al. (2013), ...

- **Debt-overhang in banking**: Myers (1977), Hanson, Kashyap and Stein (2011), Thakor (2014), Bahaj and Malherbe (2016), Occhino (2017), Admati et al. (2018), ...

- **Banking and macro-economic fluctuations**: Kiyotaki and Moore (1997), Bernanke, Gertler and Gilchrist (1999), Goodfriend and McCallum (2007), Gerali et al. (2010), Meh and Moran (2010), Gertler and Karadi (2011), Angeloni and Faia (2013), Angelini (2014), Clerc et al. (2015), Nguyen (2015), Curdia and Woodford (2016), Mendicino et. al (2018), ...

Structure of the model

- "Standard" New-Keynesian DSGE model with household and firms
  - Price rigidity (Calvo pricing)
  - Taylor rule with persistence and response only to inflation
- Bank that intermediates between household and capital producer
  - Perfectly competitive (representative) bank
  - Finances its loans with equity and deposits from households
  - Can issue outside equity without frictions
  - Capital producer borrows from bank to finance capital stock
  - Crucial friction is that bank may receive a government recapitalization

Bank when recapitalizations are absent (benchmark)

The bank maximizes its future stream of excess profits:

$$\max_{L_t, D_t, E_t} \mathbb{E}_t \sum_{\tau=0}^{\infty} \Lambda_{t+1+\tau} \left(\Pi^B_{t+1+\tau} \right),$$

where real profits at $t+1$ are defined as:

$$\Pi^B_{t+1} \equiv \frac{R^L_t}{\pi_{t+1}} L_t - \frac{R^D_t}{\pi_{t+1}} D_t - \frac{R^E_t}{\pi_{t+1}} E_t + \Pi^K_{t+1}.$$

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Given the balance sheet identity and the equity requirement:

$$\begin{aligned} L_t &\equiv D_t + E_t, \\ E_t &= \kappa L_t, \end{aligned}$$

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the first-order condition for the bank lending rate is:

$$R^L_t = (1-\kappa) R^D_t + \kappa R^E_t.$$

Bank when recapitalizations are immediate

The bank maximizes its future stream of excess profits:

$$\max_{L_t, D_t, E_t} \mathbb{E}_t \sum_{\tau=0}^{\infty} \Lambda_{t+1+\tau} \left(\Pi^B_{t+1+\tau} + S_{t+1+\tau} \right),$$

which include government recapitalizations that are received to compensate for any shortfalls:

$$S_{t+1} \equiv \max \left(0; \frac{R^D_t}{\pi_{t+1}} D_t - \frac{R^L_t}{\pi_{t+1}} L_t - \Pi^K_{t+1} \right),$$

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The first-order condition for the bank lending rate is:

$$R^L_t = \frac{(1-\kappa) R^D_t + \kappa R^E_t}{1 + \Gamma(\bar{\omega}_t)},$$

where $\Gamma(\bar{\omega}_t) > 0$ is larger when expected future recapitalizations are larger.

Bank when recapitalizations are delayed

If the bank experienced a shortfall at time t, it receives a recapitalization at the end of $t+1$ that equals:

$$\max\left(0, \frac{R_t^D}{\pi_{t+1}} S_t - \max\left(0; \Pi_{t+1}^K + \frac{R_t^L}{\pi_{t+1}} L_t - \frac{R_t^D}{\pi_{t+1}} D_t\right)\right),$$

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The first-order condition for the bank lending rate before a shortfall is:

$$R_t^L = \frac{(1-\kappa) R_t^D + \kappa R_t^E}{1 + F(\tilde{\omega}_t) \Gamma(\bar{\omega}_t)},$$

where $F(\tilde{\omega}_t) \in (0,1)$ is the probability of experiencing a shortfall in the next period and receiving a recapitalization in the period thereafter.

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which equals the shortfall at t minus any profits made during $t+1$.

The first-order condition for the bank lending rate after a shortfall is:

$$R_t^L = \frac{(1-\kappa) R_t^D + \kappa R_t^E}{1 + F(\tilde{\omega}_t)\Gamma(\bar{\omega}_t) + \Gamma(\hat{\omega}_t)},$$

where $F(\tilde{\omega}_t) \in (0,1)$ is the probability of experiencing a shortfall in the next period and receiving a recapitalization in the period thereafter.

$\Gamma(\hat{\omega}_t) \leq 0$ reflects that profits in $t+1$ reduce the expected recapitalization in $t+1$ ($\Gamma(\hat{\omega}_t) > 0$ when $S_t > 0$)

Four versions of the model

Banking sector without recapitalizations (efficient lending):

$$R_t^L = (1-\kappa)R_t^D + \kappa R_t^E.$$

Before a shortfall with immediate recapitalizations (over-lending):

$$R_t^L = \frac{(1-\kappa)R_t^D + \kappa R_t^E}{1+\Gamma(\bar{\omega}_t)}.$$

Before a shortfall with delayed recapitalizations (less over-lending):

$$R_t^L = \frac{(1-\kappa)R_t^D + \kappa R_t^E}{1+F(\tilde{\omega}_t)\,\Gamma(\bar{\omega}_t)}.$$

In between a shortfall and a delayed recapitalization (potential under-lending):

$$R_t^L = \frac{(1-\kappa)R_t^D + \kappa R_t^E}{1+F(\tilde{\omega}_t)\,\Gamma(\bar{\omega}_t)+\Gamma(\hat{\omega}_t)}.$$

Calibration of the model

Parameter	Description	Value
β	Household discount factor	0.99
σ	Rate of inter-temporal substitution	1
φ	Inverse of the labor supply elasticity	2
χ	Weight of labor in the utility function	15.06
κ	Bank equity requirement	0.04
σ_ω	Standard deviation of the return on bank loans	0.02
α	Share of capital in the production function	0.3
ρ^Z	Autoregressive coefficient for productivity shocks	0.67
δ	Capital depreciation rate	0.025
θ	Final good substitution elasticity	∞
ξ	Share of firms that cannot re-optimize their price	0.75
γ	Degree of price indexation	0
π^*	Steady state inflation rate	1
ϕ^R	Smoothing coefficient in the interest rate rule	0.9
ϕ^P	Response to inflation in the interest rate rule	1.5

Intermezzo: IRFs frictionless banking sector (benchmark)

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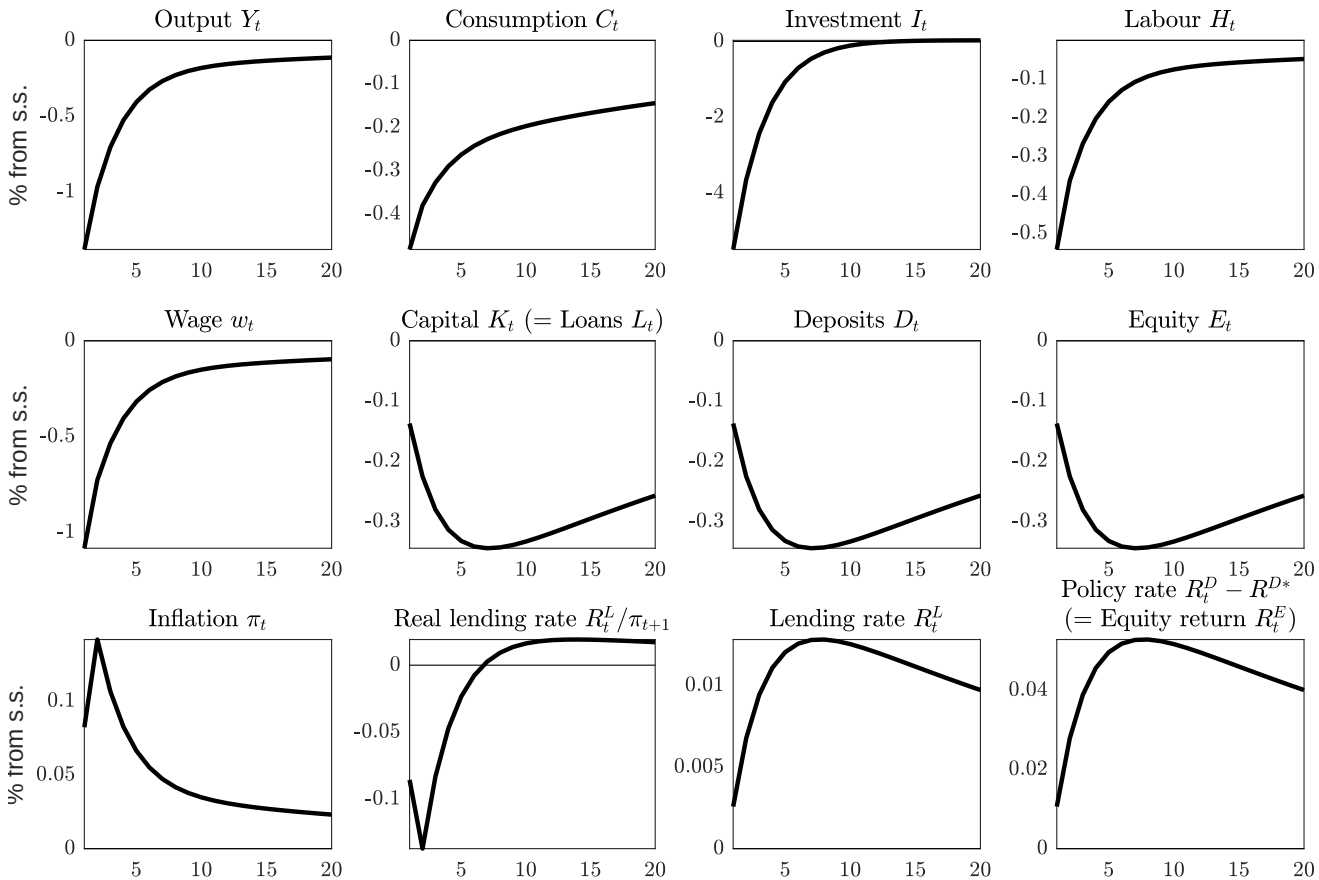
Figure: A 1% decrease in TFP when the banking sector is frictionless



Monetary transmission and recapitalization policies

Monetary transmission and recapitalization policies

- Monetary transmission in the standard New-Keynesian DSGE model:
  1. An increase in the policy rate raises the cost of capital, causing firms to raise prices $\rightarrow$ inflation goes up
  2. An increase in the policy rate reduces aggregate demand, causing firms to reduce labor demand and lower wages $\rightarrow$ inflation goes down
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- Typically 2 dominates 1. However, our model shows that:

$$\frac{\partial R_t^K}{\partial R_t^D} = \frac{\partial R_t^L}{\partial R_t^D} = \frac{1}{1 + F\left(\tilde{\omega}_{t+1}\right)\Gamma\left(\bar{\omega}_t\right)},$$

- Recapitalization policies imply $F\left(\tilde{\omega}_{t+1}\right)\Gamma\left(\bar{\omega}_t\right) > 0$, which weakens 1 and strengthens monetary transmission to inflation

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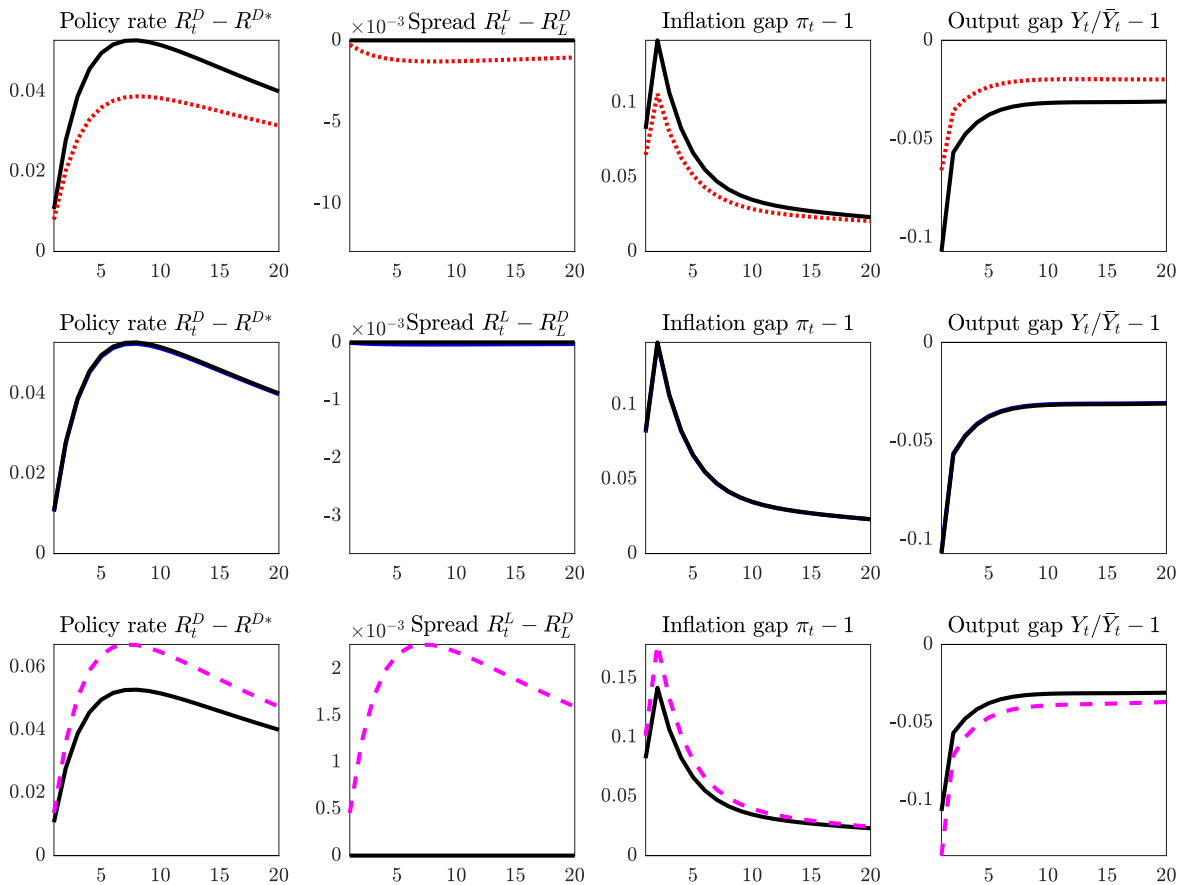
- Recapitalization policies imply $F\left(\tilde{\omega}_{t+1}\right)\Gamma\left(\bar{\omega}_t\right) > 0$, which weakens 1 and strengthens monetary transmission to inflation
- In between a shortfall and a delayed recapitalization $\Gamma\left(\hat{\omega}_t\right) < 0$, which strengthens 1 and weakens monetary transmission to inflation

IRFs Monetary transmission and recapitalization policies

Figure: Monetary transmission after a 1% decrease in TFP



Responses before a shortfall with immediate recapitalizations (top row), before a shortfall with delayed recapitalizations (middle row), and in between a shortfall and a delayed recapitalization (bottom row). The black line in each panel reflects the benchmark without recapitalizations.

Results so far

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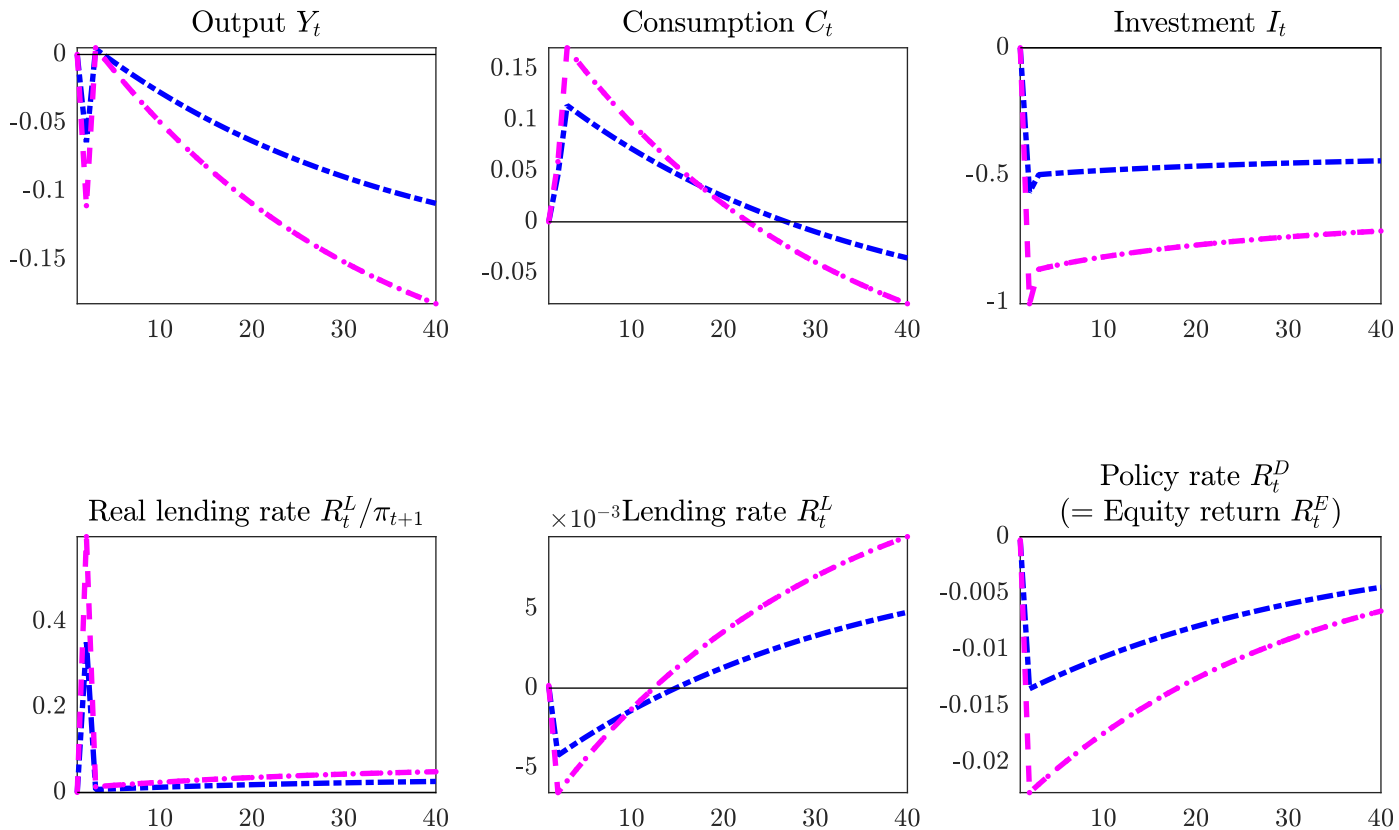
- This complicates designing optimal recapitalization policies (i.e., immediate or delayed?)
- A more efficient policy in the model to stabilize banks is therefore to reduce the need for bank recapitalizations by raising bank equity requirements

Transition dynamics to higher bank equity requirements

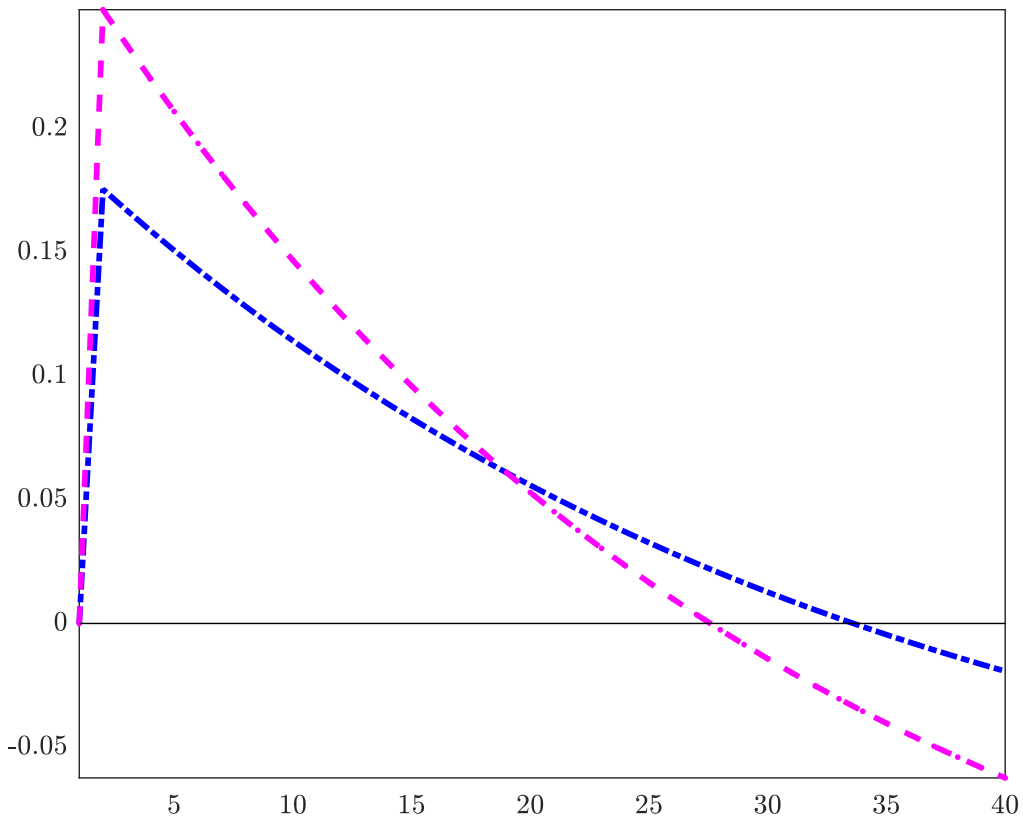
Figure: A permanent increase in the bank equity requirement by 0.5 p.p.



The blue line describes the situation before a shortfall when recapitalizations are delayed and the pink line describes the case in between a shortfall and a delayed recapitalization.

Utility after increasing bank equity requirements

Figure: Utility after a permanent increase in the bank equity requirement



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Conclusion

- Banking sector recapitalizations affect both credit supply and the transmission of monetary policy
- Before a crisis, recapitalizations cause banks to charge inefficiently low lending rates (especially immediate ones)
- Between a crisis and a delayed recapitalization, banks:
  - suffer from debt-overhang
  - which causes them to raise their lending rates
  - and weakens monetary transmission to inflation (but not to output)
- Higher bank equity requirements reduce the need for recapitalizations, which reduces output but increases lifetime utility