Interbank Market Turmoils and the Macroeconomy[1]

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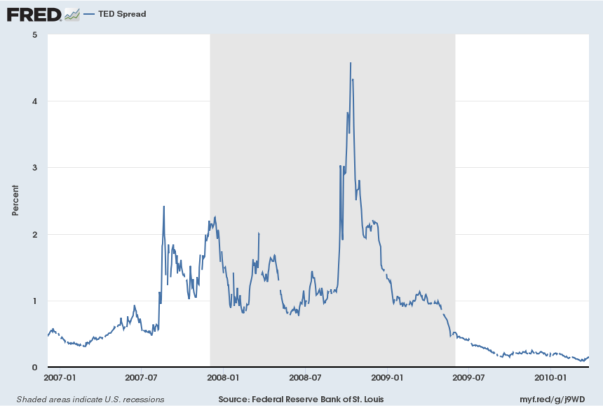
Narodowy Bank Polski

[1]The views presented in this paper are those of the author, and should not be attributed to Narodowy Bank Polski.

Intro 1: LIBOR / T-bill spread



Contributions

- Macroeconomic perspective on interbank market disruptions
- A tractable DSGE model where monetary policy is implemented through banking sector (where NK is a special case)
- The macro consequences of non-conventional policy tools: interbank market guarantees

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The model

- Building blocks:
  - Real sector: New Keynesian framework, households - depositors, firms - loan takers
  - Banking sector: a modified version of the model by Bianchi and Bigio (2014) (R&R ECMA) - reserves traded in a frictional interbank market as in Afonso and Lagos (2015)

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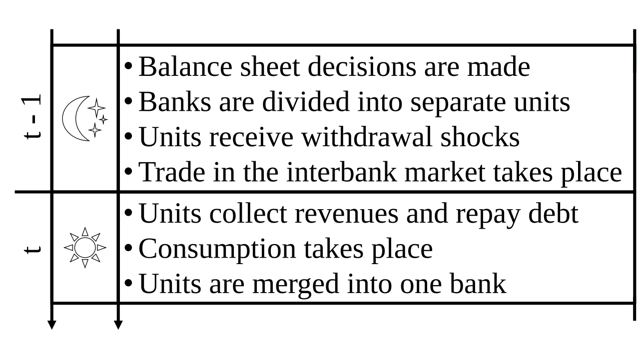
Banking sector: no counterparty risk

- Timeline:



Banks: no counterparty risk

$$V\left(e_{t-1},A_{t-1}\right)=\max_{\{\{c_t(\delta)\},l_{t-1},m_{t-1},d_{t-1},e_t\}}\left\{\int_{-1}^{+\infty}u\left(c_t\left(\delta\right)\right)d\mu\left(\delta\right)+\beta_B\cdot\mathbb{E}V\left(e_t,A_t\right)\right\}$$

$$\begin{cases} l_{t-1}+m_{t-1}=e_{t-1}+d_{t-1} \\ \forall_\delta:\ \ c_t\left(\delta\right)+e_t+\Phi_E\left(e_t,\bar{e}_t\right)\leq \\ \frac{1+i_{L,t-1}}{\Pi_t}\cdot l_{t-1}+\frac{1+i_{ER,t-1}}{\Pi_t}\cdot m_{t-1}-\frac{1+i_{D,t-1}}{\Pi_t}\cdot d_{t-1} \\ +\left(\mathbb{I}_{\{\delta<\delta^*_{t-1}\}}\cdot\chi_t^-+\mathbb{I}_{\{\delta\geq\delta^*_{t-1}\}}\cdot\chi_t^+\right)\cdot\mathscr{M}\left(m_{t-1},d_{t-1}|i_{D,t-1},i_{L,t-1},\delta\right)\end{cases}$$

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Interbank market: no counterparty risk

- Fed funds rate (results from the Nash bargaining problem):

$$i_{FF,t} = \frac{i_{ER,t} + i_{DW,t}}{2}$$

- Effective rates on loans in the market:

$$\chi_t^- = \psi_{t-1}^- \cdot \frac{i_{FF,t-1} - i_{ER,t-1}}{\Pi_t} + \left(1 - \psi_{t-1}^-\right) \cdot \frac{i_{DW,t-1} - i_{ER,t-1}}{\Pi_t}$$

$$\chi_t^+ = \psi_{t-1}^+ \cdot \frac{i_{FF,t-1} - i_{ER,t-1}}{\Pi_t}$$

- Spread between rates i_L and i_D depends on interbank market conditions:

$$i_{L,t-1} - i_{D,t-1} = \Pi_t \cdot \frac{\mathbb{P}\left(\delta < \delta_{t-1}^*\right) \cdot \mathbb{E}_\delta \left(u'\left(c_t\left(\delta\right)\right) \cdot \left[\tilde{\delta}_{t-1} + \psi \cdot \left(1 - \delta\right)\right] | \delta < \delta_{t-1}^*\right) \cdot \chi_t^-}{\mathbb{E}_\delta\left(u'\left(c_t\left(\delta\right)\right)\right)}$$

$$+ \Pi_t \cdot \frac{\mathbb{P}\left(\delta \geq \delta_{t-1}^*\right) \cdot \mathbb{E}_\delta \left(u'\left(c_t\left(\delta\right)\right) \cdot \left[-\tilde{\delta}_{t-1} + \psi \cdot \left(1 + \delta\right)\right] | \delta \geq \delta_{t-1}^*\right) \cdot \chi_t^+}{\mathbb{E}_\delta\left(u'\left(c_t\left(\delta\right)\right)\right)}$$

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Households: no counterparty risk

- Bellman equation for household $j \in [0,1]$:

$$W\left(\tilde{d}_{j,t-1}, A_t\right) = \max_{c_{j,t}, \tilde{d}_{j,t}} \left\{ u\left(c_{j,t}\right) - v\left(n_{j,t}\right) + \beta_H \cdot \mathbb{E} W\left(\tilde{d}_{j,t}, A_{t+1}\right) \right\}$$

$$\textit{subject to}:$$

$$\begin{cases} c_{j,t} + \tilde{d}_{j,t} + \tau_t + \frac{\phi_w}{2}\left(\frac{w_{j,t}}{w_{j,t-1}} - 1\right)^2 \cdot n_t \leq \\ \frac{1+i_{D,t-1}}{\Pi_t} \cdot \tilde{d}_{j,t-1} + \frac{w_{j,t}}{p_t} \cdot n_{j,t} + \pi_t \\ n_{j,t} = \left(\frac{w_{j,t}}{w_t}\right)^{-\gamma_w} \cdot n_t \end{cases}$$

Firms: no counterparty risk

- Bellman equation for firm $i \in [0,1]$:

$$F_i\left(p_{i,t-1}, \tilde{l}_{i,t-1}, S_t, A_t\right) = \max_{p_{i,t}, l_{i,t}, n_{i,t}, y_{i,t}} \left\{ \frac{p_{i,t}}{p_t} \cdot y_{i,t} - \frac{1+i_{L,t-1}}{\Pi_t} \cdot \tilde{l}_{i,t-1} \right.$$

$$\left. - \frac{\phi}{2}\left(\frac{p_{i,t}-p_{i,t-1}}{p_{i,t-1}}\right)^2 \cdot y_t + \mathbb{E}\Lambda_t \cdot F_i\left(p_{i,t}, \tilde{l}_{i,t}, S_{t+1}, A_{t+1}\right) \right\}$$

$$\textit{subject to}:$$

$$\begin{cases} \tilde{l}_{i,t} = w_t \cdot n_{i,t} \\ y_{i,t} = n_{i,t} \\ y_{i,t} = \left(\frac{p_{i,t}}{p_t}\right)^{-\gamma} \cdot y_t \end{cases}$$

Government: no counterparty risk

- Government chooses: rates i_{FF}, i_{DW}, i_{FF}, supply of reserves $\tilde{m}$ and tax τ

- Budget constraint of consolidated government:

$$\frac{1+i_{ER,t-1}}{\Pi_t}\cdot\tilde{m}_{t-1}=\tilde{m}_t+\tau_t+\Phi_E\left(e_t,\bar{e}_t\right)$$

$$+\left(1-\psi^{-}_{t-1}\right)\cdot\frac{i_{DW,t-1}-i_{ER,t-1}}{\Pi_t}\cdot\left|\int_{-1}^{\delta^*_{t-1}}\mathscr{M}\left(\delta\right)d\mu\left(\delta\right)\right|$$

- Monetary policy rule:

$$\log(1+i_{FF,t})=(1-\rho_m)\cdot\log(1+i^{ss}_{FF})+\rho_m\cdot\log(1+i_{FF,t-1})$$

$$+(1-\rho_m)\cdot[\nu_\Pi\cdot(\Pi_t-\Pi^{ss})+\nu_y\cdot(\log y_t-\log y^{ss})]+\varepsilon_m$$

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Relationship to the standard NK model

Proposition

Equilibrium prices and quantities converge to those associated with the standard New Keynesian model with price/wage adjustment costs as in Rotemberg (1982) and the cost channel as in Ravenna and Walsh (2006) if:

1) Bank units get risk neutral: $\rho \to 0$

2) Matching frictions in the interbank market decay: $\alpha_{FF} \to +\infty$

3) Policy requirements concerning reserves and bank equity are eliminated: $\psi, \xi \to 0$

Model with counterparty risk

- Before entering the IB market banks learn the value of shock S
- Proportion $1-S$ of bank units suffers from defaults on corporate loans
- They default on interbank loans and deposits
- Government guarantees deposit repayment (FDIC)
- Interbank loans are not secured so lending banks generate losses
- Interbank market rate becomes:

$$i_{FF,t} = \frac{i_{ER,t} + i_{DW,t} + \overbrace{\frac{1-S_t}{S_t - \mathbb{P}(\delta \geq \delta_t^*)}}^{\text{The counterparty risk component}}}{2}$$

- Monetary policy is impaired: rates i_{DW}, i_{ER} and money supply $\tilde{m}$ remain constant

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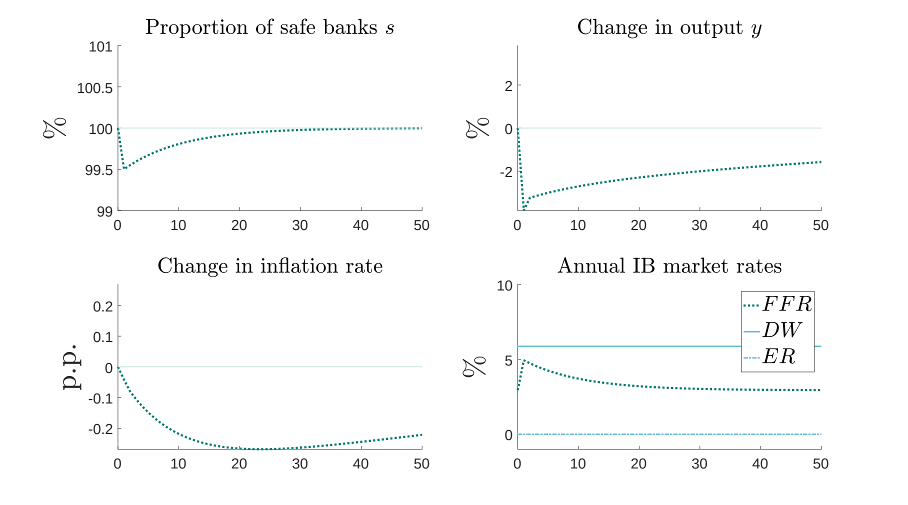
Simulation: a decrease in S



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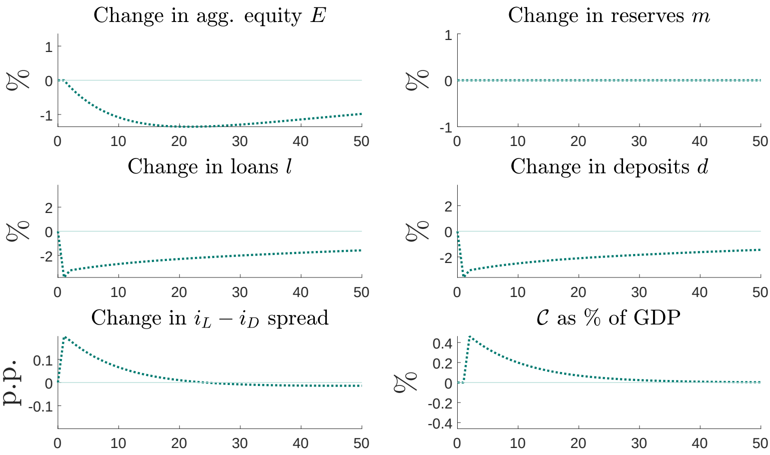

Interbank market guarantees

- $\mathscr{P} \in (0,1)$ denotes the proportion of non-performing interbank loans that are guaranteed by government
- I choose $\mathscr{P} = 0.5$
- Interbank market rate becomes:

$$i_{FF,t}(\mathscr{P}) = \frac{i_{ER,t} + i_{DW,t} + \frac{(1-\mathscr{P})\cdot(1-S_t)}{S_t+\mathscr{P}\cdot(1-S_t)-\mathbb{P}(\delta \geq \delta_t^*)}}{2}$$

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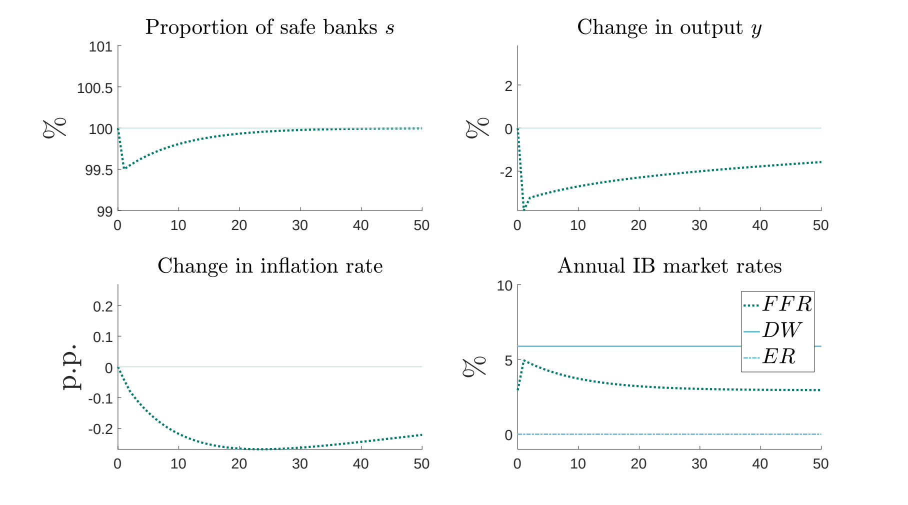

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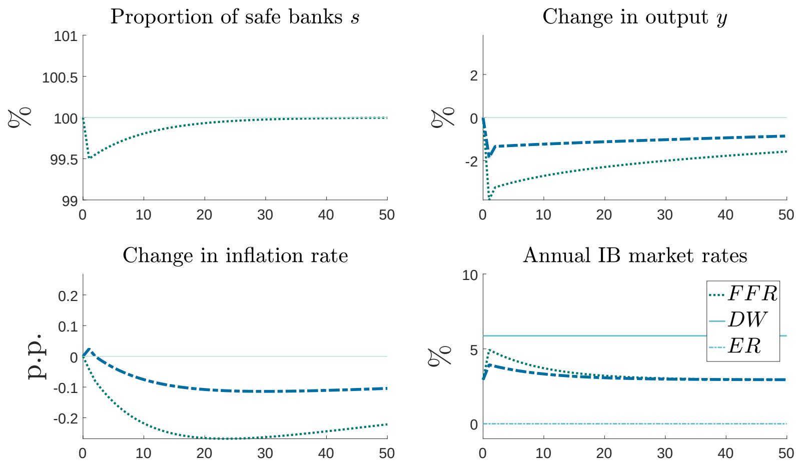

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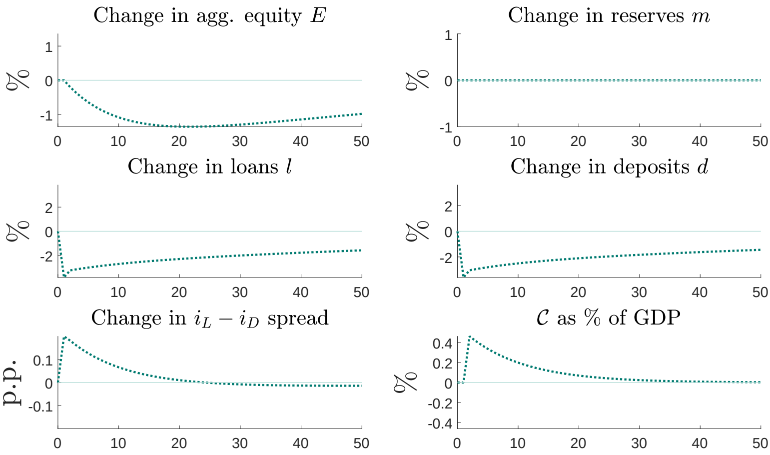

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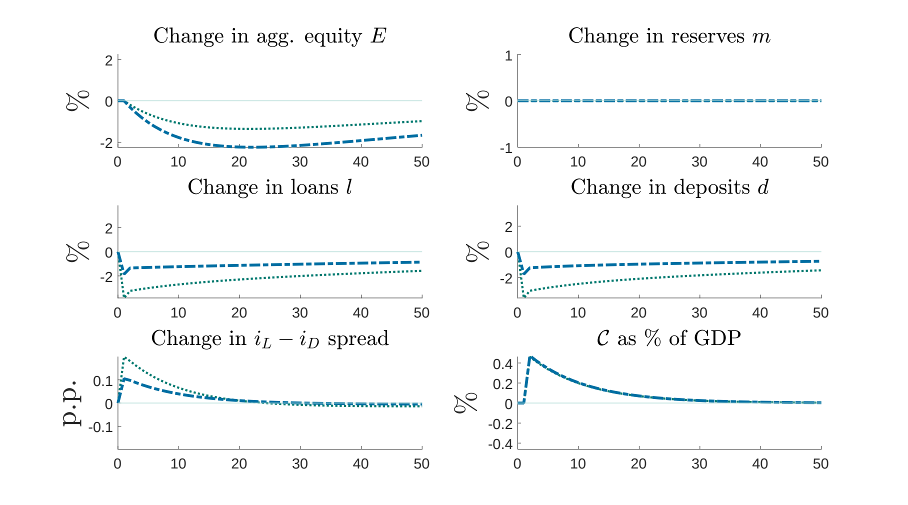

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The End

Thanks for your attention!