Managing the transition to central bank digital currency

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Introduction

Motivation

- ✓ Many central banks are investigating options to introduce a retail CBDC.
- ✓ In this context,
  - → limits on individual's CBDC holdings,
  - → negative interest on CBDC exceeding a certain baseline amount,
  - → limited access to CBDC for foreigners

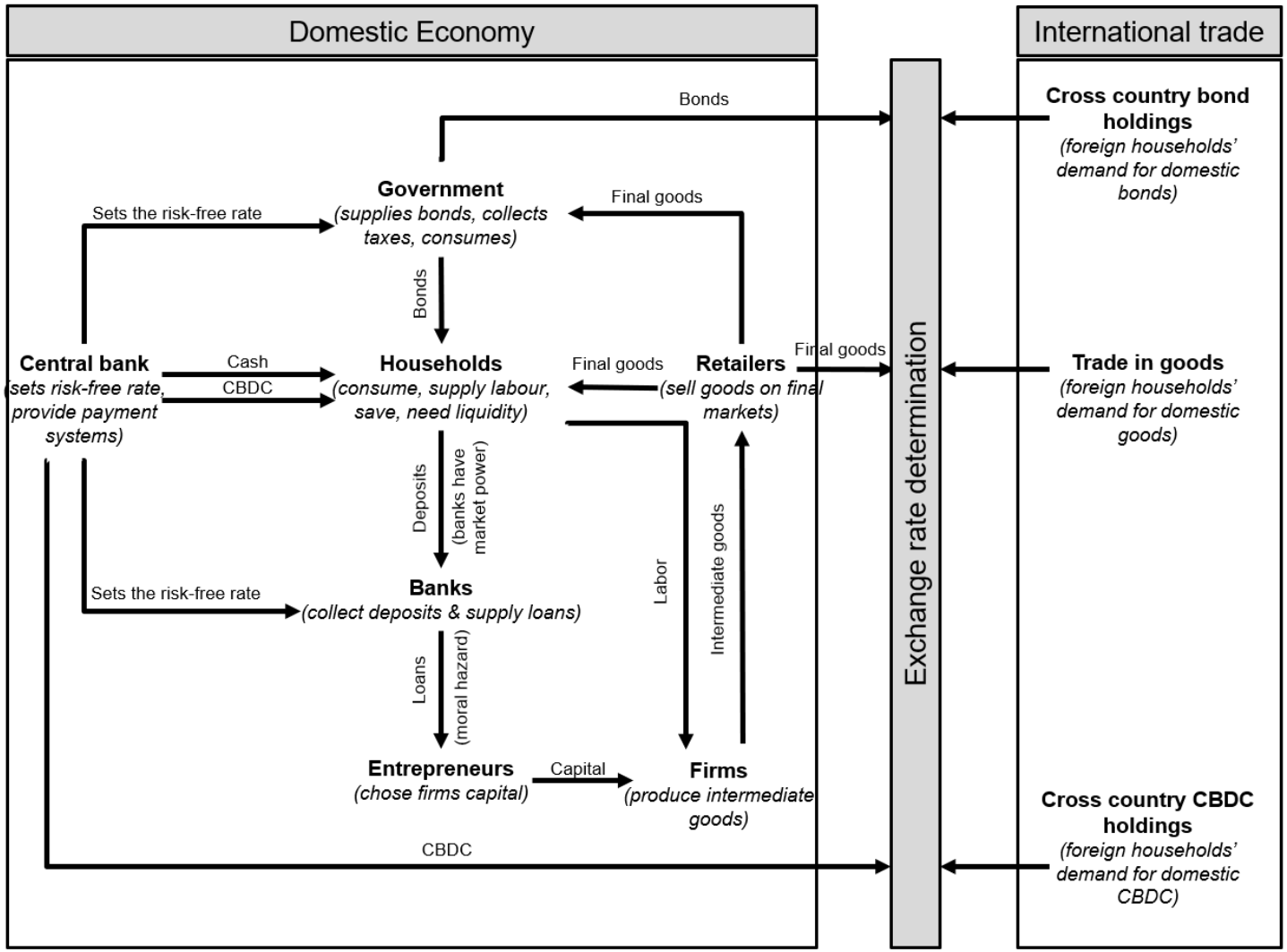
  have been proposed as measures to deal with structural bank disintermediation through deposit substitution.
- ✓ To avoid an unintended tightening of the monetary policy stance, the central bank could also provide additional liquidity (Brunnermeier and Niepelt, 2019; Adalid et al., 2020).

What we do

- ✓ We study the transition from a steady state without CBDC to one with CBDC, when the central bank can implement policies to mitigate welfare effects that arise during the transition (as occasionally binding constraints).
- ✓ We find that CBDC demand overshoots persistently during the transition to the new steady state, causing deposits, investments, GDP and welfare to fall.
- ✓ Mitigating policies can reduce the welfare loss during the transition.
  - → Holding limits turn out to be most effective.
  - → Interest policies and asset purchases also reduce welfare loss but are less effective.

The model

Model in one chart



Key features

HHs demand payment services:

$$C_t = \chi_L \left[\mu_M M^{1-\eta_L} + \mu_D D^{1-\eta_L} + \mu_{DC} DC^{1-\eta_L}\right]^{\frac{1}{1-\eta_L}}$$

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Cash is issued by the central bank and carries a holding cost.

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The domestic central bank issues a CBDC in a monetary policy neutral way (no expansion of the balance sheet). Foreign HHs can hold CBDC but face a cost. CBDC demand in the home country is:

$$\gamma_t \mu_{DC} \chi_L C_t^{\eta_L} DC_t^{-\eta_L} = \lambda_t - \beta E_t \left(\lambda_{t+1} \frac{R_t^{DC}}{\pi_{t+1}}\right)$$

Banks

Banks maximise profits under monopolistic competition in the deposit market and extract a rent through the deposit contract (Andolfatto, 2021):

$$\gamma_t \mu_D \chi_L C_t^{\eta_L} D_t^{-\eta_L} = \lambda_t - \beta E_t \left(\lambda_{t+1} \frac{R_t^D}{\pi_{t+1}} \right)$$

The optimal deposit rate is endogenously determined as a mark-down on the loan rate F_t.

$$F_t = R_t^D \frac{\theta_{t,D} - 1}{\theta_{t,D}}$$

with $\frac{\theta_{t,D}-1}{\theta_{t,D}} > 1$.

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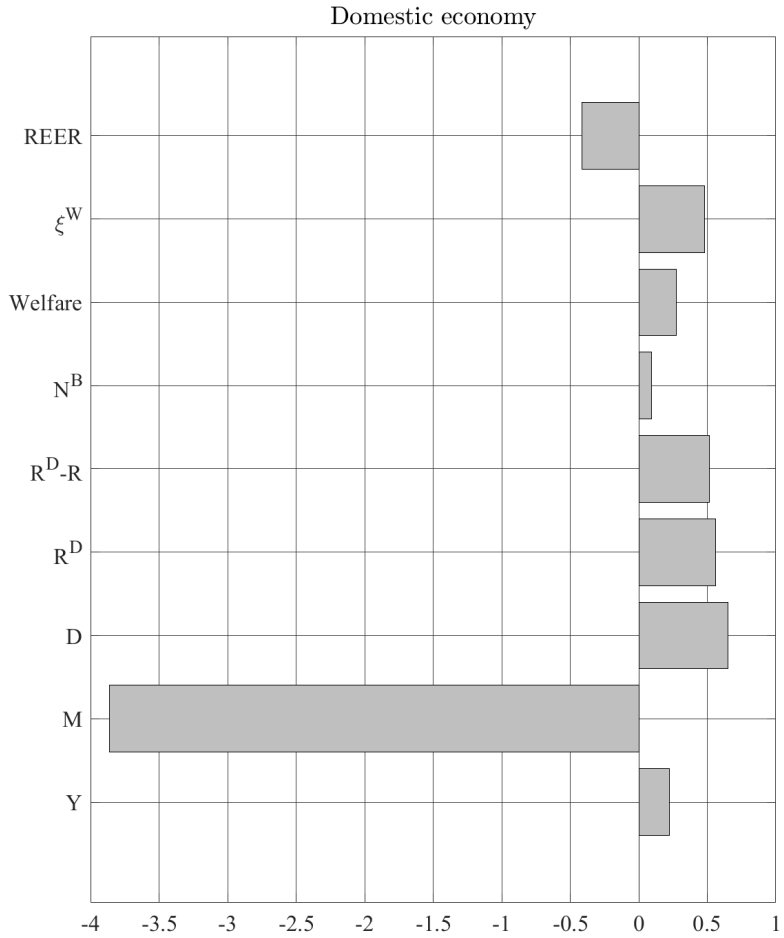
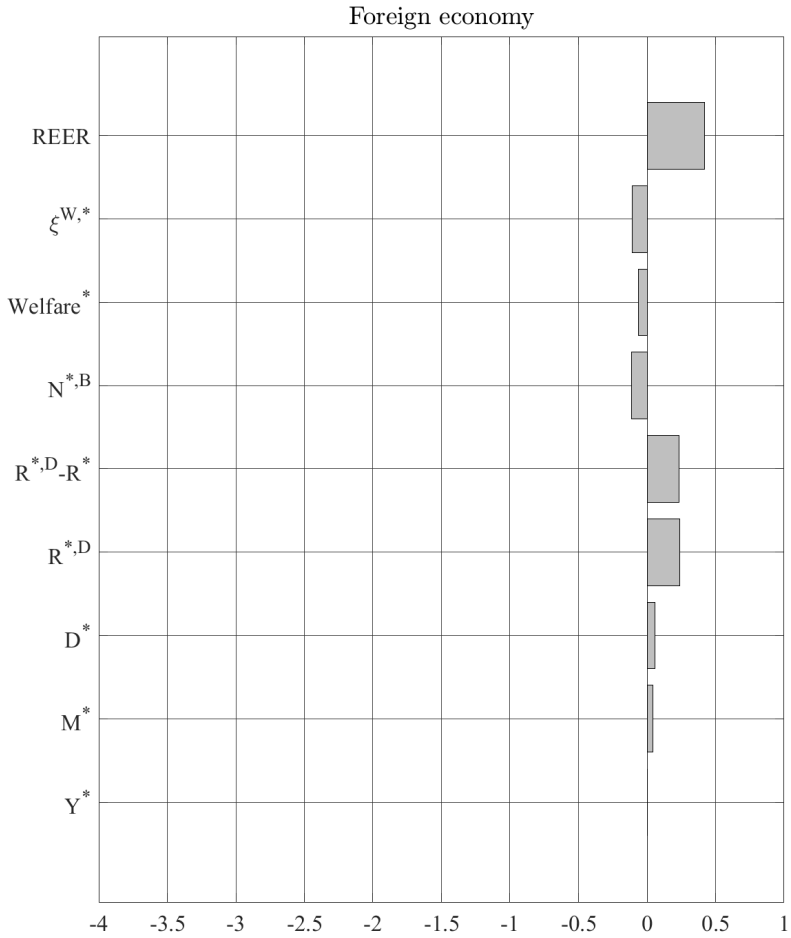
$\rightarrow$ A CBDC reduces the market power of banks by adding a new payment instrument to HHs' portfolio.

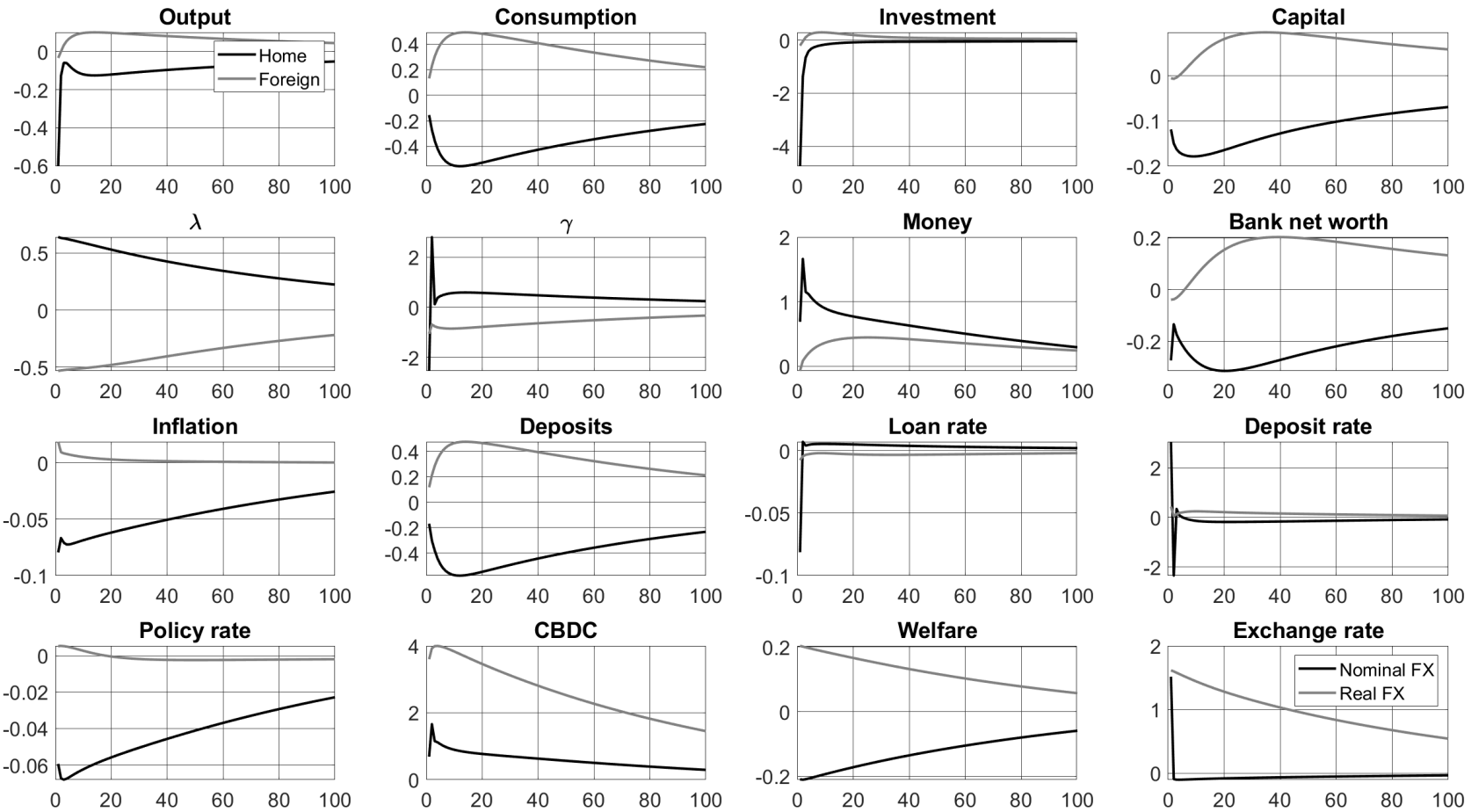
Steady-state impact





Transition dynamics

Transition from steady state without to one with CBDC



Shown as percent relative to new steady state.

Policies during the transition

Quantity limits

$$DC_t = \begin{cases} DC \text{ demand} & \text{if } DC_t < \overline{DC} \\ \overline{DC} & \text{if } DC_t \geq \overline{DC} \end{cases}$$

$$DC_t^* = \begin{cases} DC^* \text{ demand} & \text{if } DC_t^* < \overline{DC}^* \\ \overline{DC}^* & \text{if } DC_t^* \geq \overline{DC}^* \end{cases}$$

- ✓ $\overline{DC}$ and $\overline{DC}^*$ are domestic and foreign quantity limits.
- ✓ Quantity limits can be set differently for domestic and foreign households.

Tiered remuneration

$$R_t^{DC} = \begin{cases} 1 \text{ (no remuneration)} & \text{if } DC_t < \overline{DC} \\ 1\frac{\overline{DC}}{DC_t} + R_-^{DC}\frac{DC_t - \overline{DC}}{DC_t} & \text{if } DC_t \geq \overline{DC} \end{cases}$$

- ✓ The thresholds ($\overline{DC}$, $\overline{DC}^*$) are set to 50% of steady-state CBDC demand in each country.
- ✓ The penalty rate R_-^{DC} is set to 0.97 (300 basis points below parity), and to 0.95 (500 basis points below parity).

Central bank balance sheet expansion

The central bank purchases assets (AP) proportional to excess CBDC demand with $\chi_{AP} \in (0, 1]$:

$$AP_t = \begin{cases} 0 & \text{if } DC_t < DC_{ss} \\ DC_t - \chi_{AP} DC_{ss} & \text{if } DC_t \geq DC_{ss} \end{cases}$$

Revenues are transferred to the government.

Limited access of foreigners to CBDC

Foreigners can either not access the CBDC at all:

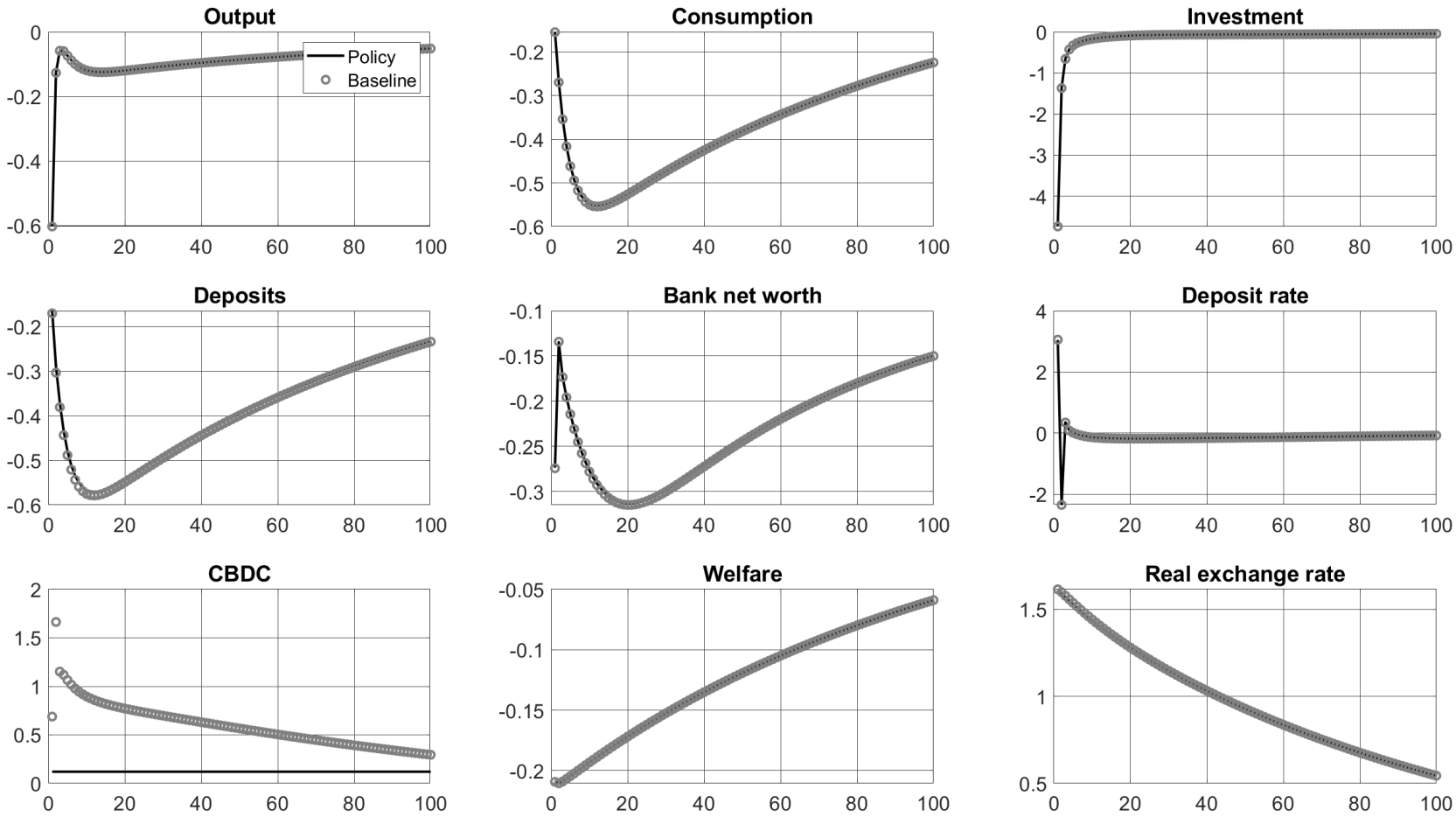
$$DC_t^* = 0 \quad \forall\, t$$

or there are higher costs for CBDC cross-border transactions:

$$\phi^{*,DC} = 0.1$$

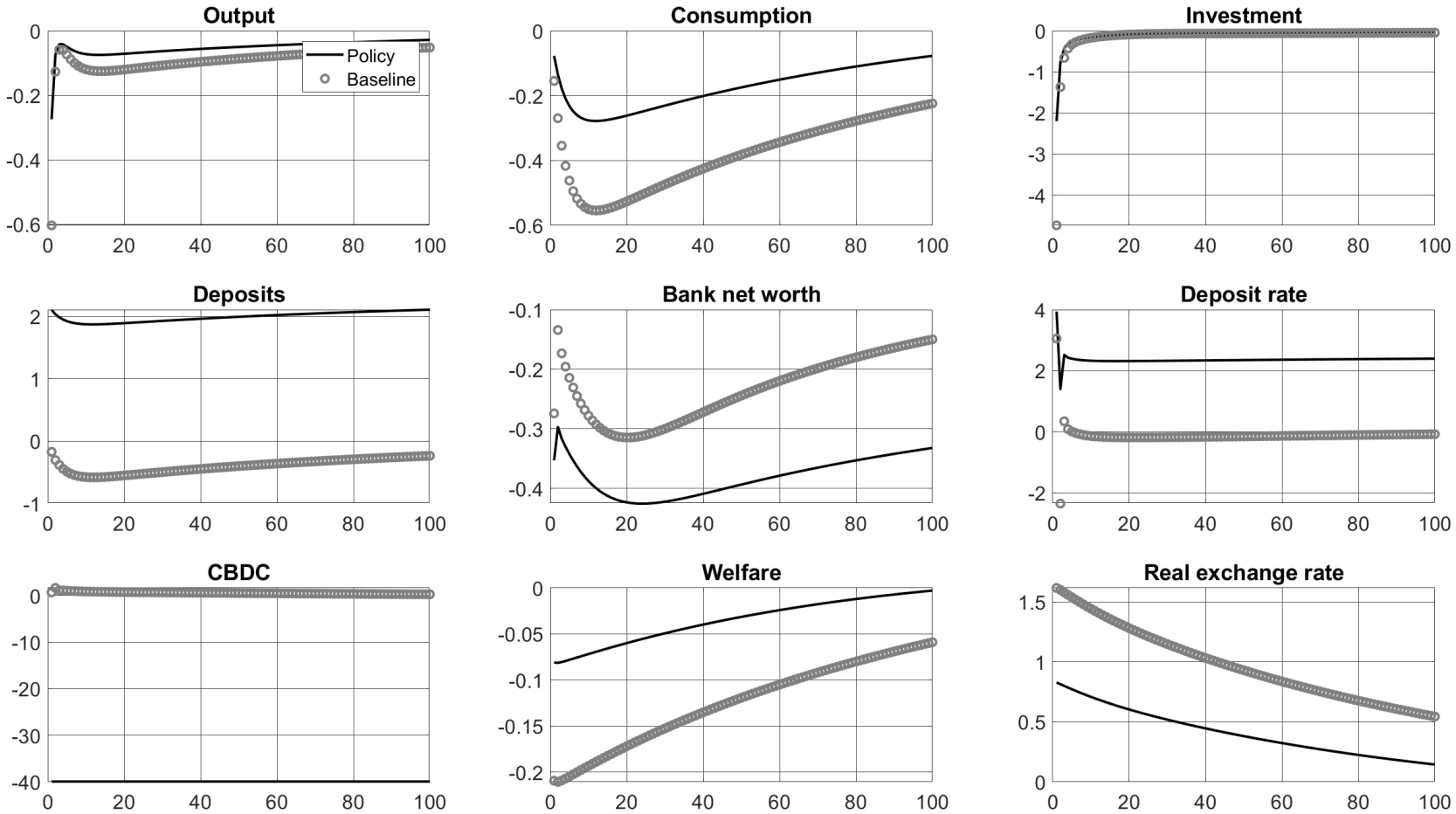
Transition dynamics with mitigating policies

Holding limit at new steady-state demand



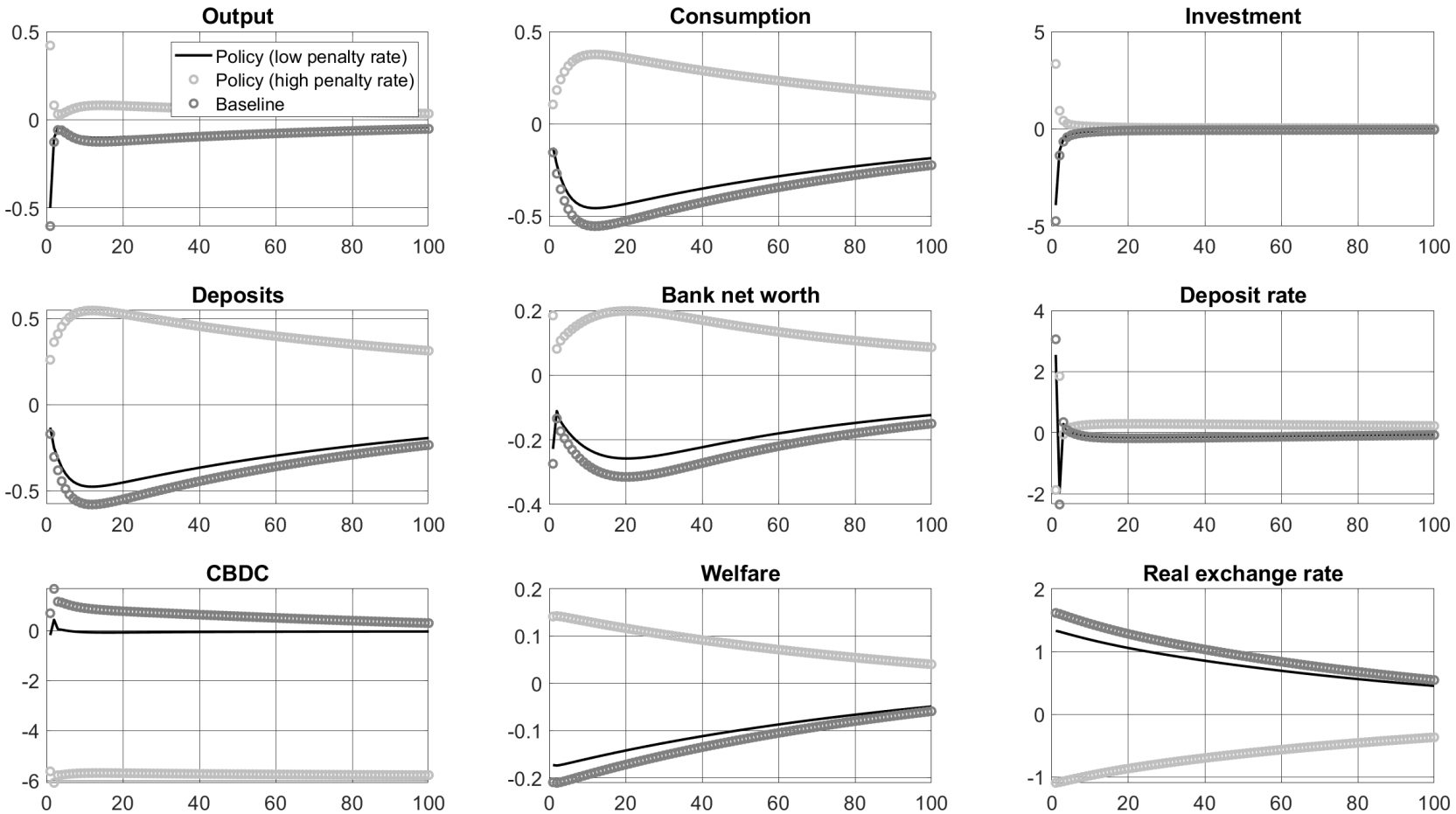
◂ Foreign Economy

Holding limit of 50% of steady-state demand



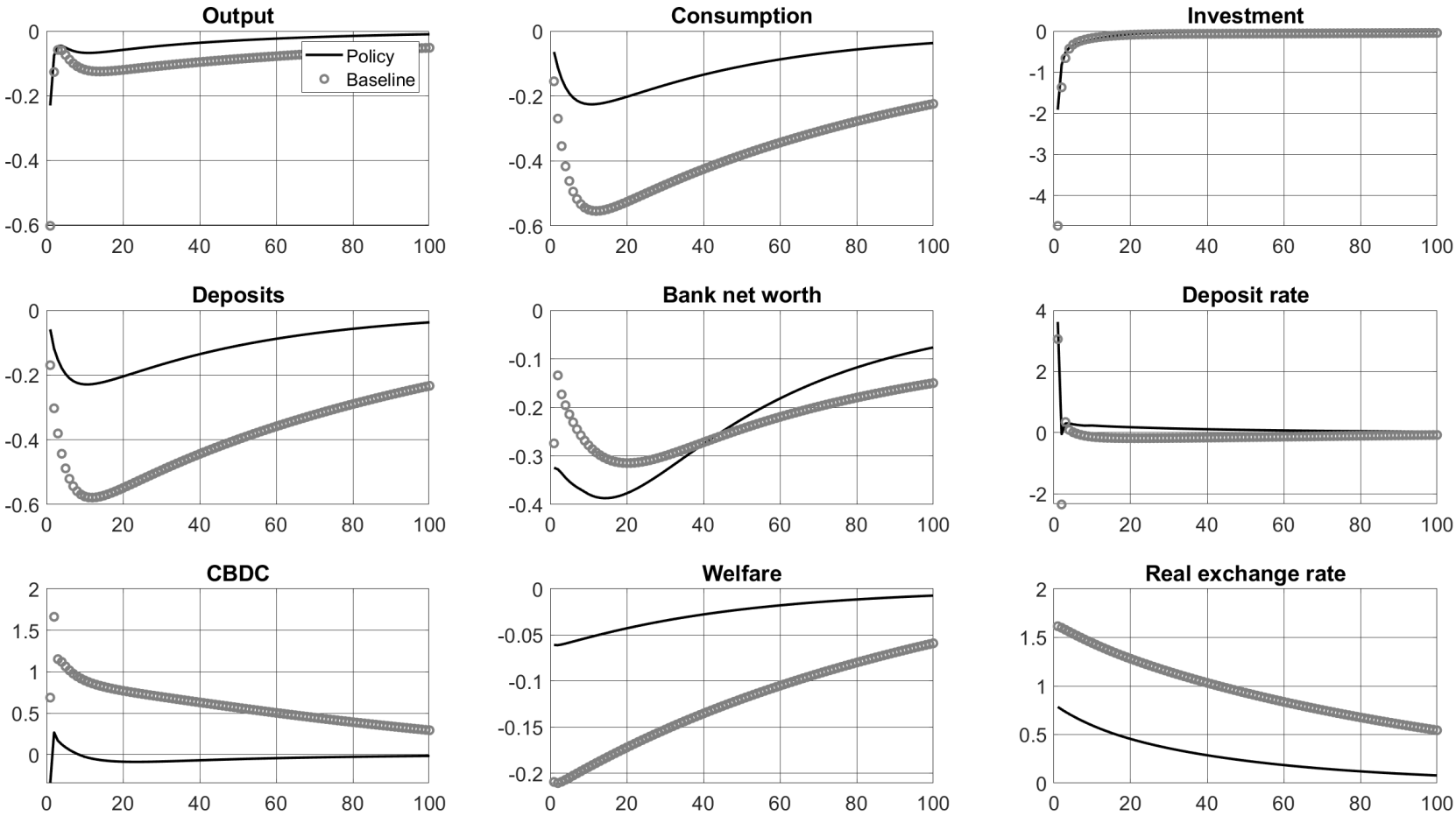
The holding limit is kept at 50% until the economy is close to the new steady state (period 100) and then gradually relaxed.

Two-tiered remuneration



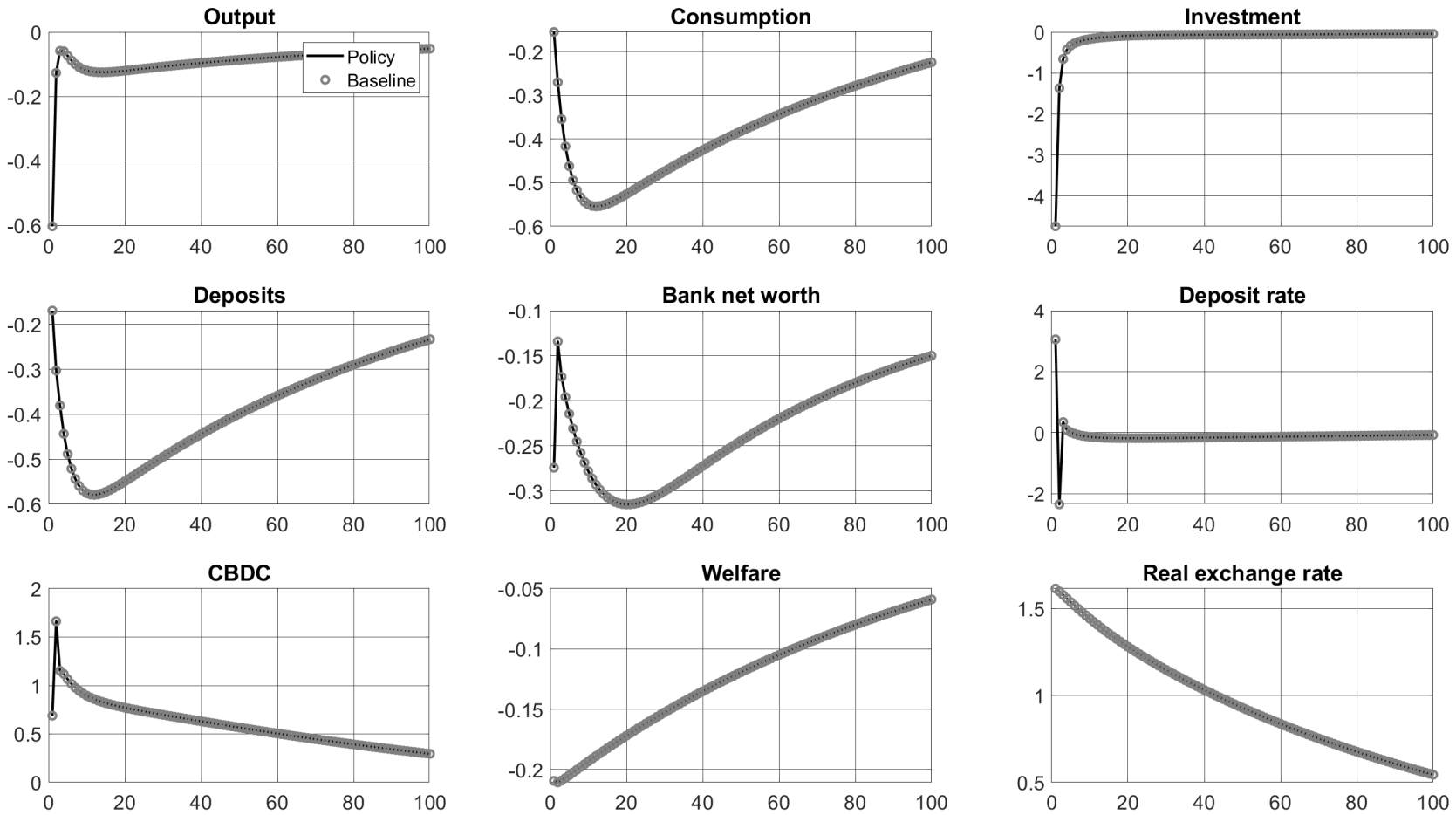
Penalty rates are 3% and 5%, respectively, for holdings above 50% of steady-state demand.

Balance sheet expansion



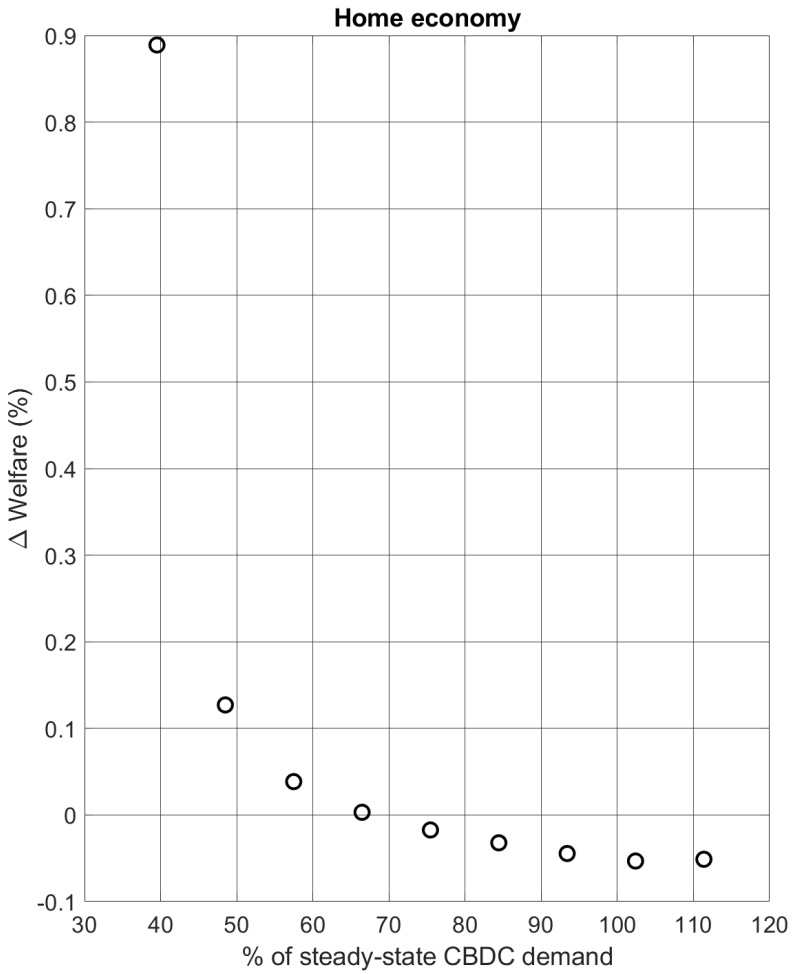
The central bank buys assets for CBDC demand in excess of new steady state.

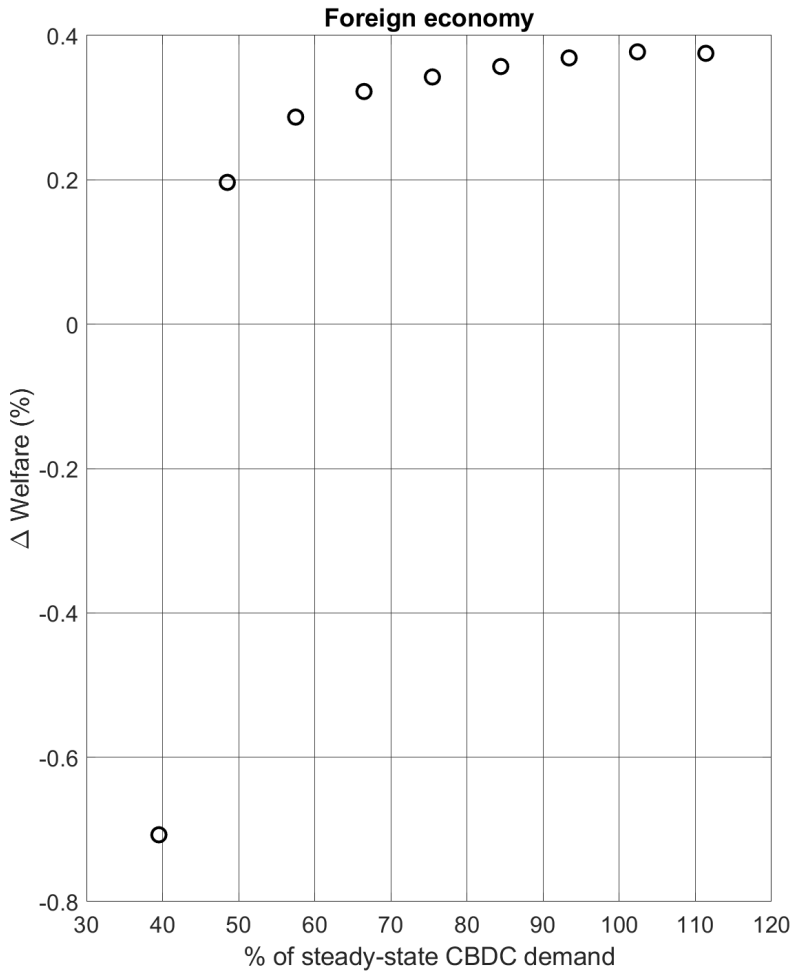
Domestic CBDC



◂ High holding costs

"Optimal" holding limit





Conclusions

Conclusions

- ✓ In steady-state a CBDC reduces the market power of banks.
- ✓ Endogenously deposits and the deposit rate increase, credit supply expands slightly, welfare improves (by about 0.5% of consumption)
- ✓ During the transition, HHs demand excess CBDC:
  - → Deposits decrease below steady-state,
  - → Investment and return on capital fall, remuneration on deposits stagnants,
  - → GDP contracts in the home country (by about 1%), foreign economy largely unaffected.
- ✓ Policies are effective in governing the transition:
  - → A hard holding limit prevents the crowding out of deposits and reduce GDP losses by more than 50%.
  - → A two-tiered remuneration system is less effective.
  - → Balance sheet expansion policies are effective in closing the output gap, but do not fully prevent the crowding out of deposits.

Appendix

Key friction – foreign economy

The problem is similar for the foreign economy. HH need liquidity:

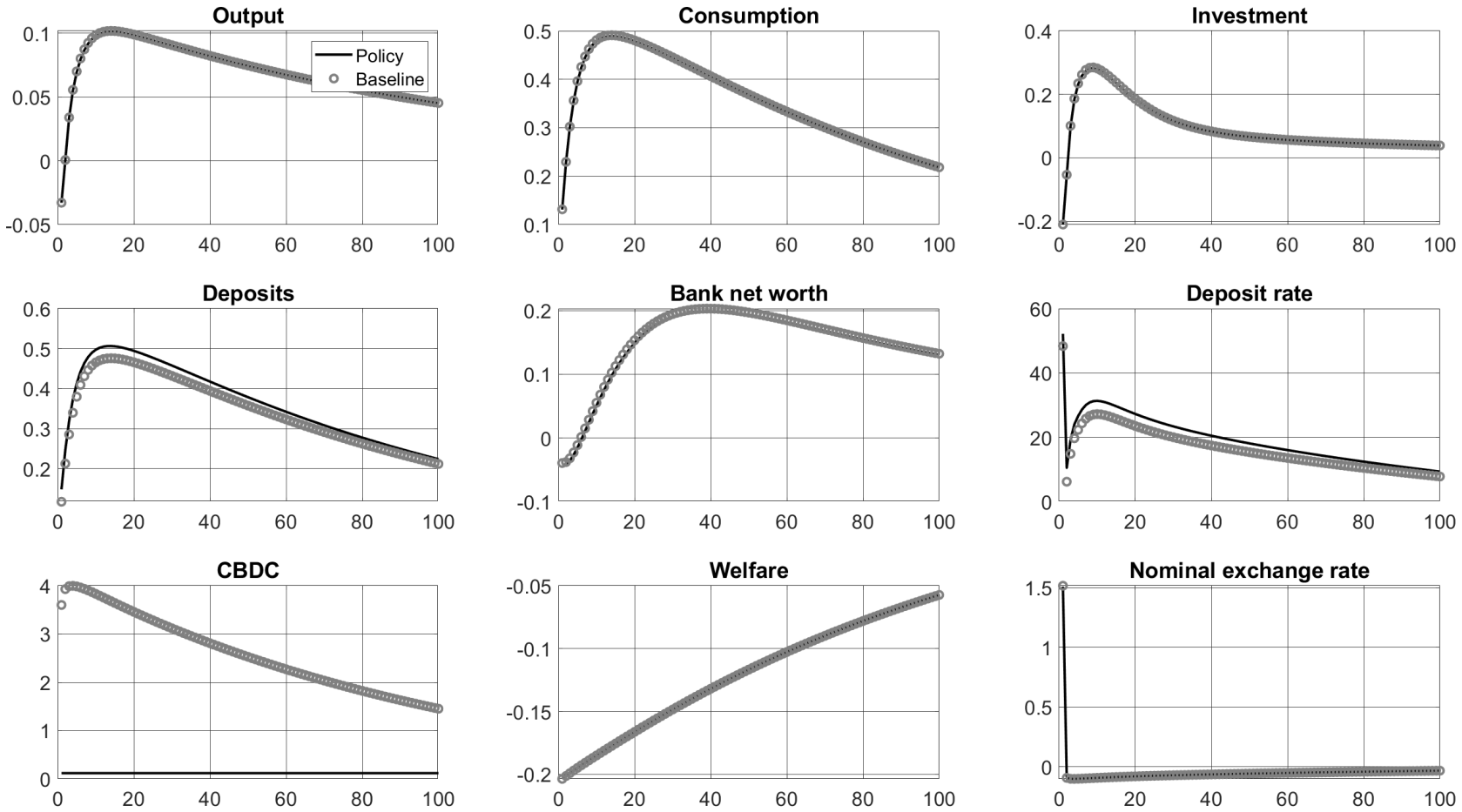
$$\mathrm{C}_t^* = \chi_L^* \left[\mu_M^* (M^*)^{1-\eta_L^*} + \mu_D^* (D^*)^{1-\eta_L^*} + \mu_{DC}^* \left(\frac{DC^*}{\mathbf{RER}_t} \right)^{1-\eta_L^*} \right]^{\frac{1}{1-\eta_L^*}}$$

cross-country CBDC holdings are subject to a quadratic cost proportional to ϕ^{DC}:

$$Cost_t = \phi^{DC} \left(\frac{DC_t^*}{RER_t} \right)^2$$

◂ Go back.

Soft holding limit – foreign economy



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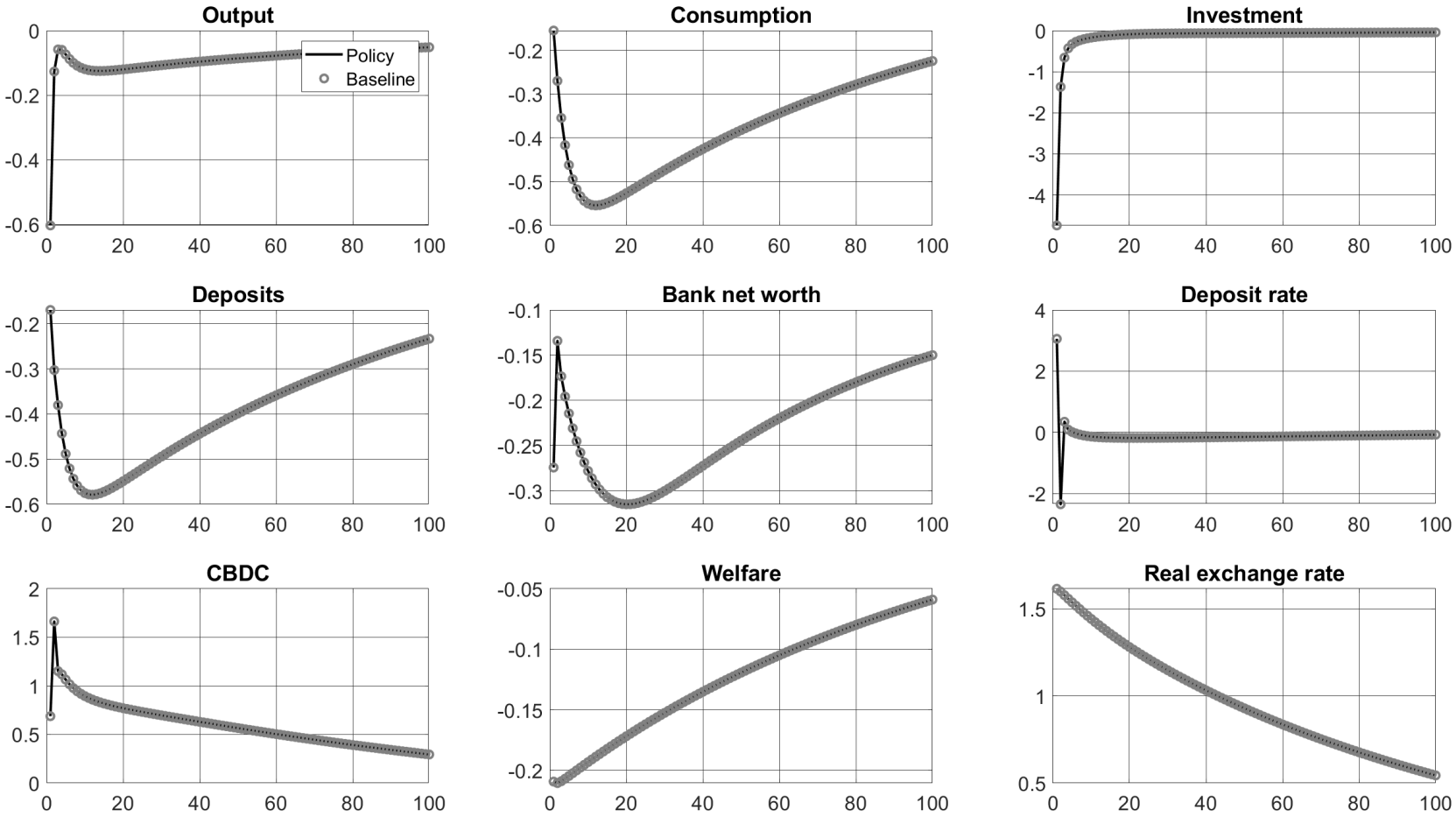
High holding costs



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