The impact of a constraint on foreign exchange rate in a small open economy. DSGE model with constraints.

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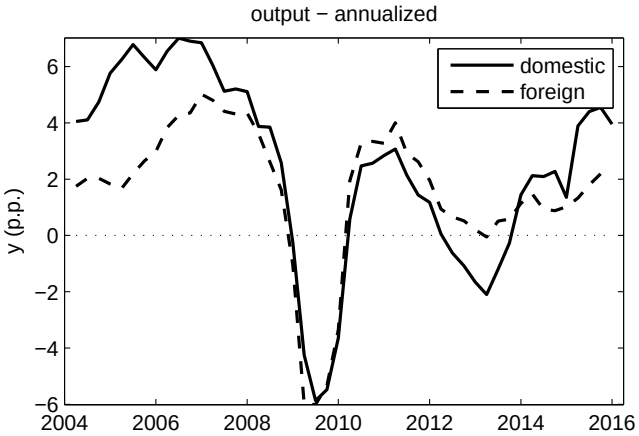
June 7, 2016

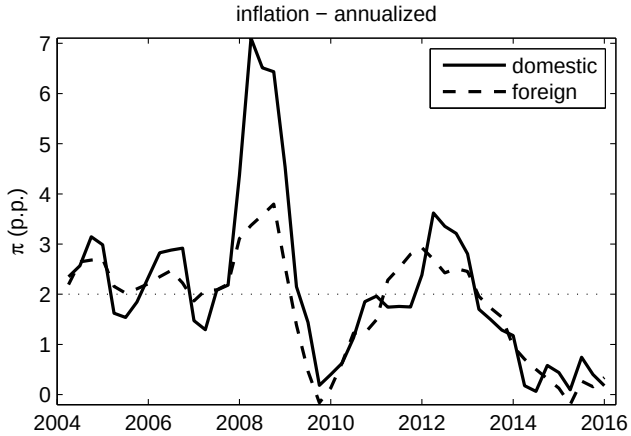
[1]This work is supported by funding of specific research at Faculty of Economics and Administration, project MUNI/A/1040/2015. This support is gratefully acknowledged.

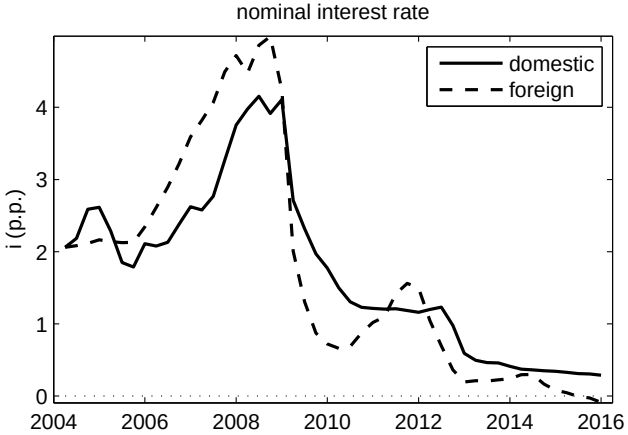
Zero Lower Bound

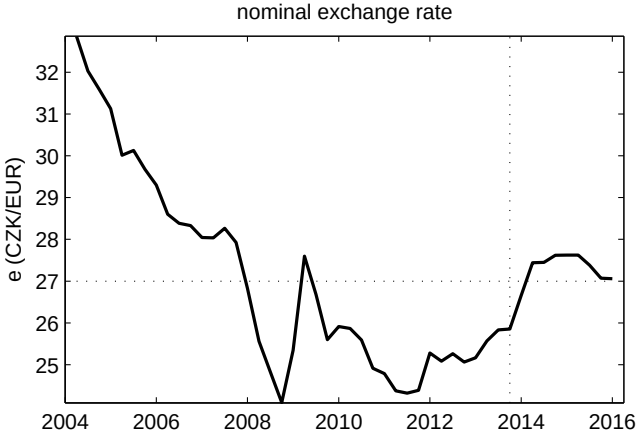
- Interest rates near or at zero
- Central bankers unable to moderate economy
- 2000– Ullersma, Eggertson, Woodford...
- Japan in 1990s, USA since 2009, ECB + CNB since 2012Q4

Czech economy + Eurozone









Transmission mechanism of intervention

Monetary authority aims to achieve

- Stable price level $\sim$ low and stable inflation rate

Depreciation of exchange rate
$\Rightarrow$ lower relative price of domestic goods to foreign alternatives
$\Rightarrow$ higher demand for domestic goods
$\Rightarrow$ higher prices + higher inflation expectations
$\Rightarrow$ higher demand for long-term consumption goods

Model

- Model following Alpanda, Kotzé, Woglom (2010)
- Changes
  1. Nominal exchange rate in UIP condition
  2. Log-differences as input
- Structure
  1. Households
  2. Firms - intermediate goods producers, final goods producers, importers
  3. Monetary authority
  4. Foreign sector modelled as a closed version of the domestic economy

- UIP condition

$$e_t - e_{t+1} = r_t^* - r_t - risk_t$$

- Monetary policy rule

$$r_t = \rho_r r_{t-1} + (1 - \rho_r)(\bar{r} + \phi_\pi(\pi_{t+1} - \pi_T) + \phi_p P + \phi_y y) + \epsilon_r$$ [2]

[2] $\rho_r = 0.9153$, $\phi_\pi = 1.5100$, $\phi_p = 0.1183$, $\phi_y = 0.4876$

Constraints in DSGE models

- Tom Holden, Michael Paetz – Efficient simulation of DSGE models with inequality constraints
- Tom Holden – Existence, uniqueness and computation of solutions to dynamic models with occasionally binding constraints.

DynareOBC

- Holdens algorithm extended into the easily applicable tool
- Conditions of model feasibility and existence of the solution + algorithm
- Matlab 2015b, Parallel toolbox, Optimization toolbox, Dynare 4.4.3
- Metacentrum[3]

[3] Access to computing and storage facilities owned by parties and projects contributing to the National Grid Infrastructure MetaCentrum, provided under the programme "Projects of Large Research, Development, and Innovations Infrastructures" (CESNET LM2015042), is greatly appreciated.

Inequality constraint

$$(A + B + C)\mu = Ax_{t-1} + Bx_t + Cx_{t+1} + I_{.,1}y_{1,t-1},$$

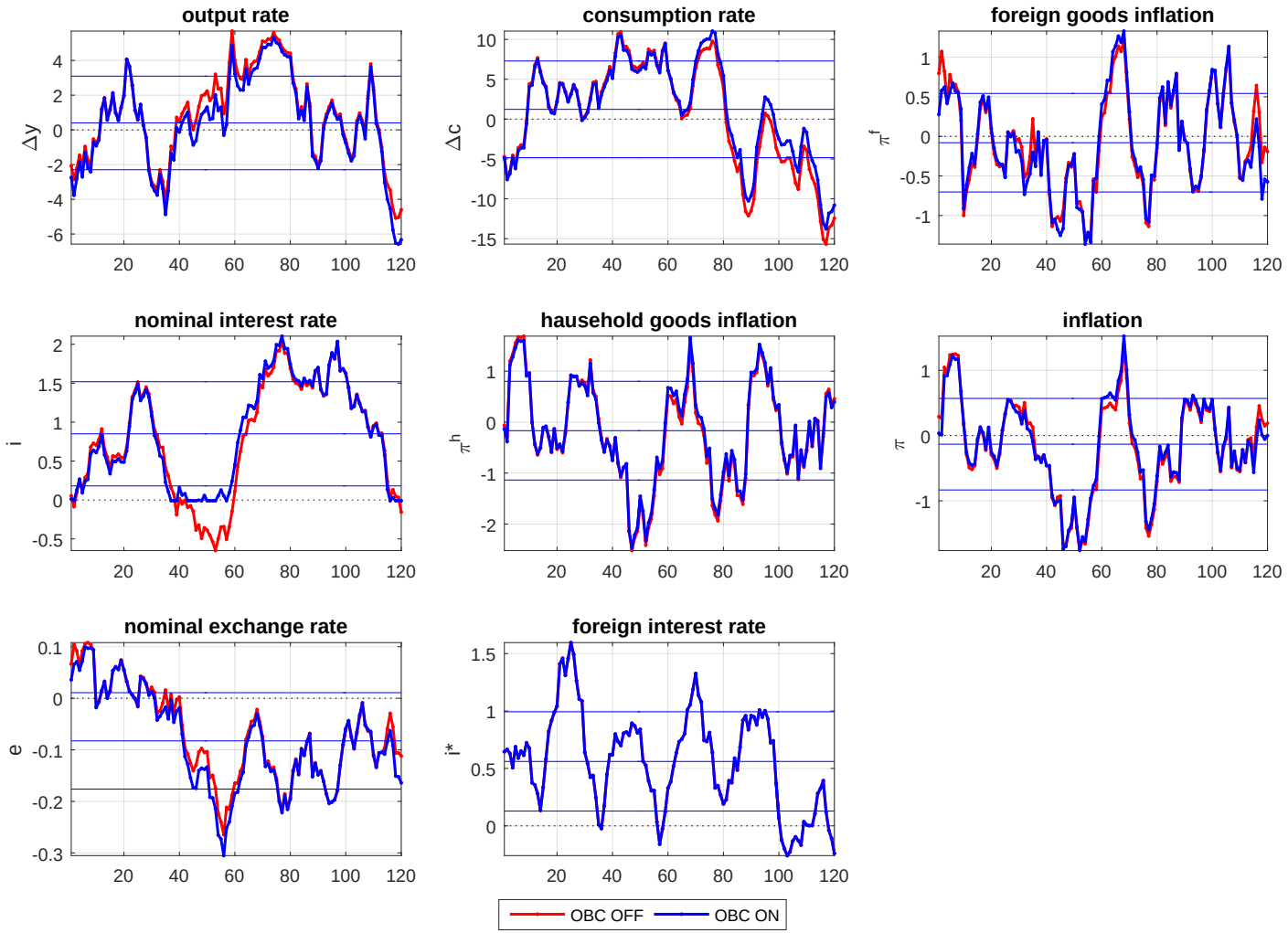
$\forall i \in \{1, \ldots, T-1\}$, $y_{i,t} = y_{i+1,t-1}$, $y_{T,t} = 0$

- T^* maximal time horizon when the constraint is expected to bind
- "News shock" in period t $y_{t,0}$
- Matrix M horizontally stacks the relative impulse responses to the news shocks, q is the solution of unconstrained problem. Then finding the solution of the problem stated above is equivalent to solving following "linear complementarity problem"

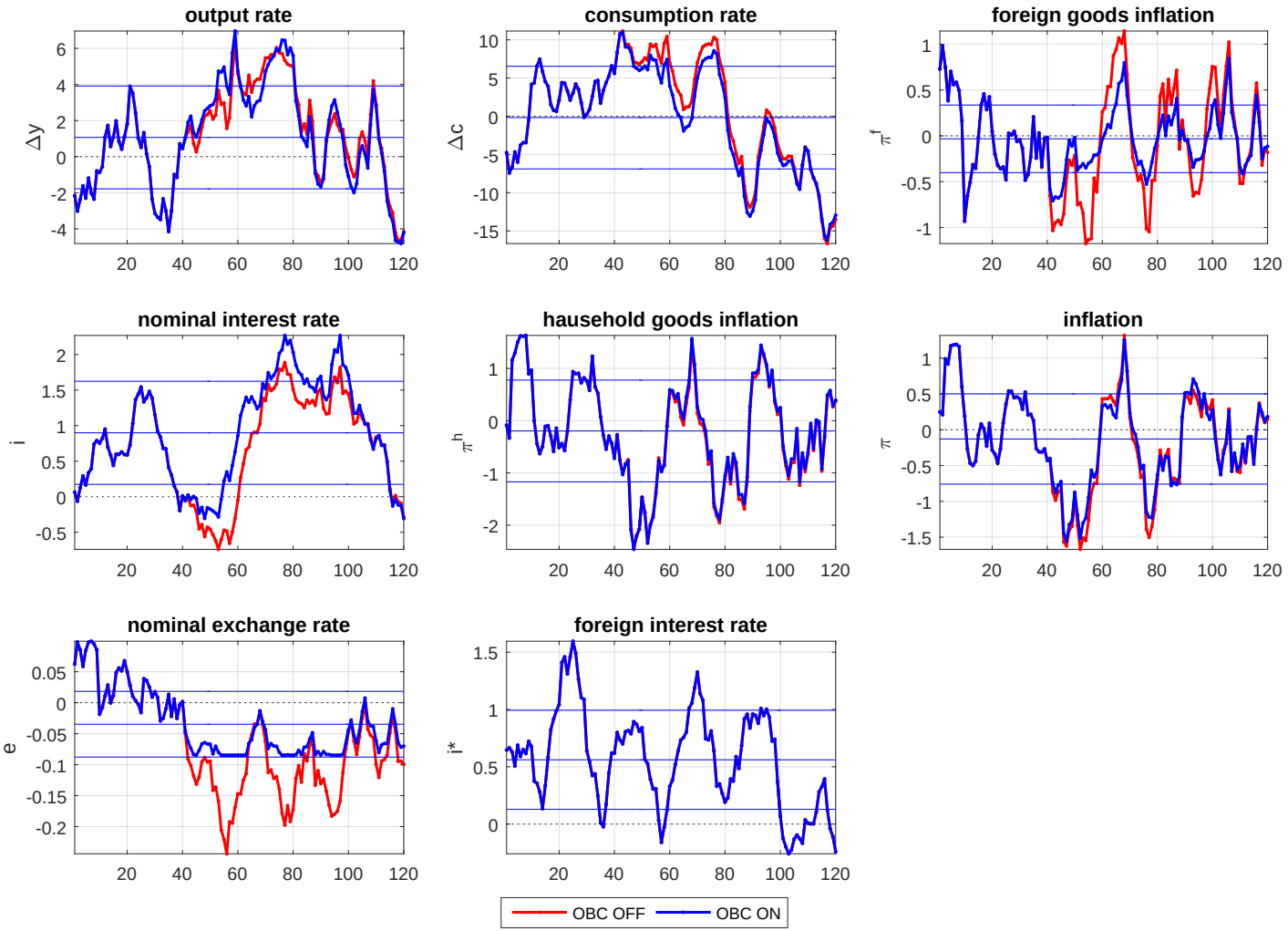
Find $y \in \mathbb{R}$ such that

$$y \geq 0, \qquad y(q + My) = 0, \qquad q + My \geq 0$$

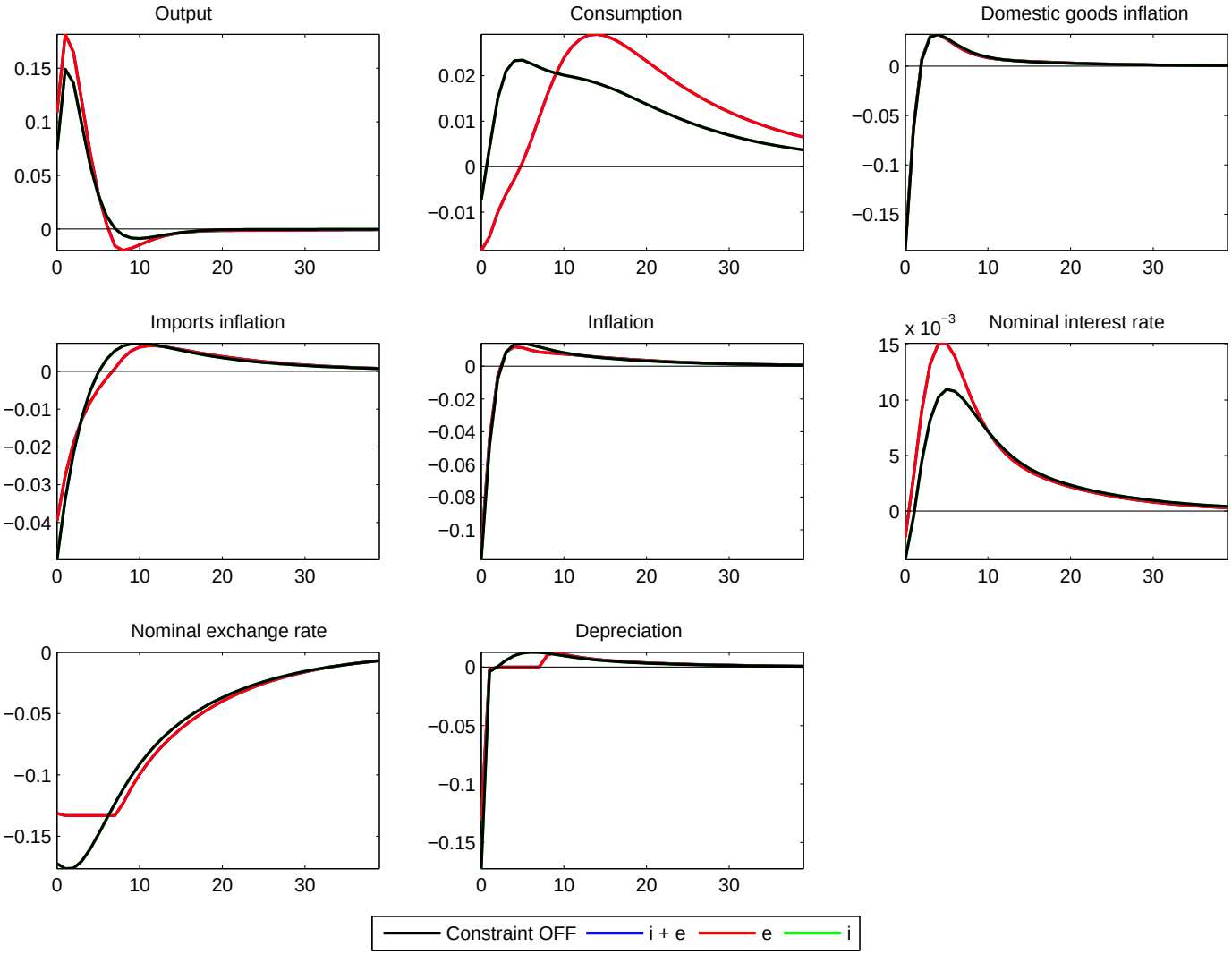
State trajectory - ZLB



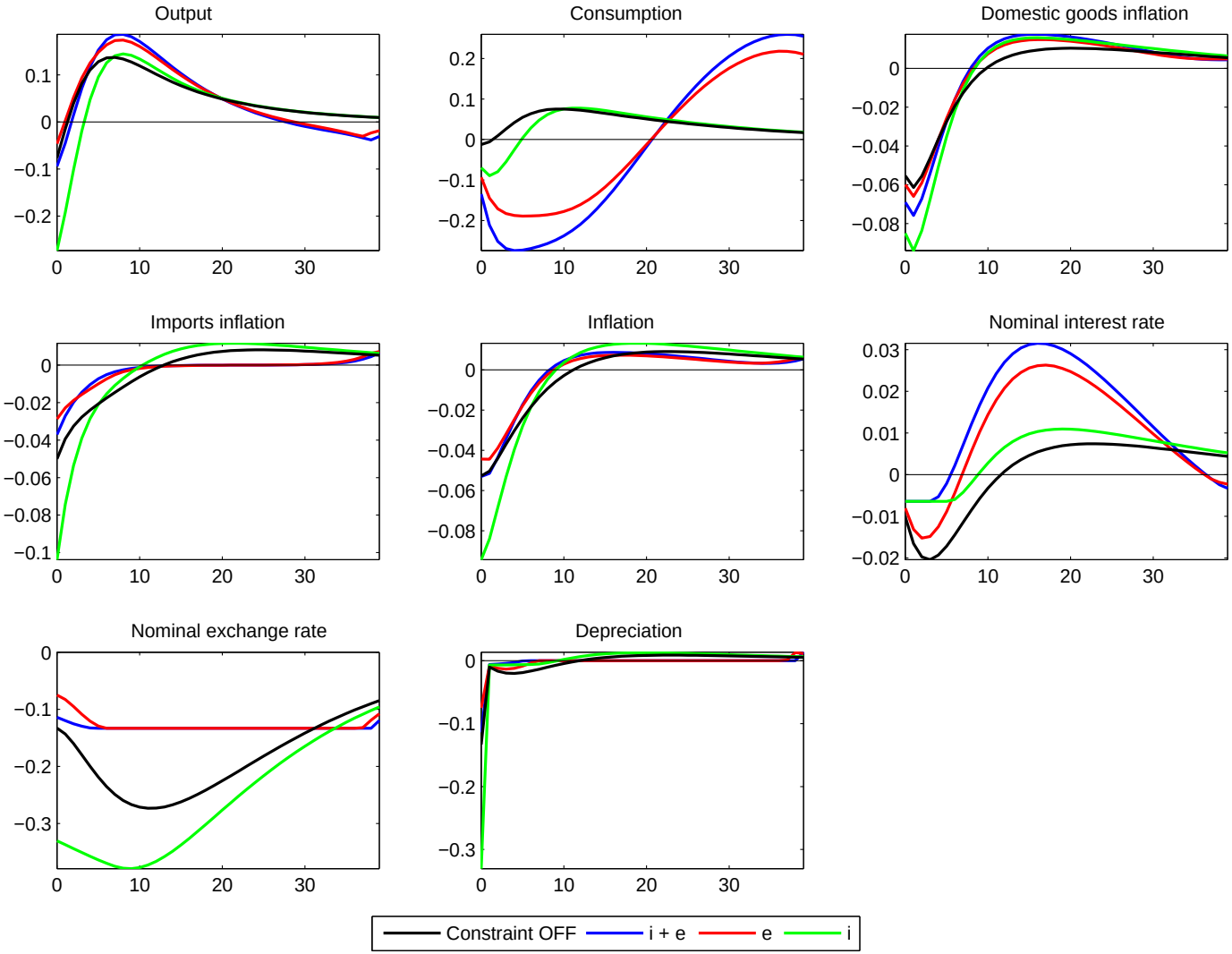
State trajectory - Asymmetric commitment



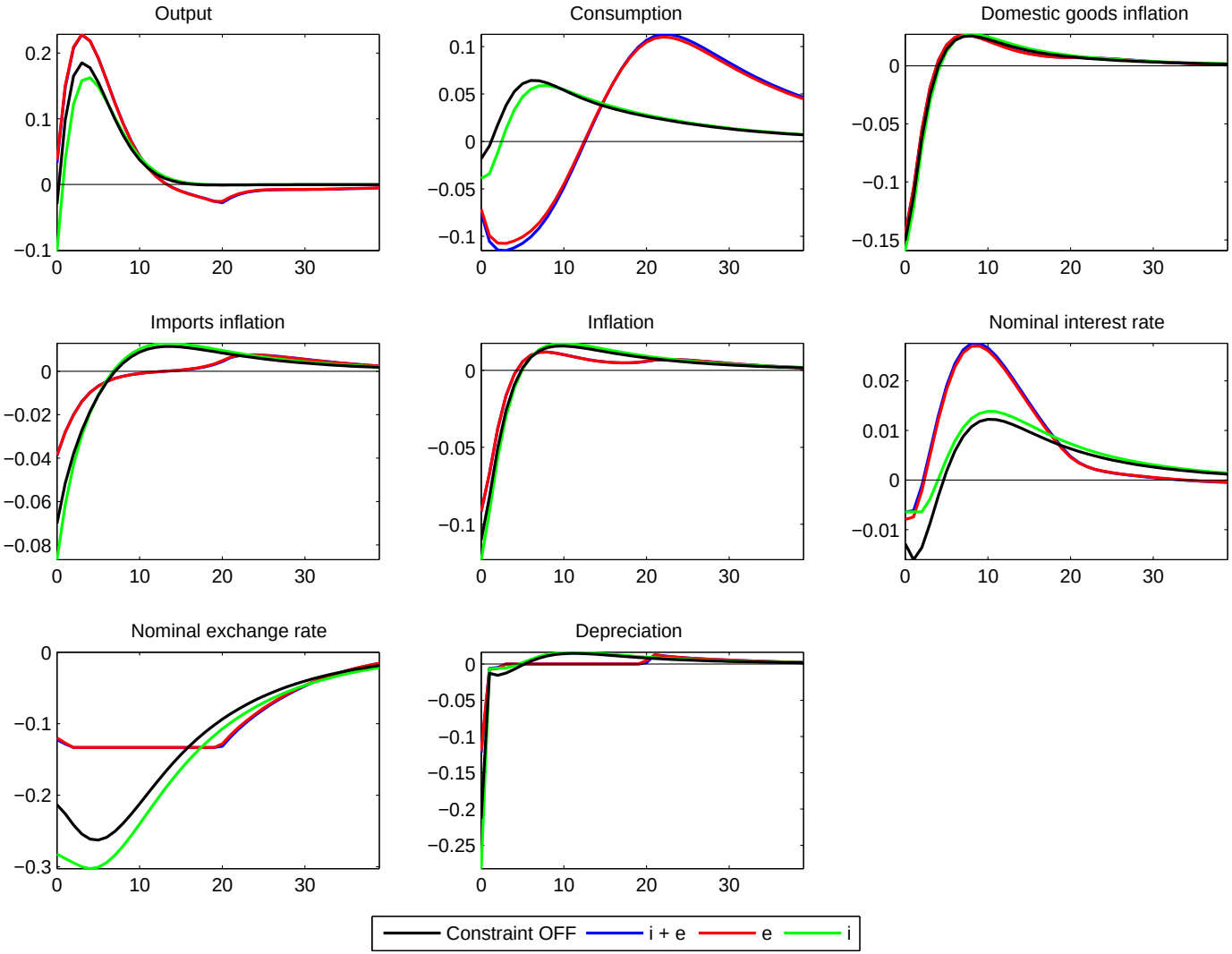
Domestic negative cost−push shock − ZLB + commitment



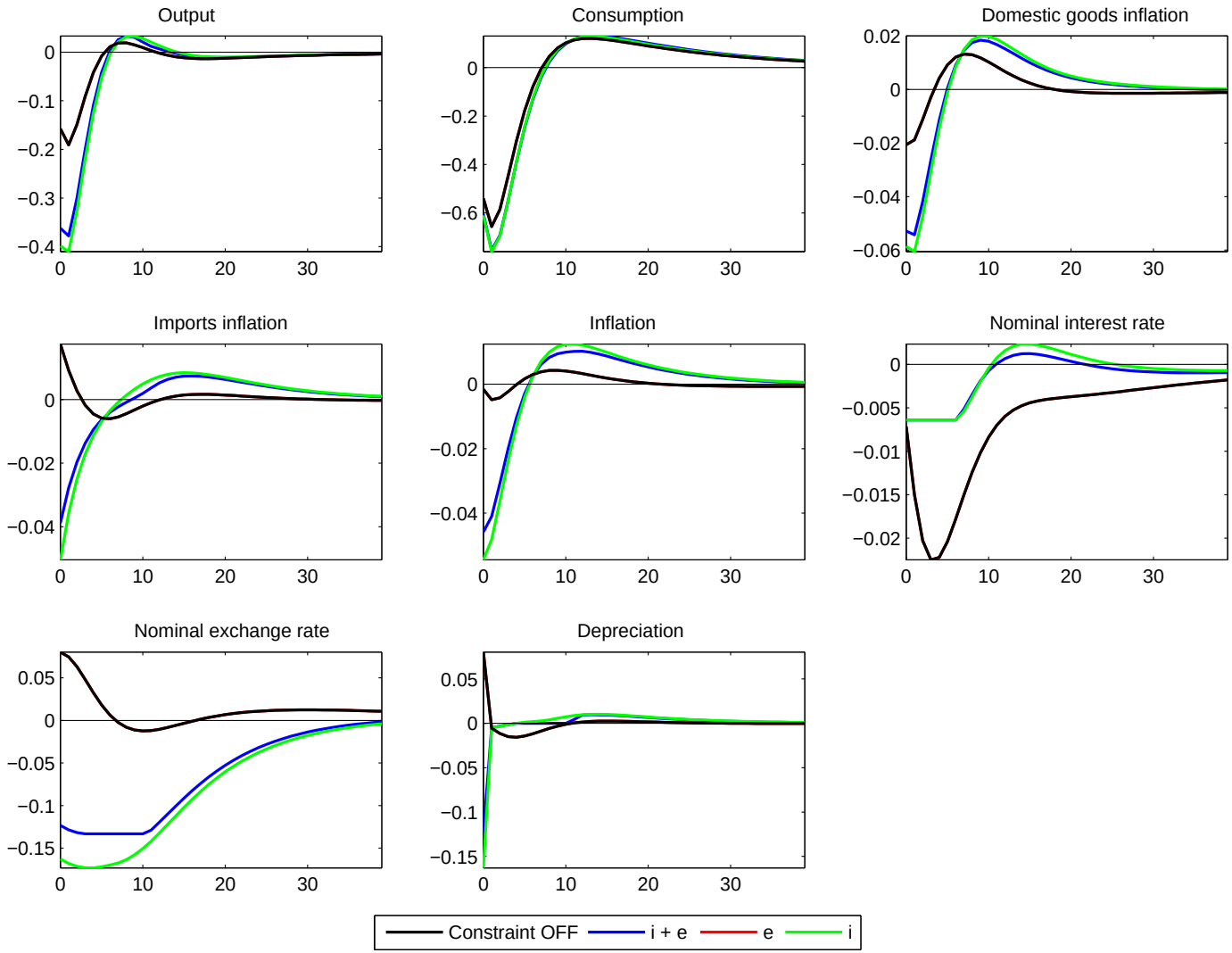
Negative wage shock − ZLB + commitment



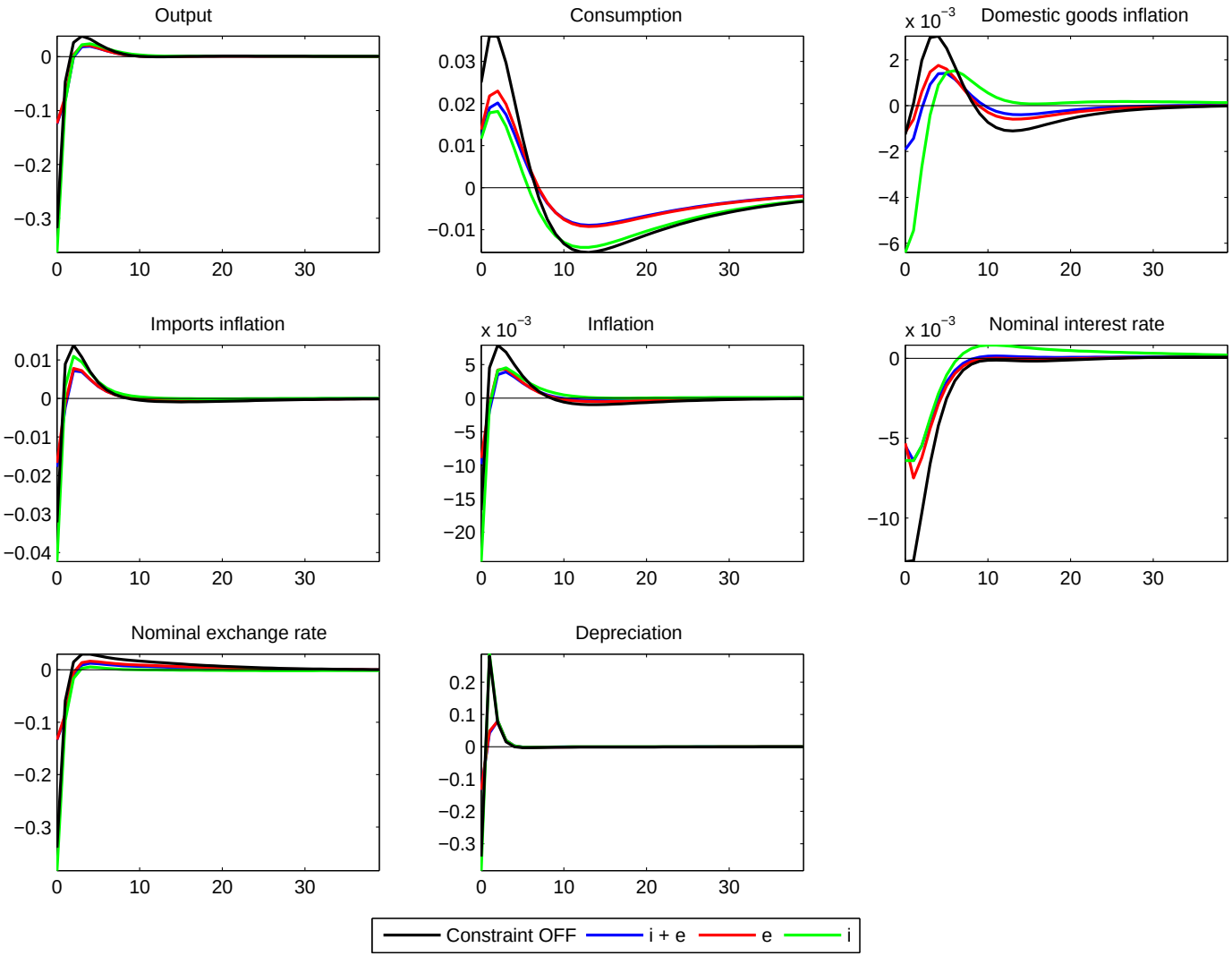
Domestic technology shock − ZLB + commitment



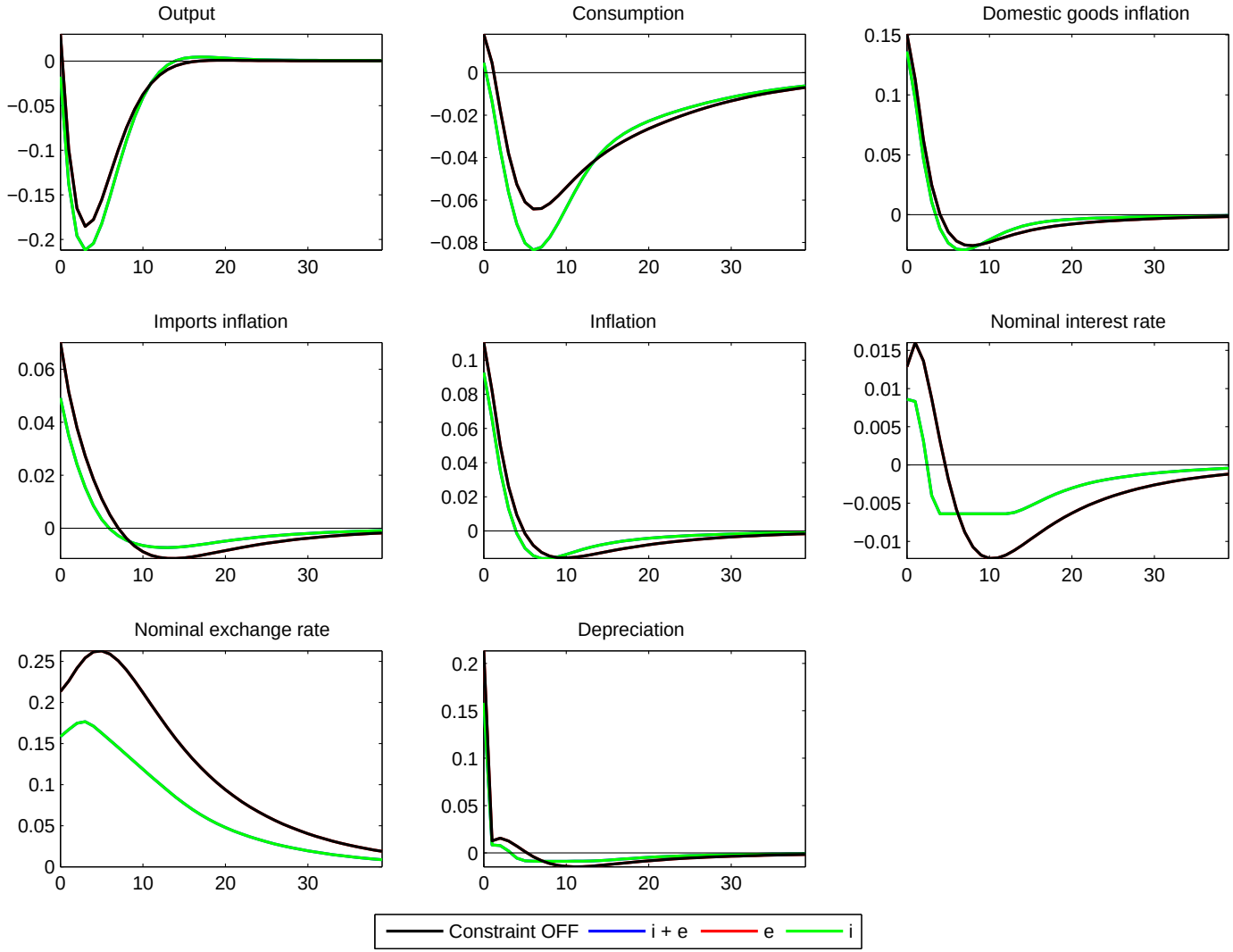
Domestic positive risk aversion shock − ZLB + commitment



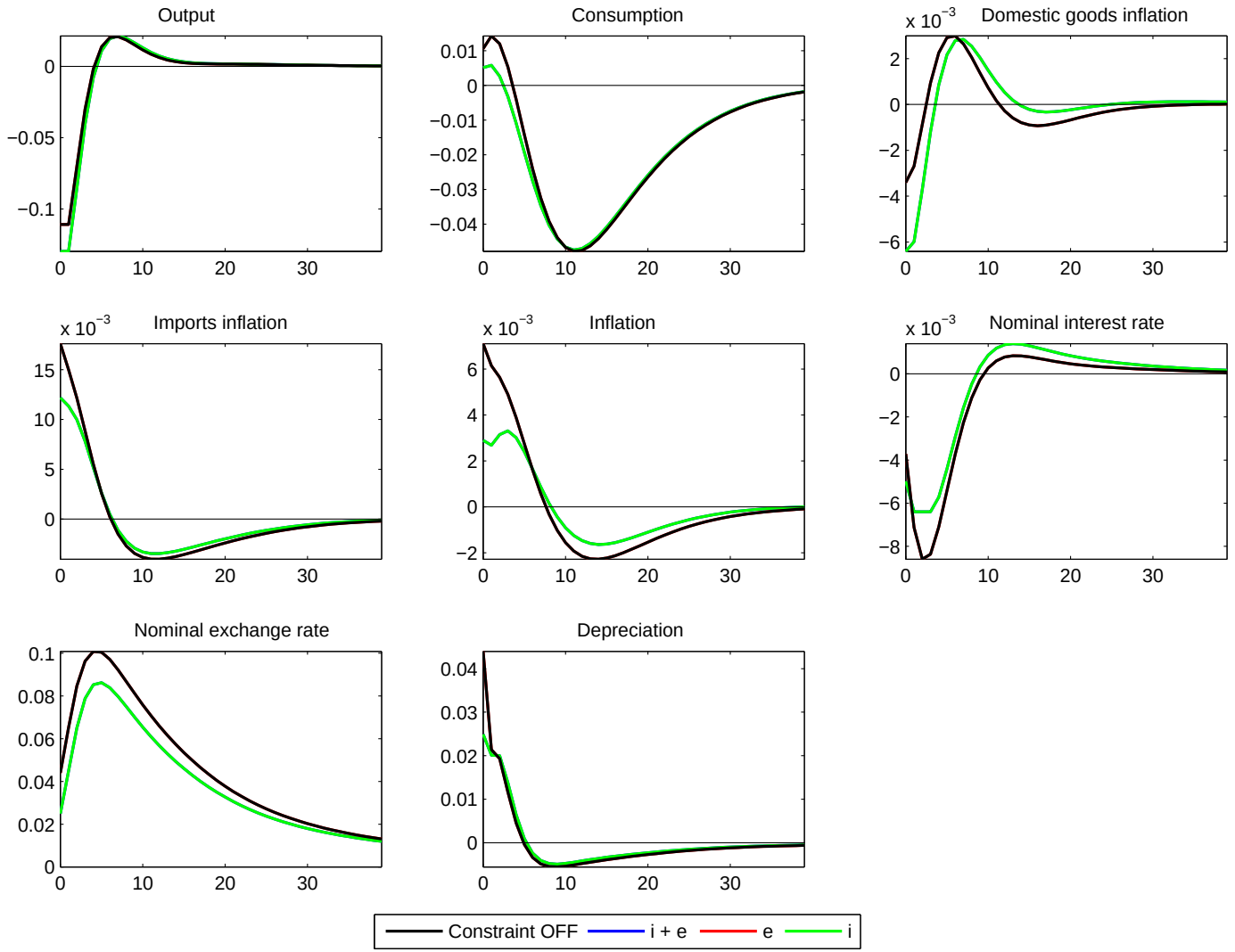
Risk premium shock − ZLB + commitment



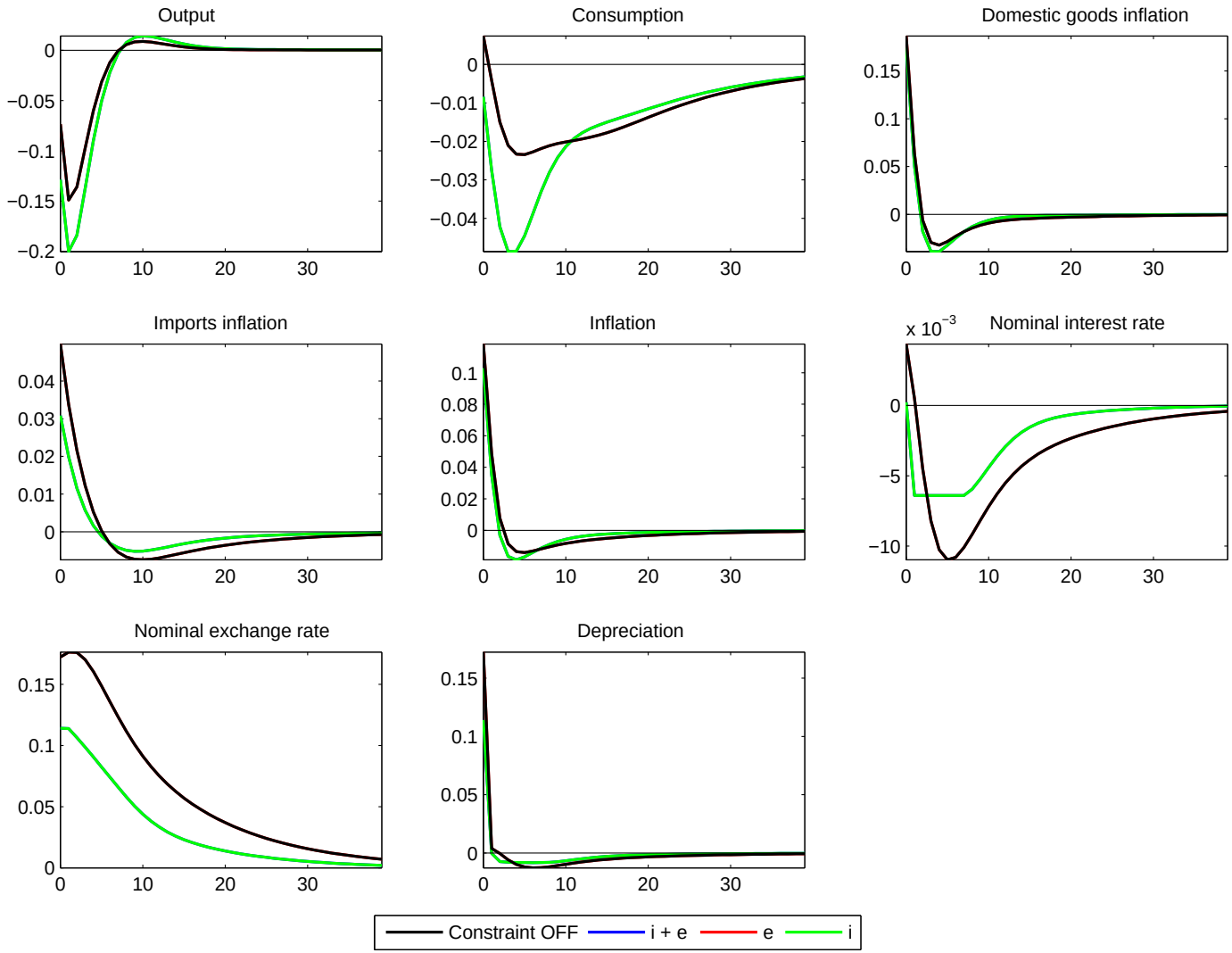
Domestic negative technology shock − ZLB + commitment



Foreign positive risk aversion shock − ZLB + commitment



Domestic cost−push shock − ZLB + commitment



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Thank you for your attention.