Fiscal policies analysis in a real business cycle model

December 2025

national treasury
Department:
National Treasury
REPUBLIC OF SOUTH AFRICA

2030 NDP

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Introduction

- We began the year by replicating the RBC sections of *Practicing Dynare*.
- Legacy functions were updated for modern Dynare, including replacing `simul` with `perfect_foresight_solver`.
- The model is being cleaned up by removing dubious variables and clarifying timing conventions.
- Previous presentations showed transition paths under different policy adjustments.
- For this round, we:
  - Re-specified fiscal policy: fiscal variables now follow AR(1) processes instead of being exogenous.
  - Added preference and technology shocks using the same structure.
  - Incorporated a Bayesian estimation of the model, showing the IRFs for different shocks.

Model structure (1/2)

Equilibrium conditions:

$$y_t = c_t + i_t + g_t \tag{1}$$

$$y_t = Ak_t^{\alpha} \tag{2}$$

$$k_t = k_{t-1} + i_t \tag{3}$$

$$r_t = A_t \alpha k_t^{\alpha-1} \tag{4}$$

$$w_t = A_t k_t^{\alpha} - k_t A_t \alpha k_t^{\alpha-1} \tag{5}$$

$$R_{t+1} = \frac{(1+\tau_{c,t})}{(1+\tau_{c,t+1})}\left[(1-\delta) + (1-\tau_{k,t+1})r_{t+1}\right] \tag{6}$$

$$s_t = (1-\tau_{k,t})A_t \alpha k_t^{\alpha-1} + (1-\delta) \tag{7}$$

$$c_t^{-\gamma} = pref_t * \beta c_{t+1}^{-\gamma} R_{t+1} \tag{8}$$

Model structure (2/2)

Shock processes:

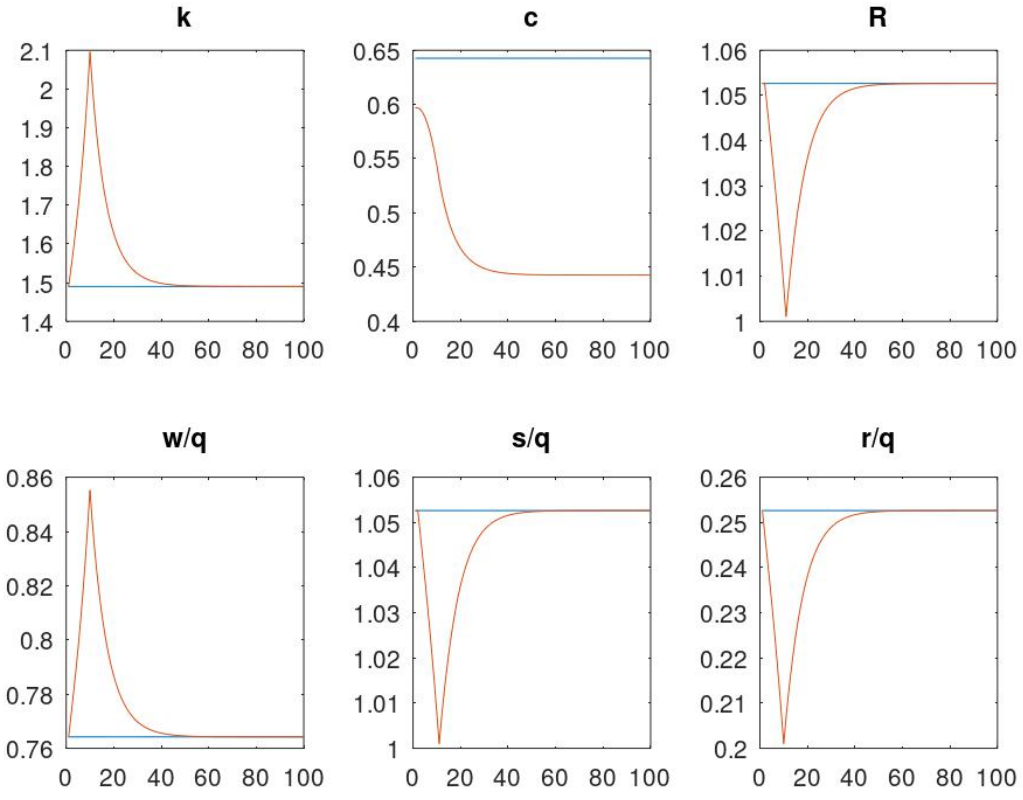
$$pref_t = \omega_p pref_{t-1} + \epsilon_{t,p} \tag{9}$$

$$A_t = \omega_A A_{t-1} + \epsilon_{t,A} \tag{10}$$

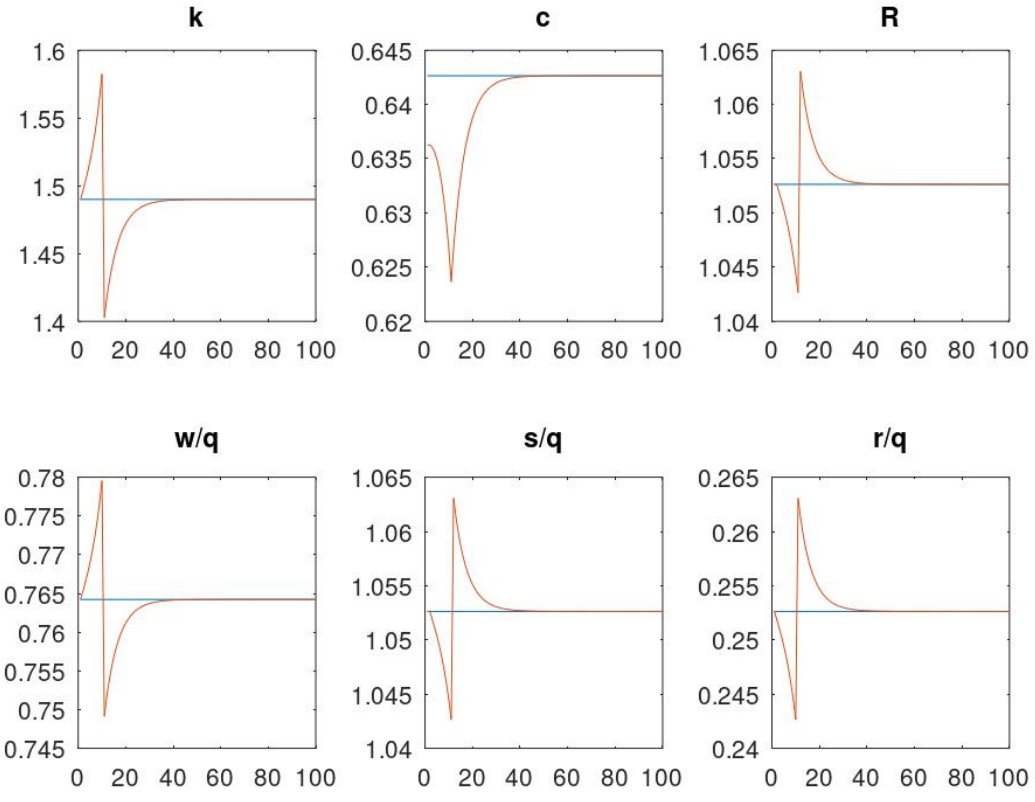
$$tau_{c,t} = \omega_c tau_{c,t-1} + \epsilon_{t,c} \tag{11}$$

$$tau_{k,t} = \omega_k tau_{k,t-1} + \epsilon_{t,k} \tag{12}$$

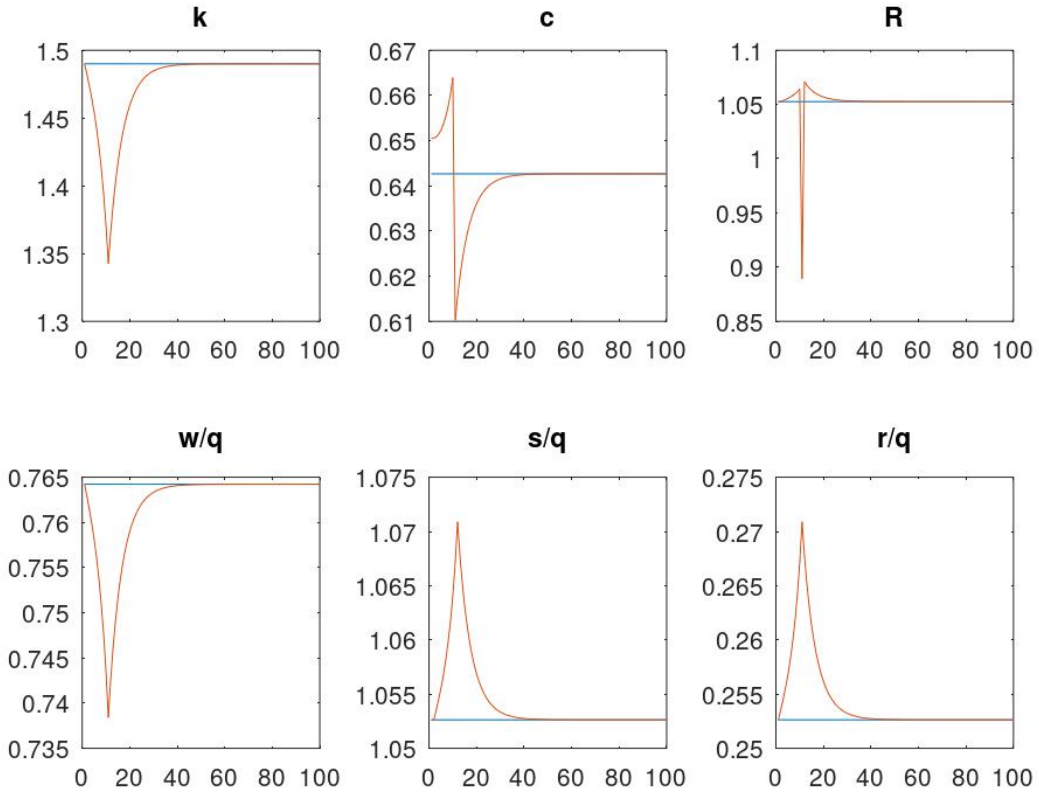
Transition path: Permanent change in g



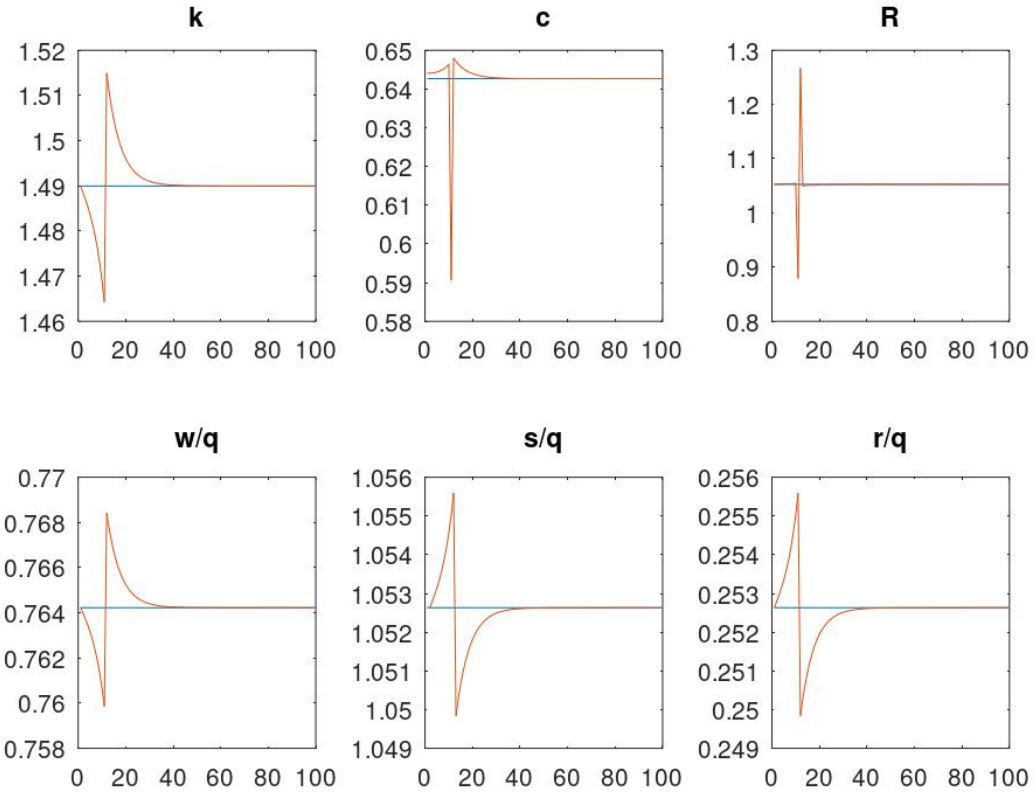
Transition path: Temporary change in g



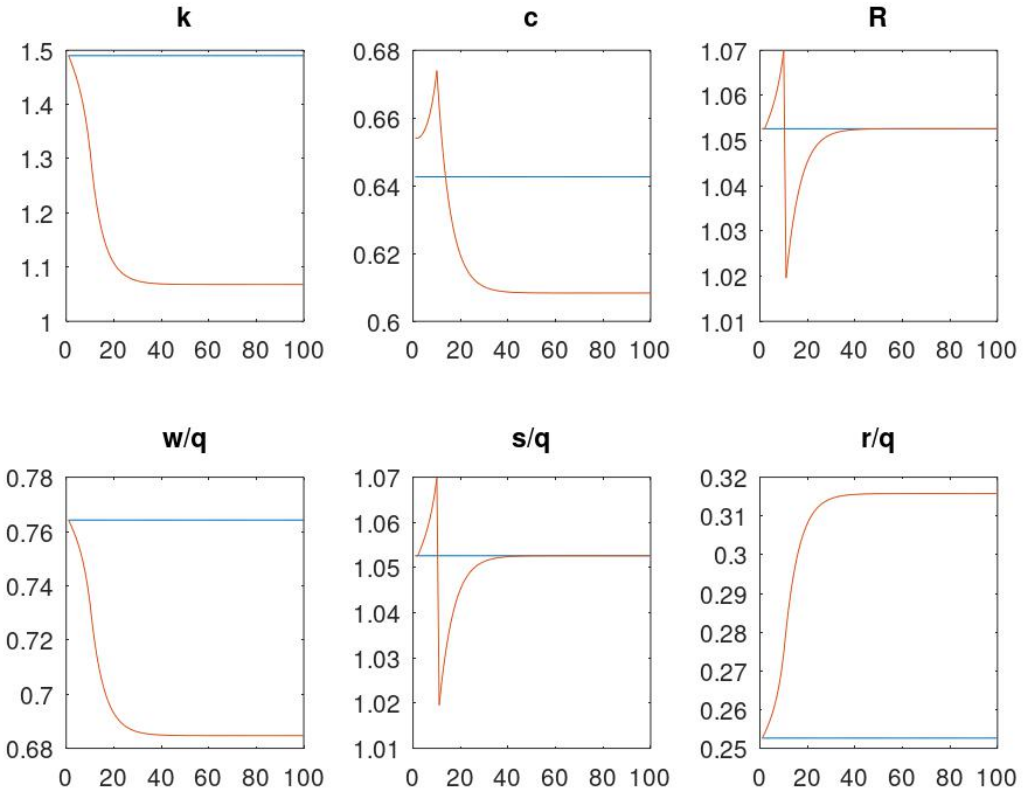
Transition path: Permanent change in tau_c



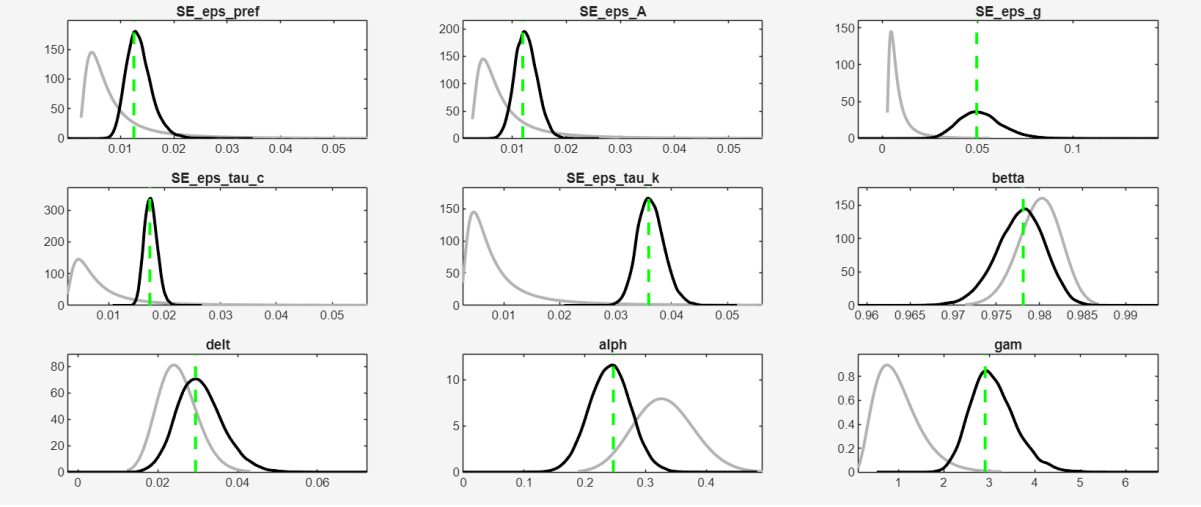
Transition path: Temporary change in tau_c



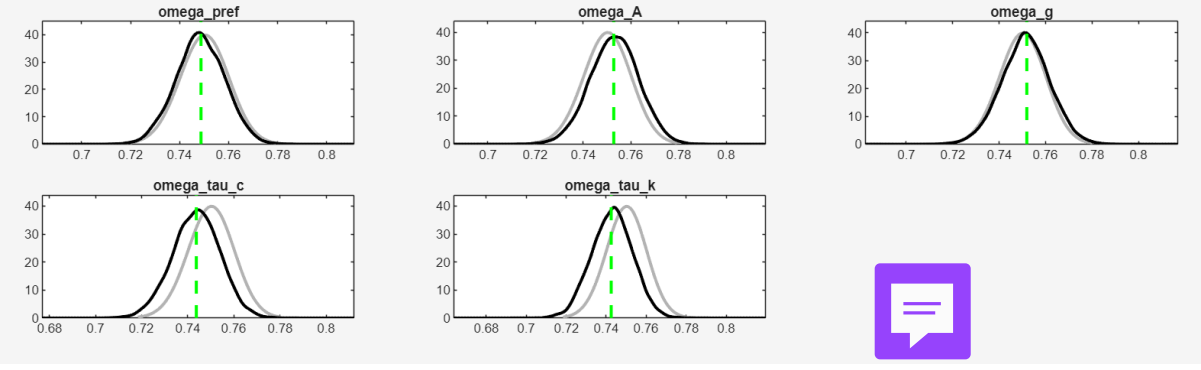
Transition path: Permanent change in tau_c



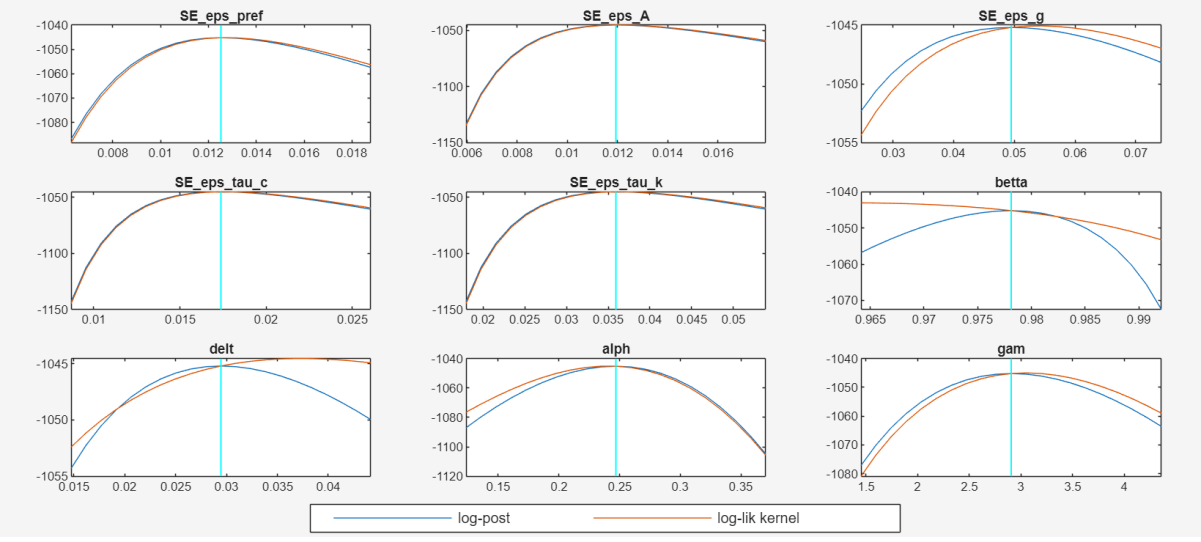
Priors and posteriors (1/2)



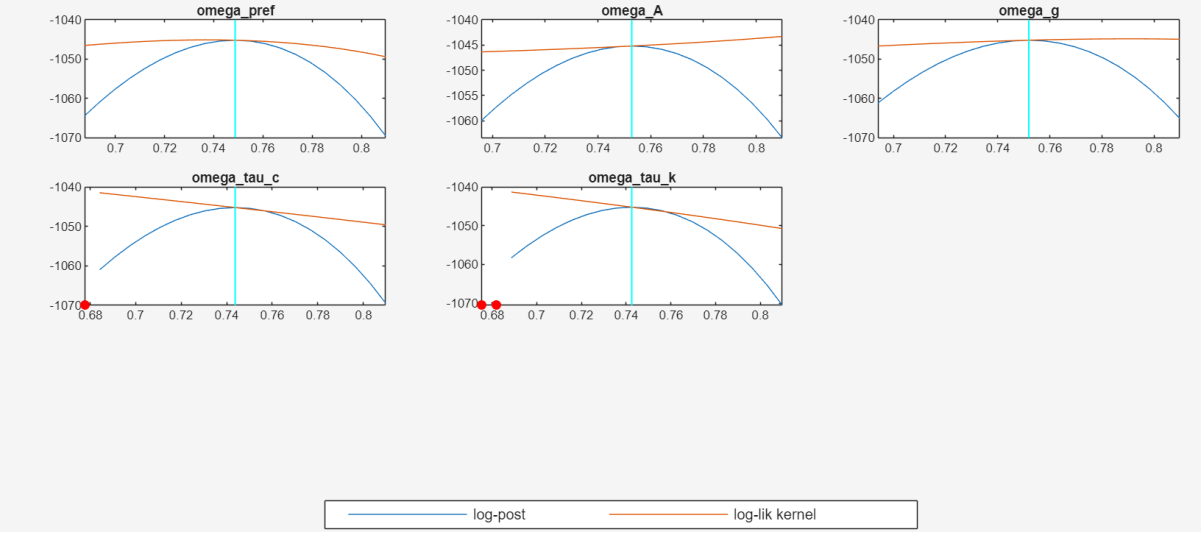
Priors and posteriors (2/2)



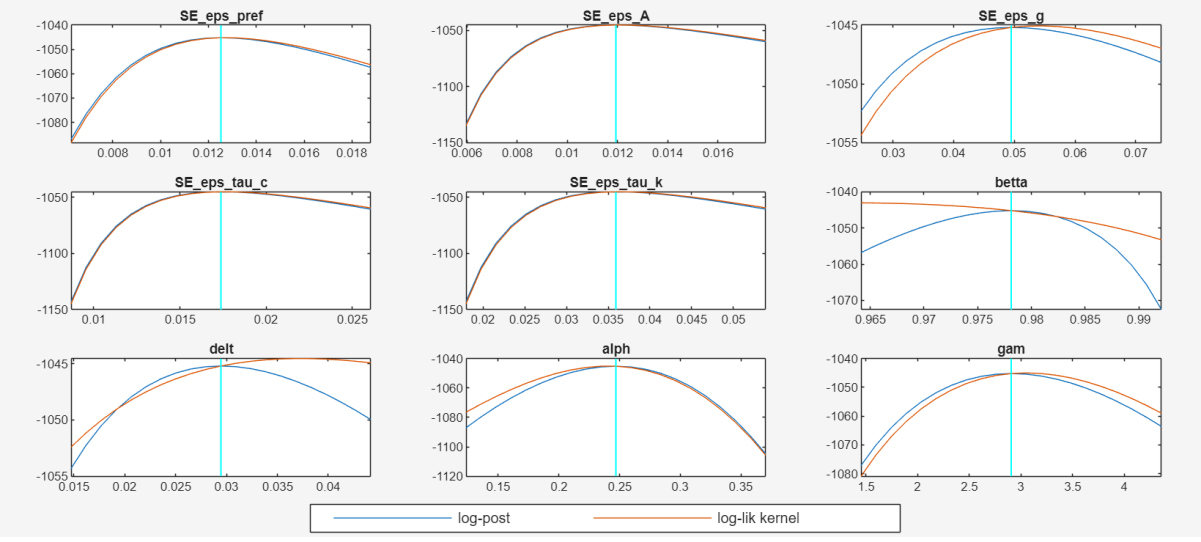
Mode check (1/2)



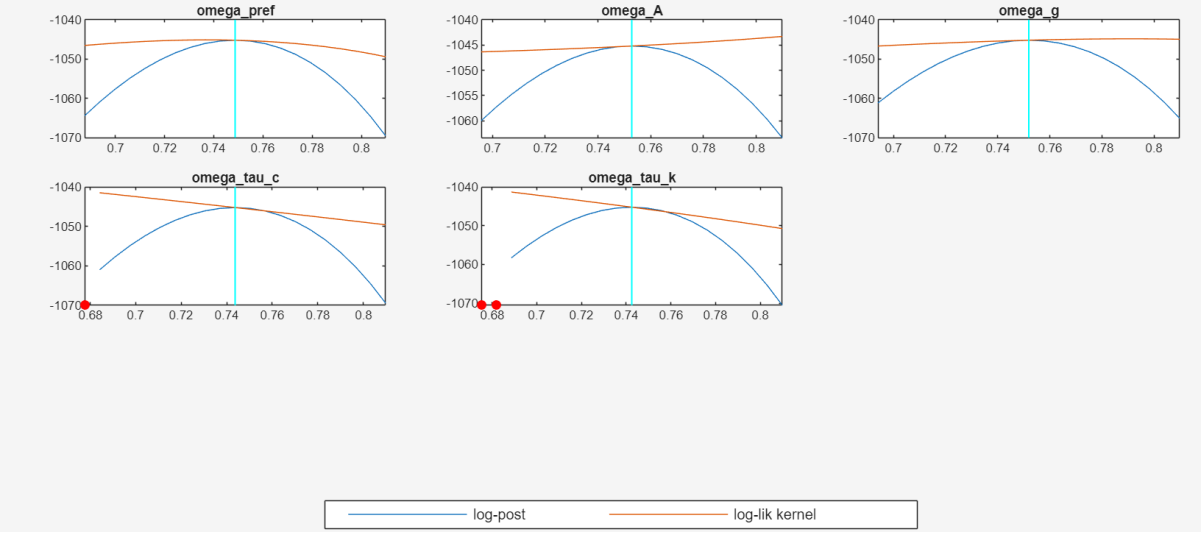
Mode check (2/2)



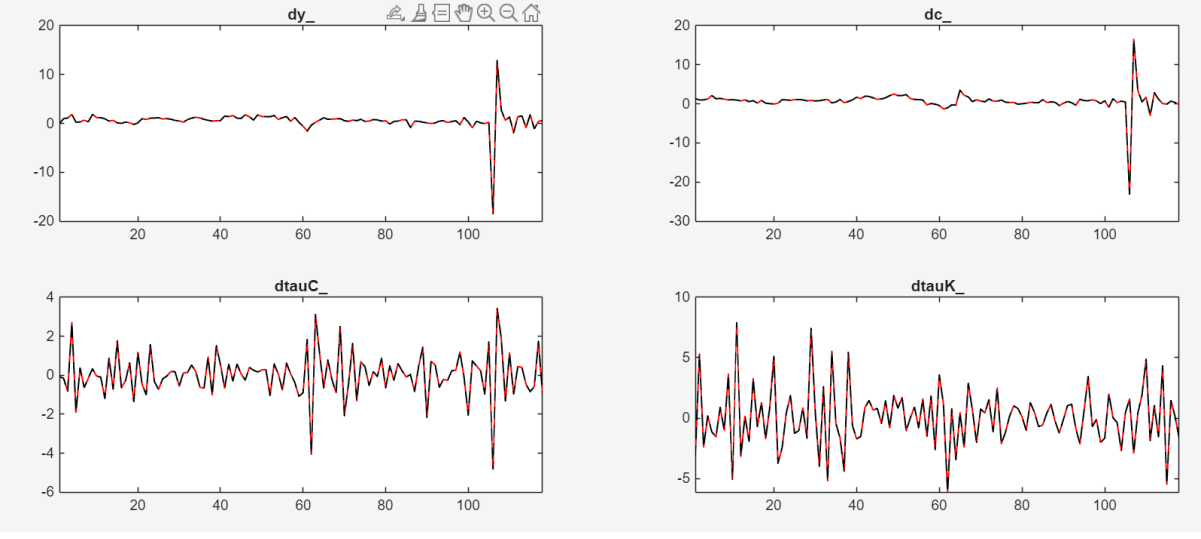
Mode check (1/2)



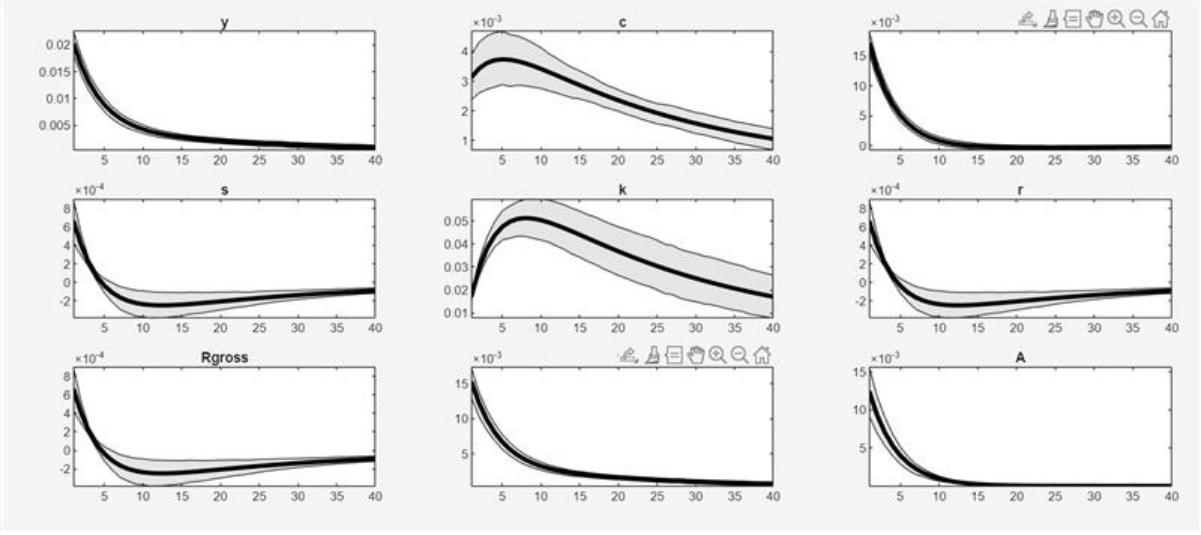
Mode check (2/2)



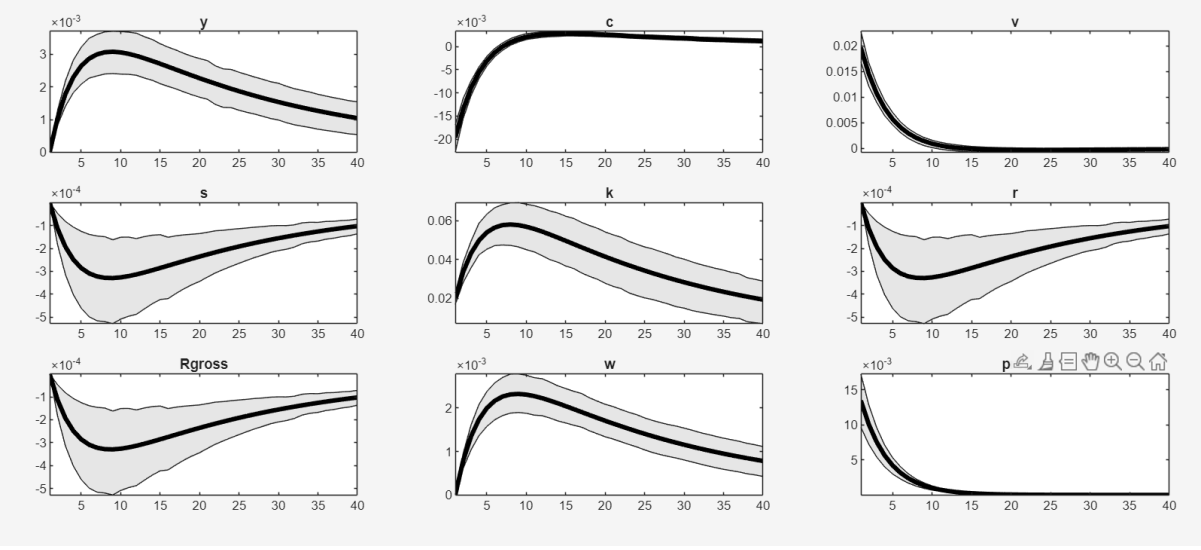
Actuals vs. Fitted



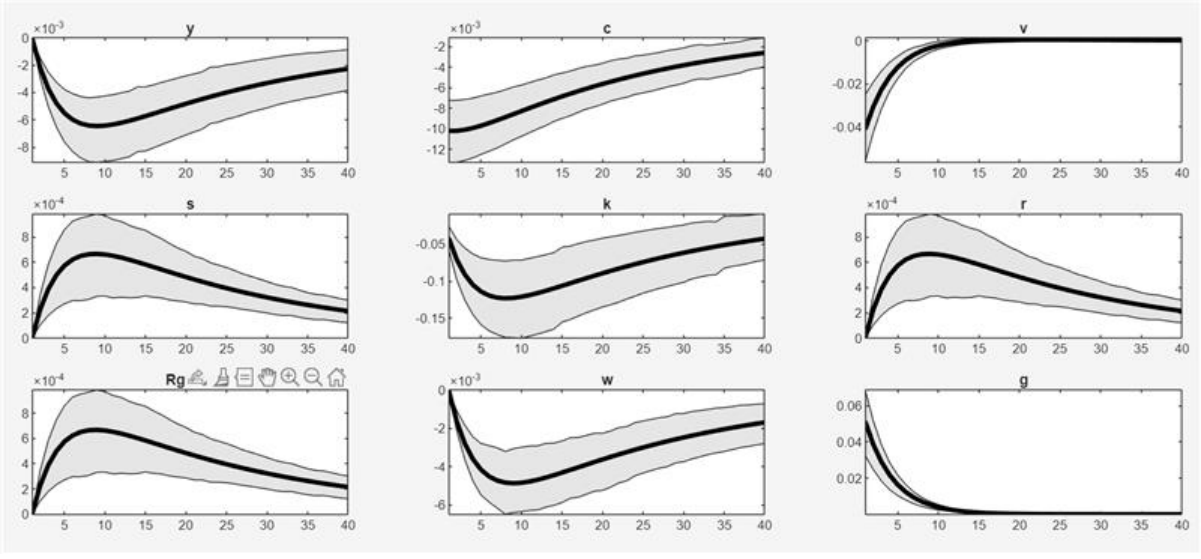
IRF: Technology shock A



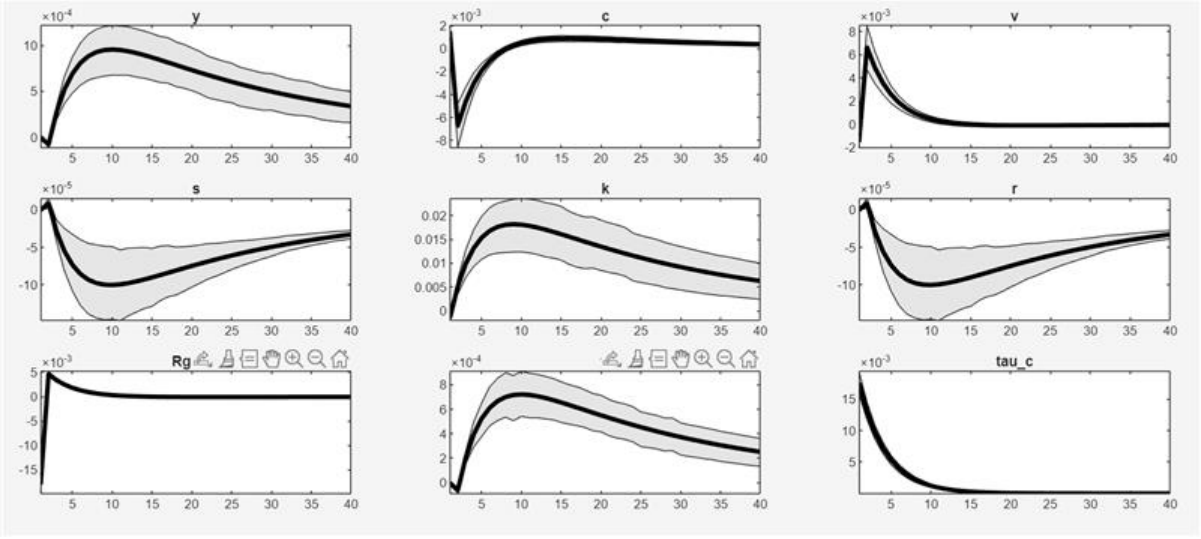
IRF: Preference shock *pref*



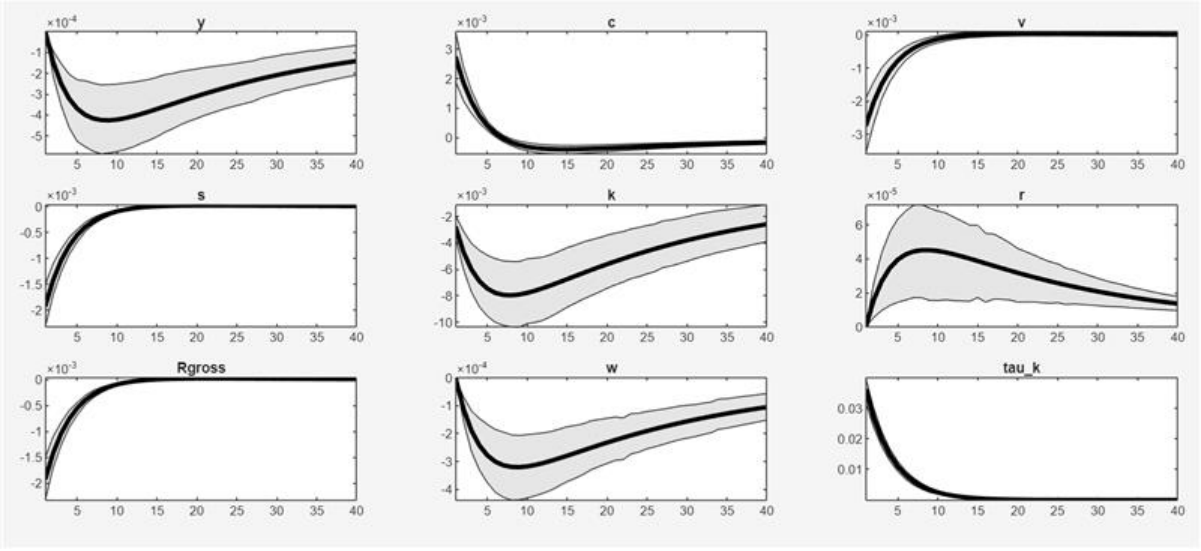
IRF: G shock g



IRF: Tax shock tau_c



IRF: Tax shock tau_k



Things to do next

- Continue cleaning and reorganising the `.mod` file.
- Introduce clearer variable names (both in Dynare and LaTeX).
- For the new *Practicing Dynare*:
  - Add clean, well-commented code blocks with brief explanations.
  - Replace inelastic labour supply with labour choice and labour taxes.
  - Add a concise section on Bayesian estimation with at least one example or key references.
  - Include optimal simple rules for calibrating fiscal policy rules.
  - Demonstrate basic forecasts and conditional projections.
  - Add a short troubleshooting section for common Dynare issues.