

# Fiscal policies analysis in a real business cycle model

December 2025



**national treasury**

Department:  
National Treasury  
REPUBLIC OF SOUTH AFRICA



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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:

$$y_t = c_t + i_t + g_t \quad (1)$$

$$y_t = A k_t^\alpha \quad (2)$$

$$k_t = k_{t-1} + i_t \quad (3)$$

$$r_t = A_t \alpha k_t^{\alpha-1} \quad (4)$$

$$w_t = A_t k_t^\alpha - k_t A_t \alpha k_t^{\alpha-1} \quad (5)$$

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

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

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

## Model structure (2/2)

Shock processes:

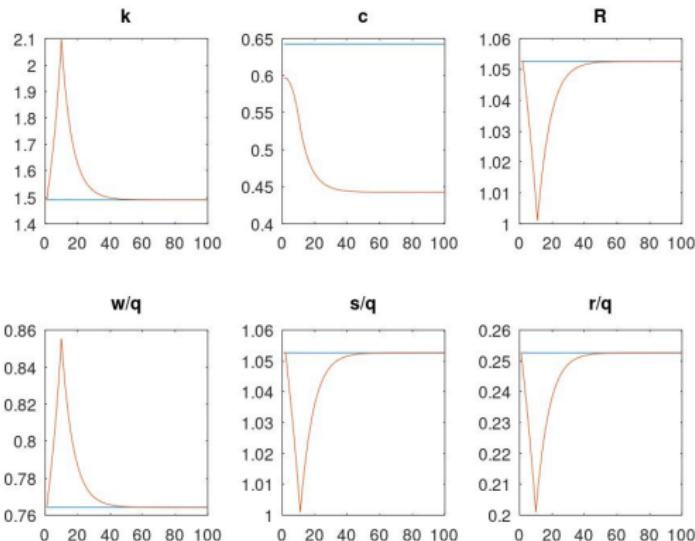
$$pref_t = \omega_p pref_{t-1} + \epsilon_{t,p} \quad (9)$$

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

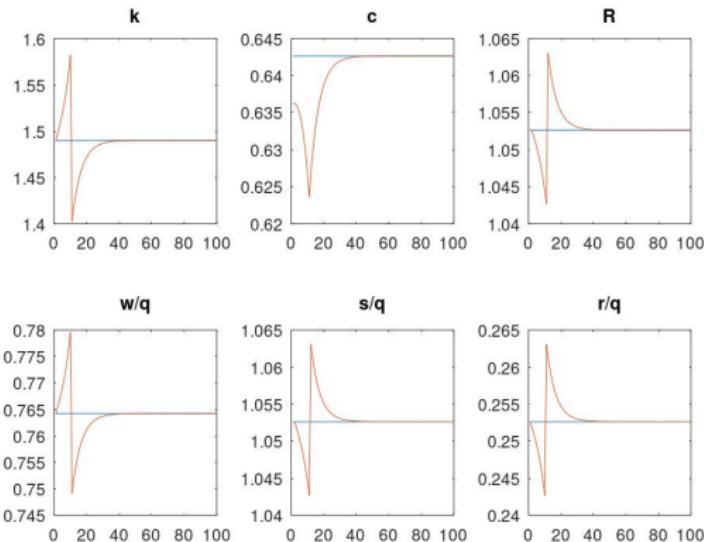
$$tau_{c,t} = \omega_c tau_{c,t-1} + \epsilon_{t,c} \quad (11)$$

$$tau_{k,t} = \omega_k tau_{k,t-1} + \epsilon_{t,k} \quad (12)$$

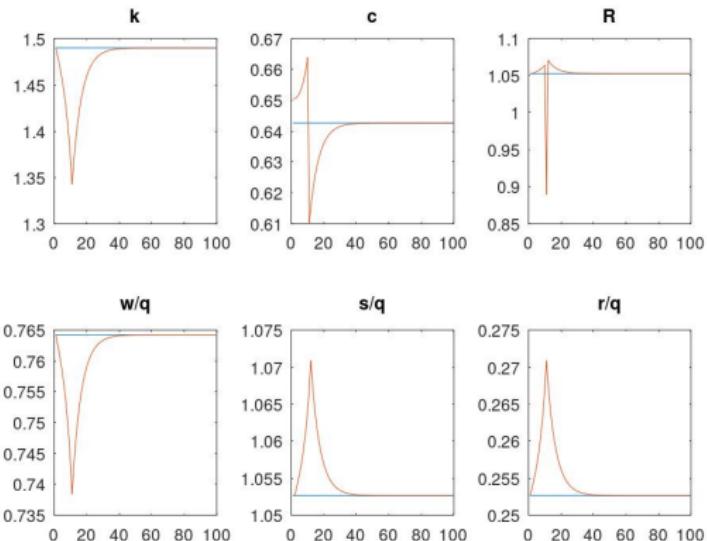
# Transition path: Permanent change in $g$



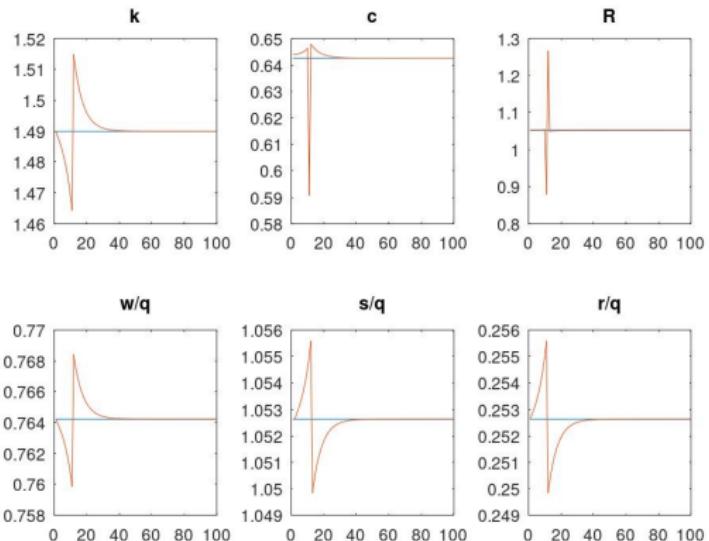
# Transition path: Temporary change in $g$



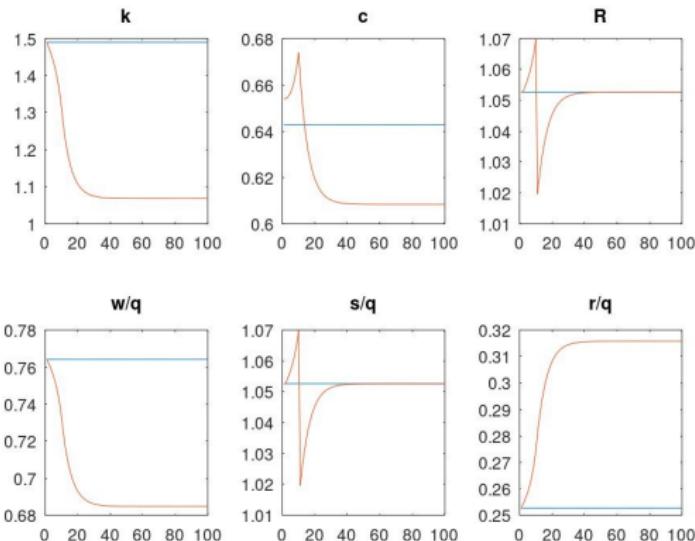
# Transition path: Permanent change in $\tau_c$



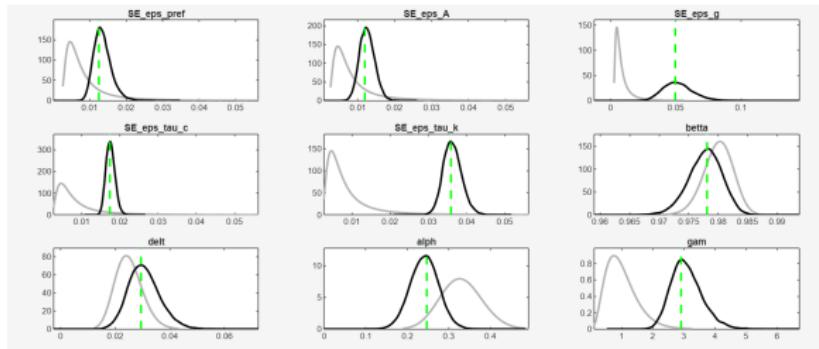
# Transition path: Temporary change in $\tau_c$



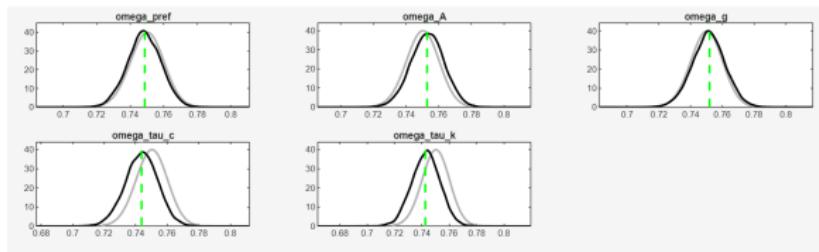
# Transition path: Permanent change in $\tau_c$



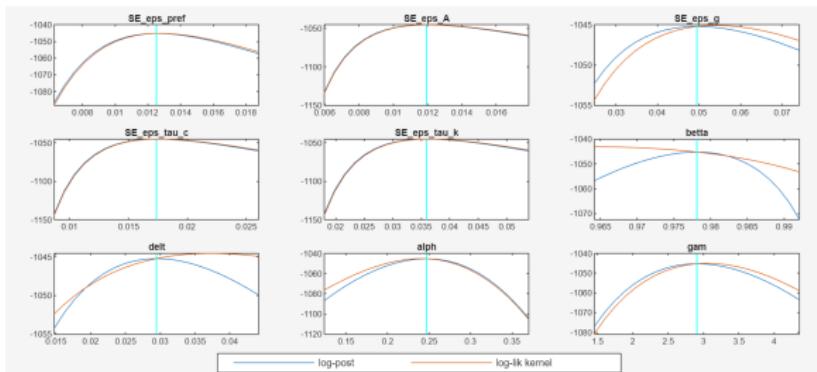
# Priors and posteriors (1/2)



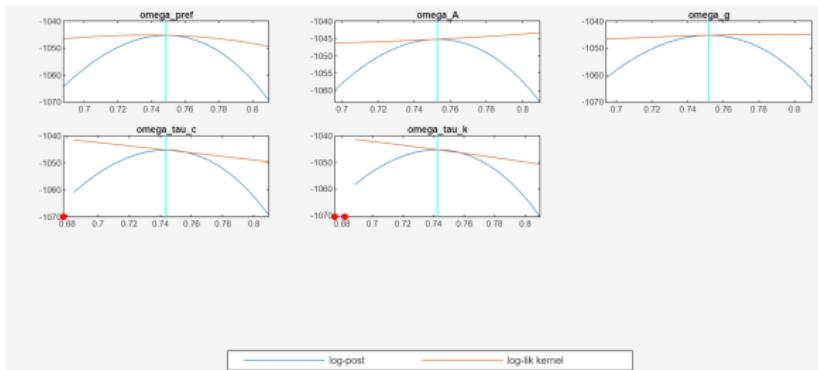
# Priors and posteriors (2/2)



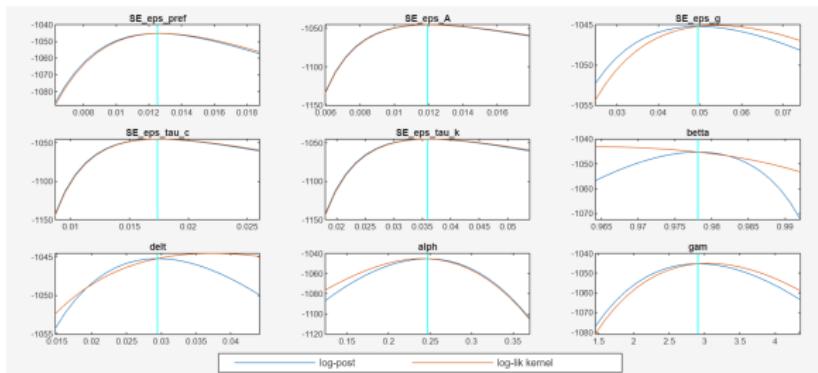
# Mode check (1/2)



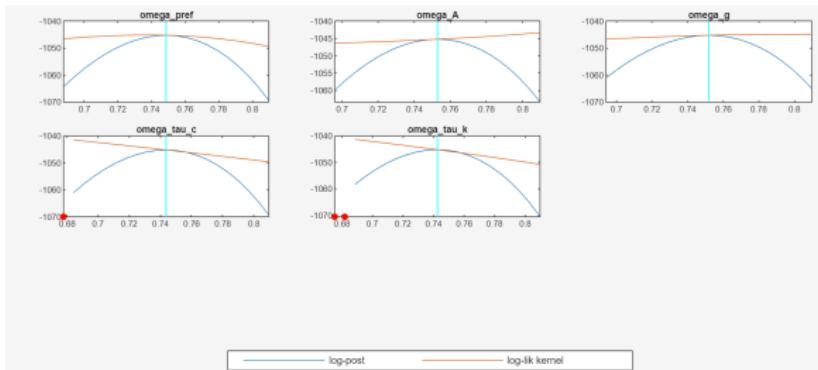
# Mode check (2/2)



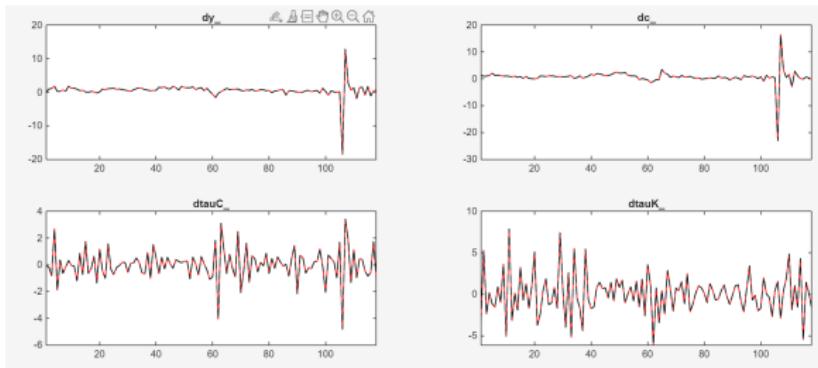
# Mode check (1/2)



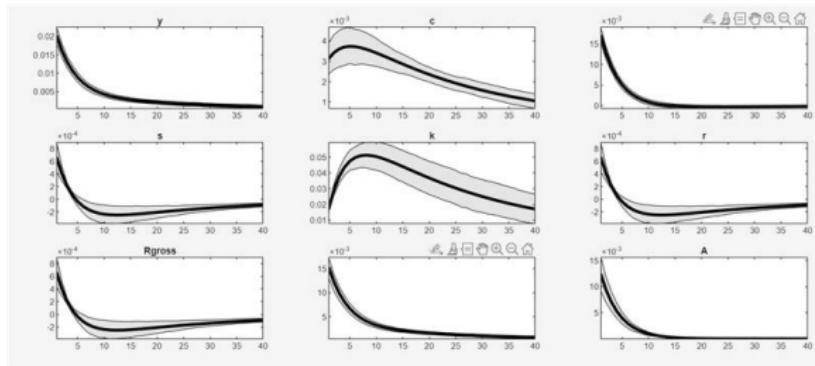
# Mode check (2/2)



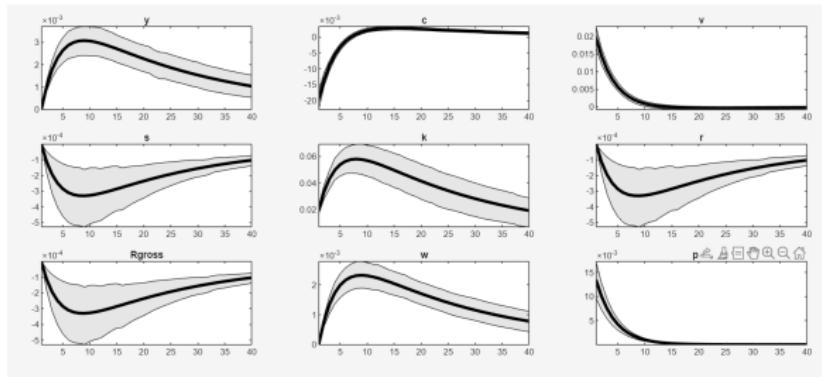
# Actuals vs. Fitted



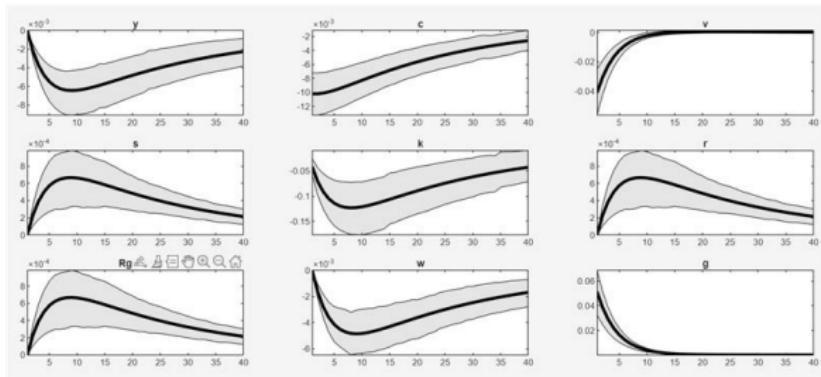
# IRF: Technology shock A



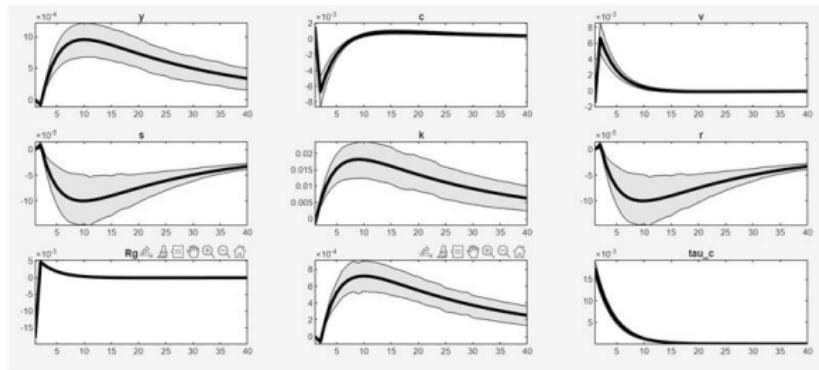
# IRF: Preference shock *pref*



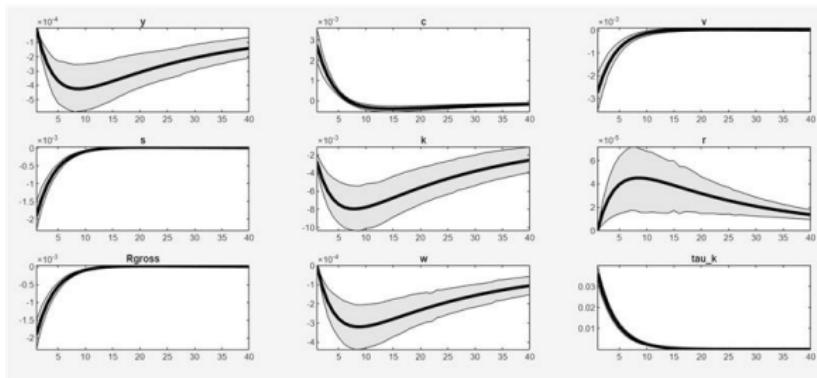
# IRF: G shock $g$



# IRF: Tax shock $\tau_{u_c}$



# IRF: Tax shock $\tau_{\text{au},k}$



## Things to do next

- Continue cleaning and reorganising the .mod file.
- Introduce clearer variable names (both in Dynare and L<sup>A</sup>T<sub>E</sub>X).
- 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.