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ECON40002
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Advanced Macroeconomics
Tutorial #6

Stochastic growth model in DYNARE**.** Suppose the planner maximizes

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\sigma}}{1-\sigma}, \qquad 0 < \beta < 1, \qquad \sigma > 0$$

subject to the sequence of resource constraints

$$c_t + k_{t+1} = z_t k_t^{\alpha} + (1-\delta)k_t, \qquad 0 < \alpha, \delta < 1$$

where c_t, k_t etc denote consumption per worker, capital per worker etc. Productivity follows an AR(2) process in logs

$$\log z_t = \phi_1 \log z_{t-1} + \phi_2 \log z_{t-2} + \varepsilon_t$$

where the innovations ε_t are IID $N(0, \sigma_\varepsilon^2)$.

(a) What are the planner's key optimality conditions for consumption c_t and capital k_{t+1}?

Suppose the following parameter values: $\alpha = 0.3$, $\beta = 0.95$, $\delta = 0.05$, $\sigma = 1$ and $\phi_1 = 1.3$, $\phi_2 = -0.4$, $\sigma_\varepsilon = 0.01$. Use DYNARE to do the following:

(b) Solve for the non-stochastic steady state values of the levels of consumption, capital, output and investment.

(c) Calculate the long-run standard deviations of the log-deviations of consumption, capital, output, investment and productivity. Which of these variables move most closely together? Which of these variables is most volatile? Explain.

(d) Suppose the economy is at steady state and that at $t = 0$ there is a 1% innovation to productivity, i.e., $\varepsilon_0 = 0.01$. Calculate and plot the impulse response functions for the log-deviations of consumption, capital, output, investment and productivity for $T = 50$ periods after the shock. Explain your findings.

(e) Suppose instead that $\phi_1 = 0.94$ and $\phi_2 = 0$. How if at all do your answers to (b), (c) and (d) change? Explain.