ESTIMATION OF AN RBC MODEL WITH DYNARE

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Consider the following RBC model (social planner program):

$$\max_{\{c_{t+j},l_{t+j},k_{t+1+j}\}_{j=0}^{\infty}} \quad \mathcal{W}_t = \sum_{j=0}^{\infty}\beta^j u(c_{t+j},l_{t+j})$$

(SP$_1$-1)

$$\begin{aligned}
&\underline{s.t.}\\
y_t &= c_t + i_t\\
y_t &= A_t f(k_t,l_t)\\
k_{t+1} &= i_t + (1-\delta)k_t\\
A_t &= A^\star e^{a_t}\\
a_t &= \rho a_{t-1} + \varepsilon_t
\end{aligned}$$

where preferences and technology are characterized as follows:

$$u(c_t,l_t) = \frac{\left(c_t^\theta(1-l_t)^{1-\theta}\right)^\tau}{1-\tau} \tag{1}$$

and

$$f(k_t,l_t) = \left(\alpha k_t^\psi + (1-\alpha)l_t^\psi\right)^{\frac{1}{\psi}} \tag{2}$$

and ε_t is a Gaussian white noise with zero mean and variance σ_ε^2. The first order conditions are given by:

$$u_c(c_t,l_t) - \beta\mathbb{E}_t\left[u_c(c_{t+1},l_{t+1})\Big(A_{t+1}f_k(k_{t+1},l_{t+1}) + 1 - \delta\Big)\right] = 0 \tag{3a}$$

$$-\frac{u_l(c_t,l_t)}{u_c(c_t,l_t)} - A_t f_l(k_t,l_t) = 0 \tag{3b}$$

$$c_t + k_{t+1} - A_t f(k_t,l_t) - (1-\delta)k_t = 0 \tag{3c}$$

(1) Write a mod file for this model (with a sensible calibration of the parameters and a steady state block)[1].

(2) Using the `stoch_simul` command simulate a sample of 10000 observations and save it in a file.

(3) Define priors over a subset of the parameters you want to estimate.

(4) Estimate the posterior mode (with the `estimation` command)[2], considering a sample of 100 observations. Check the estimated posterior mode (using the `mode_check` command). If Dynare

[1] An example is available here.

[2] If you consider that more than one endogenous variable is observed you will run into problems. Why? How to solve this issue?

warns you saying that the hessian matrix is not positive definite, use another optimization algorithm starting from your previous estimate of the posterior mode or change the initial conditions.

(5) Once you are satisfied with the posterior mode estimation, run a MCMC with 3×5000 iterations. Check the convergence diagnostics. If the MCMC did not converge to the (ergodic) posterior distribution rerun a metropolis without discarding the previous draws.

(6) Evaluate the robustness of your results with respect to the specification of the prior beliefs (re-estimate the prior mode with different priors).

(7) Using the same dataset, estimate a misspecified model[3] (for instance the same model with a Cobb-Douglas production function, or the same model with a separable utility function, or the same model with a representative household offering inelastically one unit of labour). Compare the estimates of the common deep parameters. Compare the marginal densities of the different models.

[3]Obviously, you also need to adapt the steady state.