Computational Methods for Economics, UC Davis

Problem Set 3

Projection Methods

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1. **RBC Model with Irreversible Investment**
   Consider the following RBC model with irreversible investment:

$$\max_{c_t, l_t, k_{t+1}} \mathbb{E}_t \sum_{t=0}^{\infty} \beta^t u(c_t, l_t)$$

subject to:

$$\begin{aligned} c_t + k_{t+1} &= z_t F(k_t, h_t) + (1-\delta)k_t \\ k_{t+1} &\geq (1-\delta)k_t \\ 1 &= h_t + l_t \\ \ln(z_{t+1}) &= (1-\rho)\ln(z^*) + \rho \ln(z_t) + \sigma \varepsilon_t \end{aligned}$$

where k is capital, c consumption, h hours worked, l leisure and z a technology shock.

Assume $F(k_t, h_t) = k_t^{\alpha} h_t^{1-\alpha}$, $u(c_t, l_t) = \ln c_t + \mu \ln l_t$, $\beta = 0.99$, $\alpha = 0.36$, $\delta = 0.025$, $\rho = 0.98$, $\sigma = 0.002$ and $z^* = 1$. Choose μ such that the hours worked h in steady state is $1/3$.

   (a) Solve the model above using projection methods. Specifically approximate k_{t+1} using a polynomial function (e.g. Chebyshev).
      i. begin with a deterministic model, no labour and no occasionally binding constraint
      ii. add labour leisure choice
      iii. add stochasticity
      iv. add occasionally binding constraint
   (b) Calculate and report the first and second moments of consumption, hours, capital, investment and output.
   (c) Compare your results with the model solved by Value Function Iteration.

2. Improvement algorithms (*This question is optional, but strongly recommended.*)

   i. Compare fixed point iteration and time iteration

   i. Use the endogenous grid method and then combine it with time iteration.

   You can use the commands *tic* and *toc* to measure speed gains and Euler errors to measure accuracy gains.

Reading

Den Haan, W. J., *Teaching Notes*, `www.wouterdenhaan.com/notes.htm`

Heer, B. and A. Maussner (2009), *Dynamic General Equilibrium Modeling: Computational Methods and Applications*, 2nd Edition, Springer, Chapters 3-4, 8-9.

Judd, K. L. (1998), *Numerical Methods in Economics*, The MIT Press, Chapter 17.