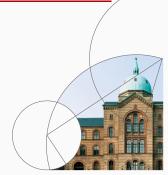


Introduction to code and exercises

Lectures at IIES

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Python

1. Pre-knowledge:

- 1.1 Python
- 1.2 VSCode
- 1.3 git

Online-course Introduction to Programming and Numerical Analysis QuantEcon cheetsheet for MATLAB vs. Python.

- 2. Updated Python: Install (or re-install) newest Anaconda
- 3. Packages: pip install quantecon, EconModel, consav
- 4. GEMoodel tools:
 - 4.1 Clone the **GEModelTools** repository
 - 4.2 Locate repository in command prompt
 - 4.3 Run pip install -e .

Packages

EconModel:

- 1. Standardized interface for economic models
- 2. Easy use of just-in-time compilation using *numba*

EconModelNotebooks/01. Using the EconModelClass.ipynb Video: On YouTube

video. On rourabe

- <u>ConSav</u>: Collection of tools for consumption-saving models In particular: See *ConSavNotebooks/04*. *Tools/**
- GEModelTools: My version of the SSJ toolbox

HANCGovModel

- No production. No physical savings instrument
- Households: Get stochastic endowment z_{it} of consumption good
- Government:
 - 1. Choose government spending
 - 2. Collect taxes, τ_t , proportional to endowment
 - 3. Bonds: Pays 1 consumption good next period. Price is $p_t^B < 1$.

$$p_t^B B_t = B_{t-1} + G_t - \int \tau_t z_{it} d\mathbf{D}_t$$
 $au_t = au_{ss} + \varphi \left(B_{t-1} - B_{ss} \right)$

Market clearing:

$$B_t = A_t^{hh}$$

Households

Households:

$$\begin{split} v_t(z_{it}, a_{it-1}) &= \max_{c_{it}} \frac{c_{it}^{1-\sigma}}{1-\sigma} + \beta \mathbb{E}_t \left[v_{it+1}(z_{it+1}, a_{it}) \right] \\ \text{s.t. } & p_t^B a_{it} + c_{it} = a_{it-1} + (1-\tau_t) z_{it} \geq 0 \\ & \log z_{it+1} = \rho_z \log z_{it} + \psi_{it+1} \ , \psi_{it} \sim \mathcal{N}(\mu_{\psi}, \sigma_{\psi}), \ \mathbb{E}[z_{it}] = 1 \end{split}$$

Euler-equation:

$$c_t^{-\sigma} = \beta \frac{\underline{v}_{a,t+1}(z_{it}, a_{it})}{p_t^B}$$

Envelope condition:

$$\underline{v}_{a,t}(z_{it-1},a_{it-1})=c_{it}^{-\sigma}$$

Questions: Stationary Equilibrium

- 1. Define the stationary equilibrium
- 2. Solve and simulate the household problem with $p_{ss}^B=0.975$ and $\tau_{ss}=0.12$.
- 3. Find the stationary equilibrium with $G_{ss}=0.10$ and $\tau_{ss}=0.12$.
- 4. What happens for $\tau_{ss} \in (0.11, 0.15)$?
- 5. When is average household utility maximized?

Questions: Transition path

Same model. Your choice of τ_{ss} . New questions:

- 1. Define the transition path.
- 2. Plot the DAG
- 3. How does the Jacobians look like?
- 4. Find the transition path for $G_t = G_{ss} + 0.01G_{ss}0.95^t$
- 5. What explains household savings behavior?
- 6. What happens to consumption inequality?

More exercises

- Master course at University of Copenhagen: Advanced Macroeconomics: Heterogenous Models
 - 1. Assignment I
 - 2. Assignment II