



Introduction to code and exercises

Lectures at IIES

Jeppe Druedahl
2023



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 .`

- 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](#)

- ConSav: Collection of tools for consumption-saving models

In particular: See *ConSavNotebooks/04. Tools/**

- GEModelTools: My version of the [SSJ toolbox](#)

- **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 $p_t^B < 1$

$$p_t^B B_t = B_{t-1} + G_t - \int \tau_t z_{it} d\mathbf{D}_t$$

- **Market clearing:**

$$B_t = A_t^{hh}$$

Households:

$$v_t(z_{it}, a_{it-1}) = \max_{c_{it}} \frac{c_{it}^{1-\sigma}}{1-\sigma} + \beta \mathbb{E}_t [v_{it+1}(z_{it+1}, a_{it})]$$

$$\text{s.t. } p_t^B a_{it} + c_{it} = a_{it-1} + (1 - \tau_t) z_{it} \geq 0$$

$$\log z_{it+1} = \rho_z \log z_{it} + \psi_{it+1}, \psi_{it} \sim \mathcal{N}(\mu_\psi, \sigma_\psi), \mathbb{E}[z_{it}] = 1$$

Euler-equation:

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

Envelope condition:

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

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. Assignemtn II