

# PROJECT 0: INAUGURAL PROJECT

**Vision:** The inaugural project teaches you to solve a simple economic model, and present the results.

- **Objectives:** In your inaugural project, you should show that you can:

1. Apply simple numerical solution and simulation methods
2. Structure a code project
3. Document code
4. Present results in text form and in figures

- **Content:** In your inaugural project, you should:

1. Solve and simulate a pre-specified economic model (see next page)
2. Visualize results

**Example of structure:** [See this repository](#)..

- **Structure:** Your inaugural project should consist of:

1. A README.md with a short introduction to your project
2. A single self-contained notebook (.ipynb) presenting the analysis
3. Fully documented Python files (.py)

- **Hand-in:** On GitHub by uploading it to the subfolder *inaugralproject*, which is located in:

github.com/NumEconCopenhagen/projects-YEAR-YOURGROUPNAME

- **Deadline:** See [Calendar](#).

- **Exam:** Your inaugural project will be a part of your exam portfolio.  
You can incorporate feedback before handing in the final version.

## Labor Supply Problem

Consider a consumer solving the following maximization problem

$$\begin{aligned} c^*, \ell^* &= \arg \max_{c, \ell} \log(c) - \nu \frac{\ell^{1+\frac{1}{\varepsilon}}}{1+\frac{1}{\varepsilon}} \\ \text{s.t.} \\ x &= m + w\ell - [\tau_0 w\ell + \tau_1 \max\{w\ell - \kappa, 0\}] \\ c &\in [0, x] \\ \ell &\in [0, 1], \end{aligned} \tag{1}$$

where  $c$  is consumption,  $\ell$  is labor supply,  $m$  is cash-on-hand,  $w$  is the wage rate,  $\tau_0$  is the standard labor income tax,  $\tau_1$  is the top bracket labor income tax,  $\kappa$  is the cut-off for the top labor income bracket,  $x$  is total resources,  $\nu$  scales the disutility of labor, and  $\varepsilon$  is the Frisch elasticity of labor supply.

Note that utility is monotonically increasing in consumption. This implies that

$$c^* = x. \tag{2}$$

## Questions

- 1) Construct a function which solves eq. (1) given the parameters.

We choose the following parameter values

$$m = 1, \nu = 10, \varepsilon = 0.3, \tau_0 = 0.4, \tau_1 = 0.1, \kappa = 0.4$$

- 2) Plot  $\ell^*$  and  $c^*$  as functions of  $w$  in the range 0.5 to 1.5.

Consider a population with  $N = 10,000$  individuals indexed by  $i$ .

Assume the distribution of wages is uniform such that

$$w_i \sim \mathcal{U}(0.5, 1.5).$$

Denote the optimal choices of individual  $i$  by  $\ell_i^*$  and  $c_i^*$ .

- 3) Calculate the total tax revenue given by

$$T = \sum_{i=1}^N [\tau_0 w_i \ell_i^* + \tau_1 \max\{w_i \ell_i^* - \kappa, 0\}].$$

- 4) What would the tax revenue be if instead  $\varepsilon = 0.1$ ?

Consider a politician who wishes to maximize the tax revenue.

- 5) Which  $\tau_0$ ,  $\tau_1$  and  $\kappa$  would you suggest her to implement?  
Report the tax revenue you expect to obtain.