

PROJECT 0: INAUGURAL PROJECT

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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. Solution and simulation of pre-specified economic model (see next page)
 2. Visualization of solution

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

- **Structure:** Your data analysis 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. (Optionally) Fully documented Python files (.py)
- **Hand-in:** On GitHub by uploading it to the folder:

github.com/projects-2020-YOURGROUPNAME/inauguralproject/

 1. Add your group to this [list](#)
 2. Create your GitHub repository [here](#)
 3. Follow step 2-3 in this [guide](#) to upload
- **Deadline:** 16th of March 23.59
- **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, ℓ is labor supply, m is cash-on-hand, w is the wage rate, τ_0 is the standard labor income tax, τ_1 is the top bracket labor income tax, κ is the cut-off for the top labor income bracket, x is total resources, ν scales the disutility of labor, and ε is the Frisch elasticity of labor supply.

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

$$c^* = x + w\ell^* - [\tau_0 w\ell^* + \tau_1 \max\{w\ell^* - \kappa, 0\}]. \tag{2}$$

Questions

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

We choose the following parameter values

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

- 2) Plot ℓ^* 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 ℓ_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 τ_0 , τ_1 and κ would you suggest him to implement?
Report the tax revenue you expect to obtain.