Tarea II
El Rol de la Heterogeneidad Microeconómica en Macroeconomía

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Fecha de Entrega: Ultimo día de temporada de examenes UAI.

Importante: Esta tarea es individual. Sin embargo, la colaboración es permitida e incentivada. Los estudiantes que colaboren deben escribir el nombre de los estudiantes con los que colaboraron en la primera pagina del informe de la tarea. La tarea (incluyendo el informe con las respuestas y los códigos y data usados) se envía por email al profesor (jorge.miranda.p@gmail.com), con copia al ayudante (asilvub@gmail.com)

1. A Quasi-natural Experiment with the 2001 Rebate in the US

Here we will replicate and extend the paper "Household Expenditure and the Income Tax Rebates of 2001"by Johnson, Parker, and Souleles, published in the American Economic Review. The replication files are in the folder *JPS_replication*.

1. Let us start by replicating Table 1 panel b. Then, using these data describe the liquid asset (balances in checking and saving accounts) position of households based on their level of income. In particular, what fraction of the low-liquid assets households (<$1000) display high income? You can answer this questions analyzing the data in different ways. Be creative but rigorous.

2. Let's us now replicate the last two columns of Table 5. Now, let's change the groups so we have poor hand-to-mouth, wealthy hand-to-mouth, non hand-to-mouth households, based on liquid assets and total income data. Be creative but consider that the groups need to have a similar amount of observations. Do you find evidence of larger MPC for households with low liquid assets and high income?

3. Now, let's collect wealth data by ourselves from the Consumption Expenditure Survey, CEX, from `https://www.bls.gov/cex/`. Let us start by reconstructing the data on liquid wealth. You will have to use the household ID in the replication files to match the original data in the CEX. Then, construct data on total wealth. Define wealth as the sum of the value of holdings of checking accounts, saving accounts, U.S. bonds, stocks,

and property minus outstanding mortgage and non-mortgage debt. Non-mortgage debt is composed of credit card debt, bank loans, credit union debt, and dentist and hospital debt.

4. Let's repeat the analysis in part 2 now using data on total wealth. Define poor hand-to-mouth, wealthy hand-to-mouth, non hand-to-mouth households based on liquid assets and total wealth data. Be creative, considering the groups need to have a similar amount of observations. Do you find evidence of larger MPC for households with low liquid assets and high wealth? What about the MPC of individuals with low liquid assets and low wealth?

2. The Aiyagari (1994) Model

The economy consists of a measure one of infinitely–lived households that are ex ante identical and a representative firm that hires capital and labor to produce the single consumption good. The labor and capital markets, in which the firm hires household labor and capital at wage rate w and rental rate r, respectively, are purely domestic (closed economy). The problem of a household is

$$\text{Max} \quad \mathbb{E} \sum_{t=0}^{\infty} \beta^t \log c$$

subject to the budget constraint

$$c_t + k_{t+1} \leq (1 + r_t - \delta)\, k_t + w_t \exp(z_t) \overline{h},$$

and the borrowing constraint

$$k_{t+1} \geq \underline{b}$$

where c is consumption (the numeraire), β the discount factor, k is capital wealth (which exogenously depreciates at rate $\delta \geq 0$), r is the real interest, z is persistent idiosyncratic household (log) productivity, and $\underline{b}$ the borrowing limit. In each period, the household inelastically supplies effective labor $\exp(z)\, \overline{h}$ at wage w. We assume that household log productivity evolve according to:

$$z_{t+1} \quad = \quad \rho_z z_t + \epsilon_{z t+1}$$

where ϵ_j, $j \in \{z\}$, is an idiosyncratic mean-zero shock with standard deviation σ_j.

In each period, the representative firm chooses capital K and effective labor L to solve

$$\max_{K_t, L_t} \{K_t^{\alpha} L_t^{1-\alpha} - r_t K_t - w_t L_t\}.$$

We examine *stationary equilibria*, which are denoted by stars and consist of constant firm capital K^* and labor L^*, a constant wage w^*, a constant household distribution Ω^* over (k, z), and optimal household decision c^*, and k^*_{t+1} such that

- the household maximizes expected utility, given prices,
- the firm maximizes profits, given prices
- the labor market and the capital market clear: $L^* = \overline{H} \equiv \overline{h} \int (z)\, d\Omega^*$, $K^* = \int k^* d\Omega^*$, respectively, where Ω^* is the stationary distribution over (k, z).

2.1. Solving the model

1. Set up the dynamic programming problem of the household in its recursive way. Define the value function. What are the control variables and state variables for the household?
2. Obtain the first order conditions of the given household and interpret them.
3. Obtain the first order condition of the representative firm and interpret them.
4. Parametrize the values of β, δ, α, ρ_z, and ϵ_z usig papers the literature. Don't forget to cite these papers. Regarding the borrowing limit, start assuming that no borrowing is allowed ($\underline{b} = 0$).
5. Solve the model by iterating over the value function you set up in part 1, using the parameters from 4. Refer to the computational appendix of the homework for more support on this question.
6. Study the effects of income risk on the interst rate in equilibrium. In particular, do you observe a larger or a smaller real interest rate in equilibrium when ϵ_z increases?[1] Explain the economic intuition behind your results.

Computational Appendix

To develop this task we recommend using the content of *QuantEcon* [2]. QuantEcon is a project dedicated to the development and documentation of modern open source computational tools for economics, econometrics and decision making.

The project delivers computational tools developed mainly in Julia and Python. In particular, we recommend using the notes "Quantitative Economics with Julia"[3] or "Quantitative Economics with Python"[4]. In these notes, there is a chapter dedicated to the resolution of the Aiyagari model (chapter 51 and 70, respectively). Depending on the programming language you choose, you will need to install the project library (https://quantecon.org/quantecon-jl/ or https://quantecon.org/quantecon-py/). With this, you will have access to many useful

[1] As we discussed in lectures, in solving the model, we convert the AR(1) process for income in a Markov process with P states. For simplicity assume there are two states of the economy. One bad (low z) and one good (high z). More details, including how to map changes in ϵ_z into changes in the markov transition process, see `http://www.fperri.net/TEACHING/macrotheory08/numerical.pdf`.

[2] `https://quantecon.org/`

[3] https://julia.quantecon.org/intro.html

[4] https://python.quantecon.org/intro.html

functions that will help you in solving problems in economics.

If you search the internet, you may find codes in Matlab. It is allowed to carry out the task using the program of your choice, but we recommend that you take the opportunity to learn new languages, such as Julia or Python, especially because of the potential they have shown in solving computationally intensive problems.

Finally, if you were interested in the content of the first part of the course, we recommend that you review the content of the book "Economics Networks" [5]. In addition to theory, the book includes codes that will allow them to solve different types of models. Do not miss the opportunity to continue learning :).

[5] https://networks.quantecon.org/