

Problem Set 1

Due: 11:59pm Thursday 14 April 2022

Instructions

You may work on this assignment in groups, but you may also work alone if desired. However, **every student must submit their own assignment** and note clearly on their submission the names of the other members of their group. If you do not credit the other members of your group, you will be penalized. Please submit your assignment via canvas. The TA is responsible for grading the problem sets. Therefore, all questions related to the problem sets, including requests for extensions, should be initially directed to the TA. Late problem sets will not be accepted without prior authorization from the TA or me. If you anticipate handing in your problem set late, you must inform your TA with a valid explanation before the deadline.

Please **do not** include print outs of all your code. You may use any programming language that you wish. Please pay attention to the units on of your figures and make sure they are meaningful. Even though you have two weeks to complete the problem set, I strongly suggest getting started on it immediately.

Part 1: Reading

1. Read one of the following survey papers, all available on Canvas. Each paper offers an overview of issues in heterogeneous agent macroeconomics from a slightly different perspective. You may wish to read the abstract or introductory section
 - (a) Heathcote, Storesletten and Violante (2009)
 - (b) Kaplan and Violante (2018)
 - (c) Krueger, Mitman and Perri (2016)
 - (d) Quadrini and Rios-Rull (2015)
 - (e) Guvenen (2011)

For you chosen paper, come up with two questions that you would ask the author about the issues discussed in their paper, that you would like to know more about or that you feel requires additional explanation or was unclear.

Part 2: Exercises

1. Consider the following infinite horizon consumption-savings problem of a household with habits. A household has preferences defined by

$$\sum_{t=0}^{\infty} \beta^t u(c_t - \psi c_{t-1})$$

for some positive, strictly increasing and strictly concave function u . The household faces the sequence of budget constraints

$$\begin{aligned} c_t + a_{t+1} &\leq (1+r) a_t + y \\ a_{t+1} &\geq 0 \\ a_0 &= 0 \\ \lim_{t \rightarrow \infty} a_t &\geq 0 \end{aligned}$$

where a_t is wealth and y is labor income. Write down the household problem in recursive form, making sure to clearly define the state variables for the problem.

Part 3: Coding

1. Consider the following finite horizon consumption-savings problem with indivisible labor supply. A household lives from ages $t = 1$ to $t = T$ and then dies. In every period t , a household chooses consumption c_t and whether or not to work. We denote $h_t = 1$ if the household works in period t and $h_t = 0$ if not. The household receives a wage w_t if working and an unemployment benefit b if not working. The household's Bellman equation is

$$\begin{aligned} V_t(a) &= \max_{c,h} u(c) - \psi h + \beta V_{t+1}(a') \\ &\text{subject to} \\ c + a' &= (1+r)a + w_t h + b(1-h) \\ a' &\geq 0 \end{aligned}$$

Assume the following functional forms and parameter values

$$\begin{aligned}
 u(c) &= \frac{c^{1-\gamma} - 1}{1 - \gamma} \\
 \gamma &= 1.5 \\
 \beta &= 0.98 \\
 r &= 0.02 \\
 \psi &= 0.5 \\
 T &= 50 \\
 w_t &= \begin{cases} \frac{t}{10} & \text{if } t \leq \frac{T}{2} \\ \frac{T+1-t}{10} & \text{if } t > \frac{T}{2} \end{cases} \\
 b &= 0.5
 \end{aligned}$$

- (a) Write some computer code that uses value function iteration to solve for the households optimal decisions and policy rules and produce a plot of the optimal paths of consumption (c), work (h) and wealth (a) as a function of the household's age.
- (b) Give the economic intuition for why the paths of consumption, work and wealth look the way that they do.
- (c) Show how the optimal paths change in each of the following circumstances. In each case, provide the economic intuition behind your result:
 - i. The interest rate falls to $r = 0.01$.
 - ii. The household faces a proportional tax $\tau = 40\%$ on their wage income. Unemployment benefits are not taxed.
 - iii. Unemployment benefits are reduced to $b = 0.1$

Part 4: Data

The public use micro data for the 2019 Survey of Consumer Finances (SCF) can be downloaded from this link [here](#). The relevant version is the Summary Extract Public Data, inflation adjusted to 2019 dollars (not the Full Public Data Set). For convenience, I have posted the Stata version of these data on Canvas, as well as the networth flowchart that shows how the definitions of wealth are related and an excel file that contains the variable definitions. You can find extensive documentation about this data set on the same webpage. Familiarize yourself with the structure of the data. In what flows, use the variable “networth” as a measure of wealth, use the variable “income” as a measure of total household income, and use the variable “wageinc” as a measure of earnings or labor income. Note that the SCF is not a random sample of households and thus you must be sure to weight your data appropriately when computing statistics. The relevant weight variable is “wgt”, which refers to the number of actual households in the US population that each survey

household corresponds to. Note also that there are multiple imputations present in the data set, making it all the more important to use weights in your analysis. This means that for every “real” household that responds to the survey, there are actually 5 observations in the dataset, one for each of the five imputations for missing values. As long as you use weights appropriately you do not need to do anything, just be aware of this.

1. Produce histograms showing the distributions across households of (a) wealth, (b) income and (c) earnings for the United States in 2019. Comment on anything interesting that you notice about these figures.
2. Compute the following measures of inequality for each for each of the three variables
 - (a) coefficient of variation
 - (b) variance of logs
 - (c) gini coefficient
 - (d) 99-50 ratio
 - (e) 90-50 ratio
 - (f) wealth share of top 10%
 - (g) wealth share of top 1%

Comment on anything interesting that you notice about these statistics.

3. Produce plots that show how the following variables vary by the age of the household head. You can combine variables on a single plot if it is useful in communicating interesting features
 - (a) mean and median wealth
 - (b) mean and median income
 - (c) mean and median earnings
 - (d) fraction of households with zero or negative networth

Comment on anything interesting that you notice about these figures.