Department of Economics - ESG-UQAM
Topics in Macroeconomics

Class Project

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There are four options below. **SOLVE ONLY ONE!** Go as far as you can. Write down what you did in a separate file in a paper format, explaining clearly all the steps. Send me also a copy of your code to my e-mail.

Project 1

(This can lead to a Ph.D. chapter) Time is discrete and indexed by $t = 0, 1, 2, ...$ Let $\beta \in 0, 1$ be the subjective discount factor, $c_t \geq 0$ be the consumption at period t and l_t be the labor supply at t. Agents are ex-ante identical and have the following preferences:

Preferences:

$$\mathbb{E}_0 \left\{ \sum_{t=0}^{\infty} \beta^t \left[\frac{{c_t}^{1-\sigma_c}}{1-\sigma_c} + \gamma \frac{(1-l_t)^{1-\sigma_l}}{1-\sigma_l} \right] \right\},$$

where $\sigma_c, \sigma_l > 1$, $\gamma > 0$. Expectations are taken over the idiosyncratic shocks $z_t \in \mathcal{Z}$, on labor productivity, where:

$$\ln(z_{t+1}) = \rho \ln(z_t) + \varepsilon_{t+1}, \rho \in [0, 1].$$

Variable ε_{t+1} is an i.i.d. shock with zero mean and variance σ_ε^2. Markets are incomplete as in Huggett (1993) and Aiyagari (1994). There are no state contingent assets and agents trade a risk-free bond a_{t+1}, which pays interest rate r_t ate period t. In order to avoid a Ponzi game, we impose an ad-hoc borrowing limit $a_{t+1} \geq \underline{a}$.

Technology: There is no aggregate uncertainty and technology is represented by $Y_t = K_t^\alpha N_t^{1-\alpha}$. Let I_t be the investment at period t, Capital evolves according to:

$$K_{t+1} = (1-\delta)K_t + I_t.$$

Let $\delta = 0.08$, $\beta = 0.96$, $\alpha = 0.4$, $\gamma = 0.75$, $\underline{a} = 0$, and $\sigma_c = \sigma_l = 2$.

a) Use finite approximation for the autoregressive process:

$$\ln(z') = \rho \ln(z) + \varepsilon,$$

where ε is a normal i.i.d. with zero mean and variance σ_ε^2. Use a 7 state Markov Process spanning 3 standard deviations of the log wage. Let ρ be equal to 0.98 and assume that $\sigma_z^2 = \frac{1-\sigma_\varepsilon^2}{1-\rho^2} = 0.621$. Simulate this shock and report the results.

b) State the household's problem.

c) State the representaive firm's problem.

d) Define the recursive competitive equilibrium for this economy.

e) Write down a code to solve this problem. Find the policy rules a', c, and l.

f) Solve out for the equilibirum allocations and compute statistics for this economy. Report basic statistics about this economy (e.g., capital to output ratio, income Gini, wealth Gini).

g) Introduce a government in this economy such that the government levies a payoff tax (firms have to pay $(1+\tau^n)w_tN_t$) and a tax on revenue (revenus are $(1-\tau^y)Y_t$). Assume that $\tau^n = 0.25$ and $\tau^y = 0$. Assume that the government makes lump-sum transfers to all households. Therefore, tax revenues should be equal to transfers to households (notice that the government treats all agents similarly when making transfers). Now let $\tau^n = 0.20$, then find the value for τ^y such that the total revenue is unchanged. Report statistics for both economies, including a measure of aggregate welfare. You can try to think about a similar taxation in Canada or in another country you are interested in study. Maybe introduce an informal sector in case you are studying a country in development.

Project 2

(This can lead to a Ph.D. chapter) Time is discrete and indexed by $t = 0, 1, 2, ...$ Let $\beta \in 0, 1$ be the subjective discount factor and $c_t \geq 0$ be the consumption at period t . Agents are ex-ante identical and have the following preferences:

Preferences:

$$\mathbb{E}_0 \left\{ \sum_{t=0}^{\infty} \beta^t \left[\frac{c_t^{1-\sigma}}{1-\sigma} \right] \right\},$$

where $\sigma > 0$. Expectations are taken over an idiosyncratic shocks, $z_t \in \mathcal{Z}$, where:

$$\ln(z_{t+1}) = \rho \ln(z_t) + \varepsilon_{t+1}, \rho \in [0, 1].$$

Variable ε_{t+1} is an i.i.d. shock with zero mean and variance σ_ε^2. Markets are incomplete as in Huggett (1993) and Aiyagari (1994). In case households pay a fixed fee ζ, they can save through a risk-free bond $b_t \geq 0$ that yield an interest rate of r. Otherwise, households are restricted and save through an inneficient technology we call money. In particular, money $m_t \geq 0$ pays no interest rate and depreciates at an inflation rate of π. We broadly interpret ζ as a pecuniary cost to access financial services. Thus, this parameter regulates the degree of financial deeping in the model. Notice that the allocation of wealth $a = m + b$ can take only two forms: $b = 0$ and $m = a$; and $b = a$ and $m = 0$.

Technology: There is no aggregate uncertainity and technology is represented by $Y_t = K_t^\alpha N_t^{1-\alpha}$. Let I_t be the investment at period t, Capital evolves according to:

$$K_{t+1} = (1-\delta)K_t + I_t.$$

Let $\delta = 0.08$, $\beta = 0.96$, $\alpha = 0.4$, and $\sigma = 2$.

a) Use finite approximation for the autoregressive process:

$$\ln(z') = \rho \ln(z) + \varepsilon,$$

where ε is a normal i.i.d. with zero mean and variance σ_ε^2. Use a 7 state Markov Process spanning 3 standard deviations of the log wage. Let ρ be equal to 0.98 and assume that $\sigma_z^2 = \frac{1-\sigma_\varepsilon^2}{1-\rho^2} = 0.621$. Simulate this shock and report the results.

b) State the household's problem.

c) State the representaive firm's problem.

d) Assume that π is given, define the recursive competitive equilibrium for this economy.

e) For a value of ζ, write down a code to solve this problem. Find the policy functions a' and c.

f) Solve out for the equilibrium allocations and compute statistics for this economy (only b can be transformed into capital). Report basic statistics for this economy (e.g., capital to output ratio, income Gini, wealth Gini, financial deepening).

g) Get data on financial deepening in Canada or in anoher economy you wish to study (share of the population with acess to financial services) and choose ζ to match this statistic in two different points in time (say 2000 and 2024). Investigate the differences between these two economies (inequality, output, and welfare - compensating variation)

Project 3

Reproduction of key results of an important paper in the macro development literature. Reproduce Table 2 and figure 4 of the paper "Finance and Development: A Tale of Two Sectors" by Paco Buera, Joe Kaboski and Yong Shin, American Economic Review, vol. 101, 1964-2002, 2011.

Project 4

Independent Research Project using Computational Macroeconomics Tools. In this project, you will propose and develop a small research project of your own choice, making use of computational methods (e.g., solving dynamic models, running simulations, or analyzing data). Your work should clearly state a research question, describe the model or dataset you plan to use, and present preliminary results. The goal is for you to apply computational tools to address a macroeconomic question of interest. Please confirm with me your project idea before starting, so we can refine the scope together. Write a project that really interests you or an advancement of something you are working already and that can be part of one of your Ph.D. chapters.