Macroeconomics II

Problem Set 1

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The solution of this problem consists of a PDF with all mathematical derivations and all graphs as well as a julia script that produces the graphs.

Consider the Neo-Classical growth model. Time is discrete and goes on forever. There is a representative agent that derives utility only from consumption and discounts future utility at a rate β. The agent owns k_0 units of capital and has an endowment of time that can be used for labor or leisure every period. The time endowment is normalized to 1. There is a representative firm that hires labor and rents capital to produce using a constant returns to scale technology. Capital rental rate is r and the wage is w. Capital depreciates fully after use.

1. Define a competitive equilibrium for this economy.

2. Define the social planner's problem for this economy.

3. Show that the equilibrium allocation of consumption, capital, and labor coincides with those of the planner's.

4. Pose the planner's dynamic programming problem. Write down the appropriate Bellman equation.

5. Assume that the utility of the consumer is $u(c) = \log c$ and that the production function is $f(k, \ell) = zk^{\alpha}\ell^{1-\alpha}$. Solve the planner's dynamic programming problem (find the value and policy functions).

6. Use the solution to the planner's problem to obtain the steady state value of $\{c, k, r, w, y\}$

7. For this exercise assume that $\alpha = 1/3$, $z = 1$. Use the solution to the planner's problem to obtain the path of $\{c, k, r, w, y\}$ starting from the steady state after the following changes:

   (a) Capital decreases to 80% of its steady state value.

   (b) Productivity increases permanently by 5%.

   Make sure to include dotted horizontal lines in all your graphs indicating the initial and final steady state of the variables.

8. Git

   (a) Create an account in github.com

   (b) Link your local repository to your github account

      - Click here for instructions

   (c) Upload your results to your github repository.