

Macroeconomics Qualifier Examination

June 2023

Time allocated: 120 minutes.

Question 1:

Consider an economy where each final good-producing firm uses a technology given by $Y_t = AL_t^{1-\alpha} \sum_{j=0}^{N(t)} X_{jt}^\alpha$. Here,

Y_t : The amount of final good produced at time t .

X_{jt} : The amount of intermediate good of type j used by a final-good producer at time t .

$N(t)$: Number of varieties of intermediate goods available at time t .

A representative household supplies one unit of labor inelastically to the market to earn a wage rate, w_t . Households also lend their asset to earn rental rates, r_t . Both labor and capital markets are competitive and clear in each period. Each household maximizes his/her lifetime utility: $\int_0^\infty u(c_t) e^{-(\rho-n)t} dt$ subject to $\dot{a}(t) = w(t) + r(t)a(t) - c(t)$, plus the no-Ponzi game condition.

The instantaneous utility is given by, $u(c_t) = \frac{c^{(1-\theta)-1}}{1-\theta}$; the population growth rate is assumed to be zero, and the household population is normalized to 1; ρ represents the rate using which households discount the future. Also, assume that there is no technological progress. Assume that it requires one unit of final good to produce a unit of intermediate good whose blueprint is currently available and that the price of the final good is equal to 1.

- (a) Solve a representative household's problem to find the growth rate of consumption.

Let p_j denotes the price of the intermediate good of type ' j '. Suppose that the government is subsidizing the sale of intermediate goods: the government pays σ amount per unit of intermediate good sold by its producers. The government finances this subsidy using a lump-sum tax on wage income.

- (b) Find the demand function facing a type- j intermediate good producer.
(c) What will be the optimal p_j to be set by the producer of intermediate good of type j ?
(d) Find an expression for profit, π_{jt} , for the producer of the intermediate good of type- j .
(e) Denote η to be the costs of innovating a new type of intermediate good. Also, assume that anyone can engage in innovation, and an innovator gains a perpetual monopoly over the new intermediate good. Accordingly, the interest rate, $r_t = \frac{\pi_{jt}}{\eta}$. Use this expression to find the equilibrium growth rate of the economy.
(f) Calculate the value of the monopoly pricing markup charged by an intermediate good producer. What value of σ should the government choose to eliminate the markup? Is it optimal for the government with a growth-maximizing objective to implement such a subsidy?

Question 2:

Consider an individual who lives for two periods. The individual's instantaneous and lifetime utility is given by $u(c) = -e^{-\gamma c}$ and $U = -e^{-\gamma c_1} - e^{-\gamma c_2}$, respectively. Assume that $\gamma > 0$. Also, assume that interest is equal to zero and that the individual has no initial wealth. The individual's first-period income, y_1 , is certain. However, the second-period income is uncertain. In particular, y_2 is normally distributed with a mean \bar{y} and a variance σ^2 .

- (a) Set up the optimization problem facing the individual.
- (b) Derive the Euler equation.
- (c) Show how the individual's consumption and saving decisions are affected by income uncertainty. [Hint: If $X \sim N(\bar{X}, \sigma^2)$ then $E[e^X] = e^{\bar{X}} \cdot e^{\frac{\sigma^2}{2}}$]