Advanced Macroeconomics II

All questions are compulsory

1. True, False or Uncertain? Explain briefly.

(a) According to the Solow model, poor countries tend to grow faster than rich ones (in terms of per capita income). [5 marks]

(b) Larger economies (in terms of the size of population) enjoy higher growth rates of per-capita income. [5 marks]

(c) The existence of human capital externalities is necessary for the Lucas (1988) model to generate long-run growth in per-capita income. [5 marks]

(d) The Aghion-Howitt (1992) model shows that the decentralized equilibrium growth rate can be higher than the socially optimal growth rate. [5 marks]

(e) In the OLG model discussed in class, money is always valued. [5 marks]

(f) Fiscal problems can cause high inflation and hyperinflation. [5 marks]

(g) According to the new Keynesian model discussed in class (Clarida, Gali and Gertler, 1999), under the optimal policy without commitment, the central bank should adjust the nominal interest rate more than one-for-one with expected future inflation. [5 marks]

(h) Even if the central bank's target for real output is just the market clearing level, there may be gains from commitment to a monetary policy rule. [5 marks]

(i) According to the search and matching model discussed in class, an increase in the unemployment benefit raises the equilibrium level of unemployment. [5 marks]

(j) A decentralized economy can get stuck in an inefficient equilibrium with an inefficiently low level of economic activity, even though a better equilibrium exists. If there was a mechanism for individuals to coordinate their activities, they could achieve a better equilibrium. [5 marks]

2. Consider the Romer (1990) model. The economy is populated with a continuum of identical households with a (constant) mass L. Each household has one unit of time which is inelastically supplied to the labor market, so the total labor supply is L. The representative household chooses per-capita consumption $c(t)$ to maximize its welfare U:

$$U = \int_0^\infty e^{-\rho t} \left[\ln c(t)\right] dt,$$

where $\rho > 0$ is the rate of time preference.

There are three production activities: (perfectly competitive) final good production, (monopolistically competitive) intermediate goods production and (perfectly competitive) R&D. A final good producer uses labor $L_Y(t)$ and intermediate goods $x_i(t)$ to produce output $Y(t)$ according to

$$Y(t) = \left[L_Y(t)\right]^{1-\alpha} \int_0^{A(t)} \left[x_i(t)\right]^\alpha di, \quad 0 < \alpha < 1,$$

where i refers to intermediate good i and $A(t)$ is the number of intermediate goods.

Each intermediate good $x_i(t)$ is produced using physical capital $K_i(t)$ with one unit of physical capital producing one unit of intermediate good, i.e. $x_i(t) = K_i(t)$.

New intermediate goods are created by R&D firms. Each R&D firm has access to the following technology:

$$\dot{A}(t) = \delta L_A(t) A(t),$$

where $\delta > 0$ is a productivity parameter. It is assumed that R&D firms are given permanent monopoly rights over the production and sale of the intermediate goods they create.

(a) Solve the profit maximization problems of a final good producer, an intermediate monopolist and an R&D firm. [5 marks]

(b) Find the steady-state equilibrium growth rate of output and explain the determinants of the equilibrium growth rate. [5 marks]

(c) Explain why the growth rate given in (b) is not optimal and how government policies can be used to induce the decentralized economy to achieve the social optimum? [4 marks]

(d) Suppose that the government controls the prices of intermediate goods by setting a price ceiling. Discuss the growth and welfare effects of the price ceiling. [4 marks]

3. Consider the Sidrauski (1967) model discussed in class. The economy is populated by infinitely lived households with a (constant) mass N. Each household chooses per capita consumption $c(t)$ and per capita real money balances $m(t)$ to maximize its lifetime utility:

$$\int_0^\infty e^{-\theta t}\left(\frac{\{[c(t)]^\beta[m(t)]^{1-\beta}\}^{1-\epsilon}}{1-\epsilon}\right)dt,$$

where $\theta > 0$, $\epsilon > 0$ and $0 < \beta < 1$. The household can hold its wealth in the form of either money or capital. Its budget constraint is given by:

$$C(t) + \dot{K}(t) + \frac{\dot{M}(t)}{P(t)} = w(t)N + r(t)K(t) + X(t),$$

where $N, C(t), K(t)$ and $M(t)$ are (household) size, consumption, holdings of capital and nominal money, respectively; $X(t)$ is government transfers; $w(t)$ and $r(t)$ are the real wage and the rate of interest; and $P(t)$ is the price level. Defining total household wealth $A(t) \equiv K(t)+M(t)/P(t)$, then per capita wealth $a(t) = k(t) + m(t)$, where $k(t)$ is per capita capital stock. As a result, the household's budget constraint becomes:

$$\dot{a}(t) = r(t)a(t) + w(t) + x(t) - c(t) - [\pi(t) + r(t)]m(t),$$

where $x(t)$ is per capita government transfers and $\pi(t)$ is the inflation rate.

We assume that firms use a constant returns to scale technology and that factor markets are competitive. Specifically, the production function is:

$$Y(t) = A[K(t)]^{\alpha}N^{1-\alpha} \quad \text{or} \quad y(t) \equiv Y(t)/N = A[k(t)]^{\alpha},$$

where $0 < \alpha < 1$ and $A > 0$. Assume that capital does not depreciate. Also assume that the money supply increases at a constant rate σ and that the money supply expands through lump-sum transfers to households.

(a) Find the first-order conditions for the representative household's optimization problems. [4 marks]

(b) How does the demand for real balances depend on consumption c and the nominal interest rate i? Provide the economic intuitions. [4 marks]

(c) Set up and solve the optimization problem of the representative firm. [2 marks]

(d) What are the steady-state values of inflation π^*, real money balances m^*, capital stock k^* and consumption c^*? Is money superneutral in steady state? [4 marks]

(e) How does the growth rate of money supply affect real money balances? What is the optimal steady-state growth rate of money σ^*? Explain your answers. [4 marks]

4. Consider the Shapiro-Stiglitz (1984) model discussed in class. The economy consists of a large number of workers $\bar{L}$ and a large number of firms N. The workers maximize their expected discounted utilities and the firms maximize their expected discounted profits. Assume that the representative worker's lifetime utility is given by:

$$U = \int_0^\infty e^{-\rho t} u(t),$$

where ρ is the discount rate and $u(t)$ is instantaneous utility at time t. The instantaneous utility function is:

$$u(t) = \begin{cases} w(t) - e(t) & \text{if employed,} \\ 0 & \text{if unemployed,} \end{cases}$$

where $w(t)$ is the wage and $e(t) \in \{0, \bar{e}\}$ is the worker's effort. At any moment, a worker must be in one of the three states: employed and exerting effort (E), employed and shirking (S) or unemployed (U).

There is an exogenously given probability b per unit time that a worker in a job (and exerting effort) will be separated from his job. There is also an exogenously given probability q per unit time that a worker who is shirking will be caught and fired. An unemployed worker will find a job with a probability a per unit time (a is taken as given by workers, but it will be determined endogenously).

A firm chooses the wage rate $w(t)$ and the number of employees (who are exerting effort) $L(t)$ to maximize its profits:

$$\pi(t) = F[\bar{e}L(t)] - w(t)[L(t) + S(t)], \quad F' > 0, \quad F'' < 0, \tag{1}$$

where $S(t)$ is the number of workers who are shirking.

Assume that in the absence of imperfect monitoring, there is full employment: $F'[\bar{e}\bar{L}/N] > 1$, that is, if each firm hires $1/N$ of the labor force, the marginal product of labor is greater than the cost of exerting effort.

(a) Derive the values of E, U and S. [3 marks]

(b) Find the no-shirking condition and explain why the no-shirking wage rate depends positively on the level of employment. [5 marks]

(c) Explain why unemployment exists in this model. [2 marks]

(d) What is the efficient level of employment? Explain why the decentralized equilibrium is inefficient. [4 marks]

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