

考試科目	個體經濟理論	所別	財政所	考試時間	5月10日(六)第一節
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(30%)

1. 假設某個完全競爭市場的產業，廠商家數有  $m$  家，成本函數皆為  $c(y) = y^2 + 16$ ；市場的總合逆需求函數為  $D(p) = 20 - p$ 。請求取

- (i) 短期的市場均衡產量與價格。
- (ii) 長期的市場均衡產量與價格以及廠商的家數。

(20%)

2. 假設某消費者的效用函數為  $u(x_1, x_2) = a \ln(x_1 - b) + (1 - a) \ln(x_2 - b)$ ，其中  $a$  與  $b$  均為常數； $x_1, x_2$  代表財貨的消費量， $p_1, p_2$  為價格， $m$  為其所得水準。請求解該消費者的 demand function  $x_1(p_1, p_2, m)$  與  $x_2(p_1, p_2, m)$  以及 indirect utility function  $V(p_1, p_2, m)$ 。

3.(50%)

A price-taking firm's production function is  $Q = 3L^{\frac{1}{3}}K^{\frac{1}{3}}$ , where  $Q$  is the amount of output produced and  $K$  and  $L$  are the amounts of capital and labor used in production, respectively. The output price is known with certainty to be  $p = 1$  and the price of the capital input is known with certainty to be  $r = 1$ . The wage rate of the labor input,  $w$ , is random and has mean  $E(w) = m$ . The firm makes its choices to maximize expected profit,  $E(Q - wL - K)$ .

- (1) Suppose that the firm must choose both  $K$  and  $L$  before observing  $w$ . Derive an expression giving the firm's optimal capital input in terms of parameters that are known at the time the capital input is chosen. What effect does uncertainty about  $w$  have on the firm's optimal capital input?
- (2) Suppose now that the firm must choose its capital input before observing  $w$  but choose the labor input after  $w$  is known. (Thus, the firm first chooses  $K$ , it then observes  $w$ , and finally it chooses  $L$ ). Let  $K^C$  denote the optimal capital stock when  $w = m$  with certainty and let  $K^R$  denote the optimal capital stock when  $w$  is a random variable with mean  $m$ . Is  $K^C$  or  $K^R$  larger?
- (3) Finally, assume again  $w$  is a random variable. Is the firm's expected profit larger if it choose both  $K$  and  $L$  before observing  $w$  (as in part (1)) or if it chooses  $K$  before observing  $w$  and  $L$  after observing  $w$  (as in part (2))?

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**Question 1 (30 points)**

An individual is endowed at time 0 with a stock of some product,  $X_0$ . Each period, he can consume some of that product ( $c_{xt}$ ) or he can sell some of the product at price  $P_t$  in order to purchase another consumption good. His consumption of that good is  $c_{mt}$ . Whatever he does not consume or sell is left over for next period:

$$X_{t+1} = X_t - c_{xt} - P_t c_{mt}$$

His objective is to maximize:

$$\sum_{t=0}^{\infty} \beta^t u(c_{xt}, c_{mt})$$

where the utility function has the usual properties. (Note there is no uncertainty in this problem).

- (1) Write down the Bellman equation, and derive the first-order conditions. (10 points)
- (2) Derive the envelope conditions for the endogenous state variables. (10 points)
- (3) Derive Euler equations. (10 points)

**Question 2 (20 points)**

Indicate whether the following statement is true or false and explain why. (You get no point for only the true/false statement. Points are entirely given for the explanations)

- (1) The smoothness of the aggregate consumption data implies that the welfare cost of business cycles must be very small. (10 points)
- (2) A permanent positive productivity shock tends to have stronger effects on labor input than a temporary one. (10 points)

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**Question 3. (35%)** Consider an economy in which output is determined by a simple neoclassical production function  $y = Ak^\alpha$  where  $k$  is the stock of physical capital,  $y$  is the flow of output, and  $A$  is a measure of aggregate productivity. Consider a representative household-firm that maximizes utility over an infinite horizon

$$U = \int_0^{\infty} \frac{c^\gamma}{\gamma} e^{-\beta t} dt$$

where  $c$  is the rate of consumption,  $\gamma$  is a parameter ( $-\infty < \gamma < 1$ ), and  $\beta$  is the constant rate of consumer time preference. Assume that there is no government in this economy.

- What are the control and state variables of this system? Write down the intertemporal flow budget constraint for the representative agent.
- Write down the current value Hamiltonian function for this problem. Derive the optimality conditions that will determine the optimal time path for this economy. Interpret them intuitively.
- Analyze the core dynamics of this system and show that the steady state equilibrium is saddle-point stable. Draw a phase diagram in the  $c$ - $k$  space (with  $k$  on the horizontal axis) to illustrate the dynamics of the system.
- Discuss algebraically and graphically the dynamic adjustment of the above equilibrium system to an unanticipated permanent increase in the rate of time preference  $\beta$ .

**Question 4. (15%)** Compare and contrast the main features of the two models:

- The infinite horizon representative agent model
- The overlapping generations model.

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