

AMERICAN UNIVERSITY
Department of Economics

Comprehensive Exam
Preliminary Theory

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Total Exam Pages: 4

COMPREHENSIVE EXAM IN PRELIMINARY THEORY

Directions: Complete *all* questions in both Part I and Part II. Please show all of your work; your grade depends on the quality of your explanations.

Part I. Macroeconomics

A. Short Answers

1. Write out an expression for the old-style Phillips curve, and explain how it was interpreted. How does the New Keynesian Phillips curve compare to the old-style one: Even if they are similar in form, are they similar in substance? Explain.
2. One expression for the steady-state value of seigniorage is:

$$S = \frac{i}{(1+i)} (1+r) mt = \omega (1+r) mt$$

where S is seigniorage, i and r are the nominal and real interest rates respectively, and mt is real money balances. Suppose money demand is as follows:

$$mt = A e^{\{- (i/1+i) D c_t\}} = A e^{\{- \omega D c_t\}}$$

where c_t is consumption, and A and D are parameters. Making use of the finding from the money-in-the-utility-function model concerning the neutrality of money, show how seigniorage varies with the inflation rate. Is there a 'Laffer curve' here? If so, what is the seigniorage-maximizing inflation rate?

B. Long Answers

1. Assume the production function is as follows:

$$Y_t = K^\alpha H^\lambda (AL)^{1-\alpha-\lambda}$$

where Y is output, K is physical capital, H is human capital, A is the level of technology, and L is labor. Assume that:

- $\alpha > 0$, $\lambda > 0$ and $\alpha + \lambda < 1$
- L and A grow at constant rates of n and g respectively.
- Output can be allocated to consumption, or investment in either type of capital.
- Both types of capital depreciate at the rate δ .
- Gross investment in physical and human capital are fixed shares of output, s_k and s_h , respectively.
- $k = K/AL$, $h = H/AL$, and $y = Y/AL$.

- a. Find expressions for Δk and Δh in terms of s_k , s_h , δ , n, g, and y.
- b. What are the steady-state values of k, h, and y?
- c. What is the rate of growth of output per capita in the steady state?
- d. Is it correct to say: “In the Solow model with human capital, it is not beneficial for a society to increase its rate of investment in human capital, because it does not accelerate the rate of growth”? Explain.

2. Consider the following two-period OLG model. People live for two periods; they work when young and retire when old. The population grows at a constant rate η .

- When young, people allocate their resources between consumption and saving so as to maximize $U = \log(c_t) + \log(c_{t+1})$.
- Young people earn a wage w_t and pay a lump-sum tax τ to the government.
- The government allocates a fraction γ of the lump-sum tax to an Individual Retirement Account, which will yield a payment of $(1 + r_{t+1}) \gamma \tau$ to the person when she is old. The government uses the rest to pay pension benefits to the current old.
- When old, people finance their consumption from the following sources:

private saving	$(w_t - \tau - c_t)(1 + r_{t+1})$
IRA payment	$(1 + r_{t+1}) \gamma \tau$
pension benefit	$(1 + \eta)(1 - \gamma) \tau$.

- a. Is this pension system funded or unfunded? Explain. Why does $(1 + \eta)$ appear in the benefit formula?
- b. Derive the representative individual’s lifetime budget constraint.

- c. Set up the Lagrangian, and derive the values of c_t and c_{t+1} that maximize lifetime utility, subject to the budget constraint.
- d. *Ceteris paribus*, how would an increase in γ affect private saving: would it rise, fall, or remain unchanged? Explain why, given that both private- and IRA-saving earn a return of r_{t+1} .
- e. *Ceteris paribus*, how would a decline in η affect private saving? Explain the intuition.

Part II: Microeconomics

A. Short Answers

1. State whether the following is true, false, uncertain, and explain your answer. A profit maximizing monopolist faces a downward sloping demand curve and produces according to a non-decreasing total cost function. The monopolist is subject to an ad-valorem tax (i.e. a given percentage of revenue is paid in tax). An increase in the tax rate cannot increase the monopolist's output.
2. Consider an n -person economy in which all individuals i have the same income m , and the same utility function, $U(x_i, g) = x_i + w(g)$, where g is the sum of all individuals' contributions to a public good, x_i is the amount that i spends on all other (private) goods, and $w(\cdot)$ is a strictly increasing, strictly concave function. Is the following statement true or false? "If this economy attempts to provide a public good by asking for private contributions, then in the symmetric Nash equilibrium, the total amount of the public good will be a strictly increasing function of n ." Explain your answer.

B. Long Answers

1. Assume that many firms can produce ball bearings according to the production function:

$$q = K^{\frac{1}{2}} L^{\frac{1}{2}}$$

Firms in this industry must pay \$1 per unit for input L and \$4 per unit for input K no matter how much output is produced by firms in this industry. How much of each input will a firm use to produce output level q ? What is the firm's long-run total and average cost at each level of output? Now suppose the quantity of demand for ball bearings is defined by:

$$Q = 100 - P$$

and the market is perfectly competitive. What are the long-run equilibrium price and quantity for ball bearings?

Now suppose that the government agrees to pay firms in this industry, including any new firms that enter the industry, 75 percent of the cost of input K . Assume that this subsidy and the taxes used to finance it have no effect on market prices of inputs, that is, the

prices received by providers of the inputs. How much of each input will a firm use to produce output level? What is the firm's net long-run total and average cost at each level of output after subtracting the subsidy from the government? Now suppose the taxes used to finance the subsidy reduce the quantity ball bearings demanded to

$$Q = 99 - P$$

What are the new long-run equilibrium price and quantity of this good? Carefully explain all of your answers.

2. A consumer has income m , and there are n goods. The price of good i is denoted by p_i , $i = 1, \dots, n$. The consumer's indirect utility function is

$$v(p, m) = m \left[\sum_{i=1}^n p_i^{\frac{\rho}{1-\rho}} \right]^{\frac{1-\rho}{\rho}}$$

where $0 < \rho \leq 1$.

- Find the Marshallian demands.
- Find the expenditure function and derive the consumer's Hicksian demands.
- Verify and explain the significance of the Slutsky equation.

Now suppose that the consumer's income is 10, and there are four goods ($n=4$).

Furthermore, assume that $\rho=1/2$. The consumer faces initial prices $p_1=1/2$, $p_2=1/3$, $p_3=1/5$, $p_4=1/6$. These prices then rise to 1 for each good.

- Find and intuitively explain the compensating variation.
- Find and intuitively explain the equivalent variation.