

考 試 科 目	個體經濟學	所 別	政大 經濟學系	考 試 時 間	2 月 25 日(星期六) 第二節
---------	-------	-----	------------	---------	-------------------

1. (25 points)

Set up a model of two producers (each producing a single commodity) and one final consumer to discuss the economic incidence of a sales tax of 5% ad valorem partially on one of the two commodities in the general equilibrium framework, in which markets are interlinked and supply and demand interact to determine a market-clearing price in each market.

Note: You will have to state first the assumptions underpinning the model, including: technology of production, behavior of factor suppliers, market structure, total factor supplies, consumer preferences.

2. (25 points in total, from 5 sub-questions)

Suppose that two swine farms are located along a river. The upstream swine farm (x) has a production function of the form:

$$X = 2000(L_X)^{0.5},$$

where L_X denotes labor employed per day by farm x, and X denotes output level of the upstream swine farm x in kilograms. The downstream swine farm (y) has a similar production technology, but its output may be affected by the effluents farm x discharges into the river. The production technology of farm y can be described as follows:

$$Y = \begin{cases} 2000(L_Y)^{0.5}(X - X_0)^a, & \text{for } X > X_0, \\ 2000(L_Y)^{0.5}, & \text{for } X \leq X_0, \end{cases}$$

where L_Y denotes labor employed per day by farm y, and Y denotes output level of the downstream swine farm y in kilograms; X_0 is the river's natural capacity for neutralizing waterborne pollutants—let's assume X_0 amounts to 38000 in this case.

Production process of farm x would have no effect on farm y if parameter a equals zero. However, if a is less than zero, an increase in the output of farm x above X_0 would drive down farm y's output.

Assuming pork sells for one dollar per kilo and the prevailing daily wage is fifty dollars.

(a) (5 points)

Discuss the optimal output and labor employment decisions of farms x and y under the scenario where there are no externalities.

(b) (5 points)

Discuss the optimal output and labor employment decisions of farms x and y under the scenario where there are negative externalities, say, $a = -0.1$.

(c) (5 points)

Discuss the inefficiency under the decentralized profit maximization as in sub-question (b), by contrasting with the decisions of output and labor employment of both farms under a merger.

(d) (5 points)

Discuss the social marginal productivity of labor input into the negative externality generating farm x

考 試 科 目	個體經濟學	所 別	2161 經濟學系	考 試 時 間	2 月 25 日(星期六) 第二節
---------	-------	-----	--------------	---------	-------------------

once the two farms are merged, and contrast it with the case of decentralized profit maximization.

(e) (5 points)

An alternative proposal to remedy the externality problem of the aforementioned case could be to tax on the upstream farm x so that its output would reduce to a level at which the externality vanishes. What rate of such a Pigovian tax would you suggest to the Minister of Agriculture and Environment? And also brief the Minister on the consequence of output and labor employment of the two farms.

3. (五十分，每小題五分) 本大題請使用英文作答。

請解釋並說明下列專有名詞，並指出其在經濟學上的重要性為何。未使用英文作答、或是未說明重要性者，該小題以零分計算。

- Convex preferences
- von Neumann–Morgenstern utility functions
- Second welfare theorem
- Substitution effects
- Production function
- Elasticity of substitution
- Nash equilibrium
- Conditional factor demand functions
- Weak axiom of revealed preferences
- Compensated demand functions

考 試 科 目	總體經濟學	所 別	經濟學系	考試時間	2 月 25 日(六) 第三節
---------	-------	-----	------	------	-----------------

Part I.

1. Multiple choice questions: choose the best possible answer in the list of suggested alternatives.
(You will get 3 points for each question if the correct alternative is chosen.)

(1). Which of following statement is CORRECT?

- A). Other things being equal, an increase in the depreciation rate of capital will induces the firm to increase its desired level of capital (machines) because the firm needs more machines in this case.
- B). A country has the following production function: $Y = K^\alpha N^\beta$, where K is capital and N is labor. If $\alpha > 0$, $\beta > 0$, and $\alpha + \beta = 1$, then the production function does not display decreasing marginal returns to capital.
- C). John is a liquidity-constrained consumer. According to permanent income hypothesis, John will change his current consumption in reaction to an expected future recession.
- D). Goods that are produced for inventory are not included in GDP.

(2) Which of the following statement is CORRECT?

- A). According to the Mundell-Fleming model, a monetary expansion is always more effective under a floating exchange rate than under a pegged exchange rate.
- B). According to the Mundell-Fleming model, fiscal policy is always more effective under a floating exchange rate than under a pegged exchange rate.
- C). The wage that is paid in a competitive labor market (equal to the value of the marginal product of labor) is called the efficiency wage.
- D). According to the theory of rational expectation, the central bank should use discretion in conducting monetary policy.

(3) According to the Solow growth model, an increase in the capital-labor ratio will

- A). reduce steady state consumption per worker if the capital-labor ratio is below the Golden rule capital stock.
- B). increase steady state consumption per worker if the capital-labor ratio is below the Golden rule capital stock.
- C). always reduce steady state consumption per worker.
- D). always increase steady state consumption per worker.

(續次頁)

考 試 科 目	總體經濟學	所 別	經濟學系	考 試 時 間	2 月 25 日(六) 第三節
---------	-------	-----	------	---------	-----------------

- (4) With the presence of consumption smoothing incentives, which of the following statement is CORRECT? If current income increases by one unit, other things being equal, then
- A). current consumption increases by more one unit.
 - B). current consumption increases exactly by one unit.
 - C). current consumption increases by less than one unit.
 - D). current consumption decreases exactly by one unit.
- (5) If a country is under full employment, then
- A). the economy has no unemployment.
 - B). the country has no cyclical unemployment.
 - C). the country's unemployment rate is equal to the labor participation rate.
 - D). the country's unemployment is equal to the sum of cyclical unemployment and frictional unemployment.
- (6) According to the life-cycle model, which of the following is CORRECT? Other things being equal,
- A). lifetime pattern of consumption is much smoother than income pattern.
 - B). lifetime pattern of income is much smoother than consumption pattern.
 - C). temporary changes in income leads to larger changes in consumption.
 - D). permanent changes in income lead to larger changes in consumption.
- (7) Other things being equal, an increase in the expected inflation rate will lead to ① in the money demand and an increase in the real income will lead to ② in the money demand.
- A). ① a decrease; ② a decrease.
 - B). ① a decrease; ② an increase
 - C). ① an increase; ② a decrease
 - D). ① an increase; ② an increase
- (8) Which of the following statement is CORRECT? Under the liquidity trap,
- A). The LM curve is vertical line.
 - B). The IS curve is vertical line.
 - C). The monetary policy is the most effective policy in stimulating the economy.
 - D). The fiscal policy is the most effective policy in stimulating the economy.

考 試 科 目	總體經濟學	所 別	161 經濟學系	考 試 時 間	2 月 25 日(六) 第三節
---------	-------	-----	-------------	---------	-----------------

(9) Which of the following statement is CORRECT? Other things being equal,

- A). an increase in the reserve requirement ratio increases the money multiplier.
- B). an increase in the government deficits must lead to an increase in trade deficits.
- C). if a country has current account surplus, then its savings must be greater than investment.
- D). if a country employs more foreign workers, then its GNP will be higher.

(10) Money demand in a country is given by $M = P \times L(Y, i)$, where M is the nominal money supply, P is the price level, and L is the (real) money demand. The (real) money demand is a function of real income Y and the nominal interest rate i . If the income elasticity of (real) money demand is $3/4$ and the interest elasticity of (real) money demand is $-1/4$, by what percent does real money demand rise if income rises 10% and the nominal interest rate rises 4%?

- A). 14%
- B). 9.0%
- C). 6.0%
- D). 6.5%

2. [Solow growth model] Country A and Country B are two closed and independent countries.

Each has the same production function given by $Y = DK^{0.5}N^{0.5}$, where Y is total output, K is capital, and N is labor employment (workers). D is constant. The savings rate, the population growth rate, and the depreciation rate of capital for both countries are equal to s , n , and δ respectively. Answer the following questions:

(1) Find out the growth rate of output per worker and the growth rate of total output in the steady state for Country A. (6%)

(2) (continued from (1)) The following statement is true or false? You must write down the reason. (6%)

“Suppose that Country A is at the steady state. Suddenly, an earthquake occurs at the country and a half of the capital stock is destroyed. If s , n , and δ remain unchanged before and after the earthquake, the occurrence of this earthquake will increase Country A's growth rate of output per worker in the short run.”

(3) Suppose that both countries are about to be united at the time when the population of both countries is equal to \hat{N} , the capital stock of Country A is equal to \hat{K} , and the capital stock Country B is equal to $2\hat{K}$. If Country B cares about output per worker in the steady state, should Country B be united with Country A or stay independent? Why? (4%)

(續次頁)

考 試 科 目	總體經濟學	所 別	經濟學系	考試時間	2 月 25 日(六) 第三節
---------	-------	-----	------	------	-----------------

- (4) [Continued from (3)] In the endogenous growth model, the technology factor D can be related to the capital stock. Suppose that $D = K^{0.5}$, where K is the capital stock of the country. Should Country B be united with Country A or stay independent in this case? Why? (4%)

Part II. Long Question.

- 中國大陸於 2011 年曾數度提高存款準備率，以抑制日益高漲的通貨膨脹。
 - 何謂「存款準備率」貨幣政策？中國人民銀行提高存款準備率的可能影響為何？(10%)
 - 試分析「存款準備率」貨幣政策的優缺點。(10%)
 - 近年來，世界各國紛紛逐步降低甚至取消存款準備率的規定，其主要的原因為何？(5%)
- 日本於 2011 年的國際收支首度發生逆差，有經濟學家提議日本中央銀行應採取「完全沖銷」之貨幣政策以爲應對。
 - 何謂「完全沖銷」(perfect sterilization) 之貨幣政策？(5%)
 - 沖銷政策的目的為何？(10%)
 - 試以日本於 2011 年的國際收支逆差爲例，來說明「完全沖銷」措施對貨幣供給額的影響。(10%)

考試科目	統計學	所別	經濟學系	考試時間	2月25日(六)第四節
------	-----	----	------	------	-------------

1. (10%) Suppose two random variables X and Y have the joint probability density function (p.d.f.)

$$f_{X,Y}(x, y) = 12xy(1 - y), \quad 0 \leq x \leq 1, \quad 0 \leq y \leq 1.$$

- (1) Are X and Y independent?

- (2) Find the marginal p.d.f.s of X and Y , $f_X(x)$ and $f_Y(y)$, respectively.

2. (20%) Assume X and Y are exponential random variables with p.d.f.s:

$$f_X(x) = \lambda e^{-\lambda x}, \quad x > 0$$

$$f_Y(y) = \lambda e^{-\lambda y}, \quad y > 0.$$

- (1) Find the moment-generating function (m.g.f.) $M_Y(t)$.

- (2) Use the m.g.f. $M_Y(t)$ to find the variance of Y , $\text{Var}(Y)$.

- (3) If X and Y are independent, find the p.d.f. of $W = Y/X$.

- (4) Let Y_1, Y_2, \dots, Y_n be a random sample of Y , find the **maximum likelihood estimator** for λ .

3. (10%) Suppose that $\{2, 7, 5, 8\}$ is a realization of a random sample of size four from the two-parameter uniform p.d.f. (θ_1 and θ_2 are unknown)

$$f_Y(y; \theta_1, \theta_2) = \frac{1}{2\theta_2}, \quad \theta_1 - \theta_2 \leq y \leq \theta_1 + \theta_2.$$

Use the **method of moments** to calculate the estimates of θ_1 and θ_2 .

4. (10%) From 1915 to 2010, the department of Economics in Harvard University had 48 vacancies for full-time professors. The table below shows the number of years in which exactly k of the vacancies occurred. Please show in detail how to test the hypothesis that those data can be described by a Poisson p.d.f., at the $\alpha = 0.01$ level of significance.

Number of Vacancies	Number of Years
0	59
1	27
2	9
3	1
≥ 4	0

考試科目	統計學	所別	16 經濟學系	考試時間	2月25日(六)第四節
------	-----	----	------------	------	-------------

5. (8%) Let $Y_1 < Y_2 < Y_3 < Y_4 < Y_5$ be the order statistics associated with n independent observations X_1, X_2, X_3, X_4, X_5 , each from the distribution with p.d.f. $f_X(x) = 2x, 0 < x < 1$. What is $\mathbb{P}(Y_4 < M)$, where M is a constant satisfying $0 < M < 1$?

6. (16%) Let X_1 and X_2 be independent random variables, each with p.d.f.

$$f_X(x) = e^{-x}, \quad 0 < x < \infty.$$

Let $Y_1 = X_1 - X_2$ and $Y_2 = X_1 + X_2$.

(1) Find the joint p.d.f. of Y_1 and Y_2 .

(2) Find the marginal p.d.f. of Y_1 .

7. (8%) Let X and Y have the trinomial p.d.f. with parameters n, p_1, p_2 , and $p_3 = 1 - p_1 - p_2$,

$$f_{X,Y}(x,y) = \frac{n!}{x!y!(n-x-y)!} p_1^x p_2^y p_3^{n-x-y},$$

where x and y are non-negative integers such that $x + y \leq n$, and $0 \leq p_i \leq 1, i = 1, 2, 3$. What is $\mathbb{E}[Y|x]$?

8. (8%) Let X have a cumulative distribution function $F_X(x)$ defined by

$$F_X(x) = \begin{cases} 0, & x < 0, \\ x^2/4, & 0 \leq x < 1, \\ 1/2, & 1 \leq x < 2, \\ x/3, & 2 \leq x < 3, \\ 1, & 3 \leq x. \end{cases}$$

Find $\text{Var}(X)$.

9. (10%) Consider a linear regression model as

$$Y_i = \alpha_0 + \beta_0 X_i + U_i, \quad i = 1, 2, \dots, n.$$

Let $\hat{\alpha}$ and $\hat{\beta}$ be the **ordinary least squares** (OLS) estimators for α_0 and β_0 , respectively. Let $\hat{Y}_i = \hat{\alpha} + \hat{\beta} X_i$ and $\hat{U}_i = Y_i - \hat{Y}_i$ for all i . Find that

- (1) $\sum_{i=1}^n \hat{U}_i$.
 (2) $\sum_{i=1}^n \hat{Y}_i \hat{U}_i$.