



# B.E. International Program

Faculty of Economics, Thammasat University



## EE 320 Introductory Mathematical Economics

Semester 2/2013

### Practice Problem 3 (Equilibrium Analysis)

#### *Easy and moderate problems*

1. (From Tubpun, 2010)

Suppose that the cost function is given by  $C = 33 + 2Q$ .

- If the price per unit is \$13, how many units of output should the producer sell in order to breakeven?
- If the producer produces 20 units of output and sells at \$13 per unit, what is the profit obtained by this producer?

2. (From Dowling, 2012)

Given the following set of simultaneous equations for two related markets, beef (B) and pork (P):

$$Q_{dB} = 82 - 3P_B + P_P \quad \text{and} \quad Q_{sB} = -5 + 15P_B$$

$$Q_{dP} = 92 + 2P_B - 4P_P \quad \text{and} \quad Q_{sP} = -6 + 32P_P$$

- What is the relationship between the demand for pork and the demand for beef?
- Find the equilibrium price and quantity for each market.

3. Consider the following system of equations:

$$Q_{d1} = 20 - P_1 + 2P_2 \quad Q_{s1} = -2 + 2P_1$$

$$Q_{d2} = 18 + 3P_1 - 2P_2 \quad Q_{s2} = 2 + 4P_2$$

- What relationship in demand do these two goods have?
- Find the inverse demand functions for both goods (i.e. write as  $P_i = f(Q_{d1}, Q_{d2})$ ).
- Find the equilibrium price and quantity for the two goods.

4. (Adapted from Sydsaeter and Hammond, 2006)

Consider the demand and supply functions:

$$Q_d = 150 - 0.5P \quad \text{and} \quad Q_s = 20 + 2P$$

- Find the equilibrium price and the corresponding quantity.
- Suppose a tax of \$2 per unit is imposed on the producer. How will this influence the equilibrium price?
- Compute the total revenue obtained by the producer before and after the tax in part (b) is imposed.
- Suppose now that a 20% tax is imposed on the producer. How does this tax affect the equilibrium price and quantity?

5. Given a simple macroeconomic model:

$$Y = C + I$$

$$C = 100 + 0.6Y_d$$

$$I_0 = 40$$

$$Y_d = Y - T$$

- Suppose  $T$  is a lump-sum tax and is equal to 50. Find the equilibrium national income.
- Suppose  $T$  is a proportional tax where  $T = 0.04Y$ . Find the equilibrium national income.
- Use graphs to illustrate the difference between the two equilibrium income levels obtained in part a) and part b).

6. Let the national-income model be:

$$Y = C + I_0 + G_0 + X_0 - M$$

$$C = C_0 + bY_d, \quad (C_0 > 0, 0 < b < 1)$$

$$Y_d = Y - T, \quad \text{where } T \text{ is a constant}$$

$$M = M_0 + mY, \quad (M_0 > 0, 0 < m < 1)$$

- Find the equilibrium level of national income.
- Find the impact of an exogenous increase in government expenditure on the equilibrium national income (i.e.  $\frac{\Delta Y^*}{\Delta G} = ?$ ). Assume everything else remains constant.
- Given that  $C_0 = 70$ ,  $b = 0.8$ ,  $I = I_0 = 80$ ,  $G = G_0 = 75$ ,  $T = 25$ ,  $X = X_0 = 65$ ,  $M_0 = 40$ , and  $m = 0.3$ , find the equilibrium national income.
- From part c., if  $T = 40$ , what is the change in the equilibrium national income?

**Harder problems**

7. Consider the following system of equations:

$$\begin{aligned} Q_{d1} &= 23 - 5P_1 + P_2 + P_3 & Q_{s1} &= -8 + 6P_1 \\ Q_{d2} &= 15 + P_1 - 3P_2 + 2P_3 & Q_{s2} &= -11 + 3P_2 \\ Q_{d3} &= 19 + P_1 + 2P_2 - 4P_3 & Q_{s3} &= -5 + 3P_3 \end{aligned}$$

- What is the relationship between the three goods?
- Find the equilibrium price and quantity for the three goods.

8. (Adapted from Tubpun, 2010)

Consider the demand and supply functions of a good:

$$Q_d = 260 - 5P \quad \text{and} \quad Q_s = -40 + 15P$$

- Find the equilibrium price and the corresponding quantity.
- In order to encourage the use of this good, the government subsidizes the producers by giving them \$4 per unit of the good sold. Find the new equilibrium price and quantity after the government subsidization.
- Use a graph to illustrate the impact of the subsidization program on the equilibrium price and quantity.
- Find the amount of money the government needs for this subsidization program.

9. Consider the following IS-LM model:

$$Y = C + I + G$$

$$C = 100 + 0.8Y_d$$

$$I = 80 - 100r$$

$$G = 100$$

$$Y_d = Y - T$$

$$T = 0.25Y$$

$$M_s = 2500$$

$$M_d = M_{tp} + M_z$$

$$M_{tp} = 0.1Y$$

$$M_z = 2500 - 150r$$

where  $M_{tp}$  = transaction-precautionary demand for money and  $M_z$  = speculative demand for money

- Write the IS and LM equations
- Find the equilibrium national income and rate of interest

- c) If the investment function is now  $I = 300 - 100r$ , find the equilibrium national income and interest rate. Use an IS-LM diagram to illustrate the impact of this change in investment.
- d) Suppose that the money supply increases to 2563, find the equilibrium national income and interest rate. Also, use an IS-LM diagram to illustrate the impact of the change in money supply.

10. Market demand is the sum of the demands of all buyers. Similarly, market supply is the sum of the supplies of all sellers. Suppose that Nadech and Mark are the only two buyers in the coffee market, and individual demands of Nadech and Mark for coffee are  $Q_{Nadech}^D = 5 - 3P^2$  and  $Q_{Mark}^D = 4 - P^2$ . Suppose further that Starbucks and Starbung are the only two sellers in the market, and their individual supplies for coffee are  $Q_{Starbucks}^S = 2 + 5P$  and  $Q_{Starbung}^S = 5 + 2P$ . Find the market demand, market supply, equilibrium price, and equilibrium quantity.