



# B.E. International Program

Faculty of Economics, Thammasat University



## EE 320 Introductory Mathematical Economics

Semester 1/2015

### Homework 1

**Due 8 September 2015**

*There are six questions in total. Each of them is worth equally.*

1. Mr. Push produces shoes for sale, and his total cost function is given by  $C(Q) = 105 + 23Q$ , where  $Q$  is the output level.
  - a. (4 points) Suppose that Mr. Push sells his shoes in a perfectly competitive shoe market at the price \$30 per pair. How many pairs of shoes should Mr. Push sell in order to break-even?
  - b. (6 points) Suppose now that Mr. Push is the only producer in this market (because his shoes have special designs), and the demand function he faces is  $Q_d = 153 - P$ . If he is still able to sell his shoes at the break-even amount in the competitive market (i.e. the quantity found in part a.), what is his new profit?

2. Consider the following system of equations:

$$Q_{d1} = 33 - 4P_1 - 4P_2 + P_3 \qquad Q_{s1} = 2 + P_1$$

$$Q_{d2} = 18 - 2P_1 - 3P_2 + 4P_3 \qquad Q_{s2} = 3 + 2P_2$$

$$Q_{d3} = 15 + P_1 + 5P_2 - 4P_3 \qquad Q_{s3} = 7 + 5P_3$$

- a. (2 points) What are the relationships among the three goods?
- b. (8 points) Find the equilibrium price and quantity for the three goods.

3. Consider the following IS-LM model:

Commodity market:

$$Y = C + I + G_0$$

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

$$I = I_0 - ar, \quad (I_0 > 0, a > 0)$$

Money market:

$$M_S = M_0$$

$$M_D = mY - hr, \quad (m > 0, h > 0)$$

- (4 points) Write out the explicit IS-LM system of equations, and determine the equilibrium national income and equilibrium interest rate.
- (2 points) Find the impact of an exogenous increase in money supply ( $M_0$ ) on the equilibrium interest rate found in part (a). Assume everything else remains constant.
- (2 points) Suppose that  $C_0 = 250$ ,  $I_0 = 150$ ,  $G_0 = 50$ ,  $b = 0.8$ ,  $a = 1000$ ,  $h = 1500$ ,  $M_0 = 200$ , and  $m = 0.4$ . Find the equilibrium national income and interest rate.
- (2 points) Based on the information in part (c), if the government expenditure ( $G_0$ ) increases to 120, all else constant, what is the *change* in the equilibrium national income?

4. Consider a café that serves both pizza and cookies. Suppose the demand curve and supply curve for pizza in a café are given by

$$\text{Demand: } Q = 300 - 20P - 20P_c$$

$$\text{Supply: } Q = 10P - 10$$

where  $P$  is the price of a pizza, and  $P_c$  is price of a cookie.

Answer the following questions:

- (3 points) Suppose the price of a cookie is  $P^c = 5$ . Find the equilibrium price and quantity of pizza.
- (4 points) Due to a change in the price of cookies, the *new* equilibrium price of pizza changes to  $P^* = 5$ . What must be the price of a cookie now?
- (3 points) Are pizza and cookies substitutes or complements in this example? Use your economic intuition to justify your answer.

5. Alex, Zander, and Clark are the only three consumers in the market for oatmeal. They have the following individual demand curves for oatmeal. The market supply curve for oatmeal is also provided to you.

$$\begin{aligned}\text{Alex:} & \quad P = 2 - Q_d \\ \text{Zander:} & \quad Q_d = 40 - 2P \\ \text{Clark:} & \quad Q_d = 20 - 4P \\ \text{Supply:} & \quad Q_s = \left(\frac{3}{2}\right)P - 12\end{aligned}$$

Answer the following questions:

- (4 points) Derive equation for market demand. Make sure you correctly specify all the domain sets of variables that make your equation economically meaningful.
- (3 points) What is the equilibrium price *and* quantity of oatmeal?
- (3 points) Under equilibrium, are there consumers rationed or excluded from the market?

6. The demand and supply curves in the market for whiskey are given by the following equations:

$$\begin{aligned}\text{Demand:} & \quad Q_d = 120 - 3P \\ \text{Supply:} & \quad P = 0.5Q_s\end{aligned}$$

where Q is the quantity of whiskey in bottles and P is the price per bottle of whiskey.

Answer the following questions:

- (1 point) Find the pre-tax equilibrium price and quantity, i.e. (P\*,Q\*).
- (1 point) Calculate the price elasticities of demand and supply at the equilibrium.
- (1 point) Based on the values of calculated elasticities, can you tell us anything about the change in the total revenue if the market price can be increased by 1%?

Now suppose that the government in this economy has levied an excise tax of \$5 on the *suppliers* of whiskey.

- (2 points) Find the post-tax equilibrium price and quantity.
- (2 point) How much total revenue can government collect?
- (3 point) In terms of economic incidence, what percentage of the tax is actually borne by suppliers?