B.E. International Program

Faculty of Economics, Thammasat University

EE 320 Introductory Mathematical Economics (Section 046402)

Semester 1/2013

Homework 1

Due 5 September 2013

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

1. Ms. Neptune produces scarves for sale, and her total cost function is given by $C(Q) = 40 + 12Q$, where Q is the output level.

   a. (2 points) Suppose that Ms. Neptune can sell her scarves at the price \$22 per piece (i.e. she is a price taker). How many scarves should Ms. Neptune sell in order to break-even?
   Ans. $\pi = 22Q - (40 + 12Q) = 0$ ➔ $Q_{BE} = 4$.

   b. (3 points) Suppose now that Ms. Neptune is the only producer in this market (because her scarves are handmade and unique), and the demand function she faces is $Q = 300 - 20P$. What is (are) the break-even point(s) in this case?
   Ans. $Q = 300 - 20P$ ➔ $P = 15 - 0.05Q$
   $\pi = (15 - 0.05Q)Q - (40 + 12Q) = 0$
   ➔ $15Q - 0.05Q^2 - 40 - 12Q = 0$
   ➔ $Q_{BE} = 20, 40$.

2. Consider the following system of equations:

$$Q_{d1} = 20 - P_1 + 2P_2 \qquad Q_{s1} = -2 + 2P_1$$
$$Q_{d2} = 18 + 3P_1 - 2P_2 \qquad Q_{s2} = 2 + 4P_2$$

   a. (1 points) What relationship in demand do these two goods have?
   Ans. They are substitutes.

b. (2 points) Find the inverse demand functions for both goods (i.e. write as $P_i = f(Q_{d1}, Q_{d2})$).

Ans. $P_1 = 0.5Q_{d1} + 0.5Q_{d2} - 19$

$P_2 = 0.75Q_{d1} + 0.25Q_{d2} - 19.5$

c. (2 points) Find the equilibrium price and quantity for the two goods.

Ans. $(Q_1^*, P_1^*) = (25.33, 13.67)$

$(Q_2^*, P_2^*) = (40, 9.5)$

3. Given the following supply and demand functions:

$Q^D = 50 - 3P$

$Q^S = 20 + 2P$

a. (2 points) Suppose that the government imposes a \$0.5 specific tax *on consumers*, what are the new equilibrium prices for consumers and producers? Find the tax burden on both producers and consumers.

Ans. $P^{consumer} = P^* + T = 6.2$, $P^{producer} = P^* = 5.7$

Tax burden on producer = 6 – 5.7 = 0.3

Tax burden on consumer = 6.2 – 6 = 0.2

b. (2 points) Suppose now that the government imposes a 25% ad valorem tax *on consumers*, what are the new equilibrium prices for consumers and producers? Also, determine the tax burden on both producers and consumers.

Ans. $P^{consumer} = (1+t)P^* = 6.52$, $P^{producer} = P^* = 5.22$

Tax burden on producer = 6 – 5.22 = 0.78

Tax burden on consumer = 6.52 – 6 = 0.52

c. (1 points) Discuss the difference between the effects of taxes in parts (a) and (b).

Ans. Tax burden from ad valorem tax on both producer and consumer is greater than the tax burden from specific tax. The difference in tax burden is greater for producer.

4. Consider the following IS-LM model:

Commodity market:

$Y = C + I + G_0$

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

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

Money market:

$M_S = M_0$

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

a. (2 points) Write out the explicit IS-LM system of equations, and determine the equilibrium national income and equilibrium interest rate.

Ans. IS: $Y = \frac{I_0+G_0-ar}{(1-b)}$

LM: $Y = \frac{M_0+hr}{m}$

$Y^* = \frac{h(I_0+G_0)+aM_0}{am+h(1-b)}$; $r^* = \frac{m(I_0+G_0)-(1-b)M_0}{am+h(1-b)}$

b. (1 points) Find the impact of an exogenous increase in government expenditure on the equilibrium national income found in part (a). Assume everything else remains constant.

Ans. $\frac{\Delta Y^*}{\Delta G} = \frac{h}{am+h(1-b)}$

c. (1 points) Suppose that $I_0 = 750$, $G_0 = 250$, $b = 0.8$, $a = 1000$, $h = 1500$, $M_0 = 500$, and $m = 0.2$. Find the equilibrium national income and interest rate.

Ans. $Y^* = 4000;\ r^* = 0.2$

d. (1 points) Based on the information in part (c), if the money supply (M_0) increases to 750, what is the *change* in the equilibrium interest rate?

Ans. $\frac{\Delta r^*}{\Delta M_0} = \frac{-(1-b)}{am+h(1-b)} = \frac{-0.2}{500} = -0.0004$

If ΔM_0=750, then $\Delta r^* = -0.3$.