Principle of Economics: Homework 2, Unit 1 - Unit 10

Short Answer Questions

Please answer the following questions briefly and precisely.

1. Suppose that Alice is one of the supplier of lunchboxes (午餐便當) in NTU, and the lunchbox market is perfectly competitive. Suppose there are two types of consumer, undergraduate students(學士生) and graduate students(碩士生). Their demand functions for lunchboxes are

$$30P = 300 - Q_u(\text{Undergrads})$$
$$40P = 360 - Q_g(\text{Graduates})$$

   And the market supply function is

$$Q_s = 40P.$$

   Based on these information, please answer the following questions.

   (a) What is the market demand function for lunchboxes?
   (b) Based on the previous question, what is the equilibrium quantity and price in the market?
   (c) Following (b). Suppose the supply curve shifts leftward and the equilibrium price increases by \$1. The price elasticity of demand of undergraduate students is ε_u, and that of graduate students is ε_g. Calculate ε_u and ε_g. (The elasticity above is **point-elasticity** (點彈性).)
   (d) If Alice increases the price of his lunchbox by one percent, holding all else unchanged, will his revenue increase, decrease, or stays the same? Explain your reasoning.

Solution.

(a) 需求函數是價格 P 的函數，因此需就不同區間分段討論：

$$\begin{cases} Q = & 0 \text{ if } P \geq 10 \\ Q = Q_u = & 300 - 30P \text{ if } 10 > P \geq 9 \\ Q = Q_u + Q_g = & 660 - 70P \text{ if } 9 > P \geq 0 \end{cases}$$

(b) $P^* = 6, Q^* = 120$

(c) 帶入 $P = 6$，得 $Q_u = Q_g = 120$。
帶入 $P = 7$，得 $Q_u = 90, Q_g = 80$。
使用點彈性計算需求彈性：$\varepsilon_u = 1.5, \varepsilon_g = 2$。

(d) Decrease。因為 “lunchbox market is perfectly competitive,” 單一廠商面對水平的需求線，抬升價格後無法售出任何 Lunchbox。故收益為 0。

2. Consider a competitive egg market, where the quantity of eggs produced by an individual farm is only determined by the amount of chicken coops (雞舍) available. In the short run, the number of chicken coops is fixed, but it can be adjusted in the long run. There are 10 identical egg farms in the market. The long-run marginal cost (MC) function of producing eggs is $MC = 10q$, where q represents the number of eggs produced by an individual farm. In this problem we assume that **no farms will enter or exit the market**. (Calculate all elasticities in this problem using the mid-point method.)

   (a) Initially, the market demand curve is $D^0 : P = 100 - Q$. The market reaches a long-run equilibrium at (Q_0, P_0). After an increase in demand, the new demand curve is $D^1 : P = 120 - Q$, and the short-run equilibrium becomes (Q_1, P_1). Calculate the **short-run price elasticity of supply**.

   (b) As time passes, egg production adjusts and the market reaches a new long-run equilibrium at (Q_2, P_2). Compute the **long-run price elasticity of supply**. (It might be helpful to draw a supply-demand diagram first.)

   (c) Following part (a), suppose the egg price committee (蛋價委員會) imposes a price ceiling of $P = 55$. Using the long-run demand curve D^1, calculate the **excess demand** in the market in the long run.

Solution.

(a) 題目中敘述

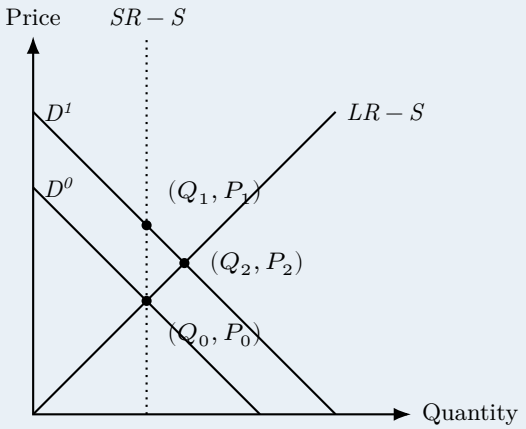
> The quantity of eggs produced by an individual farm is only determined by the amount of chicken coops.

以及

> In the short run, the number of chicken coops is fixed.

因此短期內供給數量無法改變，供給線為垂直 (perfectly inelastic)，故供給彈性為 0。

(b) 長期廠商能調整雞舍數量，因此長期供給線為 long-run MC curve. 原本長期均衡在 (Q_0, P_0)，短期價格上升至 (Q_1, P_1)，長期則調整至 (Q_2, P_2)。



市場供給線為個別廠商供給線的加總。個別供給線為 $q = 0.1P$，10 家廠商：

$$Q^s = 10q = 10 \times 0.1P = P$$

使用 D^0 計算 (Q_0, P_0)：$100 - P_0 = P_0$。
使用 D^1 計算 (Q_2, P_2)：$120 - P_2 = P_2$。

$$(Q_0, P_0) = (50, 50), (Q_0, P_0) = (60, 60)$$

計算長期供給彈性：

$$\varepsilon^s = \frac{60 - 50}{60 - 50}\frac{55}{55} = 1$$

備註： 此題註明 no farms will enter or exit the market，因此長期產業供給線並不會是水平線。

(c) 價格上限 $P = 55$ 帶入長期供給線與需求線 D^1，得需求量為 65，供給量為 55。超額需求為 10。