

**Economics 431**  
**Homework 1**  
**due Wed July 5**

**Part I Entry in a competitive industry**

Honey is produced in a beehive with bees and sugar. Each farmer operates one beehive which he rents for \$1/month from a landlord. Producing  $q$  gallons of honey a month requires spending  $q$  dollars a month on bees and  $q^2$  dollars a month on sugar.

a) What is total cost  $C(q)$  for the farmer?  $AC(q)$ ?  $MC(q)$ ? If each farmer is a price-taker, what is his supply curve?

b) Suppose that if the price for honey is  $p$ , consumers are willing to buy  $13 - p$  gallons of honey per month. If the honey industry consists of a total of 10 farmers, what will be the equilibrium price for honey and the total monthly sales?

d) Will this be a long-run equilibrium?

e) Suppose that demand for honey goes up to  $19 - p$  gallons per month. In the short run equilibrium, how much profit will each farmer make? What is the long-run equilibrium? How many more farmers will enter in the long run?

**Part II Elasticity of residual demand and price-taking behavior**

Why do we associate a large number of firms on the market with price-taking behavior? Why do firms believe they cannot affect the market price when there are a lot of rivals?

In words, the more firms are there in the industry, the lesser fraction of the market is supplied by one particular firm. The lesser fraction is supplied, the more elastic is the demand faced by one individual firm. The more elastic the individual firm's demand, the closer its behavior to that of a price taker.

Suppose that there are  $n$  identical firms on the market. If firm  $i$  wants to produce quantity  $q_i$ , its total cost is  $C(q_i) = cq_i^2$ .

a) What is  $AC(q_i)$ ,  $MC(q_i)$ , firm supply as a function of market price  $p$ ?

The total quantity supplied by this  $n$ -firm industry at price  $p$  (denote it  $Q(p)$ ) is the sum of quantities supplied by each individual firm.

$$Q^S(p) = \sum_{i=1}^n q_i(p)$$

b) Show that the elasticity of supply equals

$$\eta_S = \frac{\Delta Q^S}{\Delta p} \frac{p}{Q} = \frac{n}{2c} \frac{p}{Q}$$

Let  $Q^D(p)$  be quantity demanded at price  $p$ . Let us compute the portion of this demand that is satisfied by firm  $i$ . This portion is called *residual demand of firm  $i$* . Let  $Q_{-i}^S(p)$  be the quantity supplied by all firms except firm  $i$ :

$$Q_{-i}^S(p) = Q^D(p) - q_i(p)$$

Then the residual demand of firm  $i$  equals to the total market demand minus what was supplied by all other firms:

$$q_i^D(p) = Q^D(p) - Q_{-i}^S(p)$$

b) Show that the price elasticity of residual demand

$$\varepsilon_i(p) = \frac{\Delta q_i^D}{\Delta p} \frac{p}{q_i} = n\varepsilon(p) - (n-1)\eta_S$$

where  $p$  is market price  $Q$  is the total quantity sold and  $\varepsilon(p)$  is the point elasticity of market demand.

c) Show that as  $n$  becomes larger residual demand becomes more and more elastic.

### **Part III. Problems from the textbook**

End of Chapter problem 2.4