Supply, Demand and Monopoly

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In this chapter, we will learn how prices are determined by supply and demand.

In our daily life, it's often not wise to sell all products at the highest price. As customers can always choose to use substitutes or be more thrift when the prices soar to the sky. Typically, the higher the prices, the lower quantities of demand on the market. What is the relationship between price (P) and quantity (Q)? Economists use price elasticity of demand (PED or Ed) to measure the responsiveness, or elasticity, of the quantity demanded of a good or service to a change in its price when nothing but the price changes. More precisely, it gives the percentage change in quantity demanded in response to a one percent change in price.

$$Elasticity\ coefficient\ E_d = \frac{per\ cent\ Quantity\ rises}{per\ cent\ cut\ in\ Price} = \frac{dQ/Q}{dP/P}$$

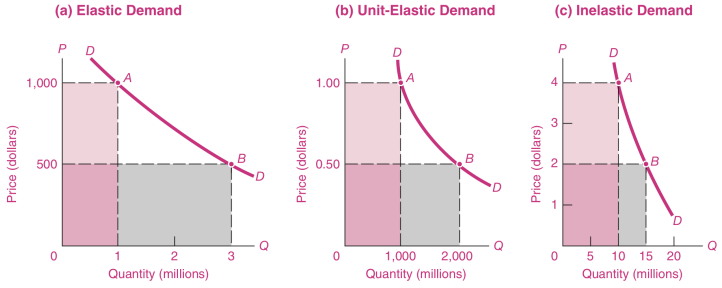

Figure 1: Elasticity of demand comes in three cases.

$E_d > 1$ means **elastic**, $E_d = 1$ means **unitary** and $E_d < 1$ means **inelastic**. Figure 1 shows the three cases. For Figure 1-(a), elastic demand shows a tendency for which more output (Q) and lower price increase the total revenue.

Different elasticity of demand lead companies ending up with different strategies. After all, the ultimate goal for any company is to earn **max profit**. However, please be aware of the difference between **profit** and **revenue** used above. Maximum revenue does not necessarily leads to maximum profits, since the effect of cost is still unknown. Here we introduce the concept of average cost (AC) and marginal cost (MC).

Definition: Marginal Cost at any output level q is the extra cost of producing one extra unit more (or less); it comes from subtracting total dollar costs of adjacent outputs.

Please be aware of the difference between marginal cost and average cost. Marginal cost is only related to the cost of producing next extra unit of product. It has no relations with any other unit of product. So it's the area under MC curve of $MC - quantity$ graph to be the total cost.

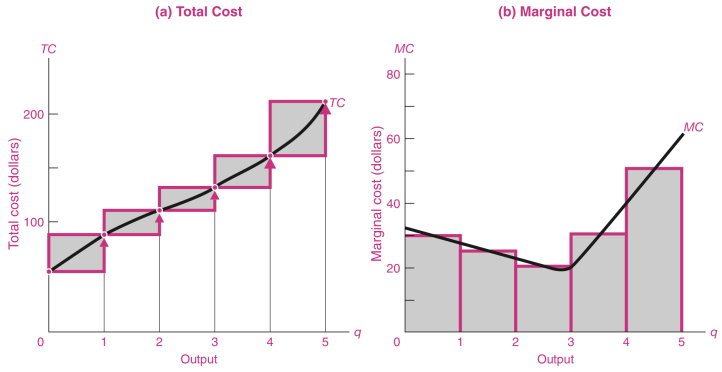

Figure 2: Total Cost and Marginal Cost tendencies.

As Figure 2 shows, a tendency for varying factors to show diminishing returns when applied to fixed factors implies a tendency for MC to be rising. If at first there is increasing returns, there is at first declining MC–but ultimately diminishing returns and increasing MC.

With demand-price-quantity curve and marginal cost curve, how to determine maximum-profit by the company?

Let's start with a simple example. Suppose, I'm a potato farmer who is unable to control the price market. In other words, as a **price-taker**, *no matter how much quantity I supply, the market price does not change.* The price-quantity curve should be a *horizontal* line. Figure 3 illustrates this idea.

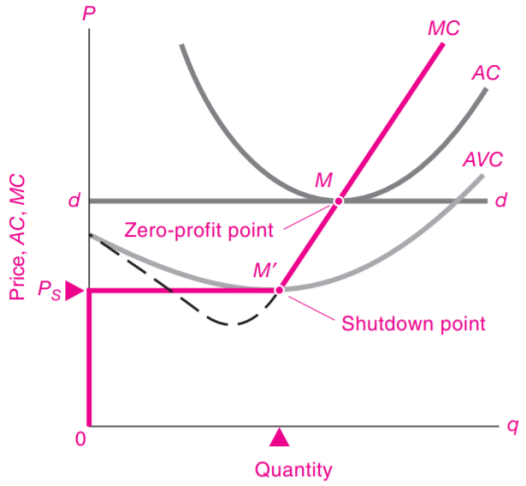

Figure 3: Firm's Supply Curve Travels Down the MC Curve to the Shutdown Point

In Figure 3, the maximum-profit point should be at M, which is also the *lowest average cost* (AC) point. The dd horizontal line implies that the quantity has no influence of the price. The price is fixed. Suppose we are at a point on the right of M on the MC curve, we are losing money because the marginal cost (MC) is above the market price (fixed dd curve). Thus, to add one extra unit of product, the cost (marginal cost MC) is more than the selling price. Similarly, if we are at a point on the left side of M on the MC curve, since the marginal price (MC curve) is below the market price (dd curve), we can still make money with more products. So what is the profit? The revenue is easy to calculate as the price is fixed. It's the rectangle's area under dd curve. The total cost is the area under the MC curve. Thus, the **area between dd curve and MC curve is the total profits**.

In summary, the maximum-profit point comes when price (P) is

$$P = MC$$

You may ask why should we use such an weird curve of demand? Why should it be horizontal? Shouldn't the quantity of demand drops when price is high?

If you are a potato farmer as in the example, you are a **perfect competitor** who **cannot control the price**, then the demand curve should be **horizontal**. If you are an **imperfect competitor** such as a *monopoly or oligopoly*, you can actually **control the price**. How? How can you persuade customers to buy more goods with the diminishing returns of utility from these abundant

of goods? You need to sell at a lower price. Unlike marginal ones, this lower price is available for all customers. Thus in this case, the *price-quantity* curve of demand in fact drops down as quantity grows.

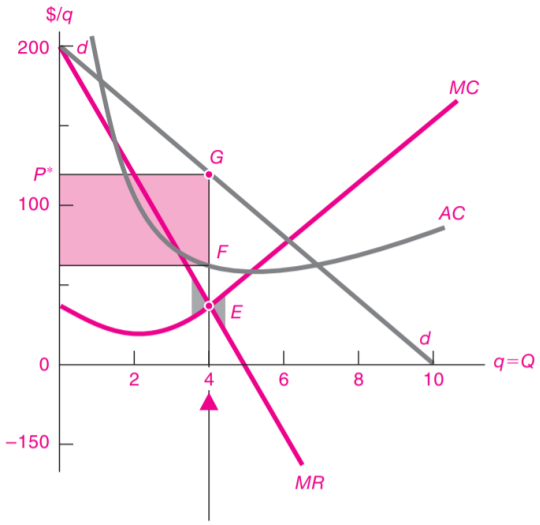

Figure 4: Profit Maximization.

Figure 4 shows a decreasing curve of demand dd. And now we can ask: what is the maximum profit point for the corporation?

Apparently, the maximum profit point should be that when the marginal revenue (earning) equals to the marginal cost. In Figure 4, it's the point E. In general,

$$R = P(Q) \cdot Q$$

$$MR = \frac{dR}{dQ} = P + \frac{dP}{dQ} \cdot Q = P + P \cdot \frac{dP/P}{dQ/Q} = P \cdot (1 + \frac{1}{elasticity})$$

where

R : *revenue*

P : *price*

Q : *quantity*

MR : *marginalrevenue*

In English, MR **curve has a steeper slope than that of** P.

What this implies is that the MR curve must be something like the one if Figure 4, it can never be above the dd curve. Further, the intersection point between MR curve and MC curve must be under the dd curve, like the point E shown in Figure 4. At point E, with maximum profit because of $MR = MC$, the price P (at point G) is much higher than marginal cost. That is, for an **imperfect competing market**,

$$P > MC = MR$$

To understand it, *the imperfect competitor is contriving to keep things a little scarce. It is contriving to keep P above MC because in that way it sets $MR = MC$ and thereby maximizes its profit. So society does not get quite so much of company's good as we really want in terms of what that good really costs society to produce.* This is how imperfection of competition hurts resource allocation.