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September 30, 2017

1 Elasticity of demand

- How much the quantity demanded of a good changes in response to a change in the price of a good? The price elasticity of demand will tell us about this!
- Not all goods respond in the same way to an equal percent change in their price. For example, if the price of vaccinations doubles, we'll probably notice a small reduction in the quantity demanded. But if the price of Incan matrimonial head masks doubles, we'll likely notice a large reduction in the quantity demanded for the masks.
- The price elasticity of demand compares the percentage change in quantity demanded to the percentage change in price, along a demand curve. The reason that we use percent changes is to get a measue that doesn't depend on the units in which a good is measures (say, millions of vaccinations and number of headmasks)
- We represent elasticity as $\varepsilon_{Q,P}$

$$\varepsilon_{Q,P} = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} \equiv \frac{\frac{Q_1 - Q_0}{Q_0}}{\frac{P_1 - P_0}{P_0}} \tag{1}$$

- the value of elasticity is negative because positive changes in prices cause negative changes in quantity demanded and vice versa. However, we are going to drop the negative sign, and work in absolute value.
- The larger the price elasticity of demand (remember in absolute value!), the more responsive the quantity demanded is to the price.
- So as the value of the elasticity gets larger, we say that the demand become more elastic.
- We classify elasticites as follows
  1. If the elasticity is greater than one, the demand is elastic
  2. If the elasticity is less than one, the demand is inelastic
  3. If the elasticity is exactly equal to one, the demand is unit-elastic
- There are two important special cases:

1. Zero elastic (perfectly inelastic) demand curve: if no matter what the price change, the quantity demanded stays unchanged, then we have a zero elastic (perfectly inelastic) demand curve. In this case, the demand curve is a vertical line.
2. The infinitely elastic (perfectly elastic) demand durve: if even a tiny rise in the price causes the quantity demanded to drop to zero or even a tiny fall in the price causes the quantity demanded to get extremely large, then we have an infinitely elastic (perfectly elastic) demand curve. In that case, the demand curve is a horizonal line.

- Factors that affect the elasticity of demand:

  1. the availabilitys of substitutes: if the substitutes are available, the demand elasticity will be higher.
  2. How necessary the good is: luxuries have higher demand elasticity than necessities.
  3. Share of income spent on the good: if a large part of our income is spent on the good, then the demand elasticity will be higher. We will be very responsive to price changes (e.g. housing). If a small part of our income is spent on the good, then we don't really care about price changes and the demand elasticity will be low (e.g. pencils).
  4. Time: as time passes we can find substitutes for a good. This means that in the long-run, price elasticity will be higher than in the short-run. In the short-run we can't easily switch away from a good.

- We already know that the quantity demanded depends on not only the price of the good, but also the price of *other* goods. We call the elasticity with respect to other prices, the cross-price elasticity

  1. If the cross-price elasticty of two goods is positive, then the goods are substitutes. A positive change in the price of one good causes a positive change in the quantity demanded of the other good. When the price of coffee rises, the quantity demanded of tea rises. Alternatively, a negative change in the price of one good causes a negative change in the quantity demanded of the other good. When the price of coffee falls, the quantity demanded of tea falls.
  2. If the cross-price elasticity of two goods is positive, then the goods are complements. A positive change in the price of one good causes a negative change in the quantity demanded of the other good. When the price of sugar rises, the quantity demanded of coffee falls. Alternatively, a negative change in the price of

one good causes a positive change in the quantity demanded of the other good. When the price of sugar falls, the quantity demanded of coffee rises.

- Another factor that affects the demand is income. Thus, we can compute the income elasticity of demand. The income elasticity is the percentage change in quantity demanded divided by the % change in income.

  1. If the income elasticity is negative, then the good is inferior. A positive change in our income causes a negative change in the quantity demanded of the good. Alternatively, a negative change in our income causes a positive change in the quantity demanded of the good.
  2. If the income elasticity is positive, then the good is normal. A positive change in our income causes a positive change in the quantity demanded of the good. Alternatively, a negative change in our income causes a negative change in the quantity demanded of the good.

- Imagine that there is only one seller in the market. She faces the market demand. What are the revenues for this seller?

- Revenues are the amount of dollars the sellers is receving as sales. $R = p \times q$, where p is the price, and q is the quantity sold in the market.

- In setting the prices, the seller needs to consider that increasing the price will result on more revenues from the units sold (price effect) but she will sell fewer units (quantity effect). Similarly, decreasing prices result on more units but she will get less revenue from the units sold. The elasticity illustrates quite nicely the effect of prices on revenues.

- We can denote the total change of revenues is ΔR. This change depends on the changes of quantity and prices. Thus,

$$\begin{aligned} \Delta R &= (\Delta Q)P + (\Delta P)Q && (2) \\ &= (\Delta P)[P + \frac{\Delta P}{\Delta Q}Q] && (3) \\ &= (\Delta Q)[P + \frac{(\Delta P)(Q)(P)}{(\Delta Q)(P)}] && (4) \\ &= (\Delta Q)(P)[1 - \frac{1}{\varepsilon}] && (5) \end{aligned}$$

- So, if $\varepsilon > 1$ and $\downarrow Q$ ($\uparrow P$), then $\downarrow \Delta R$. That is, a elastic (inelastic) demand curve implies a negative (positive) relationship between prices and revenues.

- Below we discuss further the seller's decision process.

Total revenue with an elastic demand

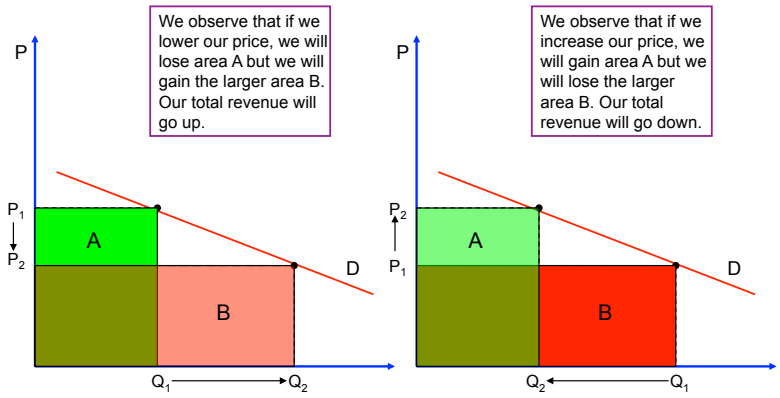

Figure 1: Total revenue

2 Monopoly

- The unique seller in the market (monopolist) needs to figure out how many units to produce (or what price to set) in the market.
- We already know that every time you change quantity, the monopolist will change revenues by $\frac{\Delta R}{\Delta Q}$. This is known as *marginal revenues*.
- We use the term *marginal* because the seller is making decisions at the margin, or for small increments.
- In economics, we usually compare the benefit against the cost. Revenues are considered as benefits since it is money (i.e. cash) that monopolist is receiving for selling its units to the market. On the other hand, the monopolist is incurring in certain costs of production.
- The incremental cost of producing ΔQ units extra is ΔC. We can say that *marginal cost* of producing is $\frac{\Delta C}{\Delta Q}$.
- The optimal decision is when the extra benefits (marginal revenues) is equal to the extra costs (marginal costs). Thus, $\frac{\Delta R}{\Delta Q} = \frac{\Delta C}{\Delta Q}$ or simply MR=MC.
- Using our expressions before we can replace the term MR for $(P)[1-\frac{1}{\varepsilon}]$. Therefore, at the optimal decision, $(P)[1-\frac{1}{\varepsilon}] = MC$, or $P = MC \times \left(\frac{\varepsilon}{\varepsilon-1}\right)$. Since $\varepsilon > 1$, note that $\left(\frac{\varepsilon}{\varepsilon-1}\right) > 1$. This last term is known as the mark-up. The monopolist sets as price equal to the marginal cost times a mark-up. In other words, the monopolist is making profits.

Total revenue with an inelastic demand

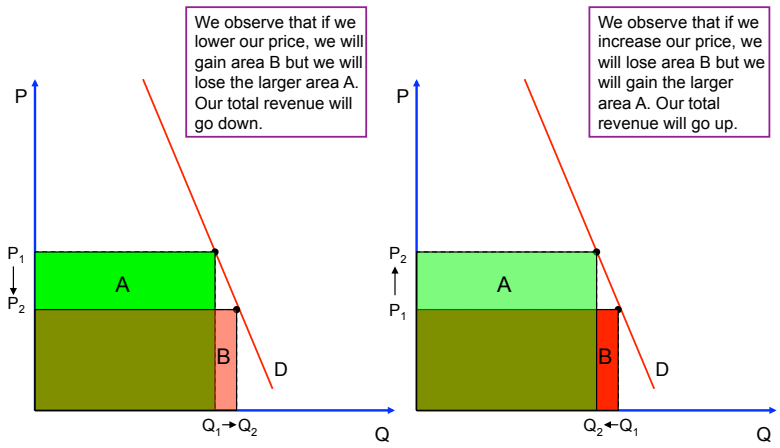

Figure 2: Total revenue

- The marginal revenue is lower than P (present in the demand curve) since the monopolist internalizes the effect on the other quantities in the market.

Marginal revenue of a monopolist

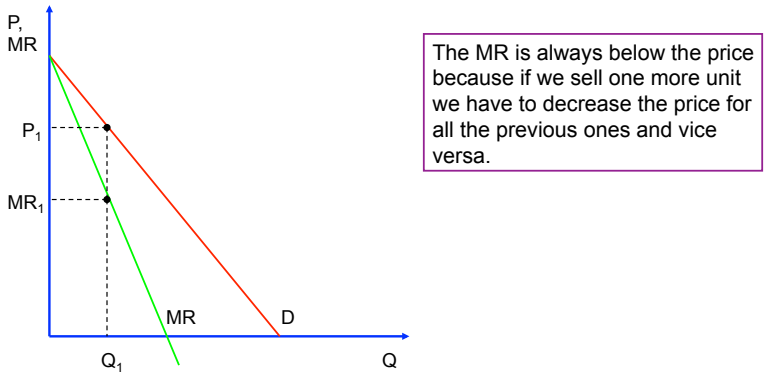

Figure 3: Marginal revenues

- If we assume that marginal cost is constant, the quantity offered by the monopolist is determined by the condition MR=MC. The price paid by consumers is above the marginal cost (recall the mark up) and the profits of the monopolist are equal to $(p_M - c) \times q_M$, where c is the constant marginal cost.

- In most textbooks, the marginal cost is not as simple as a horizontal line. They assume that it decreases for small units and then every additional unit becomes more

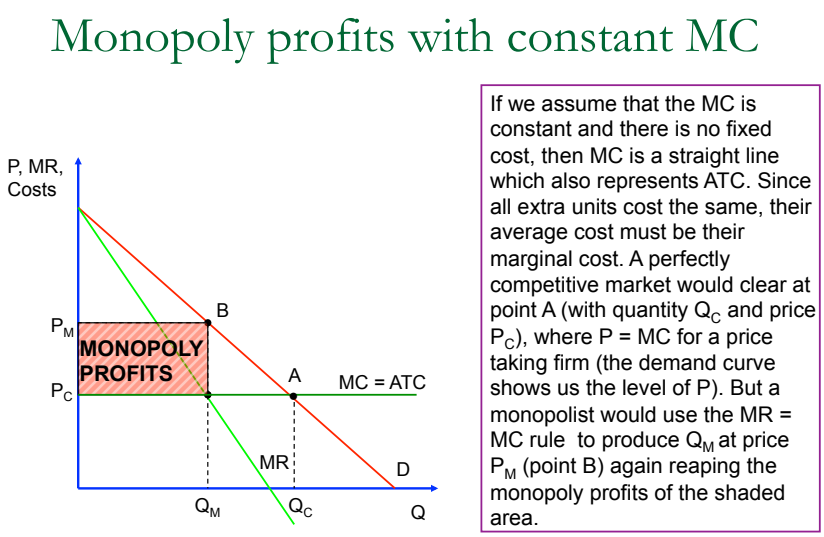

Figure 4: Monopoly

costly. That is, first it is decreasing (negative slope) and then increasing (positive slope). If we associated the marginal cost to the (average) cost of production (defined as $\frac{cost}{Q}$), then we can see that unit cost is decreasing and then increasing. Notice that MC curve crosses the lowest point of the average total cost. Why? Notice that lowest point of the average curve satisfies that the slope $\Delta(C/Q) = 0$. We can rewrite the slope as $\frac{\Delta C}{C} - \frac{\Delta Q}{Q} = 0$. Reorganizing terms, we find that $\frac{\Delta C}{\Delta Q} = \frac{C}{Q}$, or MC=ATC.

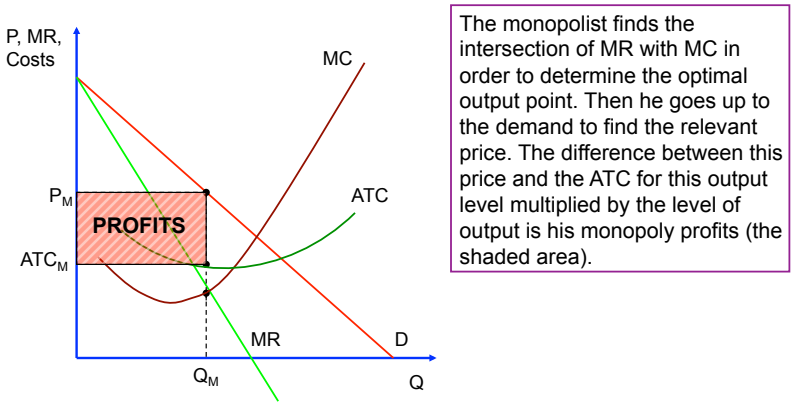

Figure 5: Monopoly with MC non constant

2.1 Monopoly vs. perfect competition

- We can compare the monopoly against a situation in which the sellers do not have market power. We can understand the lack of market power as as situation in which the mark-up is zero! We are going to use the term *perfect competition* for this situa-

tion. Notice that sellers are selling its units at the marginal cost. P=MC.

- P is driven by the demand equation, and notice that this point is on the right of the units sold by a monopolist.
- Assuming a constant MC we can observe that CS is much higher under perfect competition, and that under monopoly there is a DWL.

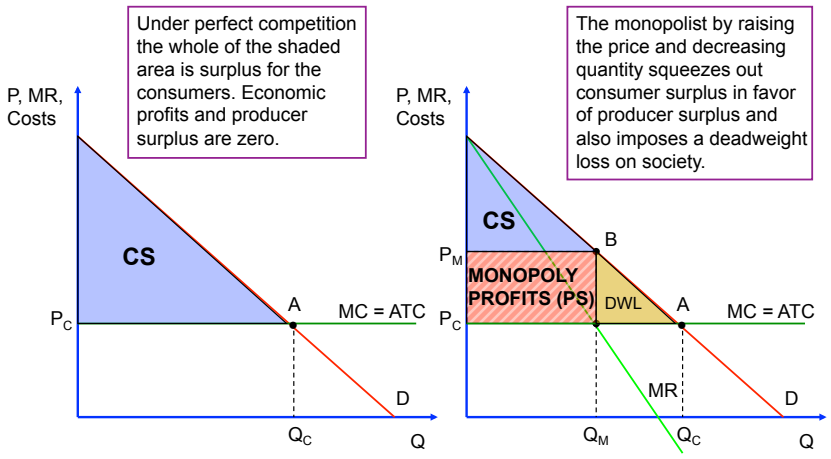

Figure 6: CS under perfect competition and monopoly