

Lecture Supplement for ECO 235: Key Economic Principles

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Overview:

Economics 235 is a unique course in the department. Many of you taking this class are ACS majors and have not had an Economics course in several semesters. The long time span between ECO 235 and ECO 105 can make retention of the main economic principles rather difficult. This paper is created to explain some of the major principles and to provide examples which are similar to homework problems.

The paper is divided into four sections. In section I, I provide definitions and explanations of key concepts. Section II, explains the perfectly competitive market. Section III explains the monopolistic market and section IV provides information about natural monopolies; a special case of monopolistic markets.

The paper can be a useful supplement to your notes and to the Power Point slides that are online. If you use the manual as a supplemental reference, it should be very useful. However, the manual is not intended as a substitute for lectures or notes. As such, much of the finer details are excluded. It is very much in your best interest not to rely on this paper as your sole source of information about economic principles relevant to ECO 235.

Section I: Terms and Concepts

This section provides explanations for several key terms and concepts. It is ordered sequentially rather than alphabetically. That is terms towards the bottom of the list tend to be explained by including terms listed before them.

Total Revenue is the total amount of money that a firm earns by selling its goods. For simplification we will assume that a firm only sells one good and that the sale price is the same for all consumers. Under these assumptions total revenue (TR) equals the product of the selling price (P) of the good and the quantity (Q) of the good that is sold.

Mathematically:

$$TR = P * Q$$

Opportunity Cost: Any activity that is undergone involves sacrifices. For example, the time spent watching a TV show can never be replaced. The sacrifice or opportunity cost of watching a TV show is the benefit or enjoyment which would be gained by doing any other activity during the time spent watching TV.

From the perspective of a firm, the time and materials used to produce good A could have been used to produce another good, say good B. The benefit to the firm of producing B would be the return on the firm's investment for producing B. The opportunity cost of producing good A is the lost return the firm would receive from producing good B.

Operating Costs are all costs associated with the production of a good. These include both direct and indirect costs. Direct costs include such items as materials, machinery and labor. Indirect costs include items such as bookkeeping, advertising, and other administrative costs.

Total Cost is the total of opportunity costs and operating costs. Please be careful with this definition. It is not the commonly used definition. The everyday usage of the term does not include opportunity costs. The inclusion of opportunity costs is almost exclusively done in economic studies. If an accountant is asked to derive the total costs of a firm, the resulting computations would be the operating costs.

Average Cost is the Total Cost to produce a quantity divided by that Quantity. If it cost \$175 to produce 25 units, the Average cost is $175/25 = \$7/\text{unit}$. In the next section, this information will help you to determine Total Cost. Total Cost can be computed by multiplying quantity by Average Cost. ($7 * 25 = 175$, the total cost in this example).

Profit is simply the difference between total revenue (TR) and total cost (TC). Mathematically: Profit (π) = TR-TC. Once again a distinction needs to be made. The common definition of profit (**Accounting Profit**) does not consider opportunity costs. For our purposes profit means **Economic Profit**. That is, Accounting Profit minus opportunity costs.

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Marginal Revenue is the change in total revenue associated with a change in the quantity of a good that is sold. If P_1 is the price when Q_1 units are sold and P_2 is the price when the units sold increases to Q_2 , then Marginal Revenue (MR) has the formula:

$$MR = (P_2 * Q_2 - P_1 * Q_1) / (Q_2 - Q_1)$$

Table 1 provides an example of Marginal Revenue.

Price	Quantity	TR=P*Q	Marginal Revenue	Marginal Revenue
			Calculations	
24	3	72	(72-0)/(3-0)	24
23	6	138	(138-72)/(6-3)	22
22	9	198	(198-138)/(9-6)	20
21	12	252	(252-198)/(12-9)	18
20	15	300	(300-252)/(15-12)	16
15	30	450	(450-300)/(30-15)	10
13	36	468	(468-450)/(36-30)	3
11	42	462	(462-468)/(42-36)	-1

Table 1

Marginal Cost is the change in Total Cost associated with a change in the quantity of the good that is produced. Mathematically, $MC = (TC_2 - TC_1) / (Q_2 - Q_1)$. Table 2 provides an example for calculating marginal cost.

Quantity	Total Cost	Marginal Cost	Marginal Cost
		Calculations	
3	13.5	N/A	N/A
6	40.5	(40.5-13.5)/(6-3)	9
9	81	(81-40.5)/(9-6)	13.5
12	135	(135-81)/(12-9)	18
15	202.5	(202.5-135)/(15-12)	22.5
30	742.5	(742.5-202.5)/(30-15)	36
36	1053	(1053-742.5)/(36-30)	51.75
42	1417.5	(1417.5-1053)/(42-36)	60.75

Table 2

Demand is an expression of the quantity of a good that consumers are willing to buy at given prices. There is an inverse relationship between quantity and price. That is the higher the price, the lower the quantity demanded. In Table 1 the demand for the good is shown indirectly. For each price listed there is a corresponding quantity that the firm can sell. For \$24 the firm is able to sell 3 units to consumers. If the firm sells the good for \$15, consumers are willing to purchase 30 units, etc.

It is important to distinguish demand from quantity demanded. A common mistake made by students is to say something such as “A change in the price of the good caused the demand to change.” A change in the price does not change the demand for a good. It changes the quantity of the good that is demanded.

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Changes in demand are caused by factors such as changes in preferences or changes in knowledge. For example, preliminary reports suggest that holding a cell phone to your ear may increase the probability of brain tumors. Since this information has been released, the demand for headsets has increased. The quantity of headsets demanded at any given price has increased.

Supply refers to the schedule of the quantity of a good that firms are willing to sell at various prices. The supply curve is positively slopes. An increase in the price of the good will lead producers to increase the quantity supplied of the good.

Once again, changes in prices do not change the supply. Price changes only change the quantity supplied. Technological improvements or other cost saving devices are factors that will change the supply. For example, the development of computers has improved the storage and retrieval processes for most companies. As a result, the amount of time and space needed to collect information has decreased. Since time and space are both costs associated with doing business, this cost reduction will cause the marginal cost to decrease and lead to increased supply. For a given price, firms are now willing to produce more output.

The Profit Maximizing Condition occurs at the quantity where marginal revenue equals marginal cost.

A common mistake made by students is to assume that profit is maximized when the difference between marginal revenue and marginal cost is the largest. This is a case of maximizing marginal profit and not total profit. To illustrate the flaw in this reasoning, suppose the marginal revenue and marginal cost for 50 units of a good are \$180 and \$120 respectively. The marginal profit is \$60. If the marginal revenue and marginal cost for 80 units of a good are \$150 and \$145 respectively, the marginal profit is \$5. Clearly, the marginal profit is greater for 50 units than for 80 units. However, marginal profit is the change in profit associated with a change in quantity. This means that producing the 80th unit of output increases profit by \$5. Since profit is increasing there must be more profit for 80 units than for 50 units. If the marginal profit for 83 units is \$2 the firm increases profit by producing. When marginal profit is \$0, the firm will no longer maximize profit by producing more output. Since marginal profit is the difference between marginal revenue and marginal cost, the profit maximizing condition occurs when:

$$0 = MR - MC$$

or simply:

$$MR = MC$$

Table 3 combines materials from Table 1 and Table 2 in order to illustrate the profit maximizing condition. At the quantity of 12 units the marginal revenue and marginal cost are both \$18 and profit is \$117. For 9 units the profit is also \$117. It is generally difficult to derive the mathematical formulas necessary to obtain a unique profit maximizing condition, however, the correct the quantity would be 12 units of output.

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Price	Quantity	Marginal Revenue	Marginal Cost	Total Revenue	Total Cost	Profit
24	3	24	N/A	72	13.5	58.5
23	6	22	9	138	40.5	97.5
22	9	20	13.5	198	81	117
21	12	18	18	252	135	117
20	15	16	22.5	300	202.5	97.5
15	30	10	36	450	742.5	-292.5
13	36	3	51.75	468	1053	-585
11	42	-1	60.75	462	1417.5	-955.5

Table 3

Elasticity of Demand is the percentage change in the quantity demanded associated with a one percent change in the price. Elasticity is used rather than marginal demand because elasticity is unit free. Suppose the figures in Table 1 refer to the monthly demand for a good. The change in the quantity associated with a change in price is 3 units/mo.

If we convert these figures to annual demand, then each quantity is multiplied by 12.

Now the change in quantity associated with a change in demand is 36 units/yr. Although the demand is the same, the marginal analysis is substantially different. However, the elasticity for either time period of measurement will be the same. The formula for price

elasticity (ε) is $\varepsilon = \frac{Q_2 - Q_1}{P_2 - P_1} * \frac{P_2}{Q_2}$.

Section II

The Model of Perfect Competition

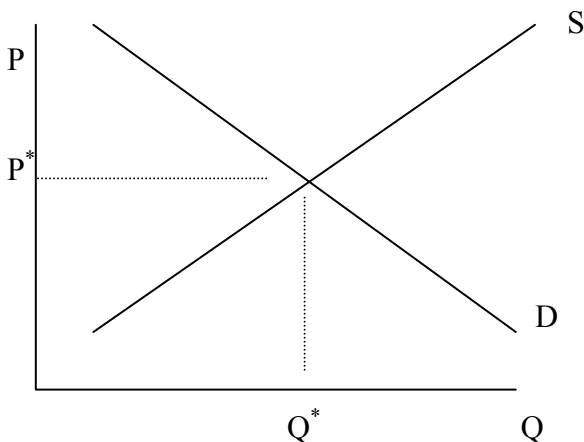
The model of perfect competition provides the framework to analyze how resources would be allocated in the ideal setting. The assumptions for the model are largely unrealistic. Although the assumptions make the model unrealistic, the model still provides a sound basis to begin our analysis.

Here are the five assumptions of the model.

1. No firm controls enough of the supply of a good to have an effect on the price at which the good is sold.
2. There is perfect information between participants in the market. Firms know the demand curves for buyers, buyers know the supply curve for sellers, and firms and workers know the market wage rate for employees.
3. Capital and Labor inputs are completely mobile. If a producer is unwilling to pay the market wage for labor, then all workers have no restrictions on his/her moving to another firm even if the firm is in another region. Suppliers of capital have the same ability if a firm decides not to pay the market rent.
4. There are no restrictions preventing entrepreneurs from entering a market or exiting a market. Anyone who wishes to produce goods can obtain the capital and labor necessary to do so. Similarly, if a firm decides to leave the market, there are no contracts or obligations preventing this action.
5. All goods within a market are homogeneous. A good produced by one firm is exactly identical to a good produced by any other firm in the market.

In section 1, I introduced the profit maximizing condition. The goal of all firms within the market is to maximize profit. This occurs when marginal revenue equals marginal cost. There are a few steps necessary to show when $MR=MC$. In the first step we need to use assumption 4. Supply and Demand are known. Graph 2-1 shows the supply and demand curves.

GRAPH 2-1



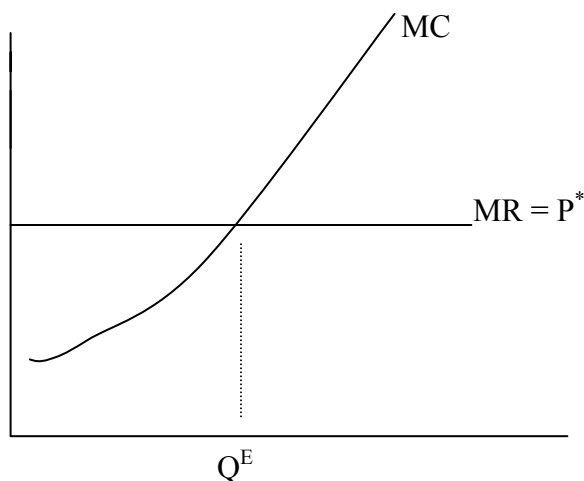
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From graph 2-1, you can see that for a price of P^* the quantity that sellers are willing to supply is the same as the quantity that buyers are willing to purchase. The point of intersection of the supply and demand curves represents the market clearing price and quantity. In this case P^* and Q^* . If the price is above P^* , firms are willing to produce more than consumers are willing to buy. There would be excess supply. If the price is lower than P^* , consumer demand would be greater than Q^* . There would be excess demand.

In graph 2-1, we have established a market clearing price of P^* . Using the assumption of perfect information, we can conclude that each firm will sell all its output for a price of P^* . If the firm tries to sell its output for more, all buyers know that all competitors are selling for P^* and will choose to buy from other sellers. Additionally, the firm knows it can sell all the units it is willing to produce for P^* / unit. Therefore, the firm has no incentive to undersell his competitors. The implication of this analysis is that the demand curve for individual firms in a competitive industry is horizontal. In this example, the firm can sell every good it produces for P^* /unit.

We can now show that the marginal revenue for firms in competitive markets is simply the market clearing price. Recall that $MR = (P_2Q_2 - P_1Q_1)/(Q_2 - Q_1)$. Suppose a firm increases its sales from 10 units to 20 units. The price does not change. Solving for MR we get $(P^* * 20 - P^* * 10)/(20 - 10) = P^*(20 - 10)/(20 - 10) = P^*$.

The formulation of the marginal cost curve will be taken for granted. In general, the curve has the shape of the upward sloping half of a “U”. In Tables 1-2 and 1-3, figures were provided for a marginal cost curve. If you plot those against quantity, you will see a shape similar to the upward sloping half of a “U”. Graph 2-2 illustrates the firms profit maximizing decision.

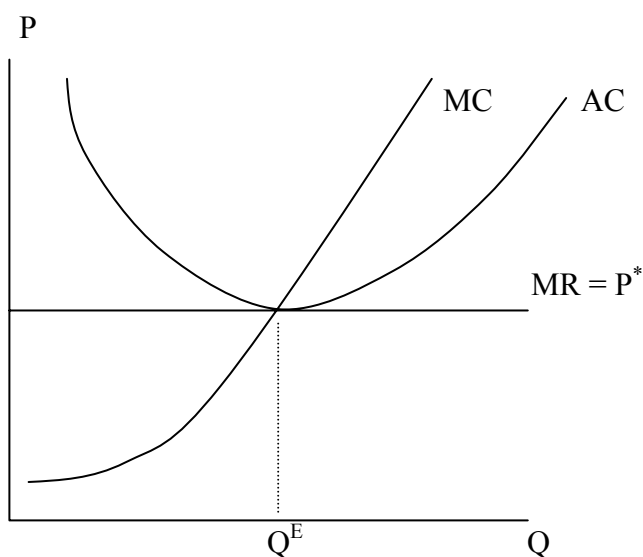


Graph 2-2

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In graph 2-2, marginal revenue equals marginal cost when output is Q^E units. Therefore this firm maximizes profit by producing Q^E units for P^* per unit. The equilibrium quantity for the market is the sum of quantities produced by all firms in the market.

Now that we know that the firm maximizes profit by producing Q^E units, a very important question to ask is “how much profit did the firm make.” Graph 2-3 will be used to help answer this question.



Graph 2-3

If you recall from section 1, Average Cost is Total Cost divided by quantity. If you multiply the number of units being produced by the average cost per unit, your answer is the total cost. $Q^E * TC / Q^E = TC$. In graph 2-3, the average cost curve is tangent to the marginal revenue curve at Q^E . This indicates that at Q^E the average cost is P^* . Since Total Cost is Average Cost time Quantity, Total Cost is $P^* * Q^E$. Total Revenue by definition is $P^* * Q^E$. This means profit is zero.

You should remember this is economic profit which is zero. The entrepreneur still enjoys returns to his/her investment. The opportunity costs are such that the same returns could be enjoyed in some other activity.

If Average Cost is below the marginal revenue curve at Q^E , then profit is greater than zero. mathematically:

$$\begin{aligned} AC &< P^* \\ AC * Q^E &< Q^E * P^* \\ TC &< TR \\ 0 &< TR - TC = \text{Profit.} \end{aligned}$$

If Average Cost is above the marginal revenue curve at Q^E , then profit is less than zero. If you substitute “>” symbols for “<” symbols in the equations above, the algebra is the same.

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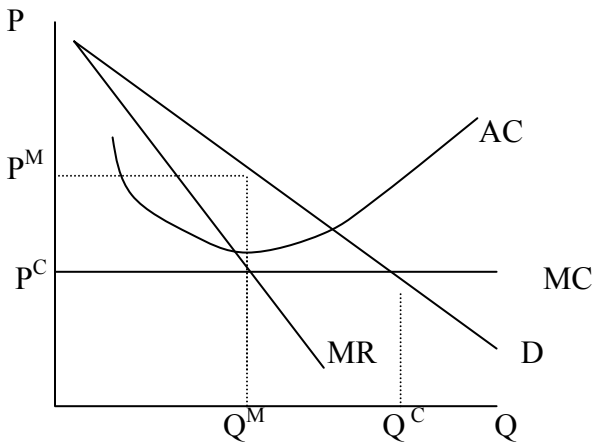
Under the assumptions of the model, **the long run economic profit of firms in a competitive market is zero.** There are no restrictions to entry or exit from the market and there is perfect information. If the firm has negative profits, the entrepreneur can exit the market freely and use his/her capital for some venture which has a lower opportunity cost. Firms losing profit will leave the market. If firms are making an economic profit, entrepreneurs know they can improve returns by entering the market. Firms will enter the market until economic profits no longer exists. If too many firms enter the market, some firms will lose profits and exit. This process continues until all firms enjoy zero economic profits.

Section III The Monopoly

A monopolistic market is one in which there is only one supplier of goods. The main assumptions of this model are listed below.

1. There are restrictions to entry into the market. In practical settings such restrictions occur due to patents or copyrights.
2. The firm can alter the supply in order to determine the price at which goods are sold.
3. Firms do not have the ability to exercise price discrimination. Do not confuse price discrimination with common definitions of discrimination. It has nothing to do with prejudices against certain subsets of the general population. Price discrimination occurs when different persons are charged according to the willingness to buy. In section 1, the demand curve indicates that 3 units can be sold for \$24 and 6 units for \$23. If firms could exercise price discrimination, they would sell the first 3 units for \$24, then drop the price to \$23 and sell the next 3 units. Without price discrimination, firms must choose the quantity they wish to sell and sell all output for the same price.

Since there is only one firm, the market demand curve is the firm's demand curve. The marginal revenue curve is no longer horizontal as it is for competitive firms. Graph 3-1 represents the marginal revenue and demand curves for the monopoly.



Graph 3-1

Also included in the graph is the marginal cost curve and average cost curve. For simplification, the marginal cost curve has been drawn as a horizontal line. At Q^M the marginal revenue curve intersects the marginal cost curve. This is the profit maximizing quantity for the monopolist. The demand for Q^M is such that the monopoly charges the price P^M . Therefore the total revenue is $P^M * Q^M$. The Average Cost curve intersects Q^M below the price P^M , indicating that economic profit is positive.

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The motivation for a horizontal marginal cost curve is to compare competitive market conditions with monopolistic market conditions. In perfectly competitive markets, the supply curve is the sum of marginal cost curves for all firms. Since there is only one firm in this market, the marginal cost curve is the supply curve. This indicates that the market clearing price and quantity are P^C and Q^C respectively. A comparison of the price and output decisions clearly show that monopolies charge higher prices and provide less output than competitive markets.

There are three major criticisms of monopolies.

1. A misallocation of resources. This is difficult to explain without becoming overly technical. There exists consumer surplus and producer surplus. These occur as a result of being unable to exercise price discrimination. Consumer surplus is the gain in consumption that consumers receive as a result of receiving the same market price regardless of individual willingness to pay.

Producer surplus follows the same process. For each good that is produced up to the final good, the price exceeds the willingness to supply. The gain to the firm from not selling each good at the price on the supply curve is the producer surplus.

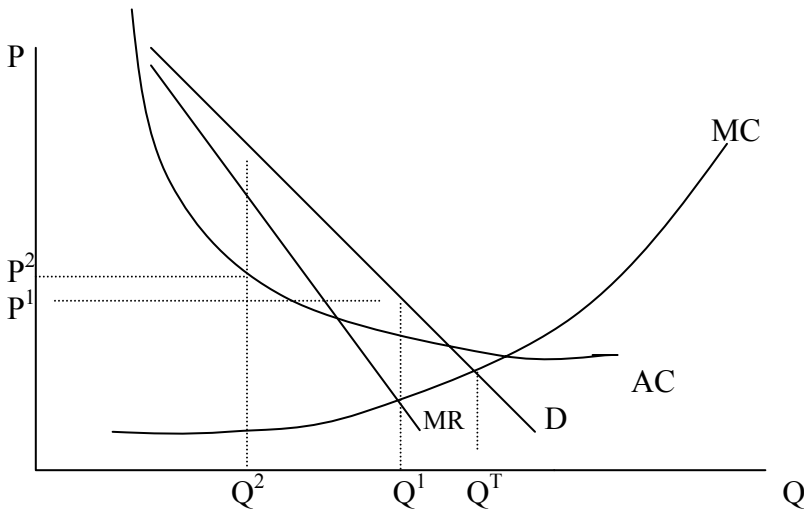
Social surplus is the sum of consumer surplus and producer surplus. The perfectly competitive firms minimize the social surplus. Therefore, these firms do a better job of allocating resources.

2. X inefficiency: Since the entrepreneur is achieving excessive returns, he/she does not have the same incentive to control costs and wasteful activities. This can lead to frivolous spending on items such as overly extravagant office furniture or activities such as weekly luncheons for employees.
3. Higher prices and lower output. This was described in graph 3-1. In competitive markets, the firm can not effect output enough to impact price. This results in the firm being a price taker. The monopoly can effect the market price and is a price setter. As a result, output is lower and price is higher in the monopoly.

Section IV: The Natural Monopoly

Section 3 ended with a discussion of why competition is preferred to monopolies. The natural monopoly, an exception to the preference of competitive markets, occurs in situations when the market has high fixed costs and low marginal costs.

In the telecommunications industry, the cost to build a network is in the billions of dollars. The cost to transmit a call once the network is built is about \$0.10/min to \$0.30/min. In graph 4-1, I show the marginal costs and the average costs for the firm; along with the demand curve and the marginal revenue curve.



Graph 4-1

In this graph, the monopoly maximizes profit by producing the quantity Q^1 for the price P^1 . If this market has more than one firm, each firm produces until profit is maximized. Suppose Q^T represents the total quantity produced if two firms are in the market. If each firm produced half the total quantity, the output for each firm would be about Q^2 . In order for these firms to break even, (zero economic profit), the price would have to be P^2 . At this price, total revenue equals total cost. The dilemma is that for a price of P^2 the total market demand is less than Q^T . As diagrammed here, the market demand is less than Q^1 . Additionally, the break even price for two competitors is higher than the price the single producer would charge.

If one firm can produce more output for a lower price than two or more firms, the firm is said to be a natural monopoly. If there is a natural monopoly, society is better off to have a single producer of goods than it is to have a competitive market.

Graph 4-1 shows that a natural monopoly still enjoys positive economic profit; meaning the returns to capital are higher in this market than for any alternative use. This implies that societal resources can be better allocated. How to better allocate societal resources, while balancing the concerns of producers and consumers is a public policy issue. In the

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telecommunications industry, the method of resolving the issue has been to provide government regulation of the industry. The remainder of the course deals with the history, problems, benefits, and implications of the regulatory process on the telecommunications industry.