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**Principles of Economics**

**Analysis of Monopoly (With No Price Discrimination)**

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4 types of market structures

Attributes of a monopoly

Price maker → downward sloping demand curve

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Short run

$P > ATC$  → operate at profit

$ATC > P > AVC$  → operate at loss

$AVC > P$  → shut down (loss = fixed costs)

Long run:

Unregulated: Maximum profit  $> 0$  (probably)

Regulated:

--to break even:  $P = AC$

--to ensure social efficiency:  $P = MC$

Long run inefficiency of unregulated monopoly

Introduction:

Firms operate within their market, which consists of:

Supply side: all of the firms producing similar products

Demand side: all buyers willing to purchase the products

Markets differ; the auto market is far different from the tomato market, for example. Thus economists separate markets into 4 categories: perfect competition, monopolistic competition, oligopoly, and monopoly. Behold the qualities of each category of market below:

*Perfect competition:* There are many, many small sellers (technically, there must be an infinite number of sellers), each of whom produces an **identical** product. It is very easy for new sellers to enter this market, and it is easy for existing sellers to leave the market.

Examples: There are no real world examples of perfectly competitive markets. Some agricultural markets come close. The stock market comes close.

*Monopolistic competition:* There are many small sellers, each of whom produces a slightly **different** product. It is very easy for new sellers to enter this market, and it is easy for existing sellers to leave the market.

Examples: Chinese restaurants, lawyer services, plumbing services, haircuts.

*Oligopoly*: There are a few large sellers that dominate the market, each of whom produces either an identical product or a slightly different product. It is difficult for new sellers to enter this market, and it can be difficult for existing sellers to leave the market.

Examples: Oil refining, autos, copper, airlines, computers.

*Monopoly*: There is one large seller with no direct competition. It is extremely difficult for new sellers to enter this market, and it can be difficult for the existing seller to leave the market.

Examples: U.S. letter delivery, residential electricity service, residential natural gas service.

In this set of notes, we shall examine the attributes of a **monopoly**. We begin by examining the firm's revenues.

**IMPORTANT NOTE: NO PRICE DISCRIMINATION.** We shall assume in this set of notes that the firm charges the same price for each unit of output; hence there is *no price discrimination*.

**MARKET POWER:** A firm is said to have *market power* if it can increase its price and not lose all of its customers; graphically, this means that the firm's demand curve is not horizontal. Some firms have more market power than others; the ultimate in market power is if a hypothetical firm, when it raises its price, loses **NONE** of its customers; graphically this is a vertical demand curve.

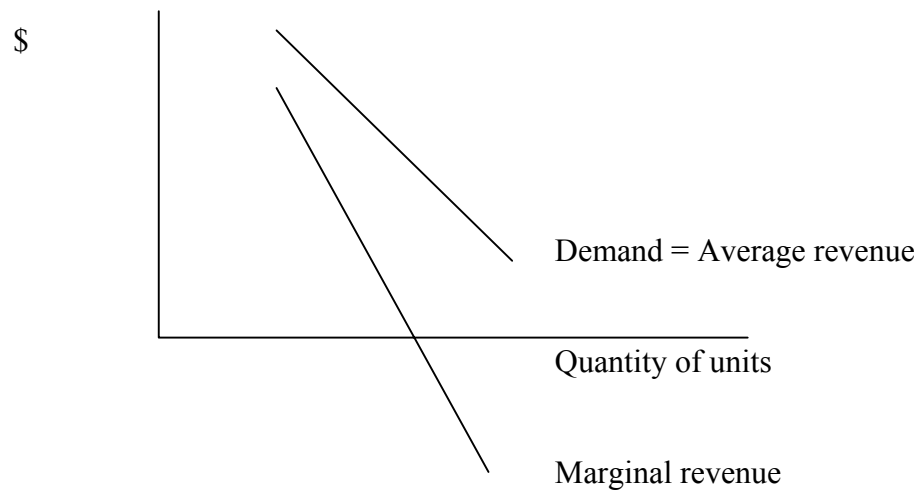
A perfectly competitive firm has no market power; firms in other markets have at least some degree of market power. A monopoly has a lot of market power, but it is rare indeed for even a monopoly to have a vertical demand curve.

### **Revenues of a monopoly**

In a monopoly, the market price is established by the interaction of buyers in total and the single seller. Since there is a single seller in the market, the monopoly can raise its price and lose only a few buyers. (Suppose, for example, that you own the only gas station within 200 miles. You can raise your gas prices and still sell a lot of gas.)

Hence a monopoly is a *price-maker*; it can set its own selling price. At a higher price, it has a bit lower demand, and at lower prices it has a bit higher demand. Implication: a monopoly has a steep, downward-sloping demand curve. (It is theoretically possible, though unlikely, for a monopoly to have a completely vertical demand curve.)

Let's illustrate a monopoly's revenues on the graph below:



Note 1 about the graphs: Since the seller loses a few buyers as it raises its price, it has a downward-sloping and steep demand curve.

Note 2 about the graphs: Recall that the price equals the firm's average revenue; hence the firm's average revenue is falling as  $Q$  rises. This means that the firm's marginal revenue is falling and is lower than the price (just as a student who keeps getting a lower and lower test score drives his average lower and lower). Hence the marginal revenue curve is below the demand curve. (See the notes file "5302-costs" for a more thorough explanation.)

Note 3 about the graphs: With a monopoly, the graph of the demand for a firm's product is equivalent to the market demand, since the firm is the only seller in the market. It is sometimes said that with a monopoly "the firm is the industry."

If we know a monopoly's demand curve, we know all we need about its total, average, and marginal revenue. Observe:

Example 1: The first two columns in the table below indicate how the demand for a monopoly's product varies with the price that it charges. Show how the monopoly's total, average, and marginal revenue vary with its level of production for  $Q = 0$  to 6

(Don't forget: we assume that each unit must sell for the same price, e.g. if the firm charges \$3 per unit then each of the 5 units sells for \$3 each.)

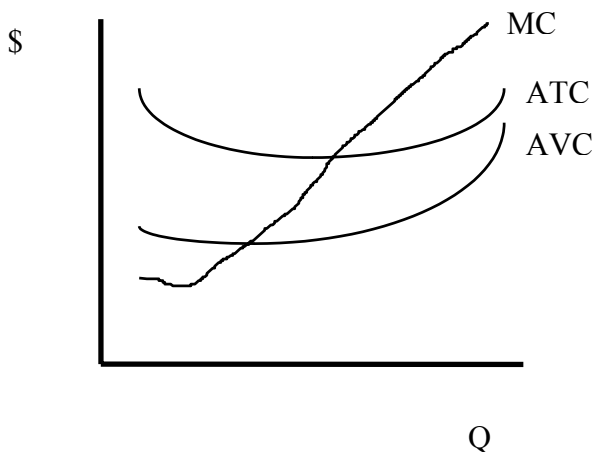
Q	Price (= average revenue)	Total revenue (= $P \times Q$ )	Marginal revenue
0	8	0	na
1	7	7	7
2	6	12	5
3	5	15	3
4	4	16	1
5	3	15	-1
6	2	12	-3

### **Short Run Costs of A Monopoly**

In the notes file "prin-gen-costs" we discussed short run costs. I review the analysis here, to refresh your recollection:

GRAPH: A fairly realistic representation of any firm's short run costs:

Any and all firms face rising marginal cost (MC), average variable cost (AVC), and average total cost (ATC), beyond some level of output (Q), due to the law of diminishing returns. Hence it is reasonable to represent any and all firms' short run costs with the graph below:

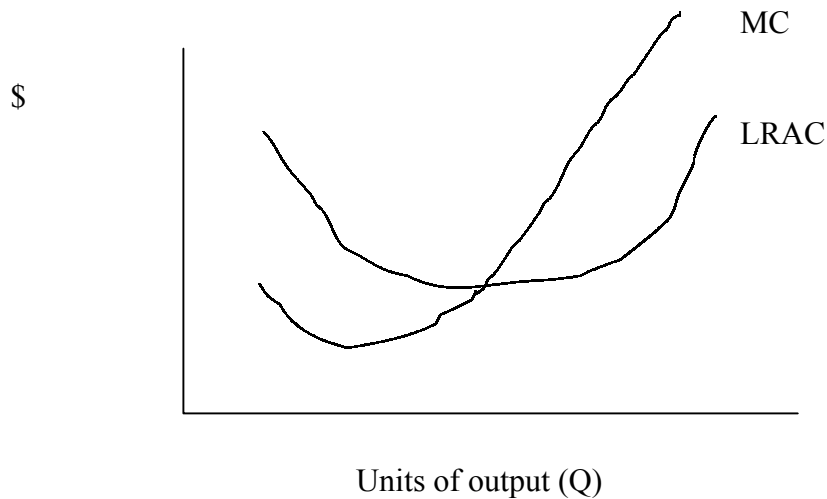


Note on the graph above how ATC, AVC, and MC all eventually rise. Note also that *MC intersects AVC and ATC at the minimum points of both the AVC and ATC curves* (the bottom of each “U”. )

### **Long Run Costs of A Monopoly**

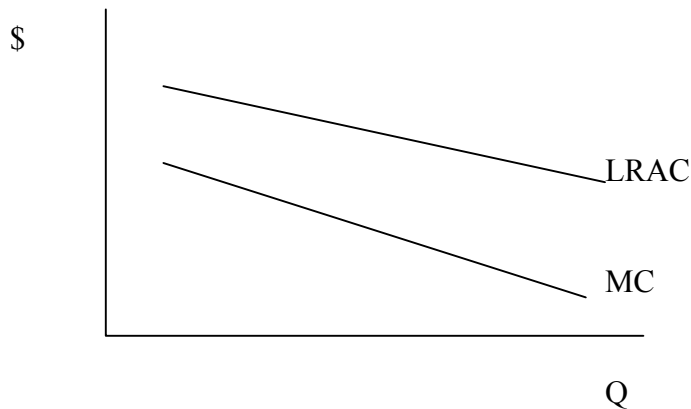
In the notes file “prin-gen-costs.doc” we discussed long run costs. I repeat some of the discussion here.

Graph: Different shapes for a firm’s long run cost curves are possible, depending upon the importance of scale economies in the production of the firm’s product. I will sometimes represent a monopoly’s long run costs with this graph: (We abbreviate long run marginal cost with “MC,” and long run average cost with “LRAC.”)



**NATURAL MONOPOLY:** Suppose that economies of scale are so large in a market that it is cheaper for 1 firm to provide all of the market's production, relative to a bunch of smaller firms. This market is called a *natural monopoly*. (It is difficult to think of a real world market where this is true. It used to be argued that electricity provision was a natural monopoly, under the reasoning that multiple firms would have to string multiple electric lines throughout the city. In New York City early in this century, there were as many as five sets of power lines running throughout the city—1 set for each of the five power companies. Clearly, if it were necessary for each power company to string its own set of power lines, then it would be less costly for 1 firm to produce all of New York City's power, and indeed this was the case in the early 20<sup>th</sup> century. Modern technology, however, allows multiple power providers to use the same set of power lines, so electricity provision is no longer a natural monopoly.)

One would graph the long run cost curves of a natural monopoly like this:



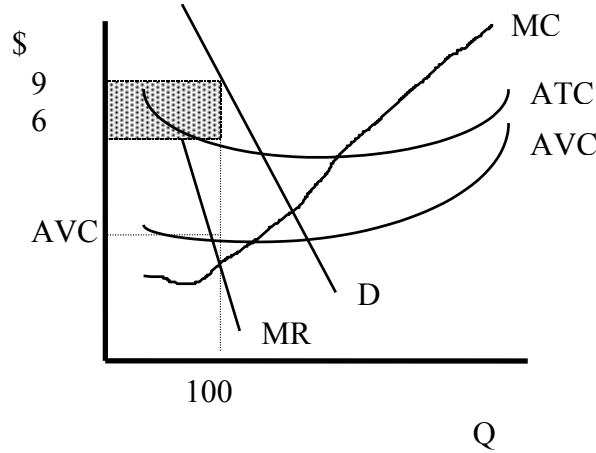
**Profit-maximizing short run strategy for a monopoly:**

Recall that any firm should:

→ produce the level of output where  $MR = MC$ , unless  $P < AVC$  at that level of output (in which case the firm should shut down, producing  $Q=0$ ).

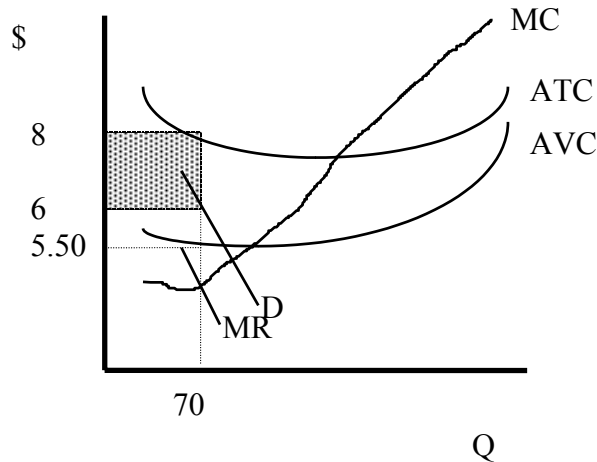
Let's look at three graphs, each representing a monopoly in the short run. The major thing differentiating the graphs is the height of the demand curve and MR curve.

Graph 1: A monopoly making a profit in the short run



The above firm is making a profit; the price of \$9 is above the average total cost of \$6. The firm is making  $\$9 - \$6 = \$3$  per unit sold, and they're selling 100 units, making total profit = \$300 (the area of the shaded rectangle).

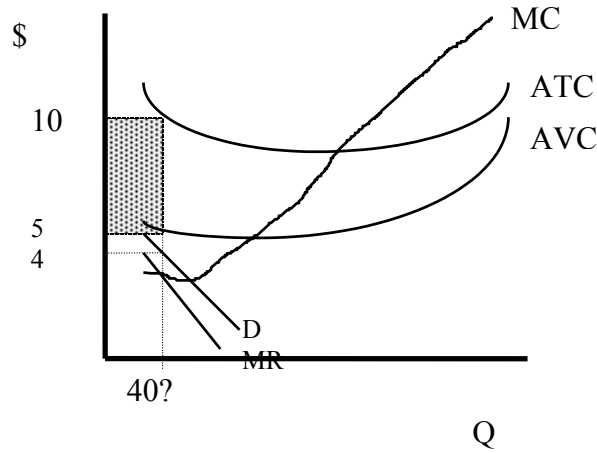
Graph 2: A monopoly operating at a loss in the short run



The above firm is operating at a loss; the price of \$6 is below the average total cost of \$8. The firm is losing  $\$8 - \$6 = \$2$  per unit sold, and they're selling 70 units, making total loss = \$140 (the area of the shaded rectangle).

Note that the firm would do worse if it shut down, since  $P > AVC$ . Indeed, the firm would lose  $(8 - 5.50) \times 70 = \$175$ , its fixed costs, if it shut down.

Graph 3: A monopoly in the short run which is shut down.

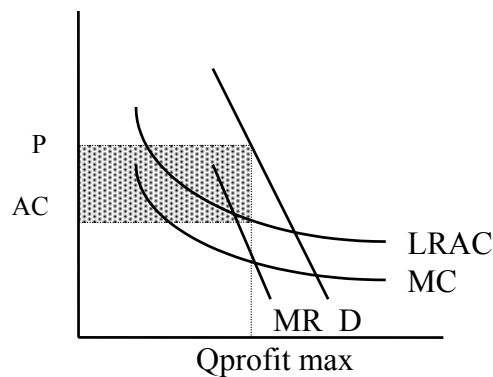


The above firm does best if its shuts down, since  $P < AVC$ . If it shuts down it loses its fixed costs,  $(10-5) \times 40 = \$200$ . If it were dumb enough to operate, it would lose  $(10-4) \times 40 = \$240$ .

**Long run monopoly: If unregulated, profits persist into long run!!!**

Recall that intense competition eliminates profits in a perfectly competitive market. In contrast, a monopoly has no direct competition, and if it can maintain the barriers that prevent competition into the long run, and if it can remain unregulated by government, then its profits will persist into the long run.

Graph: An unregulated natural monopoly in the long run, with no price discrimination:



We have seen profit-maximizing strategies under monopoly. But is profit-seeking “good” for society? Under monopoly, it is NOT. Read on.

### **Monopoly, Worldly Philosophers, and Economic Efficiency**

Suppose you are a worldly philosopher, and want to measure if production in your economy is serving your citizens. You might have a measure as follows:

*Social (or allocative) Efficiency:* Extra production occurs as long as society feels that the benefit from the extra production exceeds the cost of extra production. Production does not occur if it costs more to produce the thing than the benefit of the production.

How do we measure the benefit of extra production? It is the PRICE that a buyer is willing to pay for the product!!! Why? Well, if someone is willing to pay for a product then they must be getting at least that much value from it.

How do we measure the cost of extra production? Marginal cost!!!

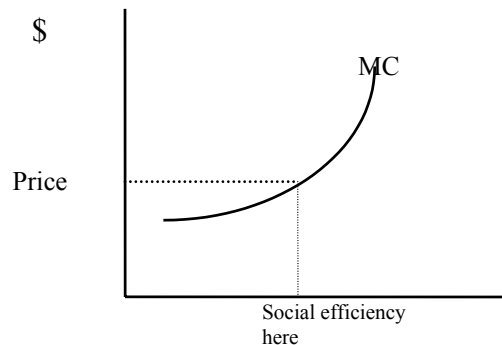
Summary of social efficiency:

If  $P > MC \rightarrow$  Society should produce more, because value  $>$  cost

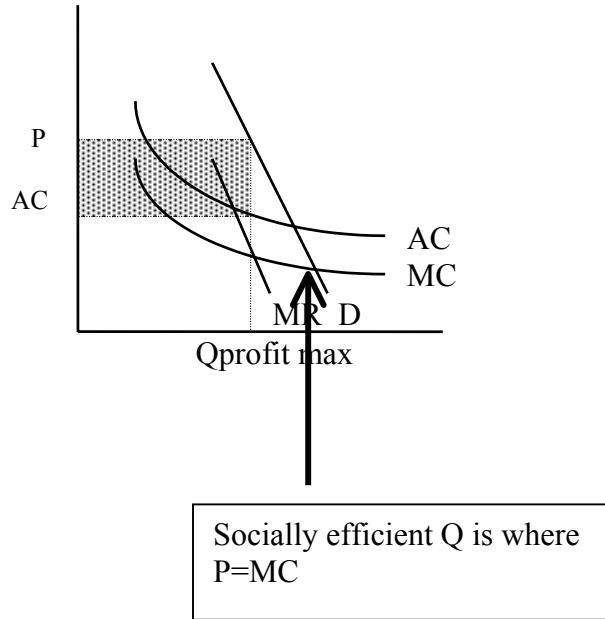
If  $P < MC \rightarrow$  Society should produce less, because value  $<$  cost

So if  $P=MC \rightarrow$  socially efficient level of production!!!

See the graph below:



UNREGULATED MONOPOLY AIN'T SOCIALLY EFFICIENT: So, you're a worldly philosopher, and you want production to have qualities of social efficiency. Does an unregulated monopoly fit the bill? No! Check out the graph on page 8. The price is way above MC. Indeed, let's redraw that graph below, while inserting an indicator of the socially efficient quantity of production:



Notice that the socially efficient quantity is higher than the profit-maximizing quantity.

Unregulated monopoly produces less than the socially efficient level of output

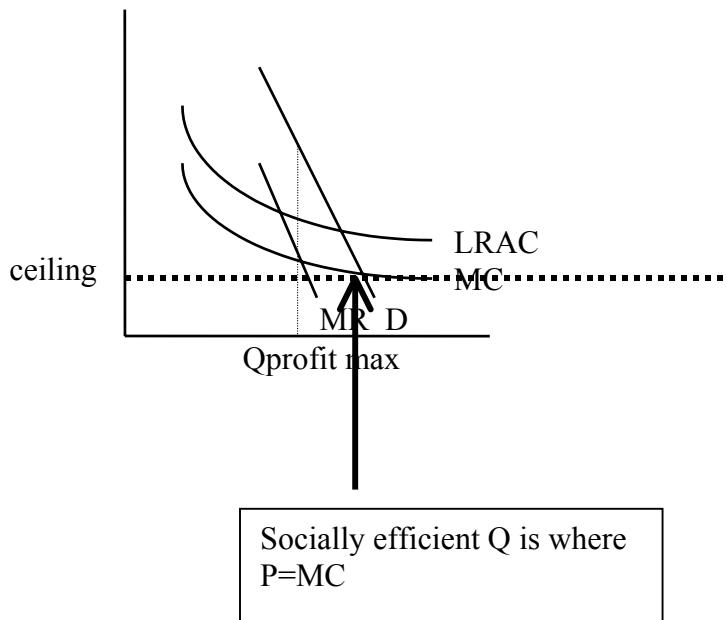
**Government regulation to reduce social inefficiency?**

In theory, government can set a price ceiling to reduce or eliminate the inefficiency of unregulated monopoly (with no price discrimination). The price ceiling prevents the firm from pursuing its profit-maximizing strategy. Here's 2 possible price ceilings:

1. Set ceiling to ensure that  $P=MC$ .

Suppose government sets a price ceiling as in the graph below.

This ensures that  $P = MC$ .

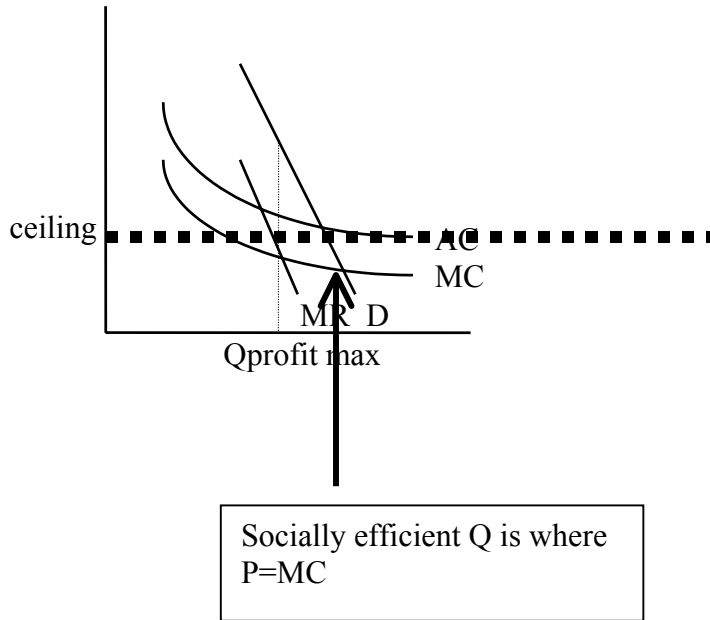


A price ceiling of the height of the heavy dashed line above ensures that production occurs at the socially efficient level. BUT WAIT! The price is below the firm's long run average cost at the socially efficient quantity! The firm would lose \$\$ and eventually go out of business, unless:

It is often necessary for government to provide a subsidy to a monopoly if it wishes the monopoly to produce the socially efficient level of output.

2<sup>nd</sup>: Set a break-even price ceiling

This is a more common practice. Monopoly prices are sometimes regulated to ensure a “fair” rate of return, which means zero economic profits. The ceiling would have to be set so that  $P=AC$ , as in the graph below:



At this ceiling no government subsidy is required. The deadweight loss is reduced but it is not eliminated.

A final word about government regulation of monopoly: In reality it is difficult for a government agency to know a monopoly’s costs with great precision; hence finding the breakeven or socially efficient price ceiling is difficult. Some monopolies exist due to government protection. It is perhaps better for government to end this protection and allow competition to enter the industry.

End of notes!