

# The Digital Economist

## Lecture 8 – Competitive Behavior

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In defining a producer optimum, we have defined the profit maximization condition with respect to the variable factor input (labor) as:

$$MP_L = w/P_x.$$

or

$$P = w/MP_L = MC.$$

For the competitive firm (a price taker), we can write:

$$\text{Revenue (TR)} = P \times Q$$

*(note: as we discuss markets, we will use the notation 'Q, Q<sub>s</sub>, Q<sub>d</sub>' for output levels rather than 'X' as in previous lectures)*

and

$$\text{Marginal Revenue (MR)} = dTR/dQ = P!$$

Thus an alternative expression for profit maximization for a competitive firm is:

$$P = MC. \quad (\text{note also: } P = MR)$$

see: <http://www.digitaleconomist.com/profit.html#perfect>

described as where the revenue from selling one more unit of output (P, MR) is exactly equal to the cost of producing that last unit of output (MC).

If  $MR > MC$  then additions to revenue exceed the additions to cost (via the production and sale of one more unit of output) and the firm will be able to increase profits by selling that additional unit.

If the opposite is true,  $MR < MC$  then additions to costs exceed the additions to revenue (via the production and sale of one more unit of output) and the firm will be able to increase profits by reducing output by one additional unit.

### Imperfectly Competitive Firms

In the case of a firm with market (monopoly) power -- a *price maker*, the market demand curve is also the demand curve for that firm's output. Assuming that the demand curve is linear we find:

$$P = a - bQ \text{ -- the inverse demand curve}$$

and

$$TR = P \times Q = aQ - bQ^2 \text{ -- Total Revenue -- a quadratic equation!}$$

and

$$\text{Marginal Revenue (MR)} = dTR/dQ = a - 2bQ$$

The equation for Marginal Revenue has the same intercept 'a' and is *twice as steep* as the slope of inverse demand. The condition for profit maximization still holds:

$$MR = MC.$$

see <http://www.digitaleconomist.com/profit.html#imperfect>

In understanding market behavior, we often speak of the competitive spectrum that is a continuum from the competitive ideal with many firms in a given industry and a high degree of competition to monopoly behavior where a single firm dominates an industry and competitive behavior does not exist. This spectrum is defined based on three primary market characteristics:

- The Number of Firms in an Industry
- Barriers to Market Entry (or Exit)
- The Type of Good offered for sale

These characteristics along with different market structures are summarized in the following table:

Characteristic	The			
	Competitive Ideal	Monopolistic Competition	Oligopoly	Monopoly
Number of Firms:	Many	Many	Few	One
Barriers to Entry:	None	Low	High	Absolute
Type of Product:	Homogeneous	Heterogeneous	Homogeneous/ Heterogeneous	One

At one end of the spectrum, we have a competitive ideal that represents a standard by which we evaluate all other types of competitive behavior. At the other end, monopoly represents an absolute lack of competition such that the single firm in the industry has a high degree of price-making ability.

### The Competitive Ideal

The concept of **Perfect Competition** defines one end of the competitive spectrum with each firm behaving as a price taker in their respective industry. What this means is that, with a large number of firms, a high degree of product similarity (homogeneous products), and perfect market information available, each individual firms has absolutely no influence on market price. In a perfectly competitive industry, prices are strictly established by the interaction of market supply (a summation of individual business firm supply choices) and market demand (the summation of all individual consumer demand

choices). Each firm then responds to this market price by making output choices that maximize the profits of that firm.

In a competitive market, profit maximization choices are based the notion of a producer optimum. This condition with respect to labor input is defined as:

$$MP_L = w/P \quad \Rightarrow \quad P = MC$$

Since the perfectly competitive firm is a *price-taker*, the price of the good being sold is set by the interaction of competitive supply and demand forces in the industry in which the firm competes. If the profit maximizing level of output for the **representative firm** (*one with an industry average cost structure*) results in abnormal profits (i.e.,  $P > ATC$ ), then new firms will be induced to enter the industry. This is possible since there are no barriers to entry.

*Abnormal profits act as signal for the market entry of new firms resulting in an allocation of factor inputs towards the production of the product being produced and sold.*

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Note: Abnormal profits are profits in excess of what is considered a normal rate of return (profits) in the industry in which the firm operates. These normal profits 'aR' represent the opportunity cost of entrepreneurship -- the amount the entrepreneur could earn in the next best use of his/her time and are built into the costs of production:

$$\text{Costs} = wL + rK + nM + aR \text{ (see lecture 7)}$$

$$ATC = \frac{\text{Costs}}{X} = \frac{wL + rK + nM + aR}{X}$$

And if:

$$P > ATC$$

Then

$$PX > wL + rK + nM + aR \text{ (note } PX = \text{Revenue)}$$

Or

$$PX - wL + rK + nM > aR$$

The firm, after paying for its labor, capital, and materials, has still earned a level of revenue in excess of normal profits -- this excess represents abnormal profits.

If

$$P = ATC$$

Then

$$\text{Profits} = aR.$$


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This market entry will lead to an outward shift in supply, creating a surplus of product and pushing prices downward. The process will continue until the abnormal profits have been eliminated. The ultimate equilibrium for the representative firm will be a level of output where:

$$P = MC = \min[ATC]$$

If the profit maximizing level of output for the representative firm results in losses (i.e.,  $P < ATC$ ), then some existing firms (those operating below their shut-down point) will leave the industry and restrict their losses to the Fixed Costs.

*(Note: Losses act as signal for the market departure of existing firms resulting in an allocation of factor inputs away from the production of the product being produced and sold).*

This market departure will lead to an inward shift in supply, creating a shortage of product and pushing prices upward. The process will continue until the losses for the remaining firms have been eliminated.

### **Monopoly Behavior**

At the other end of the competitive spectrum is **monopoly** where there is only one firm in a given industry. Consumers in this market have no choice but to buy from that one firm or not at all. For this reason, the monopolist is known as a *price-maker* one that can set prices at any desired level. Monopolies occur largely due to the existence of barriers to entry in a given industry. These barriers include:

- Legal Barriers (patents and licenses)
- Economic Barriers
- Natural Barriers

With these barriers, the monopolist is able to set a level of output consistent with the rule of profit maximizing:

$$MR = MC$$

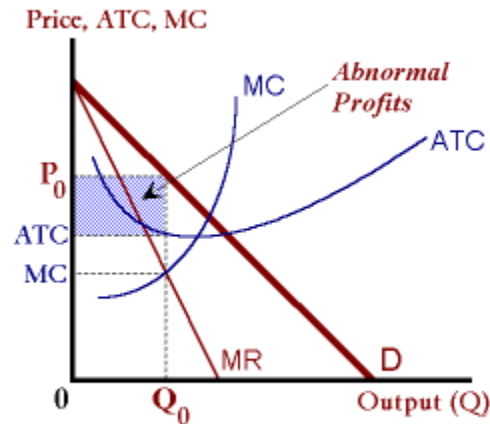
Since the monopolizing firm is the only firm in the industry, the market demand curve is also the demand curve facing the firm. With a typical downward sloping demand curve we find that:

$$P > MR \text{ for } Q > 0$$

and under conditions of profit maximization,

$$P > MC \text{ given } MR = MC$$

thus this profit-maximizing level of output is less than would be the case if output decisions were based on  $P = MC$ .

**Figure 1, Monopoly Pricing**

This reduced level of output is considered to represent an inefficient level of output in that the price consumers are willing to pay for one more of output (a measure of the benefits received from consuming that last unit) is greater than the opportunity costs of producing an additional unit. Social welfare could be improved allocating resources to the production of this good and making it available to consumers. As production and sale of this good increases, the price consumers are willing to pay for each additional unit declines (diminishing marginal utility). In addition, with increased production cost will rise (increasing opportunity costs). Eventually output will increase until  $P = MC$  and an efficient allocation of resources is realized.

If it is the case that profit-maximizing behavior results in abnormal profits (i.e.,  $P > ATC$ ), then given these barriers to entry, the profits will persist. Profit-maximizing behavior results in an equilibrium condition with no incentive for the firm to alter the level of output.

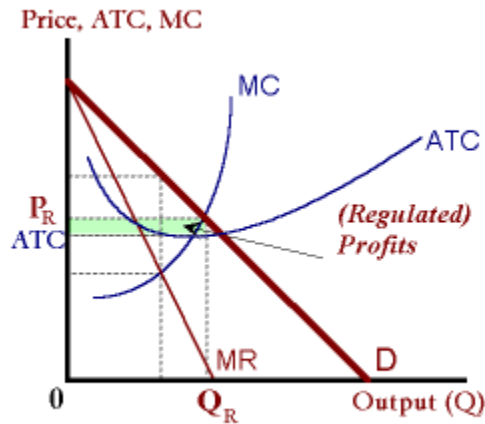
### **The Regulation of a Monopolist**

Regulation of a monopolist (in the case of natural monopolies), is based on the condition for market efficiency leading to greater level of output and lower prices relative to prices based on profit maximizing behavior:

$$P = MC$$

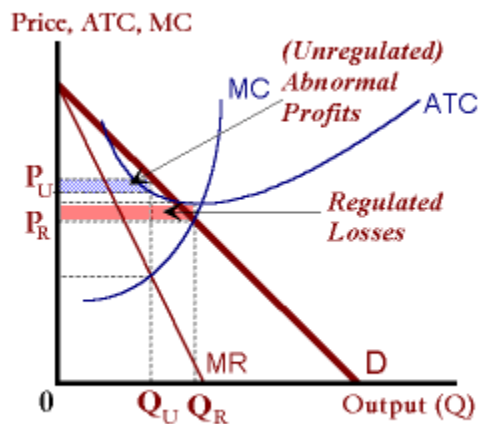
As stated above, this efficiency condition equates the benefits of consuming an additional unit of output (as measured by the price the consumer is willing to pay for the unit) to the costs of producing that additional unit (these costs actually represent the opportunity cost of production -- the next best use of the factor inputs).

**Figure 2, A Regulated Monopoly**



Sometimes, however, Marginal Cost pricing leads to losses for the monopolist. These losses will eliminate any incentive for the monopolist to remain in business. Because this particular firm is the only producer of the good in question, going out of business implies that the product will not be available to the consumer.

**Figure 3, Regulated Losses**



Thus an alternative pricing scheme in these cases is to regulate the firm based on Average Cost Pricing where output levels are determined by the condition:

$$P = ATC$$

In this case, the firm will be allowed to earn a normal rate of profit and produce a level of output slightly below that of an efficient level.

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*Be sure that you understand the following concepts and terms:*

- Costs (of Production)
- Demand
- Inverse Demand
- Marginal Costs (MC)
- Marginal Revenue (MR)
- [An] Imperfectly Competitive Firm
- Monopoly
- [A] Perfectly Competitive Firm
- [A] Price-maker
- [A] Price-taker
- [A] Producer Optimum
- (Sales) Revenue
- Total Revenue (TR)
- Abnormal Profits
- Barriers to Entry
- Competition
- Heterogeneous Goods
- Homogeneous Goods
- [An] Industry
- Losses
- Market Entry and Exit
- Monopolistic Competition
- Monopoly
- Normal Profits
- Oligopoly
- Perfect Competition
- [A] Price-maker
- [A] Price-taker
- [A] Producer Optimum
- Profits
- Profit Maximization
- [A] Representative Firm
- Abnormal Profits
- Average Cost Pricing
- Economic Barriers to Entry
- Efficiency
- Legal Barriers to Entry
- Marginal Cost Pricing
- Monopoly
- Natural Barriers to Entry
- Regulation
- Regulated Profits
- Regulated Losses

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*Optimizing Conditions Discussed:*

$$MP_L = w/P \quad \text{or} \quad P = MC \Rightarrow \text{* Profit Maximization for a Competitive Firm *}$$

$$P > MR = MC \quad \Rightarrow \text{*Profit Maximization for a Price-making Firm *}$$

## The Digital Economist

### Worksheet #7: Competitive Behavior

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1. Given the following **Total Revenue**, **Total Cost**, and Profit ' $\Pi$ ' functions:

$$\mathbf{TR} = 22\mathbf{Q} - 2\mathbf{Q}^2$$

$$\mathbf{TC} = 24 + 6\mathbf{Q}$$

$$\mathbf{\Pi} = \mathbf{TR} - \mathbf{TC}$$

- a. Derive the *marginal revenue* and *marginal cost* functions.
  - b. What is the profit maximizing level of output ' $\mathbf{Q}$ '?
  - c. Find the breakeven points for this firm by factoring the profit function.
2. Complete the following table (assume Perfect Competition)

<b>Q</b>	<b>FC</b>	<b>VC</b>	<b>TC</b>	<b>ATC</b>	<b>AVC</b>	<b>MC</b>	<b>P</b>	<b>TR</b>	<b>MR</b>	<b><math>\Pi</math> or Loss</b>
3	20	100					\$30.00			
4		120								
5		130								
6		136								
7		155								
8		188								
9		250								
10		330								
11		425								
12		535								

- a. Under conditions of perfect competition, what is the profit-maximizing level of output?
- b. In the Long Run, will firms enter or exit this industry? Explain why.
- c. What level of output defines the long run equilibrium for this particular firm?



