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Lecture 6 – Market Behavior

In defining a producer optimum, we have defined the profit maximization condition with respect 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:

Revenue (TR) = P x Q

(*note: as we discuss markets, we will use the notation 'Q, Q_s, Q_d' for output levels rather than 'X' as in previous lectures*)

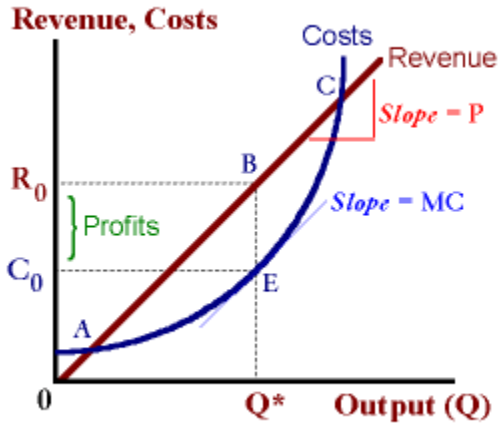
and

Marginal Revenue (**MR**) = dTR/dQ = P!

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

P = **MC**. (*note also: P = MR*)

Figure 1, Profit Maximization: A Competitive Firm



see: http://www.digitaleconomist.com/perfect_comp.html

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 -- the inverse demand curve

and

TR = PxQ = aQ - bQ^2 -- Total Revenue -- *a quadratic equation*!

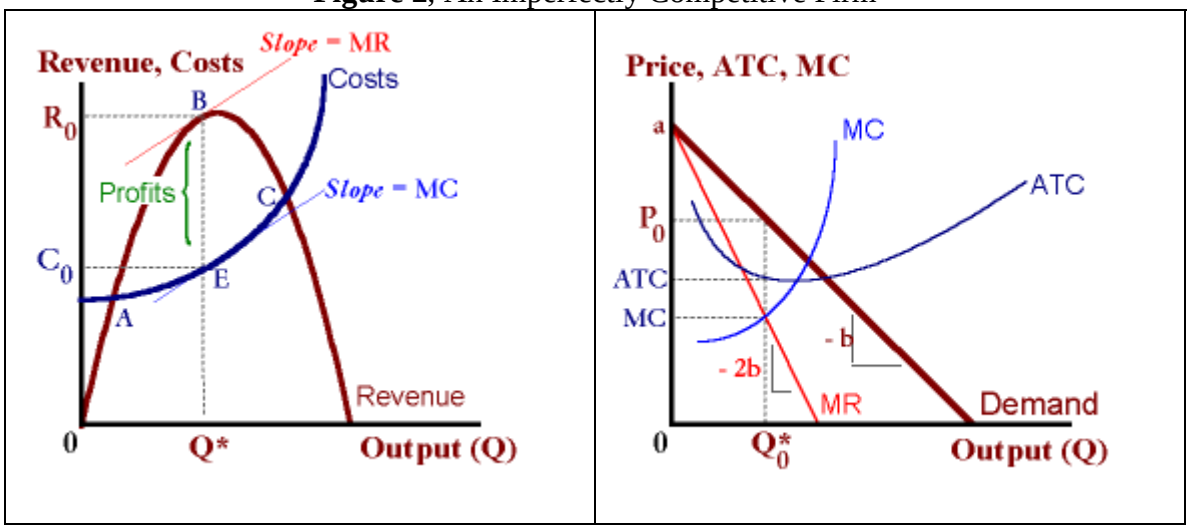
and

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.**

Figure 2, An Imperfectly Competitive Firm



see http://www.digitaleconomist.com/imperfect_comp.html

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.

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:

Costs = w**L** + r**K** + n**M** + a**R** (*see lecture 7*)

$$ATC = \frac{Costs}{\mathbf{X}} = \frac{w\mathbf{L} + r\mathbf{K} + n\mathbf{M} + a\mathbf{R}}{\mathbf{X}}$$

And if:

P > ATC

Then

P**X** > w**L** + r**K** + n**M** + a**R** (*note P**X** = Revenue*)

Or

P**X** **-** w**L** + r**K** + n**M** **> 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

Profits = a**R**.

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:

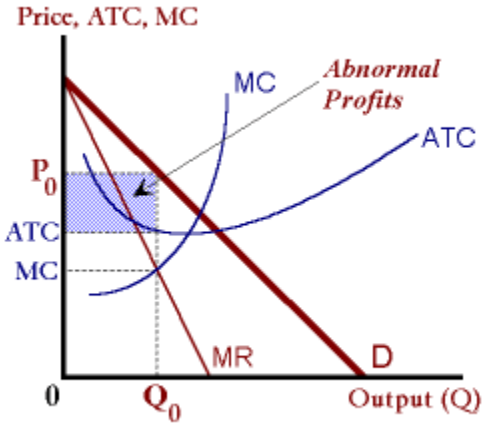
P > MR for Q > 0

and under conditions of profit maximization,

P > MC 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 3, 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.

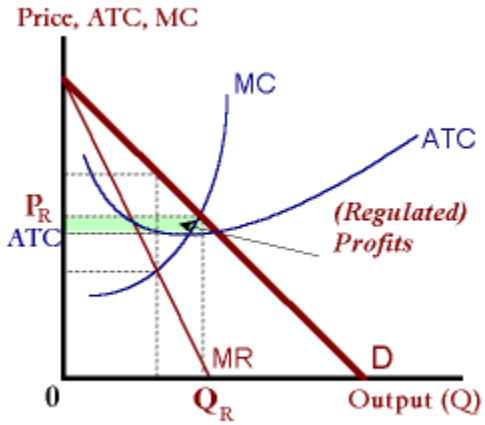
If it is the case that profit-maximizing behavior results in abnormal profits (i.e., P > ATC), then given these barriers to entry, the profits will persist. Profit-maximizing behavior results in an equilibrium condition with no incentive for the firm to alter the level of output.

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

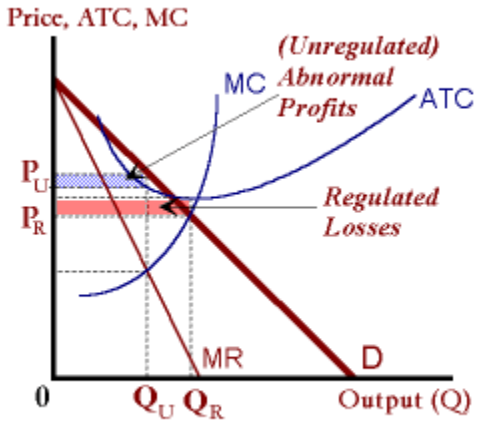
As stated above, this efficiency condition equates the benefits of consuming an additional unit of output (as measured by the price the consumer is willing to pay for the unit) to the costs of producing that additional unit (these costs actually represent the opportunity cost of production -- the next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

Figure 4, 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 5, 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.

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

Optimizing Conditions Discussed:

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

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

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Worksheet #5: Market Behavior

1. Given the following **T**otal **R**evenue, **T**otal **C**ost, and Profit '**Π**' functions:

   TR = 22**Q** -2**Q**^{2}
   TC = 24 + 6**Q**
   Π = TR - TC

   a. Derive the *marginal revenue* and *marginal cost* functions.

   b. What is the profit maximizing level of output '**Q**'?

   c. Find the breakeven points for this firm by factoring the profit function.

2. Complete the following table (assume Perfect Competition)

Q	**FC**	**VC**	**TC**	**ATC**	**AVC**	**MC**		**P**	**TR**	**MR**	**Π** *or Loss*
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?

Managerial Economics, Worksheet #5

3. Given the following equations:

   P = 100 - 10Q {Inverse Demand}
   VC = 20Q {variable costs}
   FC = 50 {fixed costs}

a. Derive the Total Revenue (TR), Total Cost (TC), Average Total Cost (ATC), Marginal Revenue (MR), and Marginal Cost (MC) functions.

b. What is the (unregulated) profit-maximizing price and level of output?

c. What are the level of profits in this case?

d. What is the dead-weight loss associated with this type of behavior?

e. If the firm were to be regulated, what would be the corresponding regulated price and level of output? Explain.

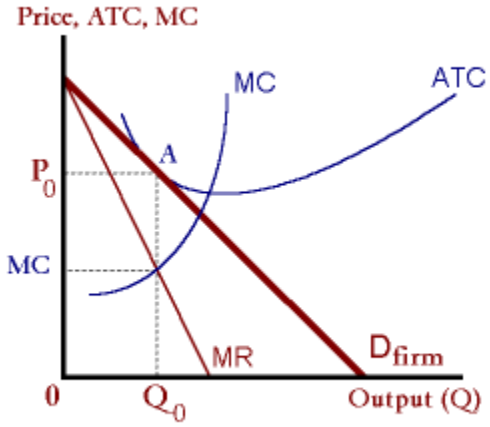
f. What are the level of profits to the firm under regulation? Discuss your answer.

PRICING POWER and PRICE DISCRIMINATION

Many firms have the ability to charge prices for their products consistent with their best interests even thought they may not be characterized as monopolies. These price makers operate in competitive markets but find that due to unique characteristics of their products or industry they may have some discretion over product pricing.

In one category firms may act as monopolies with respect to their customers due to brand loyalty even though similar substitute products exist. These firms operate in, what is known as, a **monopolistically competitive** environment. They will engage in profits maximizing behavior (MR = MC) with respect to prices charged, however, competition in the industry will force product prices to some industry average. This average will be close to the average costs of production eliminating any abnormal profits for individual firms (point '**A**' in the diagram below).

Figure 6, A Monopolistically Competitive Firm



Price Discrimination
Business firms operating in competitive markets are not restricted to charging only one price for their product. These firms may find that by charging different customers different prices for a common product may actually increase the profits of the firm. This charging of different prices for a particular good is known as **Price Discrimination** and is very common in various markets around the globe.

Price discrimination is categorized into three types:

- **First degree** price discrimination – *charging what ever the market will bear,*
- **Second degree** price discrimination – *quantity discounts or versioning,*
- **Third degree** price discrimination – *separate markets and customer groups.*

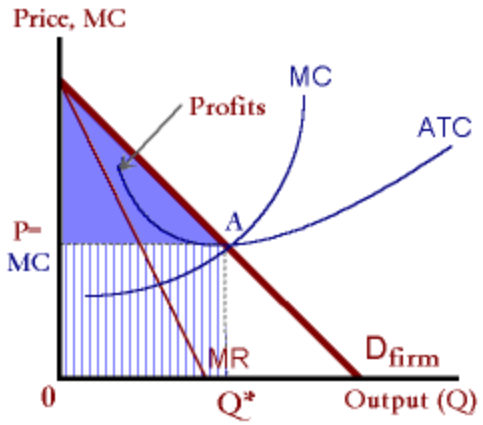
These three types all involve additional effort on the part of the firm to determine the preferences of different customers and their willingness to pay. These efforts are justified

by a greater level of profits relative to that which can be earned by charging a single price.

First Degree Price Discrimination
This first type of product pricing is based on the sellers ability to determine exactly how much each and every customer is willing to pay for a good. Different consumers have different preferences and levels of purchasing power and thus the amount they would be willing to pay for a good often exceeds a single competitive price. This difference between what a consumer is willing to pay and the price actually paid is known, of course, as consumers surplus. Thus a firm engaging in first degree price discrimination is attempting to extract all the consumers surplus from its customers as profits.

The seller will take the time to bargain or *'haggle'* with the customer about the price that customer is willing to pay – some buyers willing to pay a higher price other buyers a lower price. The firm will sell a quantity of output '**Q***' up to the point where the price of the last unit sold just covers the marginal costs of production. The difference between the price charged on each unit and the average costs of producing '**Q***' units of output will be the firm's profits.

Figure 7, First Degree Price Discrimination

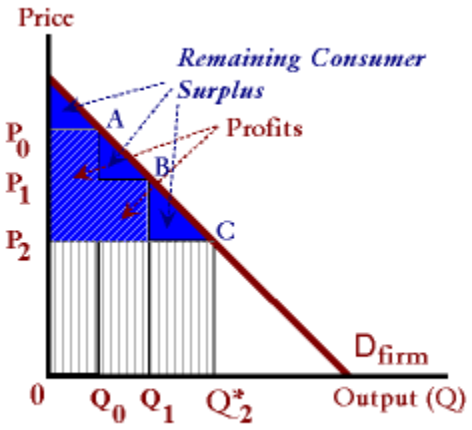


Common examples of first degree price discrimination include car sales at most dealerships where the customer rarely expects to pay full *sticker price*, scalpers of concert and sporting-event tickets, and road-side sellers of fruit and produce.

Second Degree Price Discrimination
The second type of price discrimination involves the establishment of a pricing structure for a particular good based on the number of units sold. Quantity discounts are a common example. In this case the seller charges a higher per-unit price for fewer units sold and a lower per-unit price for larger quantities purchased. In this case the seller is attempting to extract some of the consumer's surplus value as profits with residual surplus remaining with the consumer over and above the actual price paid. Like the case of first degree price discrimination, the firm will produce a level of output where the price charged just covers the marginal costs of production.

In the diagram below, we find an example of a firm charging three different prices for the same product. The price P_0 is charged per unit if the buyer chooses to buy Q_0 units of the good. A lower price P_1 is charged for a greater quantity Q_1 and the price P_2 is charged for the quantity Q^*_2 (the level of output such that P_2 = **MC**):

Figure 8, Second Degree Price Discrimination



Common examples of second degree price discrimination include quantity discounts for energy use; the variations in price for different sizes of boxed cereal, packaged paper products; and sodas and French fries at fast food outlets.

Third Degree Price Discrimination

The last type of price discrimination exists where the firm is able to segment its customers into two or more separate markets, each market defined by unique demand characteristics. Some of these markets might be less price sensitive (price inelastic) relative to other markets where quantity demanded is more sensitive to price changes (price elastic). The firm might find that by charging a higher price P_1 and selling a level of output Q_1 in the first market and a lower price P_2 selling a level of output Q_2 in the second market; profits are greater than in that firm charged a single price P* ($P_2 < P^* < P_1$) for all units sold. Specifically, the firm will attempt third degree price discrimination if:

$$P_1Q_1 + P_2Q_2 > P^*Q^* \quad (Q^* = Q_1 + Q_2 \text{ , } \textit{Total Costs are the same in either case})$$

In order for this type of price discrimination to be effective, the firm must be able to prevent a third party from engaging in arbitrage (*buying in the second market at a price slightly above* P_2 *and selling in the first market at a price slightly below* P_1 forcing both prices towards P^*) and profiting from the price differences. The markets must be kept separate!

Examples of third degree price discrimination include: business vs. tourist airfares, business vs. residential telephone service, and senior discounts.

Be sure that you understand the following concepts and definitions:

- Profit Maximizing Behavior
- Monopoly
- Monopolistic Competition
- Price Discrimination (1^{st}, 2^{nd}, and 3^{rd} degree)
- Consumers Surplus
- Price Elasticity of Demand

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Worksheet #6: Price Discrimination

1. Given the following equations:

P = 100 - 10**Q**	--	*Inverse Demand*
MR = 100 - 20**Q**	--	*Marginal Revenue*
MC = 20	--	*Marginal Costs*
TC = 20**Q**	--	*Total Costs*

a. Compute the *profit maximizing* level of output and corresponding price.

b. What are the level of profits associated with this *profit maximizing* level of output?

c. What is the level of output for a monopolist under *First-Degree Price Discrimination*?

d. What are the corresponding profits under *First-Degree Price Discrimination*?

e. What is the *Welfare Loss* associated with *profit maximizing* behavior. How about with *First-Degree Price Discrimination*?