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Economics 201

Profit maximization and the Perfectly Competitive firm

Our first look at firm behavior comes within the context of perfect competition. What comes below is an explanation of the process by which a typical perfectly competitive firm would maximize profit. Note that this is not an actual *real world process*, we are simply describing behavior within the context of theory.

Based on theory, we know that in perfectly competitive markets, it is the market that sets the market price. Firms in this environment do not individually set the market price, and cannot influence the market price by selling more or less. There are many firms producing homogeneous goods and each firm is too small relative to the market to have an impact on the overall market. The market price is set by through the process of determining equilibrium, using market demand and market supply. Let's assume that the market demand and supply curves look like this:

Market Demand:	$P = 100 - 0.078Q_D$	(where P = price, Q_D = quantity demanded)
Market Supply:	$P = 2 + 0.02Q_S$	(where Q_S = quantity supplied)

Given these curves, the market equilibrium price and quantity is P*= $22 and Q*= 1000 units. In a perfectly competitive market, firms take this price as given, and then decide how much to supply. Firms do so on the basis of the benefit associated with producing and selling units, relative to the cost of producing and selling those units. We determine those costs by using what we'll assume are the cost curves for a typical firm in this market:

Total Cost:	$TC = q^2 + 2q + 100$	(where q = firm's quantity of output)
Average Cost:	$AC = q + 2 + \frac{100}{q}$	
Marginal Cost:	$MC = 2q + 2$	

How much should the typical firm produce in this market?

First, we want to assume that each firm in the market is interested in maximizing their own net benefit, where the net benefit would be the profit earned from producing and selling units of output. Once the price is set, firms will choose an output level on the basis of the benefit and cost associated with producing and selling output. Note that when the firm decides how much to

produce, their chosen output level will bring maximum profit. That implies that the firm's output level will also be an equilibrium, because once the firm discovers that profit-maximizing output level, there's no reason to produce a different amount. Therefore, let's assume that this firm makes their output decision using marginal analysis – since this process will always lead us to an equilibrium.

The benefit of producing and selling output is what each firm receives in revenue for those units, and since the price is set by the market (where firms take the price as given), that means the marginal benefit of producing and selling units of output in this market is the price (i.e. MB = P). The marginal cost is already provided to us in the form of the MC equation.

The table below shows us the various cost values for different levels of output. As the price is set by the market and not something the firm can influence, the price remains at $22 no matter how much output the firm produces.

P	q	TC	AC	MC
$22.00	1	$103.00	$103.00	$4.00
$22.00	2	$108.00	$54.00	$6.00
$22.00	3	$115.00	$38.33	$8.00
$22.00	4	$124.00	$31.00	$10.00
$22.00	5	$135.00	$27.00	$12.00
$22.00	6	$148.00	$24.67	$14.00
$22.00	7	$163.00	$23.29	$16.00
$22.00	8	$180.00	$22.50	$18.00
$22.00	9	$199.00	$22.11	$20.00
$22.00	10	$220.00	$22.00	$22.00
$22.00	11	$243.00	$22.09	$24.00
$22.00	12	$268.00	$22.33	$26.00
$22.00	13	$295.00	$22.69	$28.00
$22.00	14	$324.00	$23.14	$30.00
$22.00	15	$355.00	$23.67	$32.00

Assume this firm begins at q = 1 and asks whether to produce that first unit. If the firm produces that unit, then the firm would find that the benefit of the first unit is greater than the cost of the first unit (i.e. MB > MC). This is a signal to the firm that she should produce more units. When q = 10, we find that MB = MC. Any additional units would lead to MB < MC, where these additional units would not be earning enough benefit, and so we stop at q = 10. This row is highlited in the table.

If MB = P, then we can see that our results leads us to what we can call an equilibrium condition for this profit maximizing firm, i.e. P = MC (which is just another way of saying MB = MC). This condition determines how much output the firm will produce, as the firm will produce until these two variables are the same.

I.e., to find the profit maximizing level of output for this firm, we set the MC equation equal to the equilibrium price determined by the market and then use the equations below to help determine our output level:

$$P^* = MC$$
$$22 = 2q + 2$$
$$q = 10$$

What are the profits of this firm?

To find the firm's profits, we can use one of the two approaches (below).

Profit = (P × q) – TC

$\text{Profit} = (22 \cdot 10) - ((10)^2 + 2(10) + 100)$

Profit = 220 – 220
Profit = 0

Profit = (P - AC)(q)

$\text{Profit} = \left(22 - \left(10 + 2 + \frac{100}{10}\right)\right)(10)$

Profit = (0)(10)
Profit = 0

The result is that this firm produces 10 units and makes zero economic profit. If we calculate the profit associated with each different level of output in the table above, then we note that the profit associated with producing any output level other than 10 gives us negative economic profit. This verifies that by producing where P = MC, the firm is maximizing profit in this example.