I. Output Decisions by Firms

Now that we have examined firm costs in great detail, we can now turn to the question of how firms decide how much output to produce. Remember that the goal of the firm is to maximize profits.

A. Perfect Competition

To simplify our analysis, we will assume that firms are in an industry that is described as perfectly competitive. Firms are said to be in perfect competition if they have the following characteristics:

1. Firms are so small and they are facing so much competition that their own behavior cannot determine the market price. That is if a firm in a perfectly competitive industry decides to increase production, that will have no effect on the market price.
2. The products sold are identical. We say that firms sell homogeneous products. There is nothing to differentiate between Firm A’s output and Firm B’s output.
3. It is very easy for new firms to enter or leave the industry. If economic profits exists then firms will enter the industry. If economic losses occur then firms will leave the industry.

Firms that are in perfectly competitive industries are price takers in the sense that they will have to charge the same price as every other firm in the market. The market price in the industry is determined by the market demand and supply curves and not by individual demand and supply. Once the market equilibrium price has been determined, individual firms will have no choice but to sell their product at the market price. At this price the firm can sell as much product as they want. This helps simplify our analysis since the only decision the firm has to make is how much output to supply. The firm will choose the level of output that will maximize profits.

Example: Stan is a strawberry farmer. The market price for strawberries is $2 a basket. It is determined by the market supply and demand curves (See Figure 1). Strawberry farming is a perfectly competitive industry because there are lots of strawberry farmers, the strawberries are identical and it is relatively easy for someone to grow strawberries. If Stan tried to charge $3 a basket for his strawberries, everyone would just go to another farmer to buy their strawberries, and Stan would sell nothing. Also, Stan would be a fool to charge a price below $2, since he could have sold the same amount of strawberries for a higher price. Thus Stan faces a perfectly elastic demand curve for his strawberries. (See Figure 1)
B. Total Revenue and Marginal Revenue

As we have already seen total revenue (TR) is the total amount that a firm receives from selling their product.

Total Revenue = Price x Quantity Sold → TR = P x Q

Marginal Revenue is the change in total revenue that results from selling one more unit. For example if the firm is selling 100 units and decides to sell one more unit, the marginal revenue is the extra revenue generated by selling that 101\textsuperscript{st} unit.

Note that for a perfectly competitive firm, the marginal revenue will just be the price of the product. When a firm sells an additional unit of output, the perfectly competitive firm will receive the price of the good. The marginal revenue curve is a graphical representation of the marginal revenue at each unit of output. However, since the firm will receive the same price for each additional unit sold, the marginal revenue curve will just be the demand curve of the individual firm. (See Figure 2)

C. Profit-Maximizing Output Level

It is easiest to show the profit-maximizing output level using a numerical example. In order to determine the level of output that will maximize profits for a perfectly competitive firm we will need to draw the marginal revenue curve, the marginal cost curve and also the average total cost curve.

Example: Suppose that a perfectly competitive firm sells corn for $12.50 a bushel. The costs for the firm, the marginal revenue and the profit for the firm is presented in Table 1.
Table 1

<table>
<thead>
<tr>
<th>Output</th>
<th>TFC</th>
<th>TVC</th>
<th>TC</th>
<th>AFC</th>
<th>AVC</th>
<th>ATC</th>
<th>MC</th>
<th>MR</th>
<th>Profit</th>
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<td>10</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>-10</td>
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<tr>
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<td>5</td>
<td>15</td>
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<td>5</td>
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<td>5</td>
<td>12.50</td>
<td>7.50</td>
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<tr>
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<td>10</td>
<td>7.5</td>
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<td>3.75</td>
<td>8.75</td>
<td>2.5</td>
<td>12.50</td>
<td>7.50</td>
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<td>12.50</td>
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<td>3.33</td>
<td>4.17</td>
<td>7.5</td>
<td>5</td>
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<td>20</td>
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<td>2.50</td>
<td>5</td>
<td>7.5</td>
<td>7.50</td>
<td>12.50</td>
<td>20</td>
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<td>6</td>
<td>8</td>
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<td>52.50</td>
<td>1.67</td>
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<td>8.75</td>
<td>12.50</td>
<td>12.50</td>
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<td>1.43</td>
<td>8.21</td>
<td>9.64</td>
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<tr>
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<td>9.38</td>
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<td>20</td>
<td>12.50</td>
<td>7.50</td>
</tr>
</tbody>
</table>

Given the costs curves you should be able to calculate the profits easily. For example, what is the profit for the firm when output is equal to 3?

Total Revenue = (P × Q) = ($12.50 × 3) = $37.50
Total Costs = $22.50
(Note we could have figured out Total Costs if we are just given the ATC). Since ATC = TC/Q if we know ATC and Q we can find what total costs are. In this example since ATC = 7.50 and Q = 3 then total costs = $22.50.
Profits = TR – TC = $37.50 - $22.50 = $15.

What we are interested in is the level of production that will maximize profits for the firm. The firm can choose any level of output and will choose the output that will give it the highest level of profits.

What if the firm chooses not to produce anything at all? In this case TR = $0, but total costs will be equal to the total fixed cost of $10. Thus the firm will be losing $10. Is this the maximum level of profit? To answer that question, suppose that the firm produces 1 unit instead of 0. Total revenue will increase to $12.50 while total costs will increase to $15.00. The profit is still negative at -$2.50 but the firm is losing less money than before so it should definitely produce the 1 unit of good. What if it produces 2 units? Total revenue will equal to $25.00 while total costs will equal to $17.50 now the firm has a profit of $7.50. Proceed in the same manner for the rest of the output levels. As long as the firm’s profits are increasing with added production, the firm should keep on producing more. At the point where profits start to decrease with added production, the firm should stop producing. For example when Q = 6 units of output, the profit for the firm is equal to $22.50. If the firm wanted to produce 7 units the total revenue will be equal to $87.50 while total costs is equal to $67.50 with profits of $20. Now profits are lower at Q=7 then they were at Q = 6. The firm has lost some profits by producing that extra unit. Thus the firm should stop production at Q=6. Since Q=6 is where the firm maximizes its profit, this is the profit maximizing level of output. The firm will supply 6 units of output to the market.

Another way we can look at this is to compare the marginal revenue to the marginal cost at each level of production.
If the marginal revenue is greater than the marginal cost the firm should produce an extra unit.
If the marginal revenue is less than the marginal cost the firm should produce less output.

***The firm’s optimal level of production is where marginal revenue is equal to marginal cost (MR=MC)***

In our example suppose the firm is at Q=3 and is deciding whether or not to increase production to 4 units of output. If the firm increases production by 1 unit, the extra revenue generated by the extra unit of production will be $12.50. The extra cost generated by the production of the 4th unit is $7.50. Since the firm will get more in revenues by producing the 4th unit than what it costs them to produce it, the firm should produce the 4th unit.

On the other hand suppose that the firm is at Q=6 and is deciding whether to produce Q=7. The marginal revenue is $12.50 while the marginal cost is $15.00. By producing the 7th unit of output, it will cost the firm more to produce it than they would get from selling it. Thus the firm should not produce Q=7.

The profit-maximizing firm will always produce as long as marginal revenue is greater than marginal costs. When MR=MC the firm will stop producing.

**Figure 4**

Figure 4 shows how firms determine their profit maximizing level of output in a perfectly competitive industry. As long as MR > MC, firms will increase their production because the revenue gained by producing 1 more unit is greater than it costs to produce it. When MR=MC the firm has maximized its profits. We see in Figure 4 that the point of profit maximization is where Q = 6.

**D. The Short Run Supply Curve and Marginal Cost Curve**

An added bonus with our analysis is that now we have an explanation on why the supply curve is upward sloping. Consider Figure 5. Suppose initially that the price of the good is at $5 (which implies that the MR is also $5). The firm will produce where MR=MC in this case the profit maximizing quantity is at 300 units. Now suppose that price where to increase to $6. This will
cause the MR curve to shift upwards. The new point of intersection between the MR and MC curve is at Point B. At that point quantity produced will be higher at 350. With an increase in price the profit-maximizing firm will produce more output. If the price increased even higher to $7, the marginal revenue curve will go to MR₂ and the firm will maximize its profits at Point C where Q=400. By definition the marginal cost curve is the short-run supply curve. This is true because the marginal cost curve shows us the quantity of output supplied at every price level. However, there is a point below which the firm will not produce. We’ll delay discussion on this special case for the next lecture.