The Firm's Problem:
Issues from Class

November 3, 2011

1 Average Total Cost and Marginal Cost

Remember from class that the ATC curve achieves it minimum at *exactly* where the marginal cost curve equals ATC. Why? I actually think Mankiw's explanation is pretty clear, so it is replicated below (page 270):

> Average total cost is like you cumulative GPA. Marginal cost is like the grade in the next course you will take. If your grade in your next course is less than your GPA, your grade point average will fall. If your grade in your next course is higher than your GPA, your grade point average will rise.

2 Marginal Cost and Supply

Recall that a profit-maximizing firm will produce, as long as it is producing, when marginal revenue is equal to marginal cost. Let's assume that is not the case, and see if we derive a contradiction. If MR>MC, then the money the firm will make on its next unit of production is greater than the cost of that unit so it will make more profit than before. So the firm would decide to continue producing. If MR<MC, then the cost of the next unit will be more than the revenue so profits will begin to decline, and the firm would decide to produce less to make a higher profit. Because the firm is dissatisfied with either MR<MC or MC>MR, it must be the case the firm will decide to produce at MC=MR.

What is the formula for marginal revenue? We know it is the additional revenue from production one more unit, or, in other words, the change in total revenue. Remember

$$
\begin{aligned}
TR &= PQ \\
MR = \text{change in } TR &= PQ_2 - PQ_1 \quad \text{but } Q_2 = Q_1 + 1 \\
MR &= P
\end{aligned}
$$

Then, **because the firm produces where MC=MR, we can also say the firm produces where P=MC=MR.**

Of all the different costs we can think of: MC, TC, FC, VC, AVC, ATC, the *firm that produces* only cares about the MC in its production decision, as seen above. Because the MC is the most important component of the quantity it produces, the market supply is closely tied with marginal cost.

3 Firms Exiting the Market

When does a firm actually produce? The firm faces two choices: produce or shut down. The decision is obviously based on 1) price, 2) costs, and 3) time span.

In the short run, a firm *cannot drop fixed costs*. Let's say Microsoft is deciding whether to shut down in the short-run, but it already has contracts on capital (machines), factories, etc. and so will be charged regardless of production. In the short-run these are fixed costs. Because Microsoft will face these prices,

regardless of its level of production, it does not affect its production decision. Microsoft still faces variable costs, however, such as labor and input materials. So Microsoft focuses on variable costs that do change with production. If revenue is greater than variable costs, the firm is fine and will stay open. If costs are higher than revenue, then the firm will obviously decide to close down. Note that this condition is represented by

$$
\begin{aligned}
TR &< VC \\
TR/Q &< VC/Q \\
P &< AVC \qquad \text{because } TR = PQ \text{ and } VC/Q = AVC
\end{aligned}
$$

So the the as long as $P \geq AVC$, the firm will produce, and it will produce where $P = MC$ (see previous section).

In the long run, a firm's fixed costs become variable in the sense that it can avoid paying all costs by leaving the market. So the firm will close now if total revenue is less than *total cost*.

$$
\begin{aligned}
TR &< TC \\
TR/Q &< TC/Q \\
P &< ATC \qquad \text{because } TR = PQ \text{ and } TC/Q = ATC
\end{aligned}
$$

We can revisit the example from class tonight,

Figure 1: Firm Exit Decision in the Long-Run (Left) and Short-Run (Right)
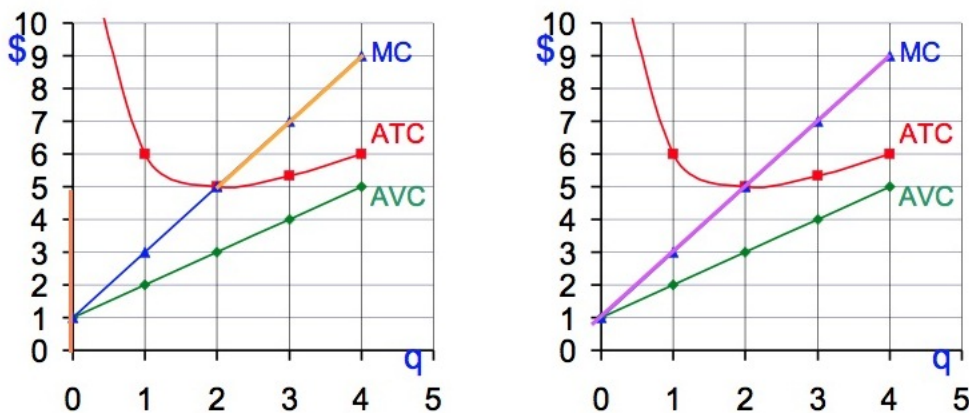
In the short-run (right figure), the price (because it equals MC) is *always* higher than the AVC, so the firm will decide to stay in the market no matter the price (even though we saw that the firm is losing money at certain prices). So the supply curve exactly follows the marginal cost curve. In the long-run, though, the firm's supply line (orange) is cut. Why? Only at $P \geq 5$ is $P \geq ATC$. Before that price, $P < ATC$ so the firm will decide to the leave the market.