EC 131 - Perfectly competitive markets - firms' decisions

Boston College
Department of Economics

Inacio Guerberoff Lanari Bo

November 2012

In general, you will be given the firm's cost structure and some demand information. For most arguments the cost structure will be enough. Throughout this handout, consider the following cost structure:

$$TC = 200 + 3Q + 0.2Q^2$$

$$MC = 3 + 0.4Q$$

Clearly, the firm faces a fixed cost of \$200, since when $Q = 0$ $TC = \$200$.

1 Short-run analysis

Given a price, we can easily derive the quantity produced. Suppose that $P = \$19$. Since the firm supply doesn't change the market price, **marginal revenue equals the price**:

$$MR = P = 19$$

Profit maximization implies that $MR = MC$. Thus:

$$19 = 3 + 0.4Q$$

$$Q = 40$$

Thus, the firm will produce $Q = 40$. Will profits be positive? In order to see that, remember that $TR = P \times Q$. Thus:

$$TR = 19 \times 40 = \$760$$

The total costs can be found by simply replacing Q by 40:

$$TC = 200 + 3 \times 40 + 0.2 \times (40)^2 = \$640$$

Profits are, thus:

$$Profits = TR - TC = 760 - 640 = \$120$$

The firm will, then, have positive profits of \$120.

1.1 Shutdown price

Remember that the condition for shutdown is $P < AVC$. Remember also that $TC = FC + VC$. It's clear that the fixed cost (FC) is \$200, and thus the variable cost VC is given by:

$$VC = 3Q + 0.2Q^2$$

and thus:

$$AVC = \frac{VC}{Q} = \frac{3Q + 0.2Q^2}{Q} = 3 + 0.2Q$$

When we consider the fact that the profit maximization condition ($MC = MR$) implies that the marginal cost curve is the supply curve, in order to know the minimal shutdown price we need to find when is it that $MC \geq AVC$:

$$MC \geq AVC \implies 3 + 0.4Q \geq 3 + 0.2Q \implies 0.4Q \geq 0.2Q \implies 0.4 \geq 0.2$$

Obviously that condition holds regardless of the value of Q. That is, $MC \geq AVC$ is *always true*. Thus, as long as P is higher than the minimum value of AVC the firm will produce a positive Q in the short-run. Since the minumum value of AVC is 3, then the firm will shutdown only if $P < \$3$.

2 Long-run analysis

In the long-run, firms will enter whenever profits are positive, and will exit whenever they are negative, shifting prices down and up respectively, until economi profits are zero. Since profits can be written as:

$$Profits = Q \times (P - ATC)$$

Then this implies that in the long-run $P = ATC$. This is, thus, the *long-run zero profit condition*. The second condition we must use in order to specify the long-run equilibrium is, of course, the *profit maximization condition*: $MC = MR$, where here $MR = P$ since it's a perfectly competitive market. Putting both conditions together, we have:

$$P = ATC \implies P = \frac{200 + 3Q + 0.2Q^2}{Q}$$
$$P = MC \implies P = 3 + 0.4Q$$

Together:

$$\frac{200 + 3Q + 0.2Q^2}{Q} = 3 + 0.4Q$$

Which solves for:

$$Q = 10\sqrt{10}$$

Which is the long-run supply for that firm. In order to find the price, we can replace back to any of the two expressions involving prices. Let's use the MC curve:

$$P = MC \implies P = 3 + 0.4 \times (10\sqrt{10})$$
$$P = 3 + 4\sqrt{10}$$

Thus, in the long-run prices will be $P = 3+4\sqrt{10}$ and each firm will supply $Q = 10\sqrt{10}$.