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Imperfect Competition and Trade

Let the firm's demand curve be defined as follows:

$$X = S\left[\frac{1}{n} - b(P - \overline{P})\right] \tag{1}$$

where X is firm sales, S is total sales, n is the number of firms. P is the price charged by the firm and $\overline{P}$ is the average industry price.

Derivation of equilibrium will follow in three steps.

1. Derive the number of firms as a function of average cost (n as a function of AC).
2. Derive the average industry price as a function of the number of firms ($\overline{P}$ as a function of n)
3. Establish conditions for exit and entry, viz., if the average industry price exceeds (is below) the average cost, the firms enter (exit) the industry ($\overline{P} > AC$, firms enter, and if $\overline{P} < AC$, firms exit).

<u>Step 1.</u> Set $P = \overline{P}$. Note that if all firms charge the same price, then equation (1) becomes $X=S/n$.

Recall average cost is given by:

$$AC = \left(\frac{F}{X}\right) + c \tag{2}$$

Substituting (1) into (2) yields:

$$AC = \left(\frac{F}{S/n}\right) + c = n \times \left(\frac{F}{S}\right) + c \tag{3}$$

Therefore the more firms in the industry, the higher is average cost.

<u>Step 2.</u> Recall the demand curve:

$$X = S\left[\frac{1}{n} - b(P - \overline{P})\right] \tag{1}$$

Assume each firm takes $\overline{P}$ as given; rewrite (1):

$$X = \frac{S}{n} + Sb\overline{P} - SbP \equiv A + BP \tag{1'}$$

where

$$A \equiv \frac{S}{n} + Sb\overline{P}$$
$$B \equiv Sb$$

The profit maximizing firm always sets the marginal revenue equal to marginal cost, MR=MC. We know for linear demand curves:

$$MR \equiv \frac{\partial R}{\partial X} = P - \frac{X}{B} = P - \left(\frac{X}{Sb}\right) \tag{4}$$

So:

$$MR = P - \left(\frac{X}{Sb}\right) = c = MC \tag{5}$$

where c is marginal cost.

Solving for the firm's optimal price yields:

$$P = c + \frac{X}{Sb} \tag{6}$$

Since all firms charge the same price, $X=S/n$, then:

$$P = c + \frac{X}{Sb} = c + \frac{(S/n)}{Sb} = c + \frac{1}{bn} \tag{7}$$

Therefore the more firms, the lower price that will be charged by firms.

Step 3. We have two countervailing effects. What determines the industry price? Notice by equation (3), as the size of the market (*S*) increases, the average cost decreases. So on the supply side, this would be represented by a shift of the cost curve; by equation (7), we know that as firm number increases, the price falls, and this is a movement along the pricing curve:

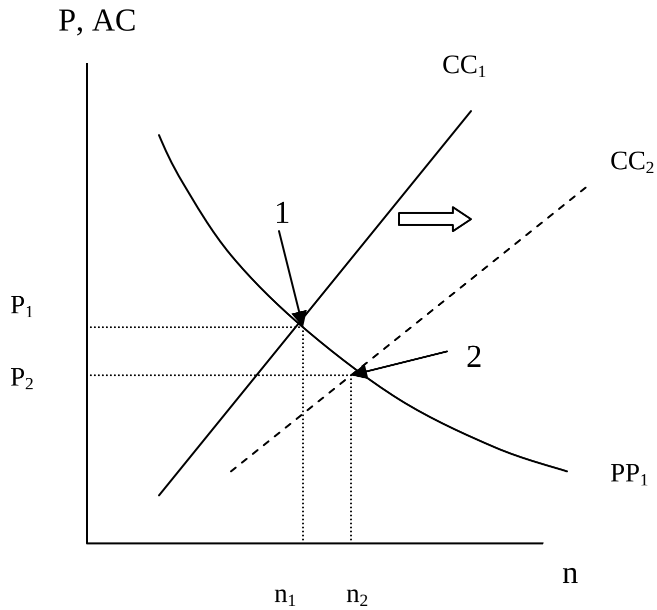

Figure 1.

Notice in the long run, price must equal average cost (this is the entry/exit condition). Set price equal to AC.

$$P = AC \Rightarrow \frac{1}{nb} + c = \frac{Fn}{S} + c \tag{8}$$

Solving:

$$\frac{1}{b} = \frac{Fn^2}{S} \Rightarrow \frac{S}{bF} = n^2 \Rightarrow n = \sqrt{\frac{S}{bF}} \tag{9}$$

Therefore, a doubling in market size leads to an approximately 1.4 increase in the number of firms. What about the price charged by the representative firm? From (7), substituting in (9):

$$P = \frac{1}{bn} + c = \left(\frac{1}{b}\right) \times \frac{1}{\left(\sqrt{\frac{S}{bF}}\right)} + c \Rightarrow P = \sqrt{\frac{F}{Sb}} + c \tag{10}$$

And sales, X, are given by the following, when $P = \overline{P}$:

$$X = \frac{S}{n} = \frac{S}{\sqrt{\frac{S}{bF}}} = \sqrt{SbF} \tag{11}$$