

Short Run Market Equilibrium

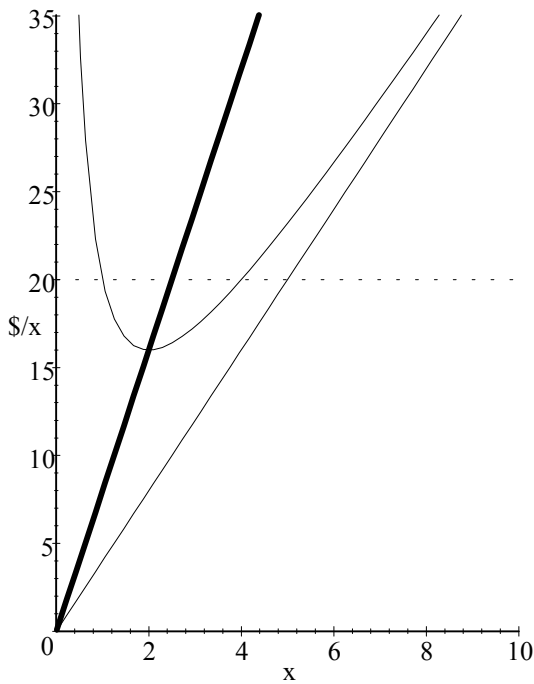
The market supply curve is found by horizontally adding the supply curves of individual firms. If there are m firms, we have

$$X^s(p_x) = \sum_{j=1}^m x_j(p_x).$$

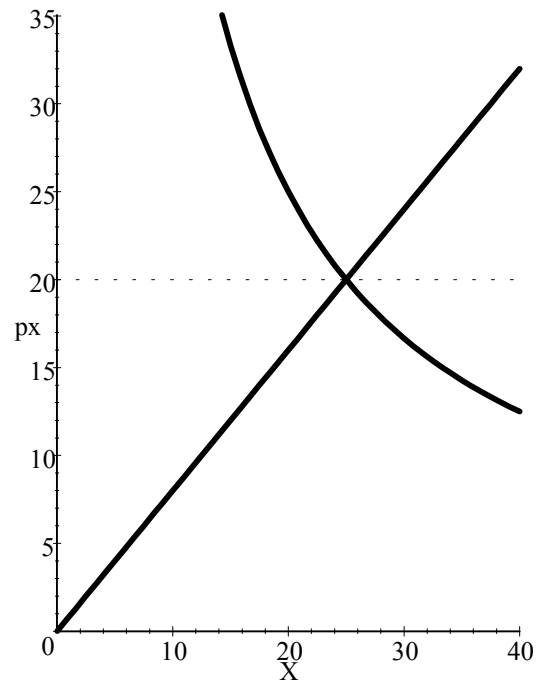
Just as we can talk about the elasticity of demand, the price elasticity of *supply* is defined as

$$\varepsilon^s = \frac{dX^s}{dp_x} \frac{p_x}{X^s}.$$

A *short run market equilibrium* is defined to be a price and a quantity of output, where (1) demand is derived from utility maximization, (2) supply is derived from firms choosing variable inputs and output to maximize profits, and (3) supply equals demand.



Firm's Supply Curve



Market Supply Curve

Each consumer and each firm individually takes the price as beyond their control. Optimization by all individuals determines the price, through demand=supply. The price then determines the quantities demanded and supplied by each consumer and firm.

Example: 1000 consumers, each with income, $M = 1$ and utility function $u(x, y) = xy$.

10 firms, each with production function $f(K, L) = K^{1/2}L^{1/2}$, and a short run capital input fixed at $\bar{K} = 1$.

$w = 4$ and $r = 16$.

Solution: For each i from 1 to 1000, consumer i 's utility maximizing demand function is

$$x_i = \frac{1}{2p_x}.$$

(We did this earlier this quarter.) Therefore, the market demand function is

$$X^d = \frac{500}{p_x}. \quad (1)$$

For j from 1 to 10, firm j 's short run production function is

$$x_j = L_j^{1/2},$$

which implies

$$L_j = x_j^2.$$

Therefore, we have

$$\begin{aligned} SRTC &= 4x_j^2 + 16, \text{ and} \\ SRMC &= 8x_j. \end{aligned} \tag{2}$$

From (2), we can solve for each firm's supply function (min SRAVC is zero, so there is no shutdown):

$$p_x = 8x_j,$$

which implies

$$x_j = \frac{p_x}{8}. \tag{3}$$

Since there are 10 firms, the market supply function is

$$X^s = 10x_j = \frac{10p_x}{8}. \quad (4)$$

The equilibrium price is found by equating supply and demand, from (1) and (4):

$$\frac{10p_x}{8} = \frac{500}{p_x}.$$

Solving for the price, we have

$$p_x^* = 20.$$

Plugging $p_x^* = 20$ into the market demand or supply function, we see that the total market quantity is 25. Each consumer demands 25/1000, and each firm supplies 2.5, has revenues of 50, total cost of 41, and a profit of 9.

Long Run Equilibrium

In the long run, firms can adjust all inputs. More importantly, new firms can enter the market in search of profit opportunities, and existing firms can exit the market if they are receiving negative profits.

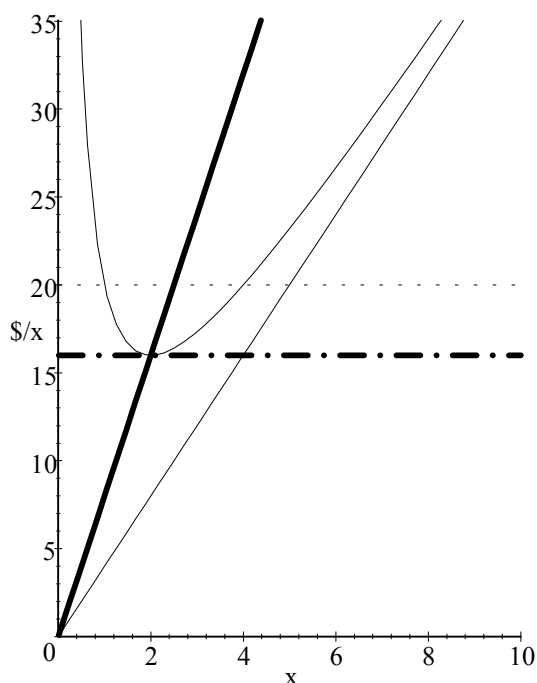
To make things simple, we will assume that there is free entry and exit, and that all firms have the same technology and therefore the same cost functions.

We will also assume that good x is a constant cost industry, meaning that input prices do not change as the industry (market) output varies. This assumption is needed to insure that an individual firm's cost curves do not change as the market expands or contracts.

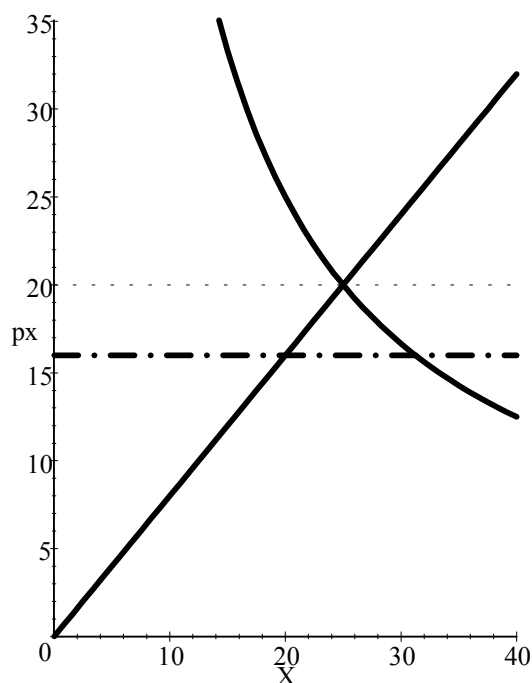
If firms are receiving profits, entry will occur, driving the price down towards zero profits. If firms are making losses, exit will occur, raising the price up towards zero profits.

In long run equilibrium, all firms receive zero economic profits. Think of this as “normal” profits. Remember that firms that own their own capital should receive a market rate of return on their capital in order to be breaking even (including opportunity cost).

$$p_x^{**} = \min LRAC$$



Firm's Supply Curve



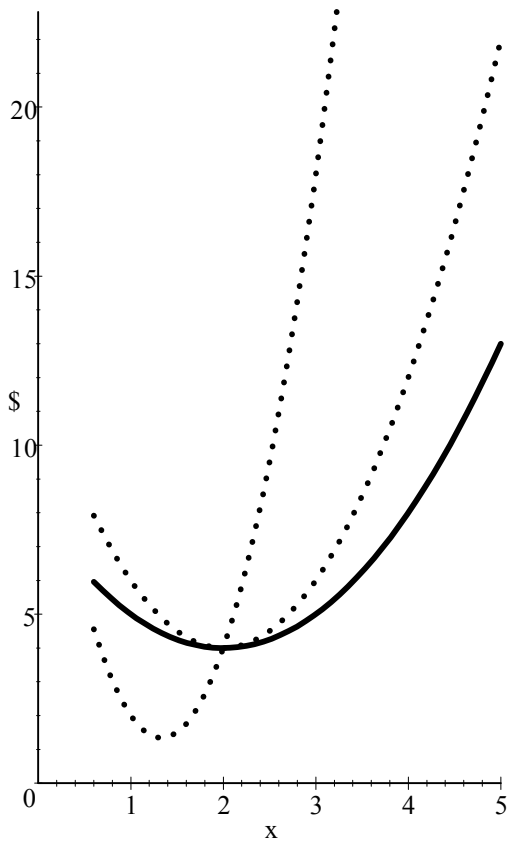
Market Supply Curve

Being in long run equilibrium also entails being in short run equilibrium. For long run optimization, firms anticipate the price p_x^{**} and choose K^{**} and L^{**} to maximize profits. If they were stuck in the short run with a capital input $\bar{K} = K^{**}$, then short run profit maximization at the price p_x^{**} leads them to demand L^{**} .

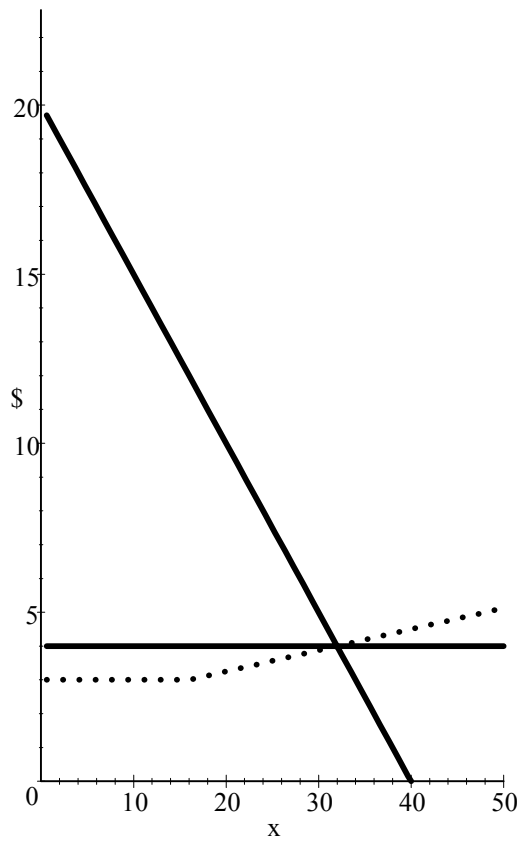
Put another way, if firms cannot increase profits by changing K or L , then they certainly cannot increase profits by changing L .

With constant returns to scale, any output level is efficient, so long run equilibrium does not pin down the output of each firm or the number of firms.

With a U-shaped LRAC curve, there is a single value of x^{**} that minimizes LRAC, and all firms are forced to produce x^{**} in order to break even. The number of firms that the market can support is X^{**}/x^{**} .



U-shaped LRAC



Long Run Eq.

With increasing returns to scale, there is no long run equilibrium, because any firm breaking even at a positive output level can earn infinite profits by producing more and more.

With decreasing returns to scale, the long run equilibrium involves an infinite number of tiny firms.

The more sensible cases are (1) constant returns to scale, and (2) U-shaped LRAC curve.