Industry Supply and Competitive Equilibrium (Ch24)

Shan Gui

Shanghai University of Finance and Economics

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What We Have Learned

Cost Minimization for Any Producer

- Find the optimal input bundle that minimizes total cost, given input prices w_1, w_2, and a target output level y.

  $\Rightarrow$ Conditional factor demand: $x_1^*(w_1, w_2, y), x_2^*(w_1, w_2, y)$.

  $\Rightarrow$ Cost function: $c(y) = w_1 x_1^* + w_2 x_2^*$.

Profit Maximization for a **Competitive Producer**

- Find the optimal output level that maximizes profit, given the output price p.

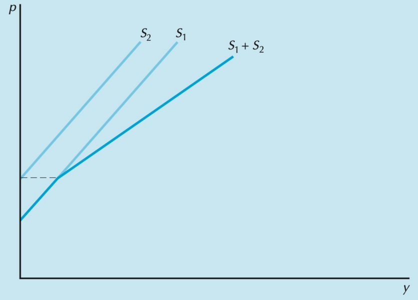
  $\Rightarrow$ Inverse supply function: $p = MC(y)$.

  $\Rightarrow$ Individual supply curve in the short run: the upward-sloping portion of the MC curve above the AVC curve.

  $\Rightarrow$ Individual supply curve in the long run: the upward-sloping portion of the MC curve above the AC curve.

Industry Supply: The Sum of the Supplies of All Firms

In the Short Run: The Number of Firms is Fixed



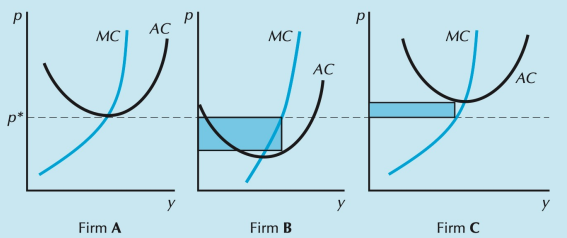
The industry supply curve. The industry supply curve ($S_1 + S_2$) is the sum of the individual supply curves (S_1 and S_2).

- The individual supply: $S_i(p) = y^*$.
- In the short run, the number of firms n is fixed.
- The industry supply: $S(p) = \sum_{i=1}^{n} S_i(p)$.

- Write p as a function of S to derive the industry supply curve.
- The industry (market) supply curve is the **horizontal sum** of individual supply curves.

Industry Equilibrium (p^*, Q^*) in the Short Run

Equilibrium: Intersection of Market Supply and Market Demand



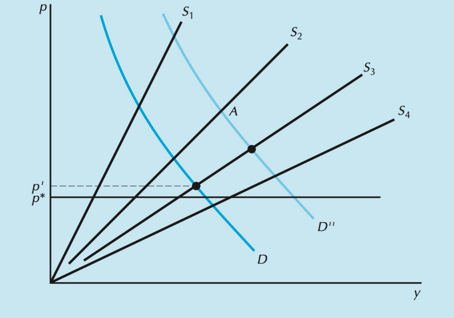
Short-run equilibrium. An example of a short-run equilibrium with three firms. Firm A is making zero profits, firm B is making positive profits, and firm C is making negative profits, that is, making a loss.

1. Find the equilibrium price p^*: $S(p^*) = D(p^*)$.
2. Find individual supply: $S_i(p^*)$.
3. The profit of a firm may be negative in the short run if $p^* < AC(S_i^*)$.
4. The profit of the industry may be negative, zero, or positive.

$\Rightarrow$ The number of firms adjusts accordingly in the long run.

Industry Equilibrium in the Long Run

In the Long Run: The Number of Firms (n) is Endogenous



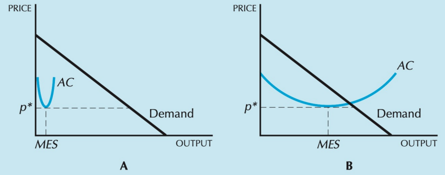
Industry supply curves with free entry. Supply curves for $1, \ldots, 4$ firms. The equilibrium price, p', occurs at the lowest possible intersection of demand and supply such that $p' \geq p^*$.

Note: In graph above, $p^* := \min AC$, p' is the equilibrium price

- No fixed costs (**free exit**): a firm exits if $p \geq AC \Rightarrow \pi \geq 0$
- **Free entry**: more firms if $\pi > 0$, no more until $\pi = 0$
- The minimum value of average cost: $p^* = \min AC$
- The equilibrium price, p', occurs at the lowest possible intersection of demand and supply such that $p' \geq \min AC$

What Determines the Market Size in the Long Run?

Demand relative to Minimum Efficient Scale (MES) (Ch 25)



Demand relative to minimum efficient scale. (A) If demand is large relative to the minimum efficient scale, a competitive market is likely to result. (B) If it is small, a monopolistic industry structure is possible.

- The minimum value of average cost: $p^* = \min AC$
- **Minimum Efficient Scale (MES)**: the individual supply at $\min AC$
- Suppose firms have the same technology; then, the number of firms is $n = \left\lfloor \frac{D(p^*)}{MES} \right\rfloor$ (rounding down).
- Monopoly if $n = 1$.

Example: Equilibrium in the Short Run and in the Long Run

Consider a demand function equal to $D(p) = 80 - 5p$

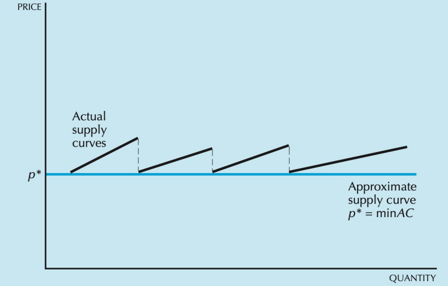
- Assume that all the firms have the same cost function: $c(y) = y^2 + 4$ if $y > 0$.
- What is the market equilibrium in the long run (with free entry)?

The Long-run Equilibrium

- The equilibrium price: $p^* = \min AC = \min \frac{y^2+4}{y} = 4$
- The equilibrium quantity: $D(p^*) = 60$
- Individual supply: $MES = 2$ ($y = 2$ as $p^* = MC = AC = 4$)
- The equilibrium number of firms: $n = \frac{D(p^*)}{MES} = \frac{60}{2} = 30$

Industry Supply Curve in the Long Run

Flat Supply Curves in Mature Industries



Approximate long-run supply curve. The long-run supply curve will be approximately flat at price equals minimum average cost.

- Part of the supply curves can be eliminated by the market demand curve.
- If there are a reasonable number of firms in the long run, the equilibrium price cannot get far from the minimum average cost.
- In an industry with free entry, profits will be driven to zero by new entrants.

Why Zero Profits in the Long Run?

Factor Prices Adjust with Output Price

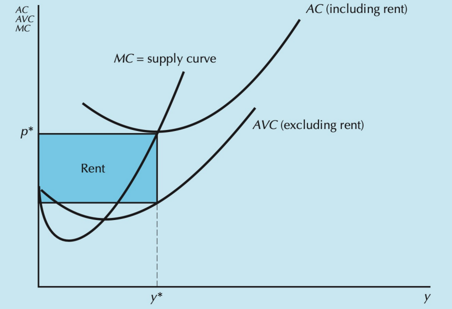
The inverse factor demand curve. This measures what the price of factor 1 must be to get x_1 units demanded if the level of the other factor is held fixed at x_2^*.

- Profit Maximization in one step: $\max_{x_1,x_2} \quad pf(x_1,x_2) - w_1x_1 - w_2x_2$
- The value of the marginal product of each factor should equal its price: $pMP_1(x_1^*,x_2^*) = w_1$, $pMP_2(x_1^*,x_2^*) = w_2$
- Write the factor price as a function of the factor demanded:

$\Rightarrow$ **Inverse factor demand curve**: $w_1 = pMP_1(x_1,x_2^*)$, $w_2 = pMP_2(x_1,x_2^*)$

Why Zero Profits in the Long Run?

The Possibility of Entry Drives Profits to Zero.

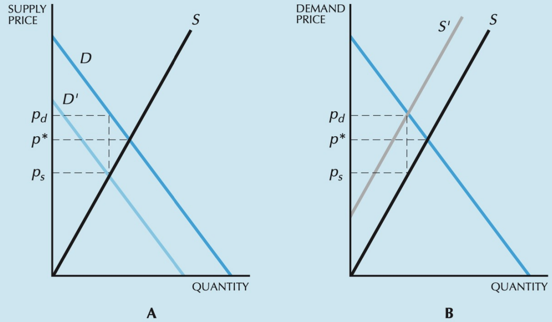


Economic rent for land. The area of the box represents the economic rent on the land.

- Whenever there is some factor that is preventing entry into an industry, there will be an equilibrium **rental** rate for that factor.
- **Economic rent**: payments to a factor of production that are in excess of the minimum payment necessary to have that factor supplied.
- Zero profit if all factors are measured at market prices/opportunity costs (including economic rent).

Who Bears the Tax More?

Tax on Producers or Consumers: It Doesn't Matter



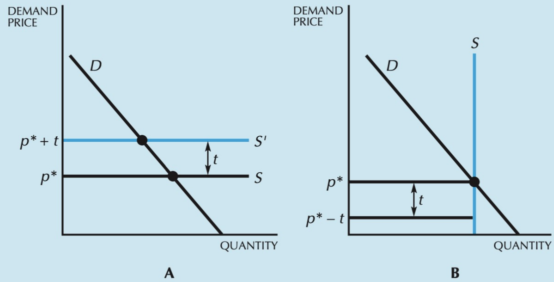
The imposition of a tax. In order to study the impact of a tax, we can either shift the demand curve down, as in panel A, or shift the supply curve up, as in panel B. The equilibrium prices paid by the demanders and received by the suppliers will be the same either way.

- A tax $t = p^d - p^s$
- Tax on consumers: shift the market demand curve down
- Tax on producers: shift the market supply curve up
- $\Rightarrow$ same equilibrium quantity, same price received by a consumer(p^d) or a supplier (p^s).

- Who Bears the Tax More? $p^d - p^* = \Delta p = ?$

Extreme Cases

Perfectly Elastic Supply and Perfectly Inelastic Supply

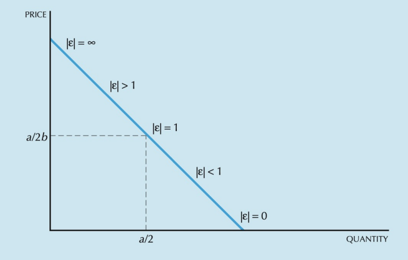


Special cases of taxation. (A) In the case of a perfectly elastic supply curve the tax gets completely passed along to the consumers. (B) In the case of a perfectly inelastic supply none of the tax gets passed along.

- Consumers bear all tax:
  $\Delta p = p^d - p^* = t$
  - Perfectly Elastic Supply
  - Perfectly Inelastic Demand
- Producers bear all tax:
  $\Delta p = p^d - p^* = 0$
  - Perfectly Inelastic Supply
  - Perfectly Elastic Demand

Tax Incidence Depends on Price Elasticity of Demand and Supply

Price elasticity: $\epsilon = \frac{\Delta q/q}{\Delta p/p}$



The elasticity of a linear demand curve. Elasticity is infinite at the vertical intercept, one halfway down the curve, and zero at the horizontal intercept.

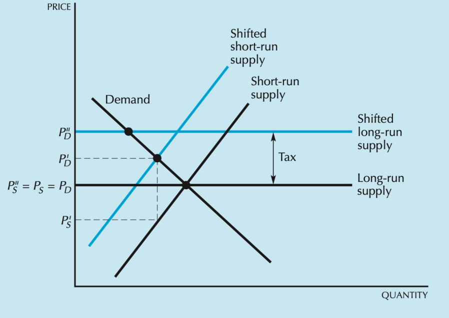
- **Price Elasticity**: percentage change in quantity when price changes by one percent
- Price Elasticity of Demand: $\epsilon^D = \frac{\Delta D/D}{\Delta p/p}$
- Price Elasticity of Supply: $\epsilon^S = \frac{\Delta S/S}{\Delta p/p}$
- Before Tax: $S(p) = D(p)$, $\Delta t \Rightarrow \Delta p$
- After Tax: $S(p + \Delta p) = D(p + \Delta p + \Delta t)$

$\Rightarrow \frac{\Delta p}{\Delta t} = \frac{D'(p)}{S'(p) - D'(p)} = \frac{\epsilon^D}{\epsilon^S - \epsilon^D}$

$\Rightarrow$ The more elastic the market demand/supply, the smaller tax burden on consumers/firms.

Taxation in the Short Run and Long Run

In an Industry with Free Entry



Taxation in the short run and long run. In the short run, with a fixed number of firms, the industry supply curve will have an upward slope, so that part of the tax falls on the consumers and part on the firms. In the long run, the industry supply curve will be horizontal so all of the tax falls on the consumers.

- Suppose the short-run industry supply (demand) curve is upward (downward) sloping.

$\Rightarrow$ Part of the tax falls on the consumers and part on the firms.

- Suppose in the long-run equilibrium: $n < \infty$, $\pi = 0$.

$\Rightarrow$ Long run supply curve is horizontal: $\epsilon^S = +\infty$.

$\Rightarrow$ All of the tax falls on the consumer.

Thank You!