Microeconomics Review: Perfect Competition

Reference: Carlton and Perloff, Chapter 3

Assumptions/Framework

- All firms sell an **identical product** (consumers view the product sold by each firm as the same)
  - Product is ***homogeneous***

- Firms and consumers are **price takers**

Firm Behavior

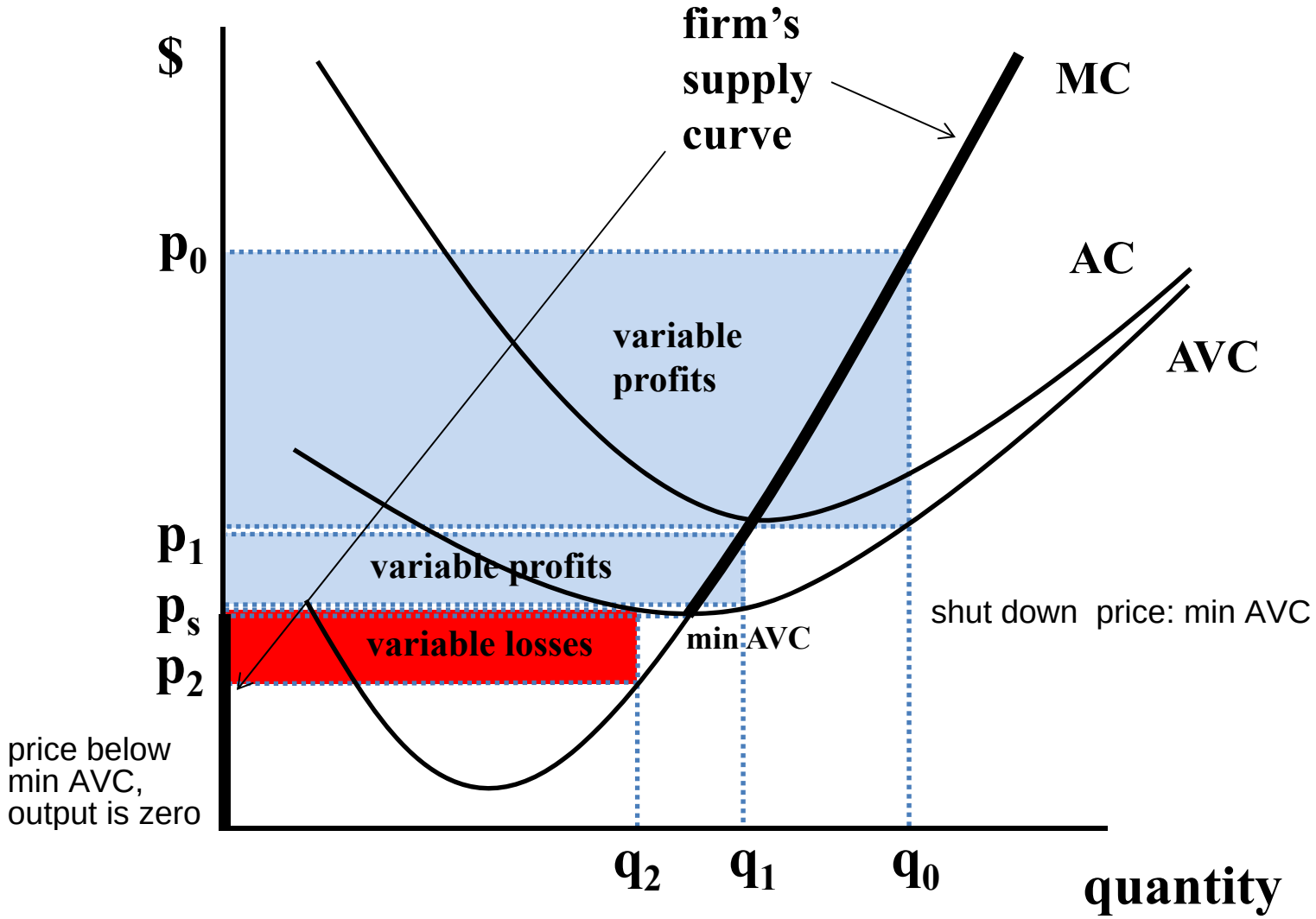
- To maximize profit a firm of *any type* **equates marginal revenue with marginal cost**.
- Profits: $\pi(q) = R(q) - C(q)$
- First-order condition:

$$\frac{\partial \pi(q)}{\partial q} = \frac{\partial R(q)}{\partial q} - \frac{\partial C(q)}{\partial q} = 0 \Rightarrow MR = MC$$

- Since the firm is a price taker, the revenue from selling another unit (the marginal revenue) is equal to the market price (MR = p). So in perfect competition **price equals marginal cost**.

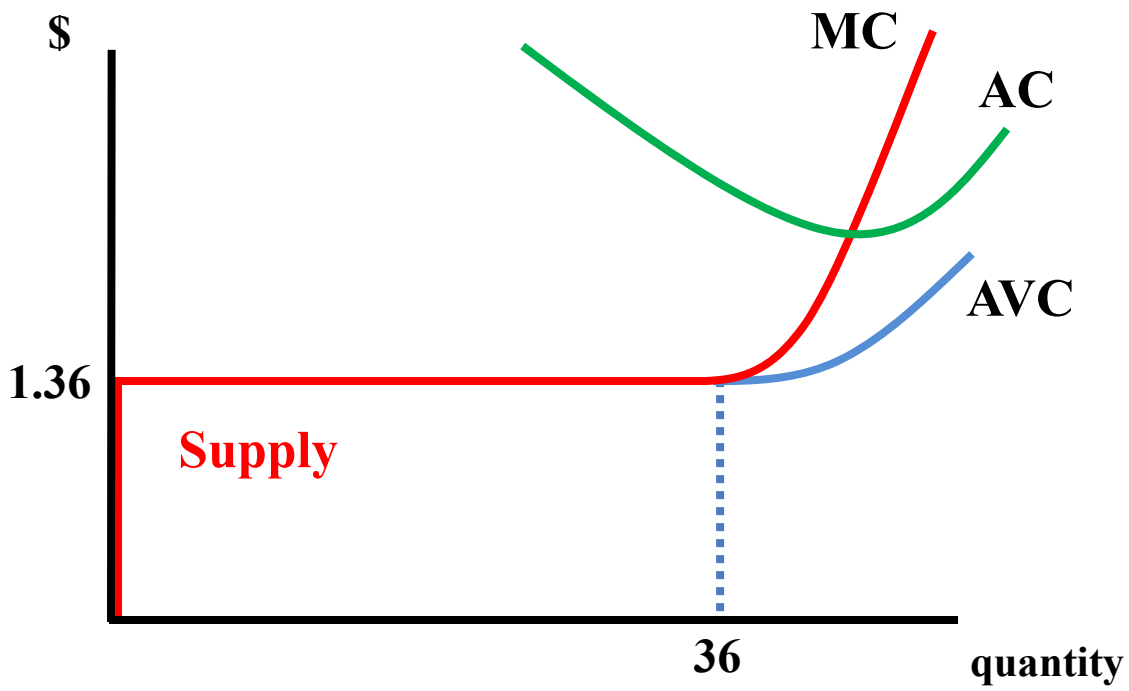
Cost curves and SR profit maximization

In the short-run, a firm produces only if p > AVC.



Empirical Example – Corn farmer

- Agricultural markets are the classic example of PC
- A single farmer's output is very small relative to market output and the product is homogeneous
- Below are estimated cost curves for a typical US corn farmer
- MC is constant for quantities in which the farmer is not land constrained
- The MC curve rises quickly after 36k bushels when land is a constraint
- The min AVC occurs at $1.36. Below $1.36, quantity supplied is 0. At $1.36 the farmer is willing to supply up to 36k bushels. At $1.36 and above, the supply curve coincides with MC

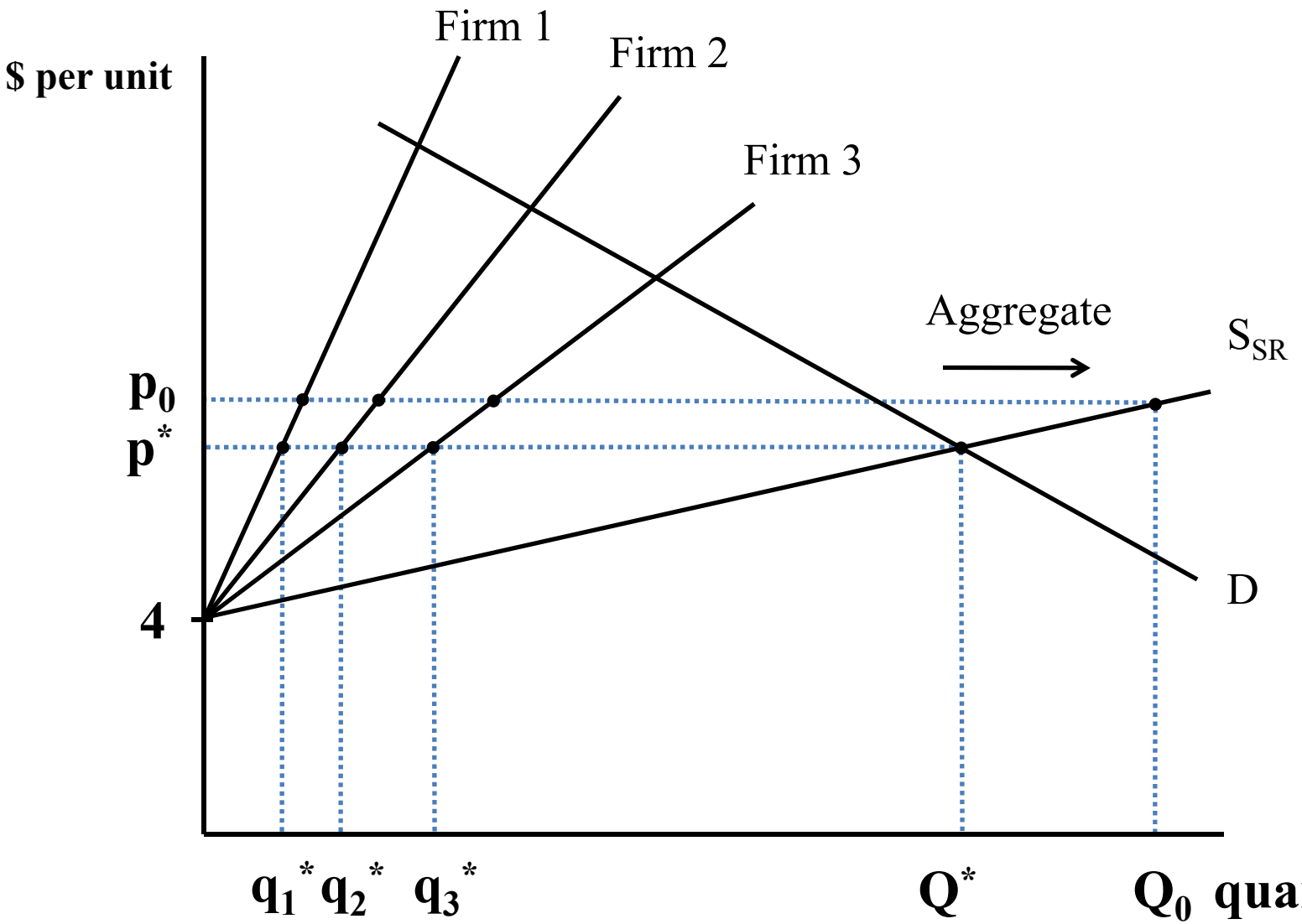


Short-run Market Supply Curve

- The short-run market supply curve is the *horizontal summation* of the individual firm's supply function
- Example: 3 firms
  - $C(q_1) = 4q_1 + 3q_1^2$ ➔ $MC(q_1) = 4 + 6q_1$
  - $C(q_2) = 4q_2 + 2q_2^2$ ➔ $MC(q_2) = 4 + 4q_2$
  - $C(q_3) = 4q_3 + q_3^2$ ➔ $MC(q_3) = 4 + 2q_3$
- Firm's supply (from p = MC) and market supply is then

$$q_1 = \begin{cases} \dfrac{p-4}{6} & if \quad p \geq 4 \\ 0 & if \quad p < 4 \end{cases} \quad \rightarrow \quad Q = q_1 + q_2 + q_3 = \begin{cases} \dfrac{11p-44}{12} & if \quad p \geq 4 \\ 0 & if \quad p < 4 \end{cases}$$

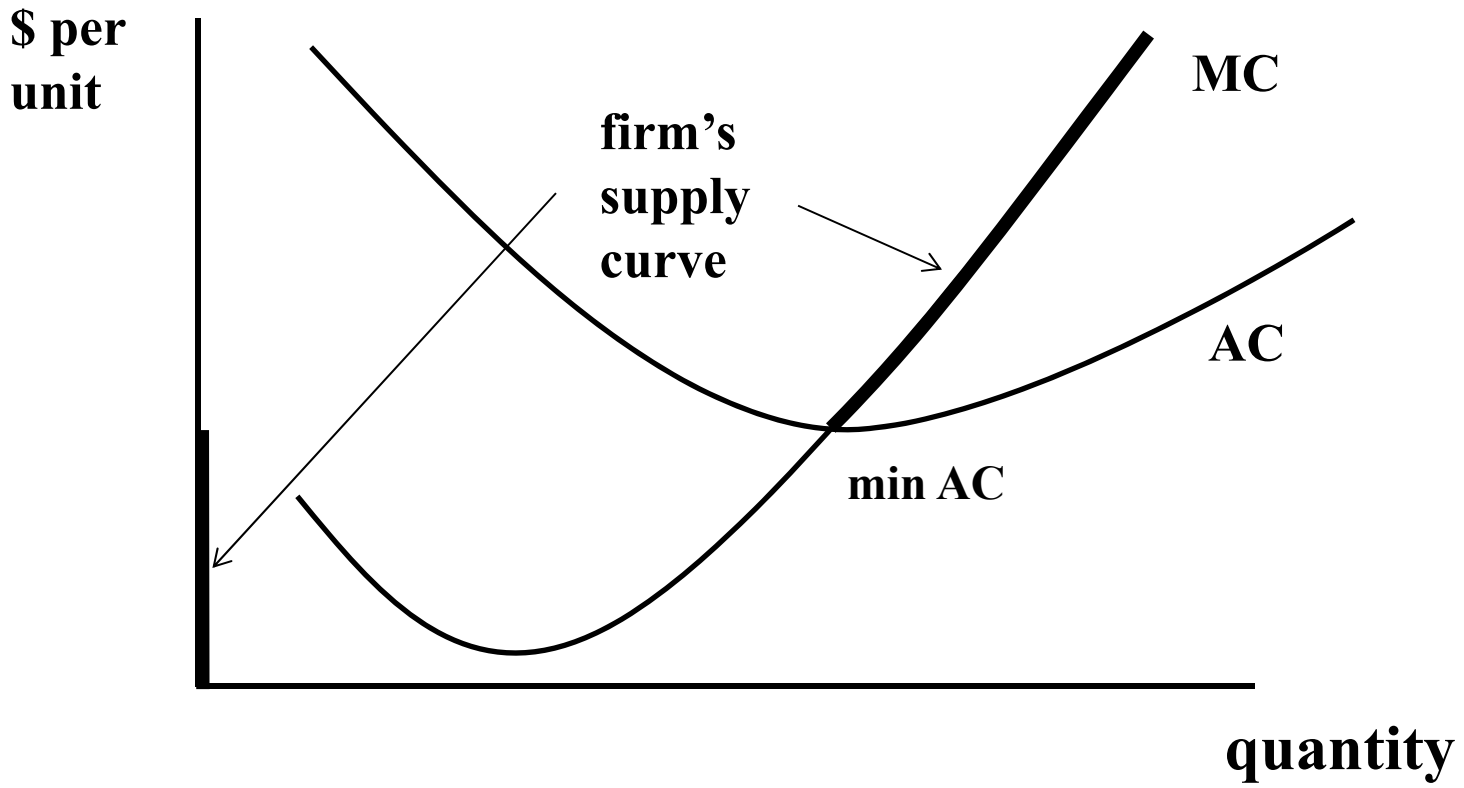
Short-run Equilibrium



summation of q1,q2 and q3

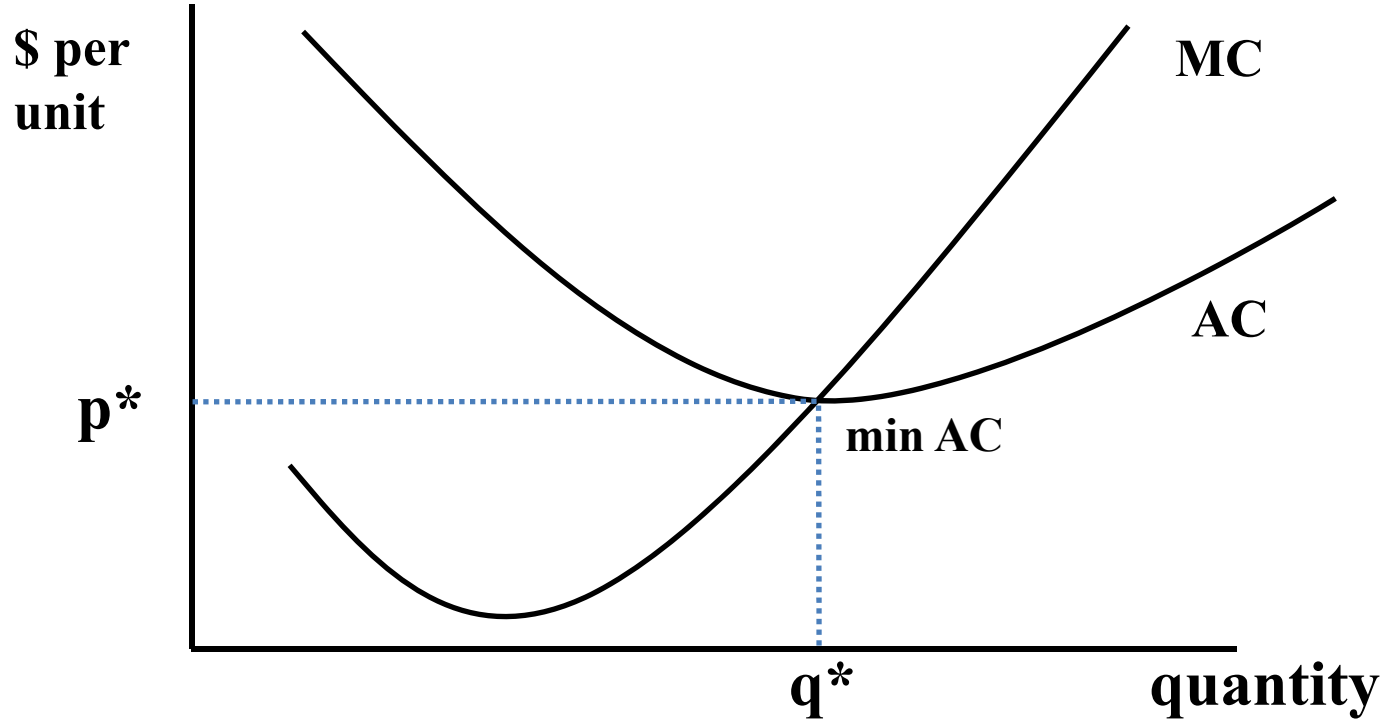
Long-run Firm Supply

- In the long run, firms can alter all inputs, including plant size, and firms can enter and exit the market all costs are variable
- The relevant cost curves are the MC and AC curves



Long-run Equilibrium

- In the long run, p* = min AC
  - At a price higher than min AC firms are making a profit which induces entry and expansion ➔ price decreases
  - At a price lower than min AC firms are losing money which induces exit and contraction ➔ price increases



Long-run Equilibrium

- Formally, in the long run, the equilibrium is defined as price, p*, quantity Q*, and number of firms n*, such that:
  - Each firm's profit is zero
  - Quantity demanded equals quantity supplied
- In the previous slide we saw how to find p* and q*
- Find Q* from the demand curve and n* = Q* / q*

Elasticities and Residual Demand Curve

- **Elasticity of Demand, ε**: % change in the quantity demanded in response to a small % increase in price

$$\varepsilon = \frac{\Delta Q / Q}{\Delta p / p} = \frac{\Delta Q}{\Delta p}\frac{p}{Q} = \frac{\partial Q}{\partial p}\frac{p}{Q}$$

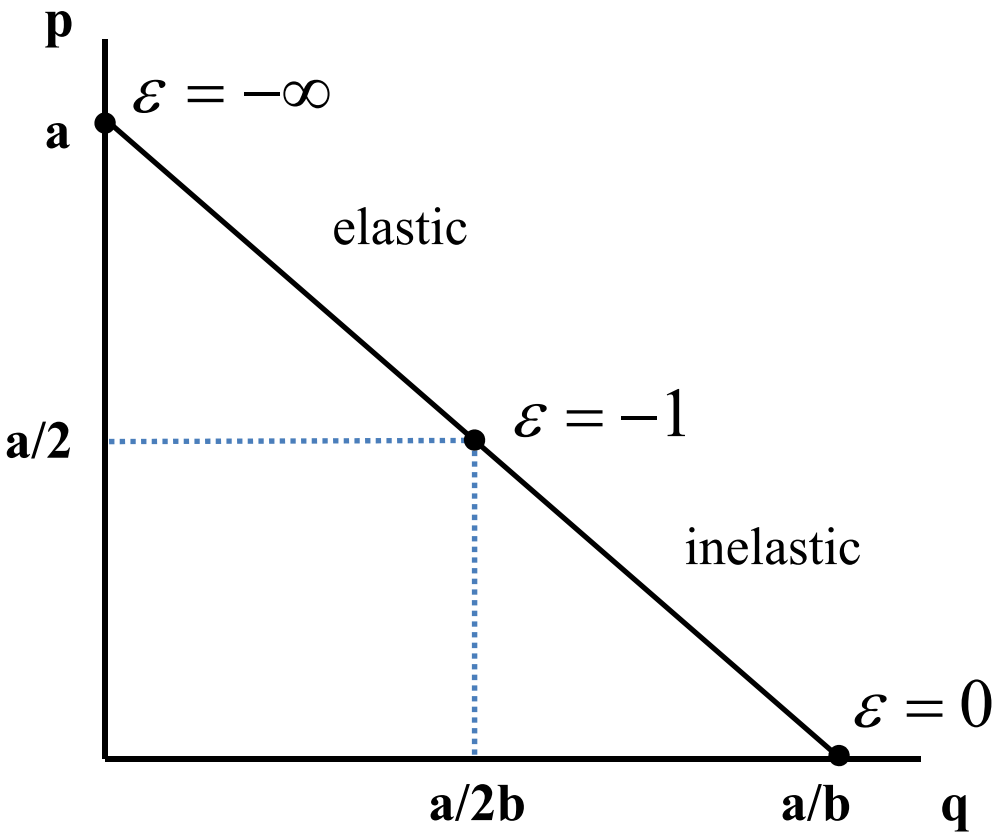
  - If $-1 < \varepsilon < 0$, then demand is inelastic.
  - If $\varepsilon = -1$, then demand is unit elastic.
  - If $\varepsilon < -1$, then demand is elastic.
  - The elasticity of demand depends on the availability of substitutes

- **Elasticity of Supply**, **η**: % change in the quantity supplied in response to a small % increase in price.
  - The elasticity of supply will depends on how quickly the firm can increase production

positive number, when price increases the supply rises.

Example. Linear Demand

$$p = a - bq \rightarrow q = \frac{a}{b} - \frac{1}{b}p \qquad \varepsilon = \frac{\partial q}{\partial p}\frac{p}{q} = -\frac{1}{b}\left(\frac{p}{\frac{a}{b} - \frac{1}{b}p}\right) = -\frac{p}{a-p}$$



$$p = 0 \quad \rightarrow \quad \varepsilon = 0$$

$$p = \frac{a}{2} \quad \rightarrow \quad \varepsilon = -1$$

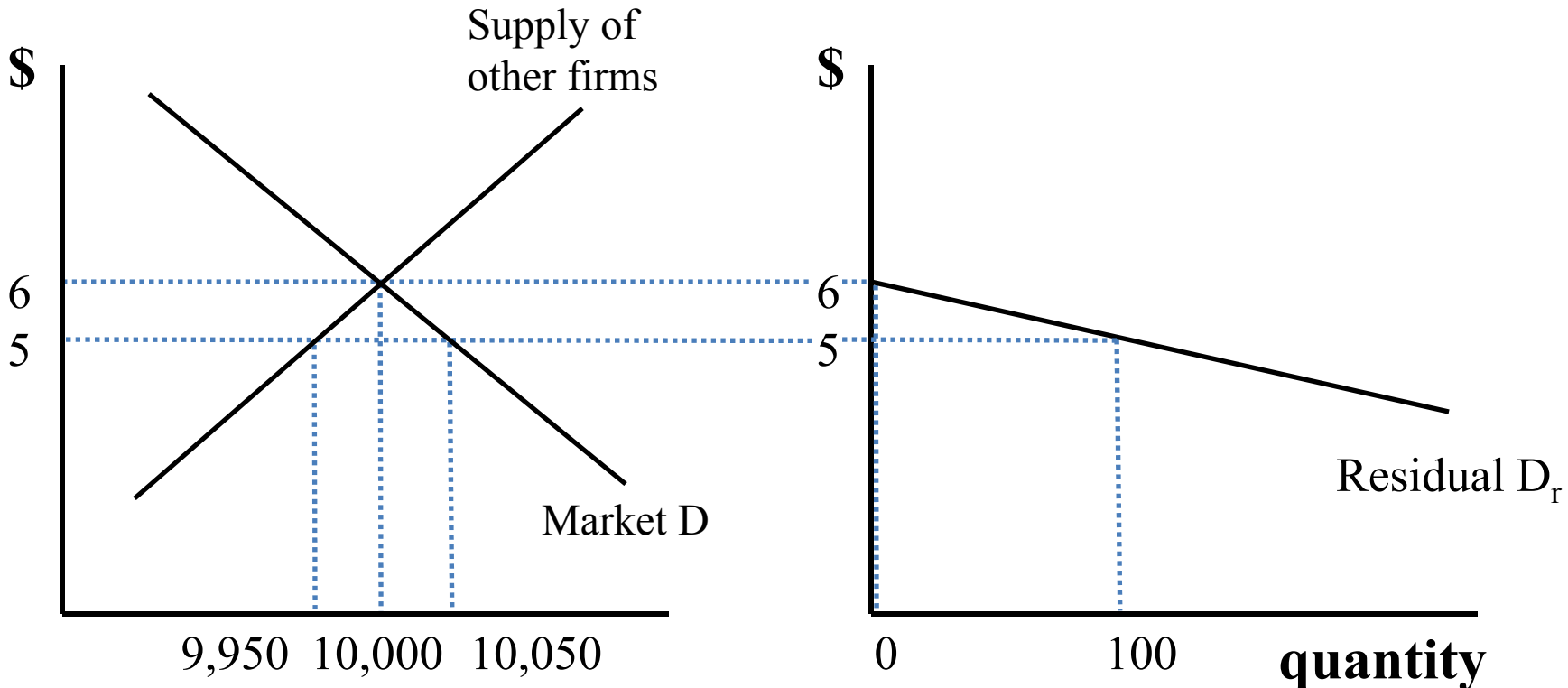
$$p = a \quad \rightarrow \quad \varepsilon = -\infty$$

P is low
When P increases, percent change in P is high.
Q decreases, percent change in Q is low.

Elasticities and Residual Demand Curve

- The residual demand curve is the demand curve faced by one firm
- If there is a **large number of firms**, a firm's residual demand curve is nearly horizontal even when the market demand curve is downward sloping

alot of firms, thus sensitivity to a particular firm is much higher than to the entire market



10050-9950=100

Elasticities and Residual Demand Curve

- Since the demand curve faced by an individual firm is flatter, the elasticity of demand for a firm in many markets is **much greater** (in magnitude) than the market elasticity, practically infinite
  - If a firm tries to increase price above **p***, it will lose all its sales
- It can be shown that that $\varepsilon_i = \varepsilon n - \eta_0 (n-1)$ (where η_0 is the elasticity of supply of the other firms) do not need to know the derivation of the equation

Empirical example – agricultural products

Crop	*Estimated Market Demand Elasticity*	*Number of Farms*	*Each Farm's Residual Demand Elasticity*
Fruits	not very sensitive to the price of apples		
apples	-0.20	28,160	-5,620
grapes	-1.03	19,961	-20,560
peaches	-0.82	14,459	-11,856
Vegetables			
asparagus	-0.65	2,672	-11,140
cucumbers	-0.30	6,821	-2,046
dry onions	-0.16	3,296	-527
sweet peppers	-0.25	6,271	-1,568
tomatoes	-0.38	14,366	-5,459

Efficiency and Welfare

- A common measure of welfare (net economic benefit) is:
  - ***consumer surplus***: difference between the amount a consumer is willing to pay for a unit of a good and the amount actually paid for that unit
  - ***producer surplus***: difference between the amount that a producer receives from the sale of a unit and the amount that the unit cost to produce
  - ***total surplus*** = ***producer surplus*** + ***consumer surplus***
- We will use these measures to show that a competitive equilibrium is efficient: resources are allocated to their most valued use

Efficiency and Welfare: Illustration

The demand curve measures the willingness to pay for each unit. Consumer surplus (CS) is the area between the demand curve and price.

The supply curve measures the marginal cost of each unit. Producer surplus (PS) is the area between the supply curve and price.

Total surplus is the sum of CS and PS. We now argue that the largest possible total surplus occurs at the competitive price (p_c).

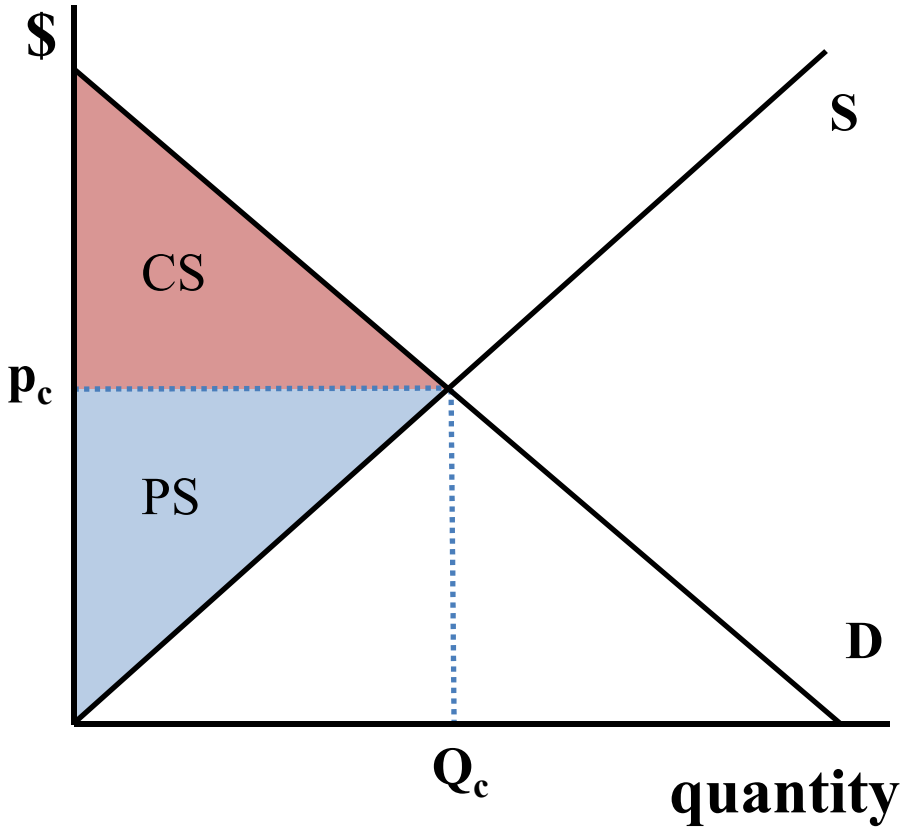


Illustration (cont.)

Suppose that a greater quantity Q_G is bought. Price has to fall to P_G.

CS increases by the yellow and green area

PS decreases by the yellow, green and orange area

The net effect is a decrease in total surplus equal to the orange area. This cost is called the dead weight loss (DWL) and means that this outcome is inefficient.