

# Perfect Competition & Welfare

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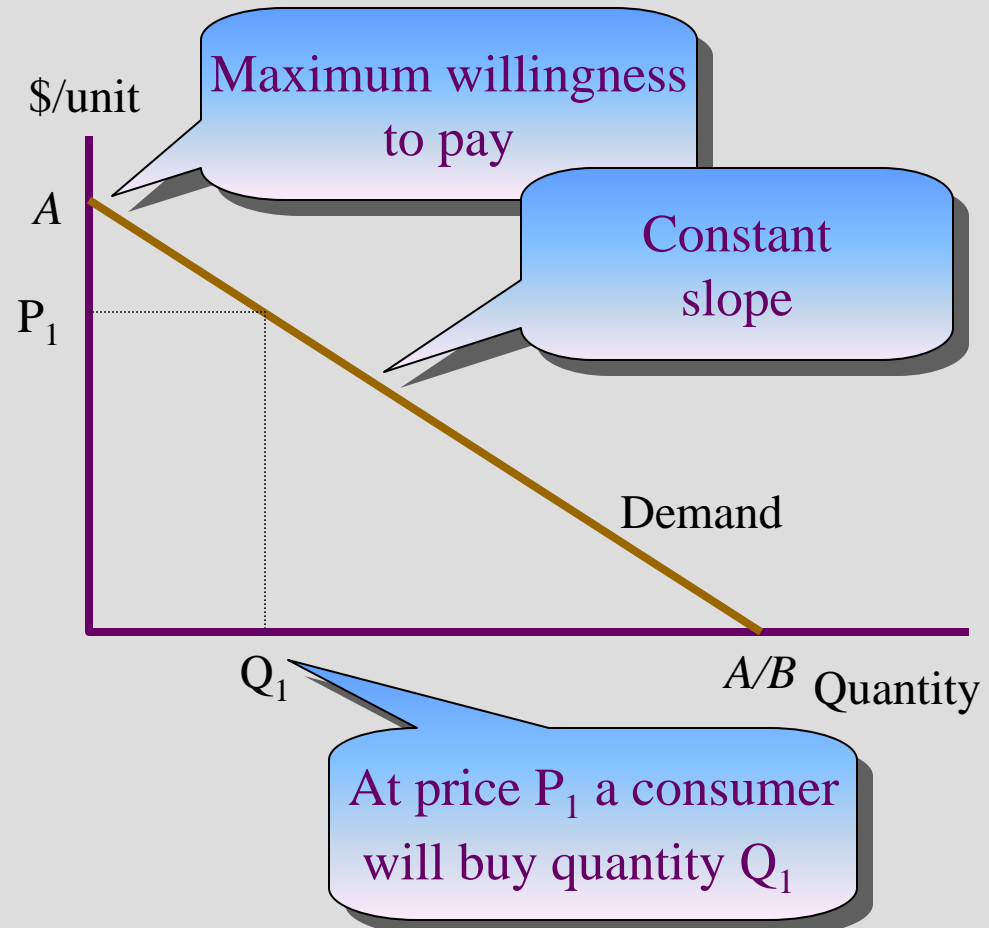
# Outline

- Derive aggregate supply function
  - Short and Long run equilibrium
  - Practice problem
  - Consumer and Producer Surplus
  - Dead weight loss
  - Practice problem
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- Focus on profit maximizing behavior of firms
- Take as given the **market demand curve**

Equation:  
 $P = A - B.Q$   
linear  
demand

- Inverse demand  
function:  
willingness to pay



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## Perfect Competition

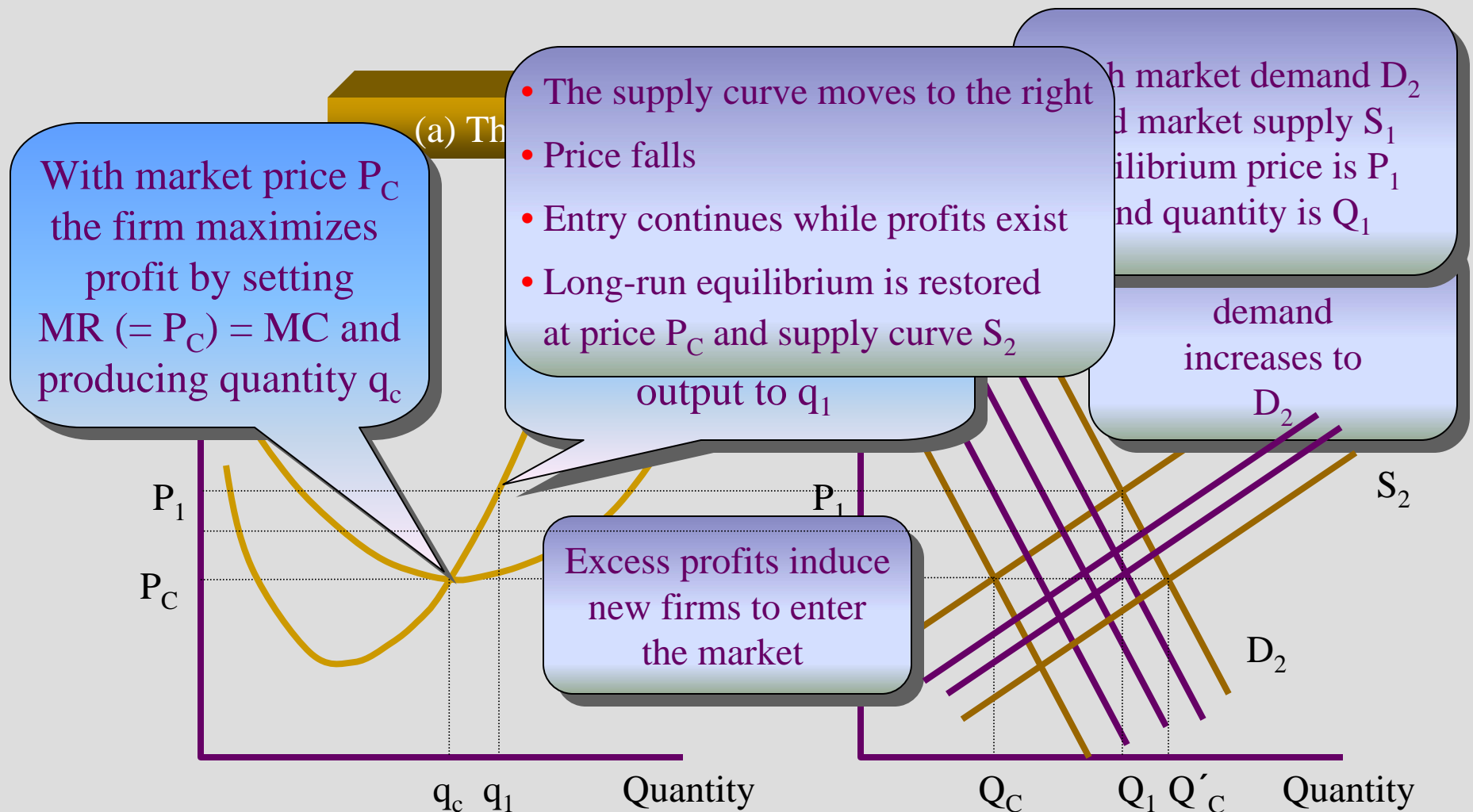
- Firms and consumers are *price-takers*
  - Firm can sell as much as it likes at the ruling market price
    - do not need many firms
    - do need the idea that firms *believe* that their actions will not affect the market price
  - Therefore, marginal revenue equals price
  - To maximize profit a firm *of any type* must equate marginal revenue with marginal cost
  - So in perfect competition price equals marginal cost
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$$MR = MC$$

- Profit is  $\pi(q) = R(q) - C(q)$
  - Profit maximization:  $d\pi/dq = 0$
  - This implies  $dR(q)/dq - dC(q)/dq = 0$
  - But  $dR(q)/dq = \text{marginal revenue}$
  - $dC(q)/dq = \text{marginal cost}$
  - So profit maximization implies  $MR = MC$
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## Perfect competition: an illustration



## Perfect competition: additional points

- Derivation of the short-run supply curve
  - this is the *horizontal* summation of the individual firms' marginal cost curves

Example 1: Three firms

Firm 1:  $q = MC/4 - 2$

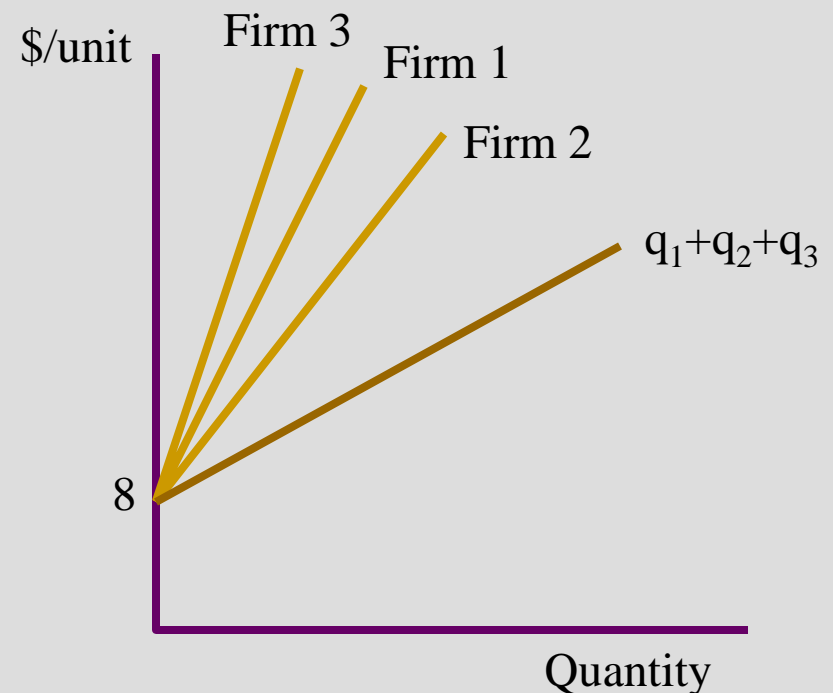
Firm 2:  $q = MC/2 - 4$

Firm 3:  $q = MC/6 - 4/3$

Invert these

Aggregate:  $Q = q_1 + q_2 + q_3$   
 $= 11MC/12 - 22/3$

$MC = 12Q/11 + 8$



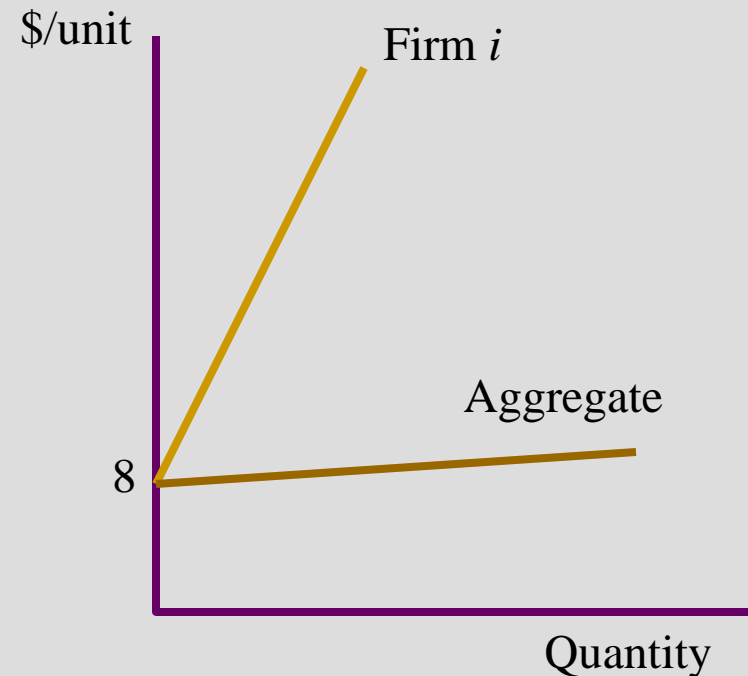
### Example 2: Eighty firms

$$\text{Each firm: } q = MC/4 - 2$$

Invert these

$$\begin{aligned}\text{Aggregate: } Q &= 80q \\ &= 20MC - 160\end{aligned}$$

$$MC = Q/20 + 8$$



- Definition of ***normal profit***
  - not the same as zero profit
  - implies that a firm is making the market return on the assets employed in the business



# Practice problem

$$\text{Demand : } Q^D = \frac{6000 - 50P}{9}$$

$$\text{Inverse Demand : } P = 120 - \frac{9}{50}Q^D$$

$$TC(q) = 100 + q^2 + 10q$$

Initial number of firms = 20

- 1) Find short run equilibrium
- 2) Find long run equilibrium

## Short run

$$Q^D = \frac{6000 - 50 P}{9}$$

$$TC(q) = 100 + q^2 + 10 q$$

$$mc = 2 q + 10$$

$$q^s = \frac{p - 10}{2}$$

$$Q^s = 10 p - 100$$

$$D = S \Rightarrow 10 p - 100 = \frac{6000 - 50 p}{9}$$

$$p = \frac{6900}{140} \approx 49.3$$

## Long run

- $P = \text{min avg cost}$
- Point at which  $MC=AC$

$$mc = 2q + 10$$

$$ac = \frac{100}{q} + q + 10$$

$$mc = ac \Rightarrow 2q + 10 = \frac{100}{q} + q + 10$$

$$q = 10$$

$$p = 30$$

$$Q = \frac{6000 - 50p}{9} = \frac{4500}{9} = 500$$

$$nq = Q \Rightarrow n = Q / q = 500 / 10 = 50$$

## Efficiency and Surplus

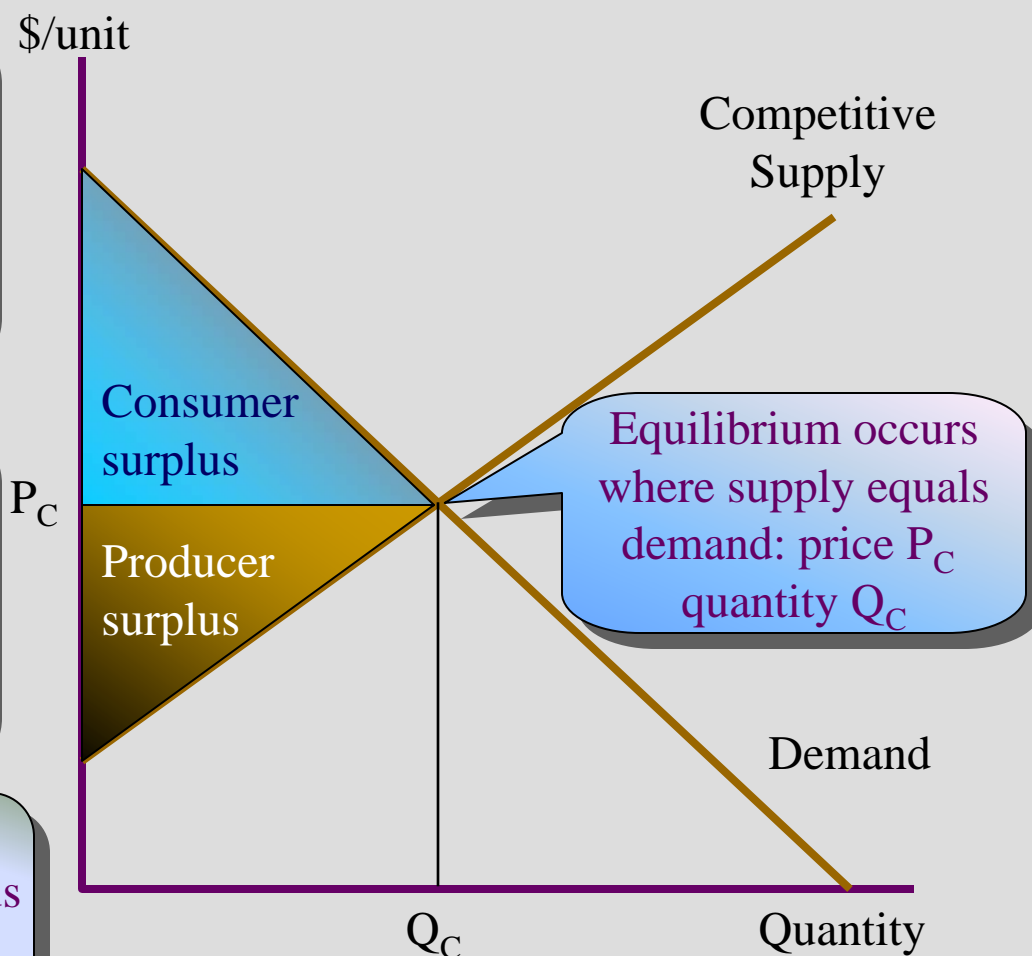
- Can we reallocate resources to make some individuals better off without making others worse off?
- Need a measure of well-being
  - **consumer surplus:** difference between the maximum amount a consumer is willing to pay for a unit of a good and the amount actually paid for that unit
  - aggregate consumer surplus is the sum over all units consumed and all consumers
  - **producer surplus:** difference between the amount a producer receives from the sale of a unit and the amount that unit costs to produce
  - aggregate producer surplus is the sum over all units produced and all producers
  - **total surplus** = consumer surplus + producer surplus

## Efficiency and surplus: illustration

The demand curve measures the willingness to pay for each unit  
Consumer surplus is the area between the demand curve and the equilibrium price

The supply curve measures the marginal cost of each unit  
Producer surplus is the area between the supply curve and the equilibrium price

Aggregate surplus is the sum of consumer surplus and producer surplus  
**The competitive equilibrium is efficient**

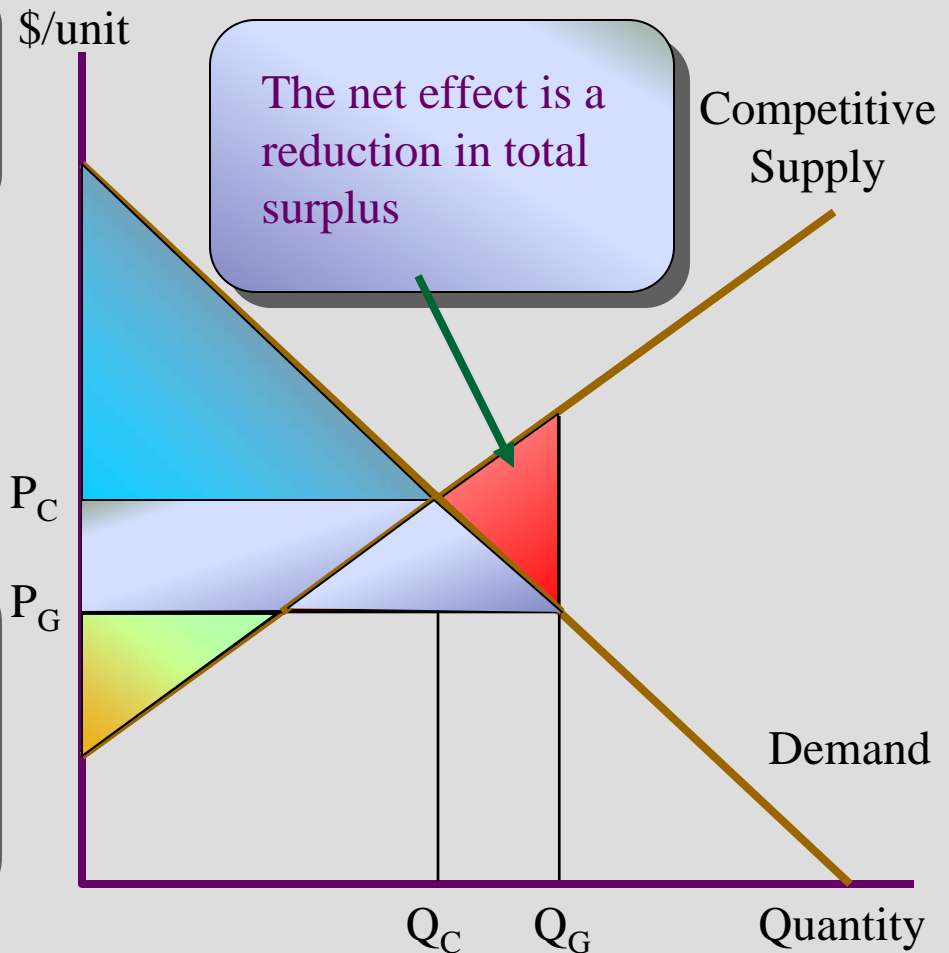


## Illustration (cont.)

Assume that a greater quantity  $Q_G$  is traded  
Price falls to  $P_G$

Producer surplus is now a positive part and a negative part

Consumer surplus increases  
Part of this is a transfer from producers  
Part offsets the negative producer surplus

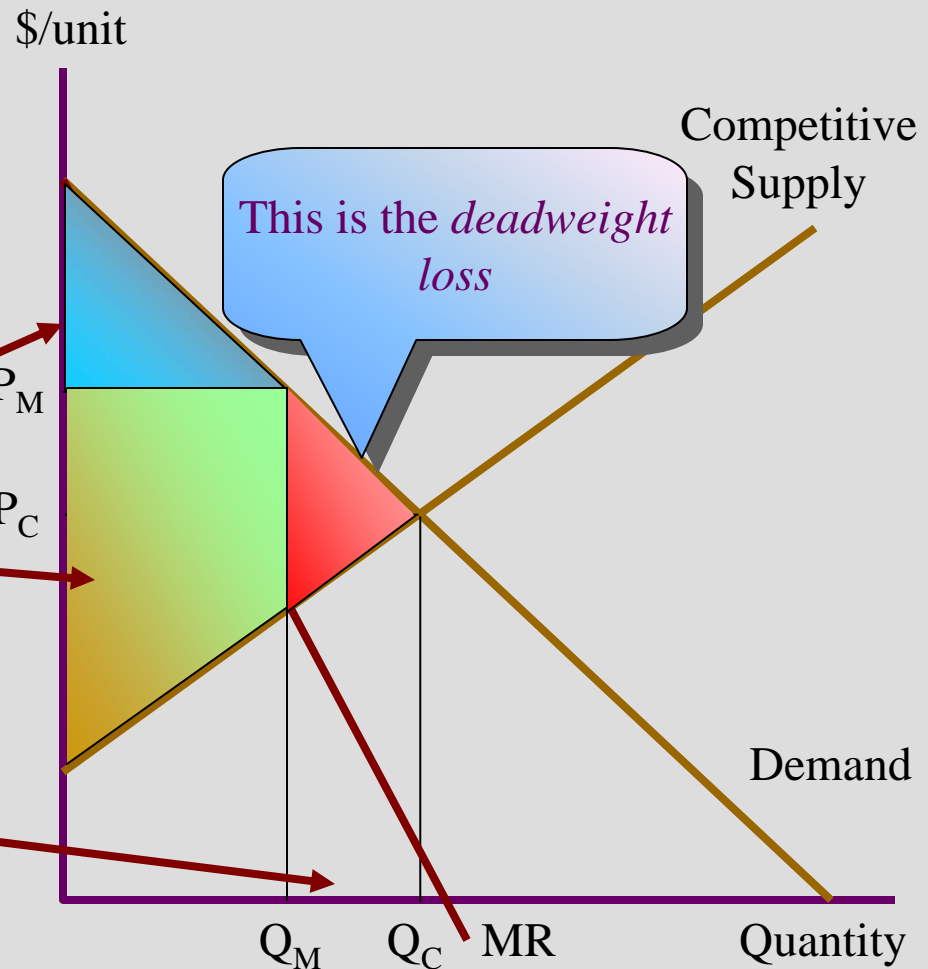


## Output restricted to $Q_M$

Suppose output is restricted to  $Q_M$   
The market clearing price is  $P_M$

Consumer surplus is given by this area  
And producer surplus is given by this area

There are mutually beneficial trades that do not take place:  
between  $Q_M$  and  $Q_C$



## Exercise

Consider a competitive industry where all firms are identical with cost function:  $C = 200 + q^2/2 + 10q$ .

Market demand is given by:  $p = 55 - Q/20$

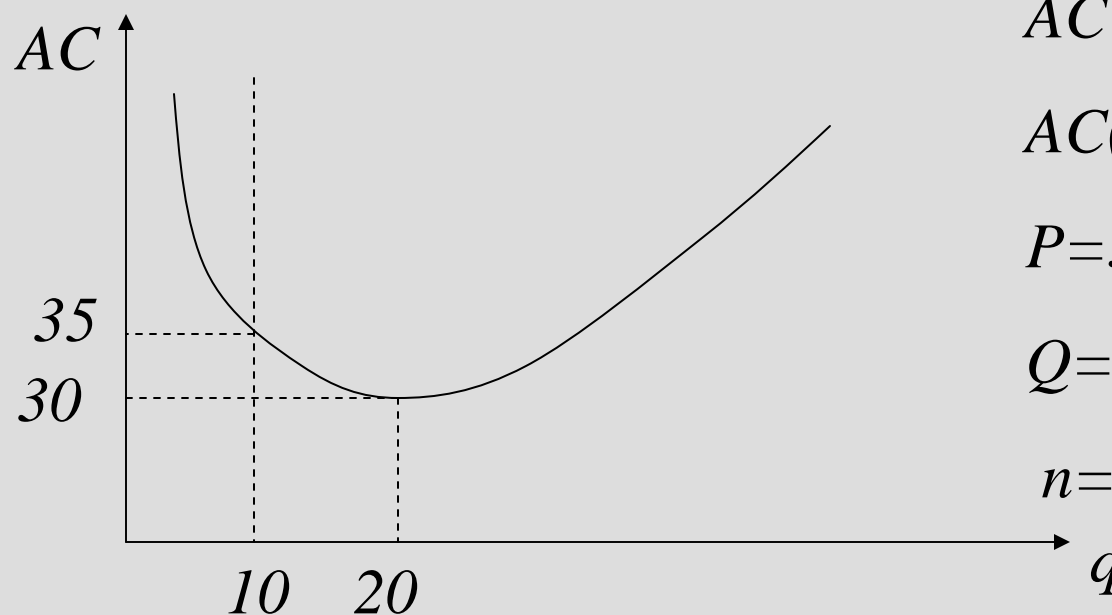
Find the long run equilibrium (price, quantity and number of firms.)

- $Mc = q + 10, AC = 200/q + q/2 + 10$
- Equating get:  $q/2 = 200/q \rightarrow q^2 = 400 \rightarrow q = 20$
- $p = mc = 30$
- Substituting in demand function:  $30 = 55 - Q/20 \rightarrow Q = 500$
- Number of firms  $nq = Q \rightarrow n = Q/q = 500/20 = 25$



## Exercise (continued)

*Suppose now the government introduces a regulation that limits the size of firms to no more than 10 units. Will there be exit or entry of firms? Find the new long run equilibrium.*



$$AC = 200/q + q/2 + 10$$

$$AC(10) = 35$$

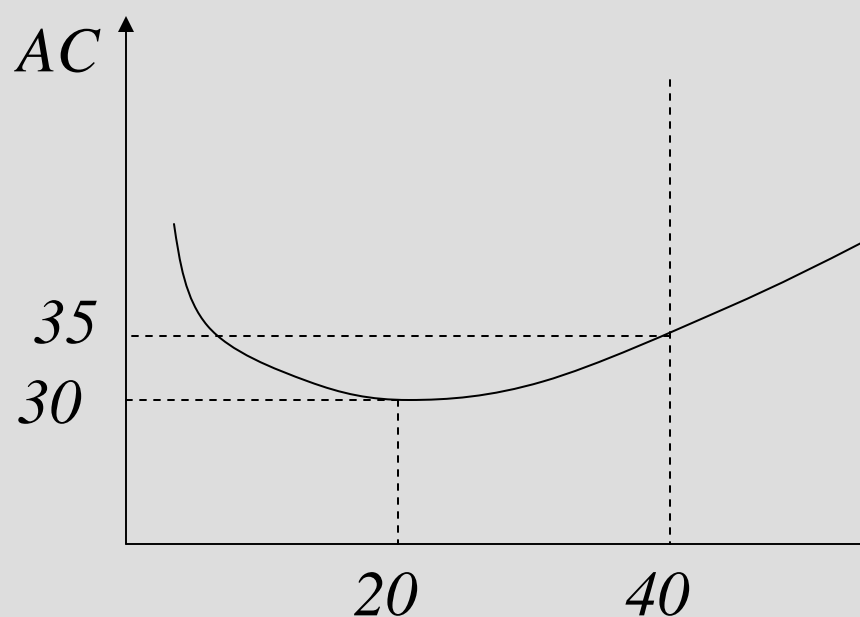
$$P = 35 = 55 - Q/20$$

$$Q = 400$$

$$n = 40$$

## Exercise (continued)

*Suppose now the government introduces a regulation that forces firms to produce no less than 40 units. Find the new long run equilibrium.*



$$AC = 200/q + q/2 + 10$$

$$AC(40) = 35$$

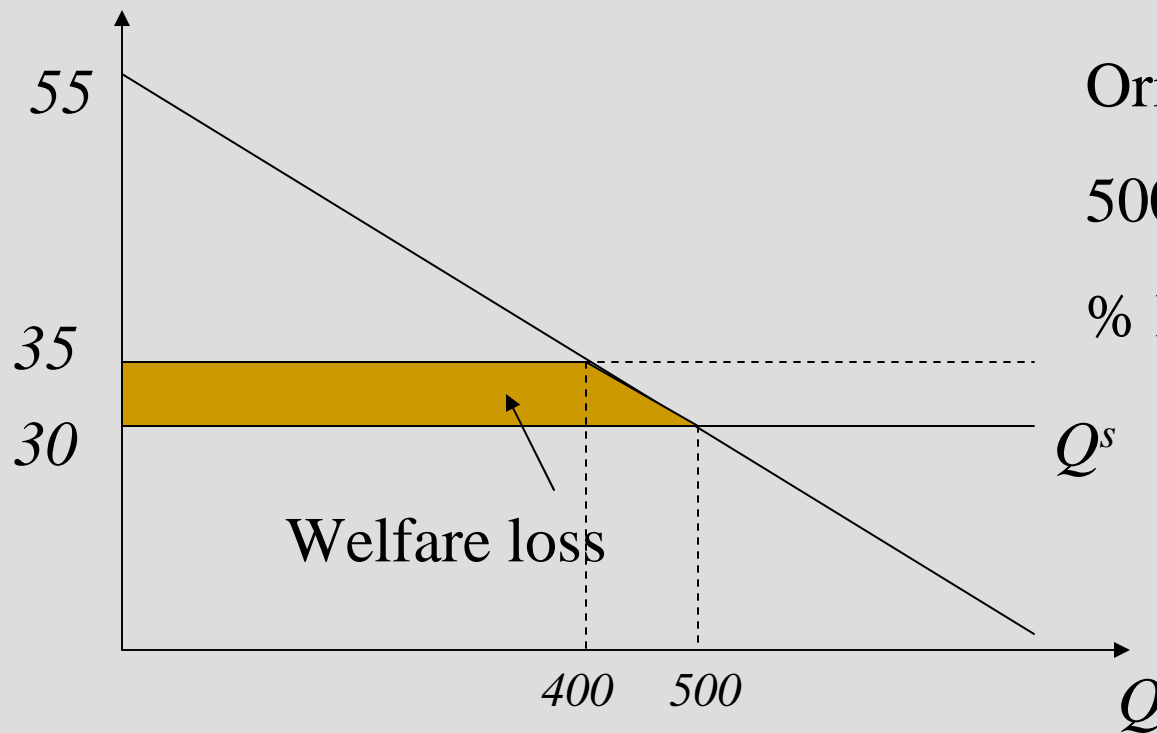
$$P = 35 = 55 - Q/20$$

$$Q = 400$$

$$n = 10$$

## Exercise (continued)

Welfare cost:



Welfare loss:

$$5 \cdot 400 + 100 \cdot 5/2$$

$$= 2,250$$

Original Surplus:

$$500 \cdot 25/2 = 6,250$$

$$\% \text{ loss} = 36\%$$