Chapter 4.1: Competitive Pricing

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4.1- Competitive Pricing

- Definition of competitive markets
- From individual to market supply functions
- Short-run price determination, firm profits and short-run producer welfare
- Long-run price determination and long-run producer welfare
- Producer, consumer and social welfare

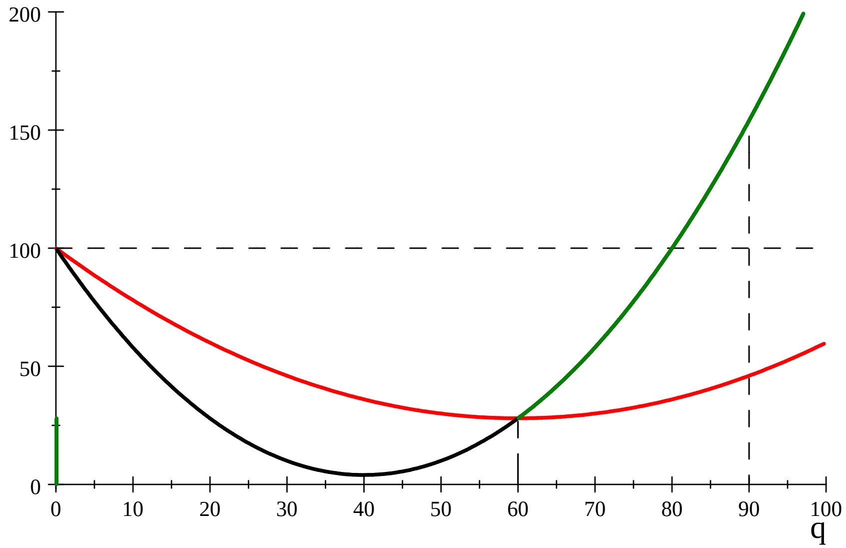
Definition of “Competitive Markets”

- Large number of firms producing a homogenous good (partial analysis)
- Firms maximise profits taking price as given
- All firms use same input and output prices
- Consumers and firms have perfect information
- Transactions are costless

Short-run price determination

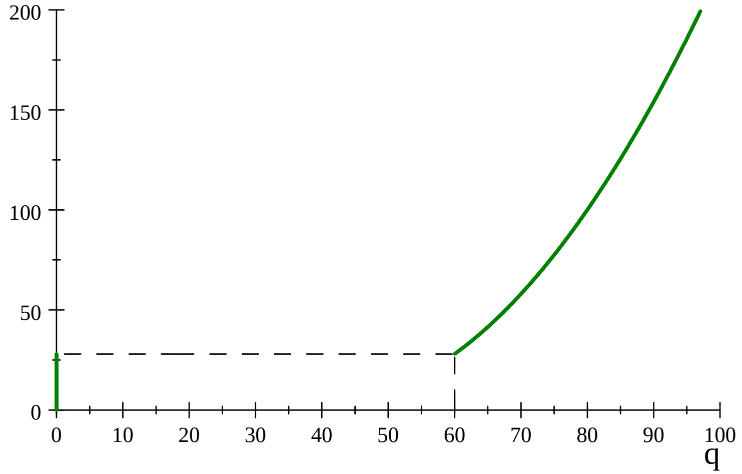
- Number of firms is fixed
- Some of the inputs might be fixed (e.g. capital)
- Firms choose quantities by altering the other (variable) inputs
- Input prices are fixed

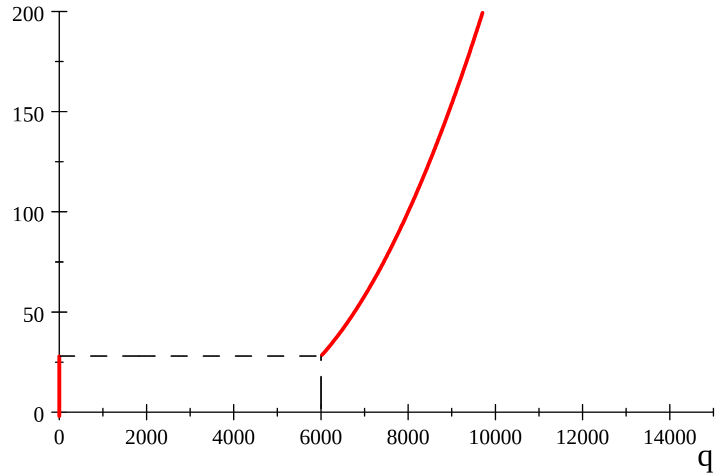
Individual supply function



- Short run marginal (black) and average costs (red) and supply function (green)
- Short-run supply function of one good by one firm

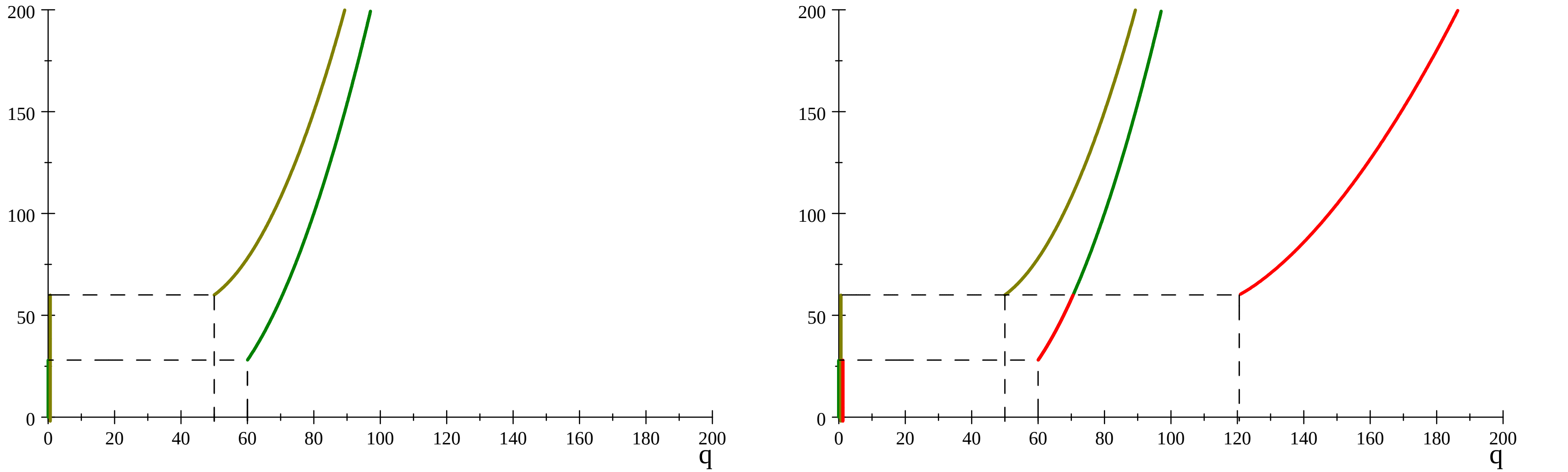
Market's supply function





- Market with 100 identical firms
- Individual (green, left) and market (red, right) supply

Another example



- Market with two different firms
- Individual (left, brown and green) and market (red, right) supply curves

Mathematically

- Short-run market supply function:

$$Q_s(w, r, P) = \sum_{i=1}^{n} q_i(w, r, P)$$

where $q_i(w, r, P)$ $(= q_i^*)$ short run supply for each firm and n number of firms

- Short-run supply elasticity:

$$e_{Q_s,P} \equiv \frac{\partial Q_s(w, r, P)}{\partial P} \frac{P}{Q_s(w, r, P)}$$

- $e_{Q_s,P} > 0$ as long as...

Remember the hamburgers?

- Cobb-Douglas $f(L,K) = 10K^{1/2}L^{1/2}$, $w = 0.25$ and $r = 1$, $K_1 = 2$:

$$STC = 2 + 0.25q^2/200$$

  and therefore

$$SMC = 0.5q/200 \quad \text{and} \quad SAVC = 0.25q/200$$

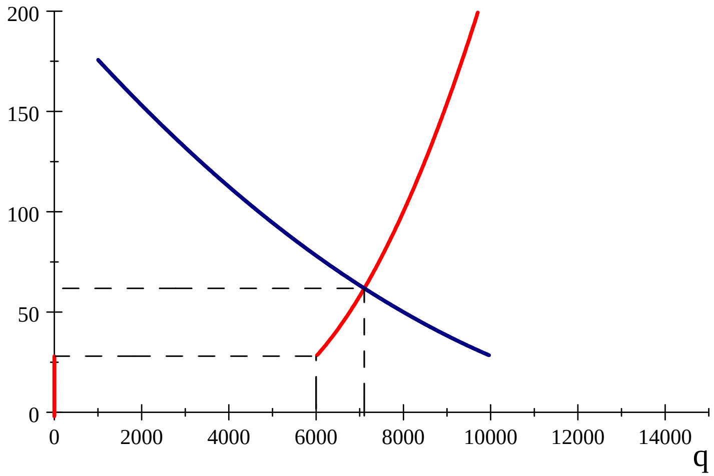
- Given that (i) $SMC'(q) > 0$ and (ii) $SMC > SAVC$ for any q, supply:

$$P = 0.5q/200 \quad \text{or} \quad q = 400P$$

- For $n = 100$ identical hamburger producers

$$Q_S = \sum_{i=1}^{100} 400P = 40000P \quad \text{and} \quad e_{Q_s,P} = 40000\frac{P}{40000P} = 1$$

Price determination



- (Short-run) market supply (red) and market demand (blue)
- Equilibrium price: $P^* = 61.822$ and quantity traded: $Q^* = 7104.5$

Mathematically

- Equilibrium price (P^*) is defined as

$$Q_D(P^*, P', I) = Q_S(P^*, r, w)$$

where P' price of other goods, I vector of individual incomes, r, w input prices

- P^* serves to signal each (price-taker) producer how much to produce
Each firm performs $MR = MC$, given technology and input prices. Total: Q^*

- P^* serves to signal each (price-taker) consumer how much to buy
Each consumer maximises utility, given preferences and income. Total: Q^*

- Equilibrium because all can buy and sell what they demand and produce at P^*

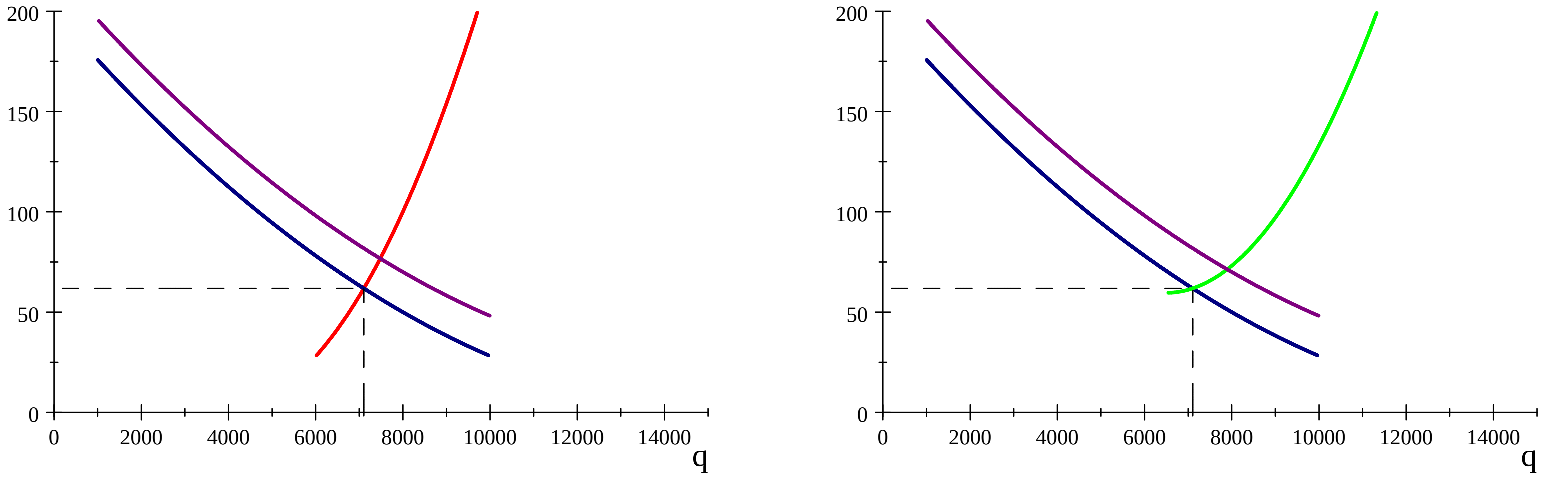
Supply and demand shifts

- Demand shifts because of a change in...
  Income(s), price(s) of other good(s), preferences

- Supply shifts because of a change in...
  Input price(s), number of producers, technology(ies)

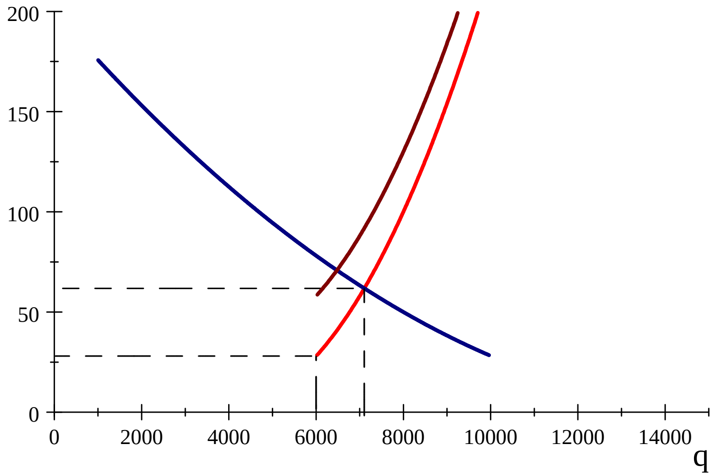
- A change in either of the two will change equilibrium price and quantity

Demand shifts upwards



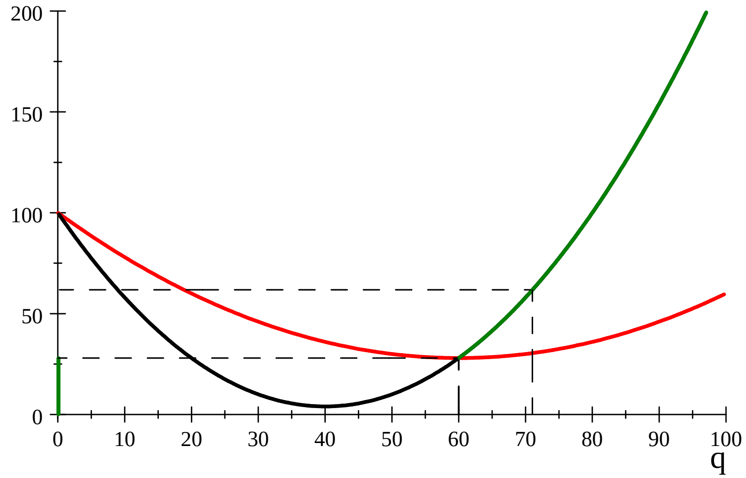
- What happens if demand shifts (from blue to purple)? Prices, quantities?
- How does the impact depend on the elasticity of supply?

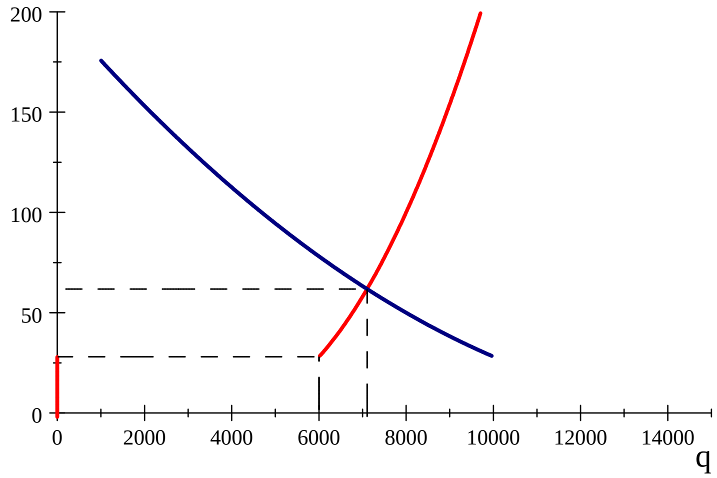
Supply shifts upwards



- What happens if demand shifts (from red to magenta)? Prices, quantities?
- How does the impact depend on the elasticity of demand?

Profits?





- $P^* = 61.822$, $q_i^* = 71$ and "shut-down" price $28 \equiv P^S = SAVC(q_i^S)$
- $SAVC$ (red) and SMC (black), individual supply (green)

Short-run producer surplus (PS)

- Individual PS (PS_i) are "societal" gains from individual production:

$$PS_i = \pi_i + SFC_i$$

- Mathematically, notice that the area between individual supply and P^*...

$$\left(P^* - P^S\right) q_i^S + \int_{q_i^S}^{q_i^*} \left[P^* - SMC_i(q)\right] dq = \left(P^* - P^S\right) q_i^S + \left|P^* q - STC_i(q)\right|_{q=q_i^S}^{q=q_i^*}$$

$$-P^S q_i^S + P^* q_i^* - STC_i(q_i^*) + STC_i(q_i^S) = -SAVC_i(q_i^S) q_i^S + \pi_i + STC_i(q_i^S)$$

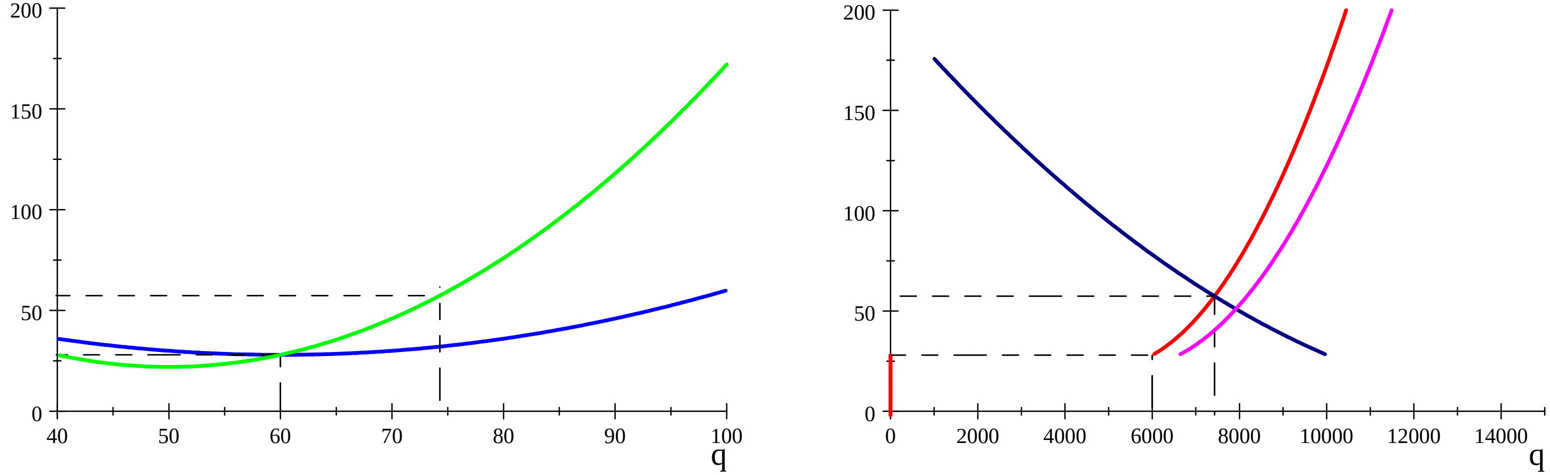
$$-SVC_i(q_i^S) + \pi_i + STC_i(q_i^S) = \pi_i + SFC_i = PS_i$$

- Total PS is sum of individual PSs. Representation?

Long-run price determination

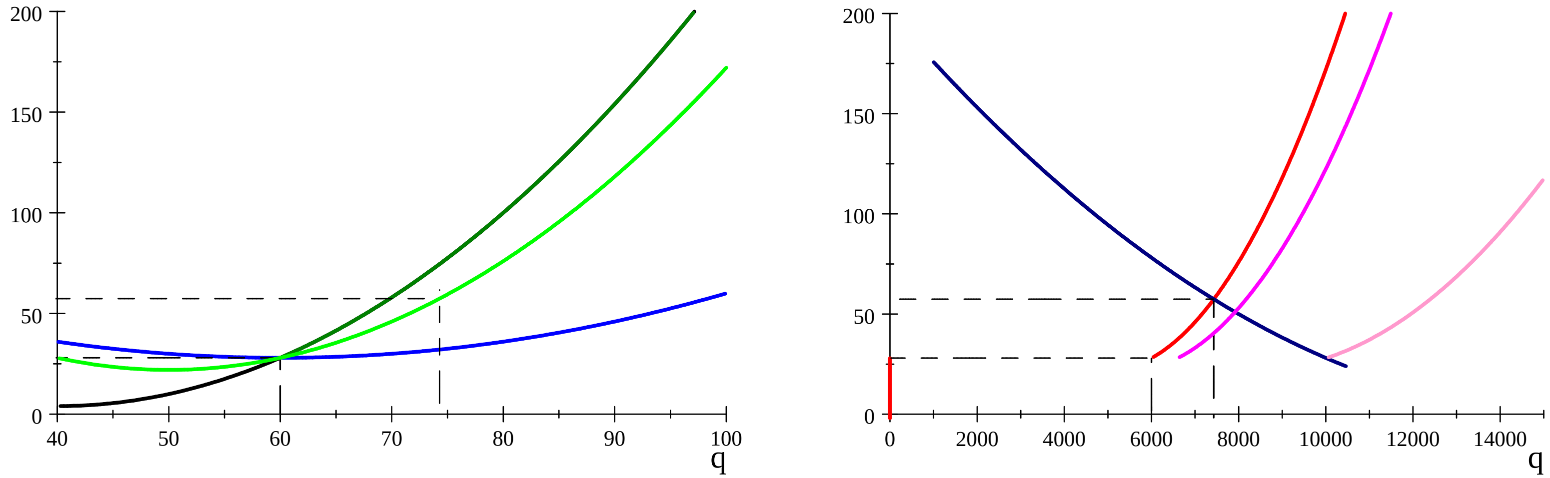
- Firms maximise profits ($P = MC$) with all inputs flexible
- New firms enter if there are positive profits:
  As a result, supply curve shifts outward
  Market price and profits fall
  Process repeats itself until profits are zero
  Firms forced to produce at $P = AC$ ($= MC$, lowest point of AC curve)
- Similarly, existing firms exit if there are negative profits
- Equilibrium here in the sense that no firm wants to enter or exit
- Assume identical firms first (see discussion at the end for asymmetric case)

Entry



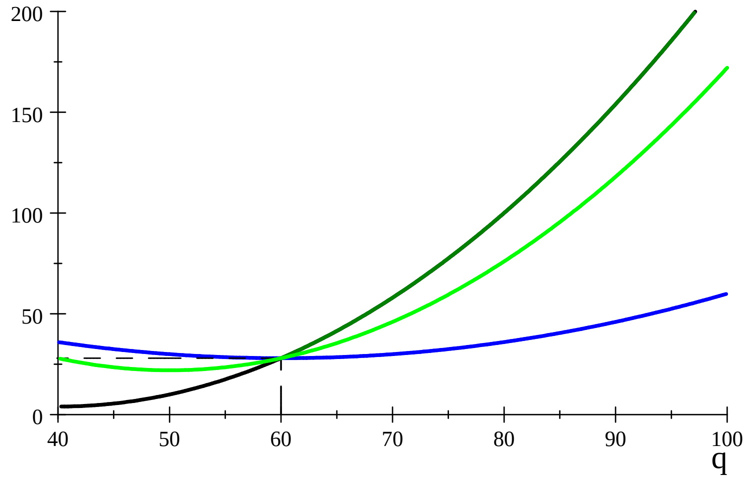
- Supply (100 identical firms) (red). $P = MC(q_i)$ (light green)
- Positive profits ($P > AC(q_i)$, light blue) induce entry
- New long-run curve (magenta). Price and profits fall.
- Entry until n^* is s.t. firms zero profits, i.e. $P^* = MC(q_i^*) = AC(q_i^*)$

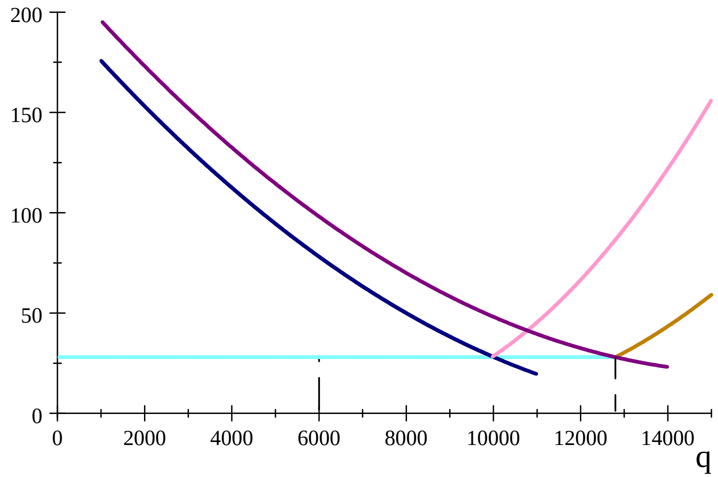
Long-run equilibrium



- Additionally, equilibrium P^*, q_i^* should be such that $P = SMC(q_i^*)$ (green)
- That is, $P^* = SMC(q_i^*) = MC(q_i^*) = AC(q_i^*)$ (lowest point of AC curve)
- P^*, Q^* is a point in the long-run supply curve. What would be the others?

Constructing the long run supply curve





- If demand curve shifts (purple), short-run equilibrium at intersection with pink
- In the long run, new entry because of profits. New $P^{*\prime} = P^*$, $Q^{*\prime} > Q^*$
- Again $P = SMC = MC = AC$. New point of long-run supply curve (cyan)

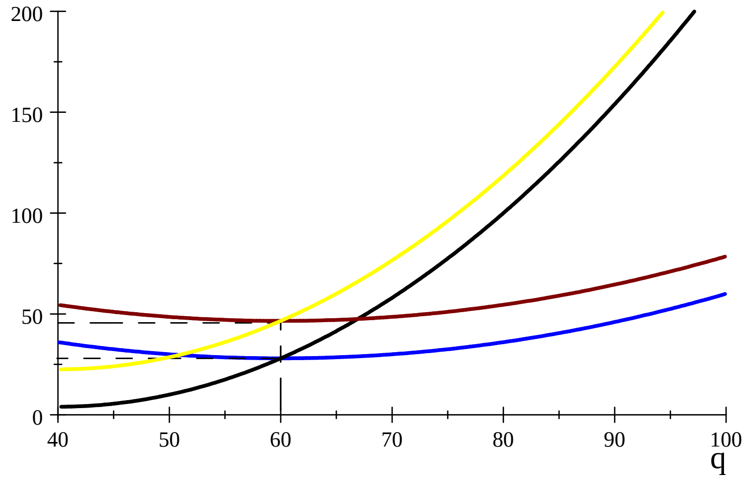
Non-constant costs case

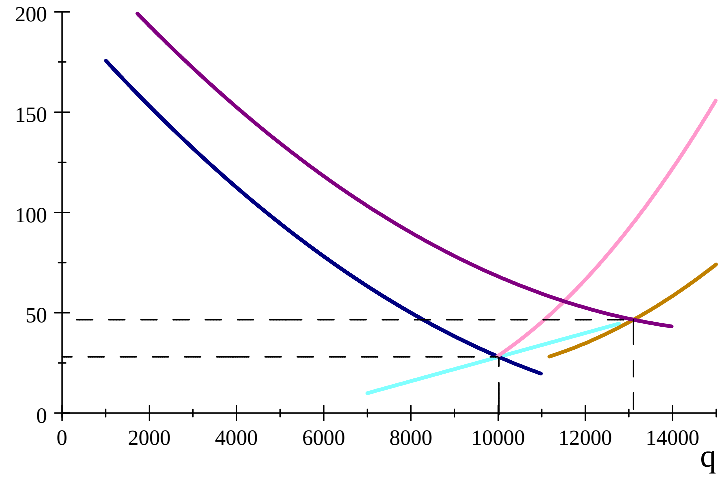
- So far, we have assumed that individual cost curves not affected by entry
  Long run supply curve flat

- But entry might make inputs scarcer
  Inputs prices are higher and therefore higher individual cost curves
  Long run supply curve will be increasing

- Potentially, it could also be that entry creates more market for the inputs
  Input prices lower and therefore lower individual cost curves
  Long run supply curve would be decreasing

Increasing costs





- Outward shift in demand (purple) generates profits and therefore entry
- More firms increases individual costs (AC in brown and MC in yellow)
- Equilibrium price is now higher. Long run supply curve (cyan) increasing

Long-run producer surplus

- Remember that short-run individual producer surplus is defined as

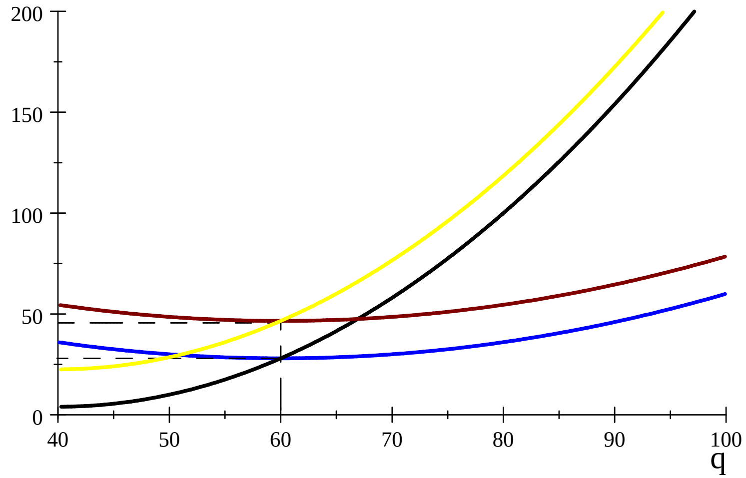
$$\pi_i + SFC_i$$

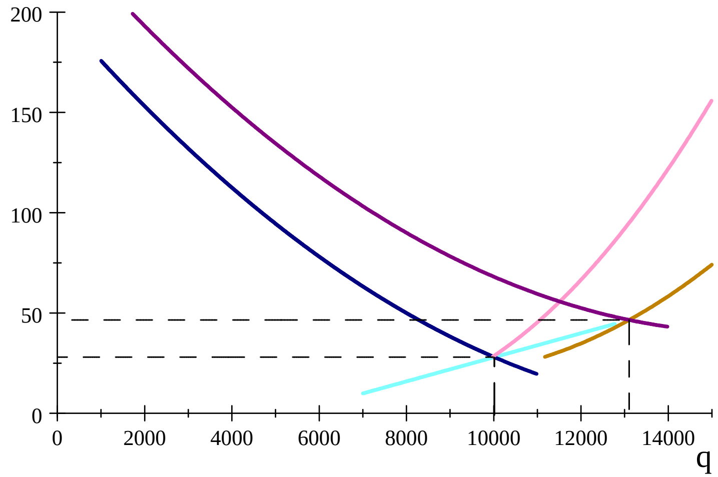
- Using this definition, what would be the producer surplus in the long-run?
- Producer surplus in long run defined as additional gains to suppliers of inputs, in excess to those obtained if industry output was zero
- This can be shown to be again equal to area below price and above supply:

$$P^*Q^* - \int_0^{Q^*} S(Q)dQ$$

where $S(Q)$ is the long run supply curve

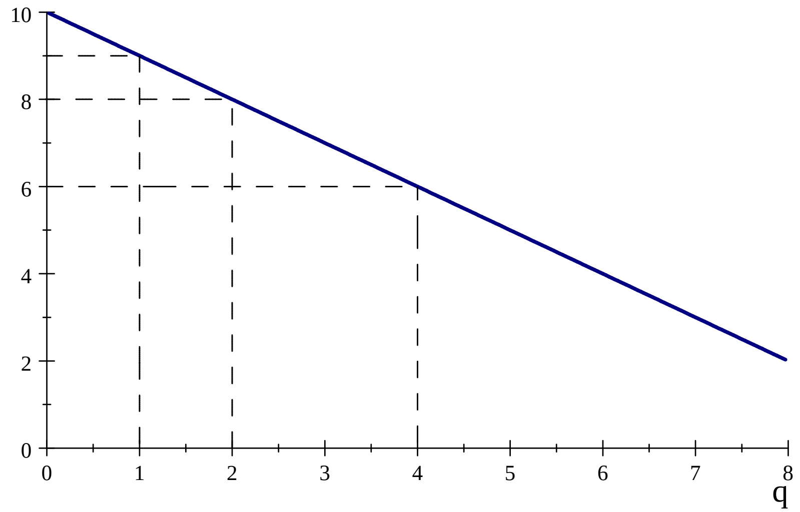
Asymmetric firms





- (Many) firms with low (black, light blue) and high costs (yellow, brown) coexist
- Blue demand only low cost produce but if purple demand, high cost also produce
- Purple demand, low cost earn long-term surplus (area below P^* and above $S(Q)$)

Individual consumer welfare (CS)



- What about consumers? Need to provide monetary measure of “welfare”
- Individual demand ($x_i = 10 - P$) can be viewed as willingness to pay per unit
- CS_i defined as difference between willingness to pay and price. CS_i if $P = 6$?

Consumer and social surplus

- Consumer surplus is the total sum of individual consumer welfare. Formally

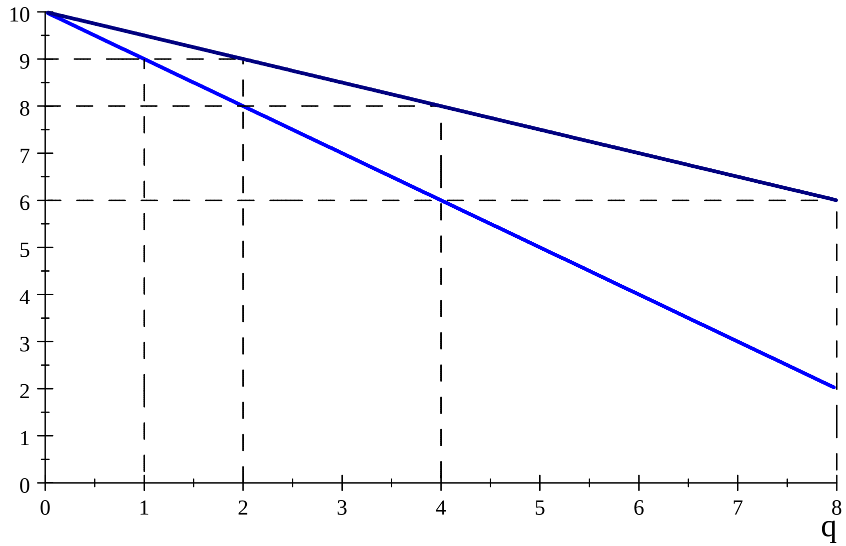
$$\int_0^{Q^*} D(Q)dQ - P^*Q^*$$

  where $D(Q)$ is "inverse demand" function (sum of consumers willingness to pay)

- What if in the previous example there are two consumers with identical demand?

- Social welfare is defined as the sum of consumer and producer welfare

Consumer surplus



- Two consumers with identical individual demands
- Representation of consumer surplus if $P^* = 8$? If $P^* = 6$? Interpretation?

Example

- Suppose market demand: $Q_D = 2(10 - P)$ and long-run supply: $Q_S = 2P - 4$
- Equilibrium price and quantity: $P^* = 6$, $Q^* = 8$
- Consumer surplus:

$$CS = \int_0^8 (10 - Q/2)\, dQ - 6 * 8 = 16$$

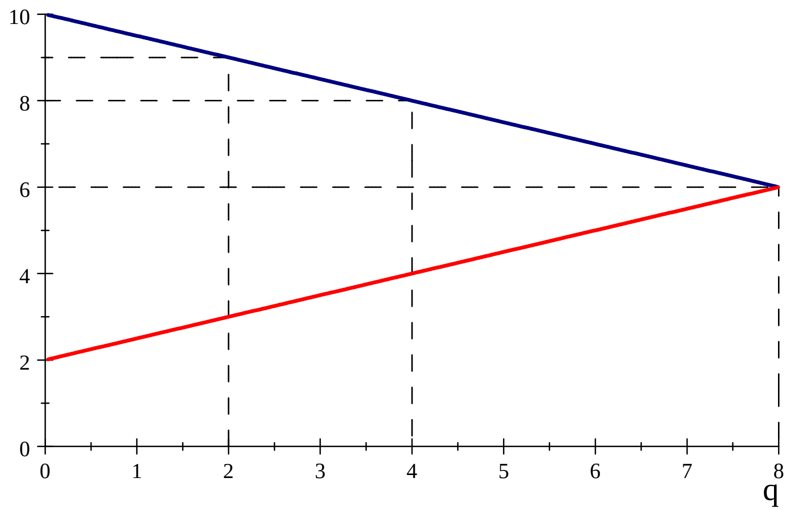
- Producer surplus:

$$PS = 6 * 8 - \int_0^8 (Q/2 + 2)\, dQ = 16$$

- Social (total) surplus:

$$TS = CS + PS = 32$$

Graphically



- Representation of consumer, producer and social surplus?
- Could consumer and producer welfare be computed in a faster way here?
- If you were a (benevolent) social planner which price would you set?

Efficiency of Perfectly Competitive Markets

- Perfectly competitive markets are "Pareto" efficient:
  Market outcome cannot be replaced by another that would increase the welfare of an individual without harming an other
  Buyers with highest willingness to pay obtain the goods
  Sellers with lowest costs produce the goods

- An efficient allocation maximizes the sum of consumer and producer surplus
  "It is not from the benevolence of the butcher, the brewer or the baker, that we expect our dinner, but from their regard to their own interest."
  Adam Smith, The Wealth of Nations (1776)

Pros and cons of markets

- Responsiveness to changing economic conditions
- Mostly self-organising
- Benefits to the society through the pursuit of self-interest

- Losers as well as winners: resulting distribution may not be “desirable” (fair)
- “Market failures” may lead to inefficient outcomes (see next chapter)