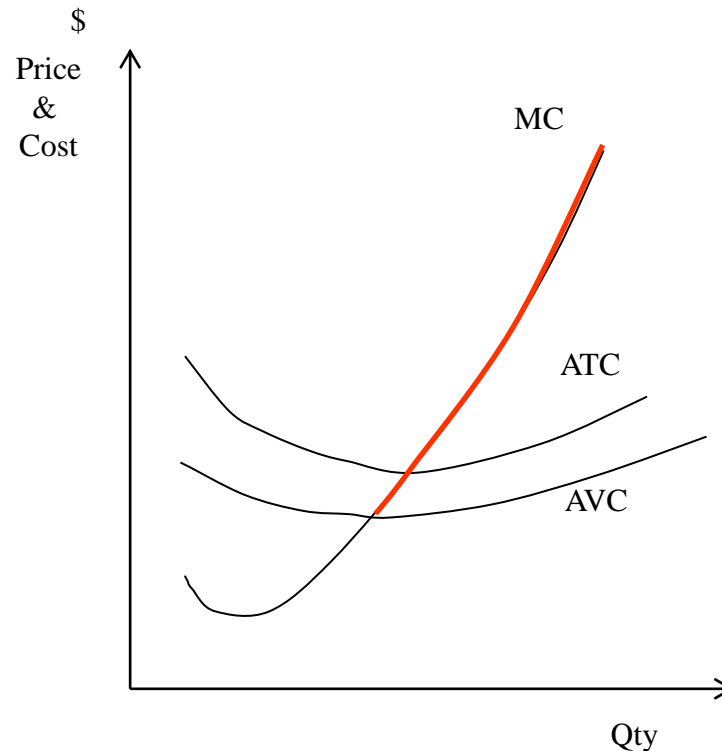# Price Determination and Analysis

Supply and elasticity

Kohls & Uhl Chapter 8

Cost Concepts and Firm Supply
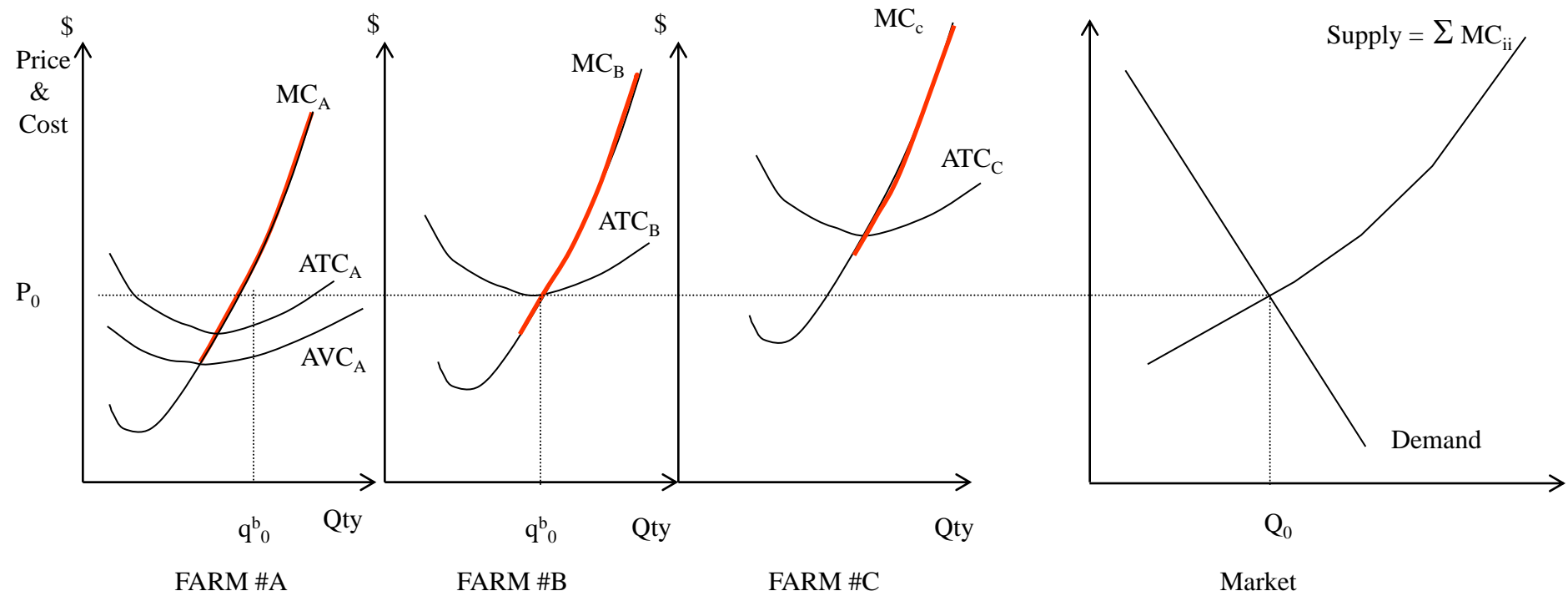
The shape of the cost curves depend the production technology (production function) and fixed input prices

$

Price
&
Cost

MC

ATC

AVC

Qty

The supply curve is the MC curve above the AVC curve

Supply is the schedule of differing quantities that will be offered for sale at different prices at a given time and place

Aggregate or Market Supply

Shifters of Supply

- Technology
- Price of inputs
- Opportunity costs
    - Returns from producing other products
    - Returns to fixed factors of production
- Government policies or institutional constraints
- Also random events - Weather

Algebraic Treatment of Supply

- Supply equations can also be depicted as an algebraic expression

- Eg. $Q^s = 10 + 200 \cdot P - 10 \cdot P^{\text{inputs}}$

- Let the price inputs equal 3 so $Q = -20 + 200 \cdot P$
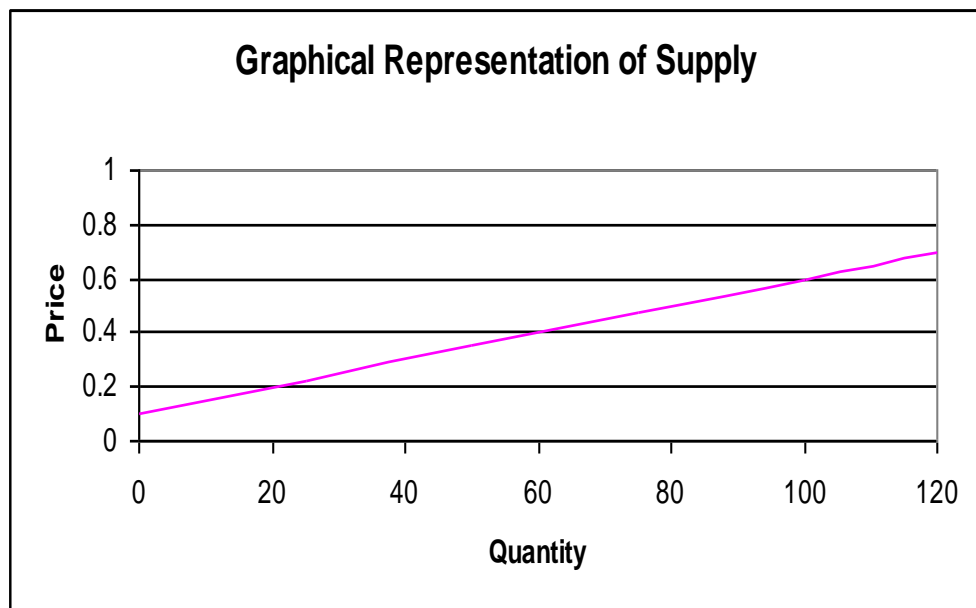
Graphical Representation of Supply

Algebraic Treatment of Supply

- Supply equations can also be depicted as an algebraic expression

- Eg. $Q_S = 10 + 200 \cdot P - 10 \cdot P_{input}$

- Let the price of inputs equal 3 so $Q = -20 + 200 \cdot P$

  » Or $P = .1 + 1/200 \cdot Q$

Note if increase input price from 3 to 5 then:
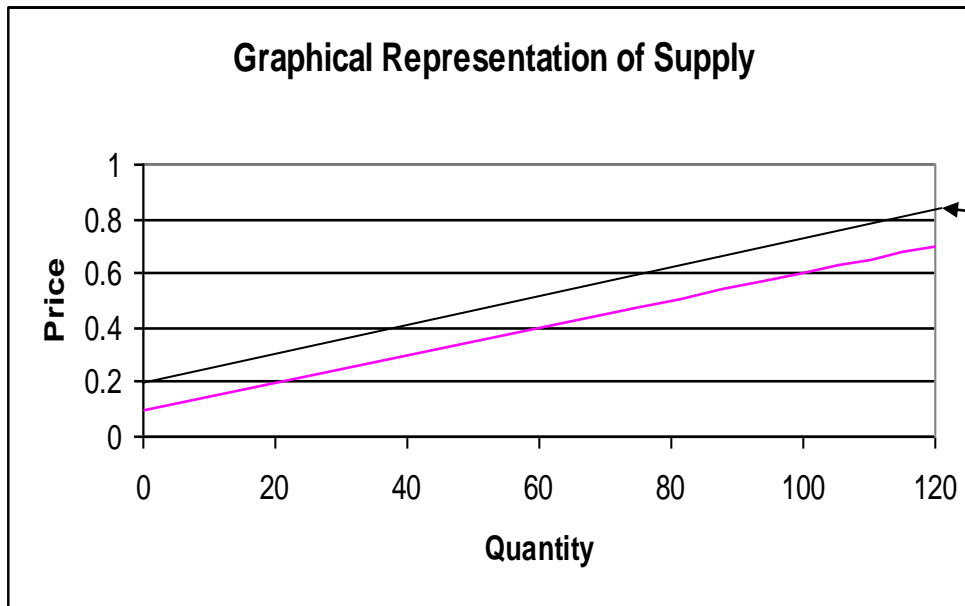
$Qs = 10 + 200 \cdot P - 10 \cdot 5$

$Qs = 10 + 200 \cdot P - 50$

$Qs = -40 + 200 \cdot P$

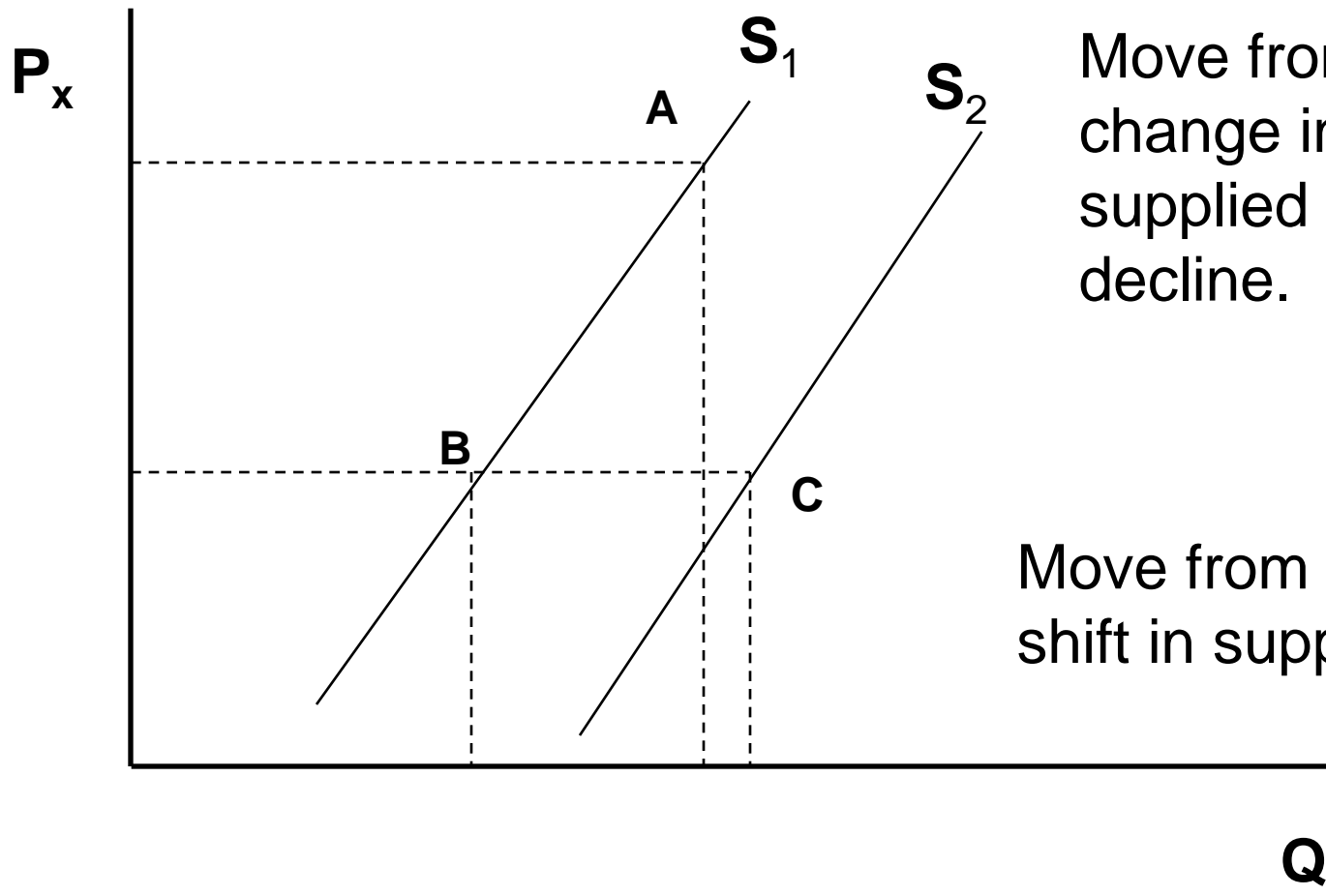$P = .2 + 1/200 \cdot Q$

ie. This shifts the supply up.

Costs are very important to supply.

Graphical Representation of Supply

Price (y-axis): 0, 0.2, 0.4, 0.6, 0.8, 1
Quantity (x-axis): 0, 20, 40, 60, 80, 100, 120

A movement along a supply curve versus a shift

P_x

S_1

S_2

A

B

C

Q_x

Move from A to B is a change in quantity supplied due to a price decline.
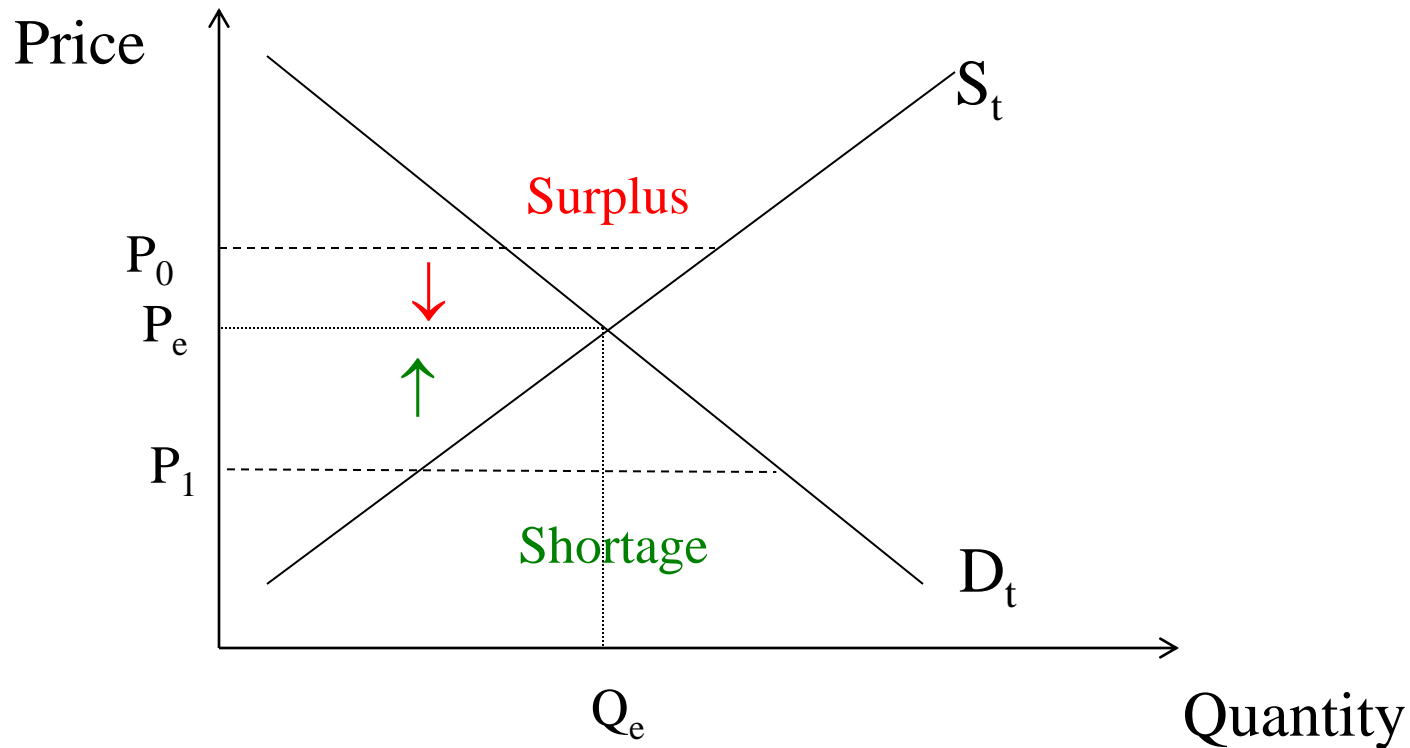
Move from B to C is a shift in supply.

Prices and the Market Mechanism

$$Q^D_t = D(P_t, Y_t^{\text{shifters}}) \qquad\qquad Q^S_t = S(P_t, Z_t^{\text{shifters}})$$

In Equilibrium $D(P_t, Y_t) \equiv S(P_t, Z_t)$ or $Q^D_t \equiv Q^S_t$

Price Determination (example)

Recall our example …. with the demand function:
$$Q^d = 100 - 100 \cdot P$$
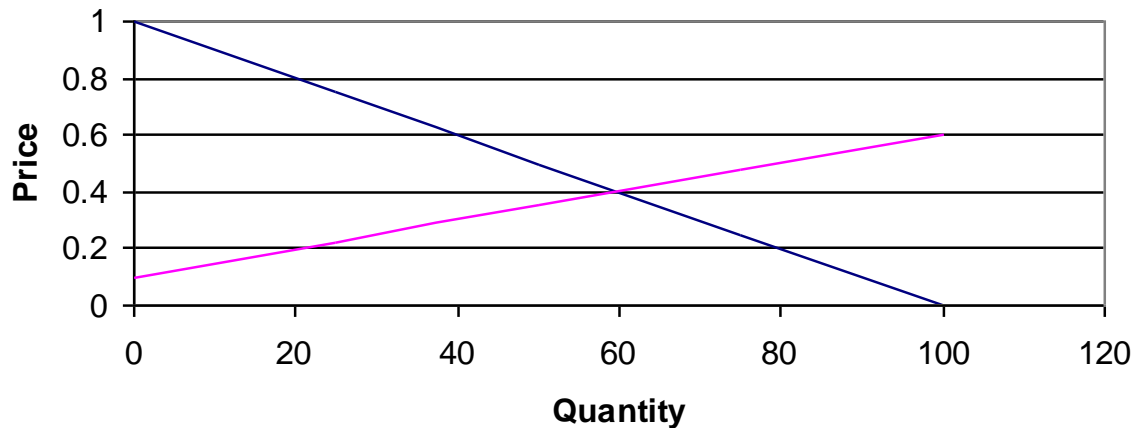And with the supply function:
$$Q^s = -20 + 200 \cdot P$$

In equilibrium demand has to equal supply: $Q^d = Q^s$
$$100 - 100 \cdot P = -20 + 200 \cdot P$$
$$120 = 300 \cdot P$$
$$P = 0.4$$

Graphical Representation of Equlibrium

Now determine the qualities:
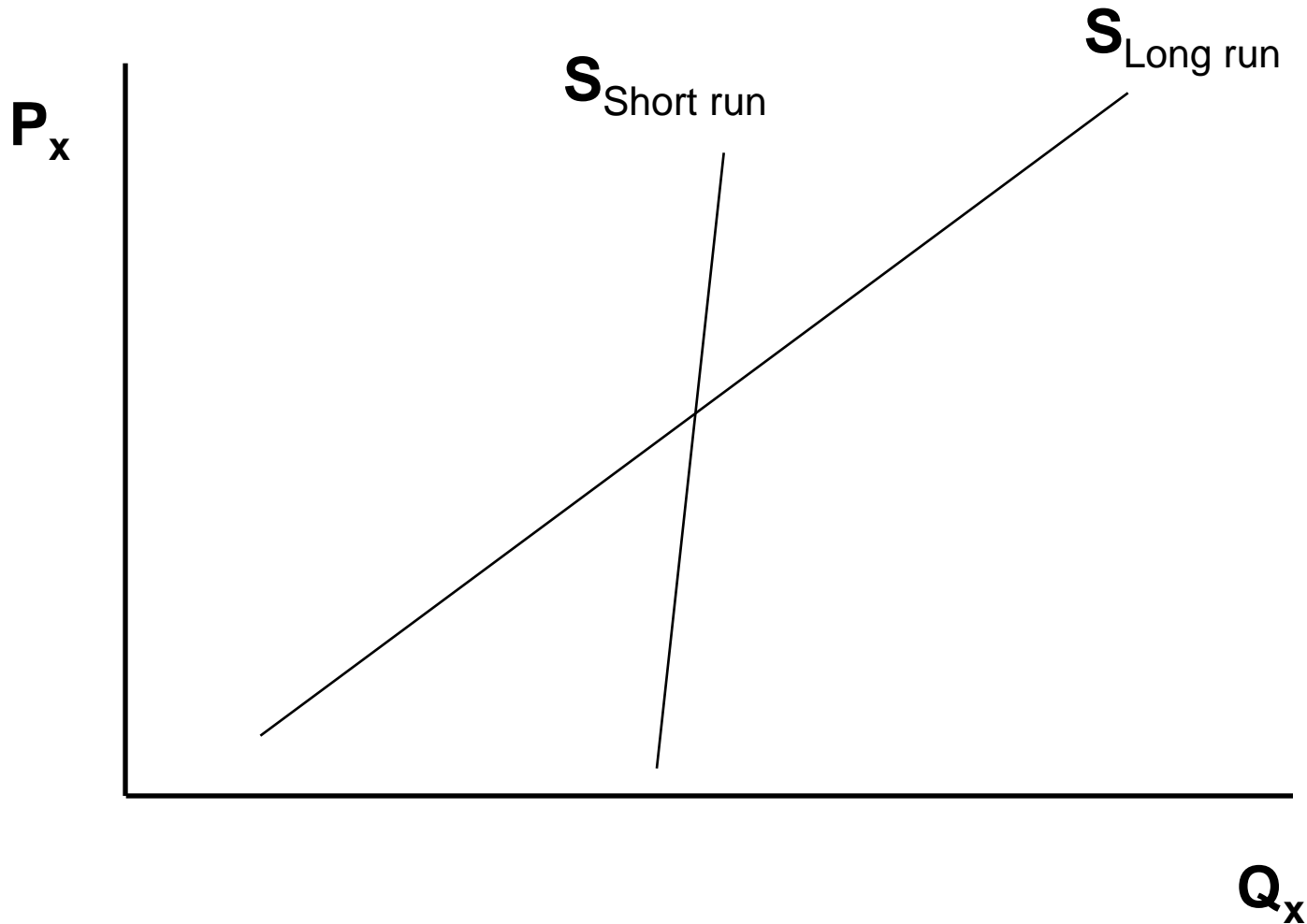$$Q^d = 100 - 100 \cdot 0.4$$
$$Q^d = 60$$
And quantity supplied
$$Q^s = -20 + 200 \cdot 0.4$$
$$Q^s = 60$$

9

Long and short run market supply curves

P_x

$S_{Short\ run}$

$S_{Long\ run}$

Q_x

10

What is Elasticity?

• Economists use the concept of elasticity which compares rates of change in consumption to rates of change in an independent variable such as price or income

➢ %Δ dependent variable ⟸?⟹ %Δ independent variable
  • Does the dependent variable change by more than, less than, or the by the same amount as the independent variable?

➢ So the elasticity is defined as:

$$\varepsilon = \frac{\%\ change\ in\ quantity\ of\ food\ demanded}{\%\ change\ in\ independent\ variable}$$

➢ We will encounter elasticities of demand with respect to:
  – the own price of the product
  – cross prices or prices of competing goods
  – income

➢ Elasticities are useful measures because they are unitless measures so that comparisons can be made between the demand responsiveness of different goods. If the changes were in absolute terms the comparison can't be made

Own Price Elasticity of Demand

- The own price elasticity of demand compares the responsiveness of the quantity demanded to changes in the price of the good in question:

$$\varepsilon_{ii}^d = \frac{\% \text{ change in quantity of food demanded}}{\% \text{ change in price of food}}$$

$$\varepsilon_{ii}^d = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}}$$

$$\varepsilon_{ii}^d = \frac{\Delta Q}{\Delta P} \frac{\tilde{P}}{\tilde{Q}}$$

- Elasticities are estimated statistically and can give useful behavioral predictions
    - For example, you estimate the that elasticity of demand is -0.8
        - If the price of food declines by 50% what what happens to the quantity of food demanded?
            - $\% \Delta Q^d = \varepsilon_{ii}^d \cdot \% \Delta P$
            - $\% \Delta Q^d = (-0.8) \cdot (-0.5) = 40\%$

Elasticity of Demand (continued)

- The own price elasticity of demand can be:

$$\text{price inelastic} \quad 0 > \varepsilon_{ii}^{d} > -1 \quad \text{then} \left| \% \Delta Q^d \right| < \left| \% \Delta P \right|$$

$$\text{unit elastic} \quad \varepsilon_{ii}^{d} = -1 \quad \text{then} \left| \% \Delta Q^d \right| = \left| \% \Delta P \right|$$

$$\text{price elastic} \quad -\infty < \varepsilon_{ii}^{d} < -1 \quad \text{then} \left| \% \Delta Q^d \right| > \left| \% \Delta P \right|$$

- Cross price elasticities can also be defined:

$$\varepsilon_{ij}^{d} = \frac{\% \text{ change in quantity demanded of good i}}{\% \text{ change in price of good j}}$$

- The income elasticity of demand compares the responsiveness of the quantity demanded to changes in income:

$$\varepsilon_{iy}^{d} = \frac{\text{rate of change in quantity of food demanded}}{\text{rate of change in income}} = \frac{\dfrac{\Delta Q^d}{Q^d}}{\dfrac{\Delta Y}{Y}} = \frac{\dfrac{Q_2 - Q_1}{Q_1}}{\dfrac{Y_2 - Y_1}{Y_1}}$$

Income Elasticity of Demand

• For a doubling of income (100% increase) the quantity demanded will vary with the income elasticity in the following manner:

ε^d_{iy}	$\%\Delta Q^d$
0.5	0.5
1	1
1.5	1.5

• Income elasticities for different responsiveness to income changes

Luxury : $\varepsilon^d_{iy} > 1$ then $\left|\%\Delta Q^d\right| > \left|\%\Delta Y\right|$

Quantity demanded changes proportionately *more* than income

Necessity : $0 < \varepsilon^d_{iy} < 1$ then $\left|\%\Delta Q^d\right| < \left|\%\Delta Y\right|$

Quantity demanded changes proportionately *less* than income

Normal : $\varepsilon^d_{iy} > 0$ then $\%\Delta Q^d > 0$
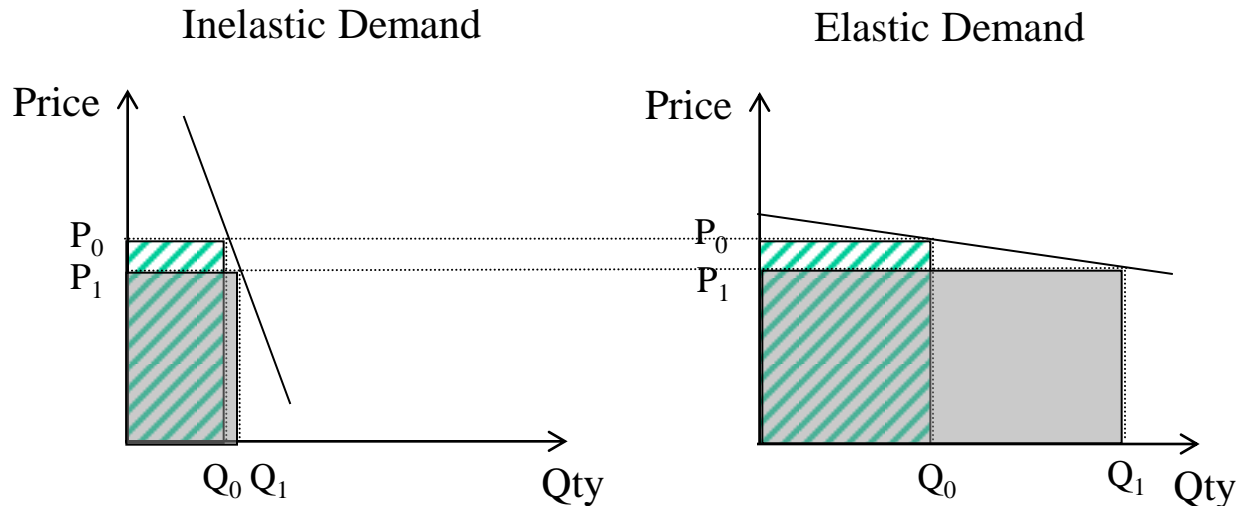
Quantity demanded increases *with* income

Inferior good : $\varepsilon^d_{iy} < 0$ then $\%\Delta Q^d \downarrow \Leftrightarrow \%\Delta Y \uparrow$

Quantity demanded moves in opposite direction to income 14

Price elasticity & total revenue

- TR = P x Q
- Elastic demand
  - P and TR inversely related
- Inelastic demand
  - P and TR directly related

Relationship between own price elasticity and total revenues

Inelastic Demand   Elastic Demand

• The unintended consequence of increasing the production of goods with the most inelastic demands will <u>decrease</u> their price proportionately more than the increase in the volume of sales → total revenue declines

  •With inelastic demand, increased production decreases price proportionately more than the change in volume so that revenues decline

  •With elastic demand, increased production decreases price proportionately less than the change in volume so that revenues increase

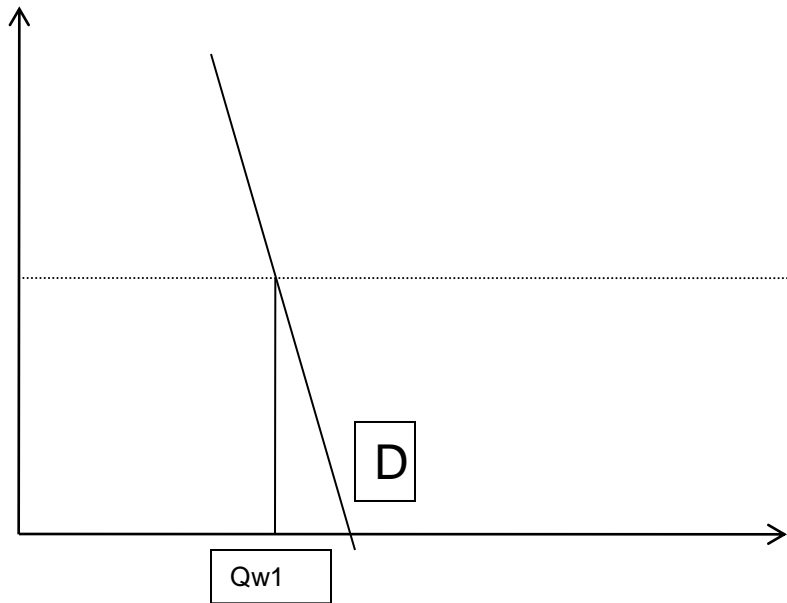 • With unitary elasticity there will be no change in total revenue

Elasticity of Supply

$$\varepsilon_{ii}^{s} = \frac{\% \text{ change in quantity supplied}}{\% \text{ change in own price}} = \frac{\frac{\Delta Q^{s}}{Q^{s}}}{\frac{\Delta P}{P}} = \frac{\Delta Q^{s}}{\Delta P} \frac{P}{Q^{s}}$$
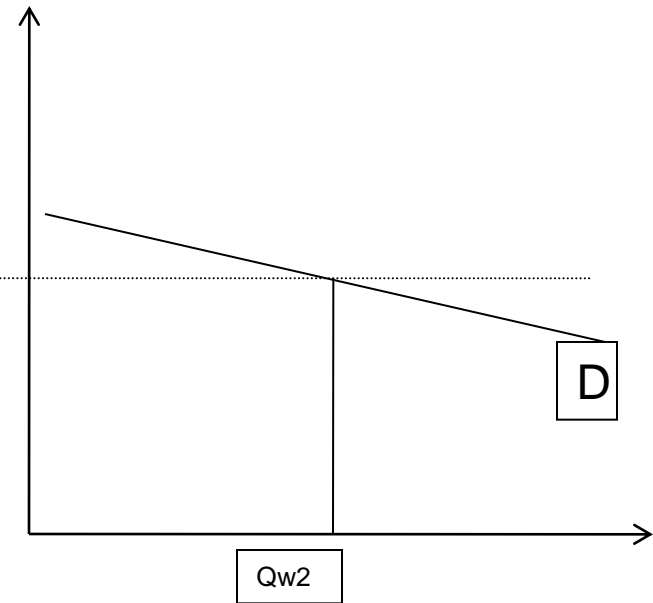
Price Discrimination
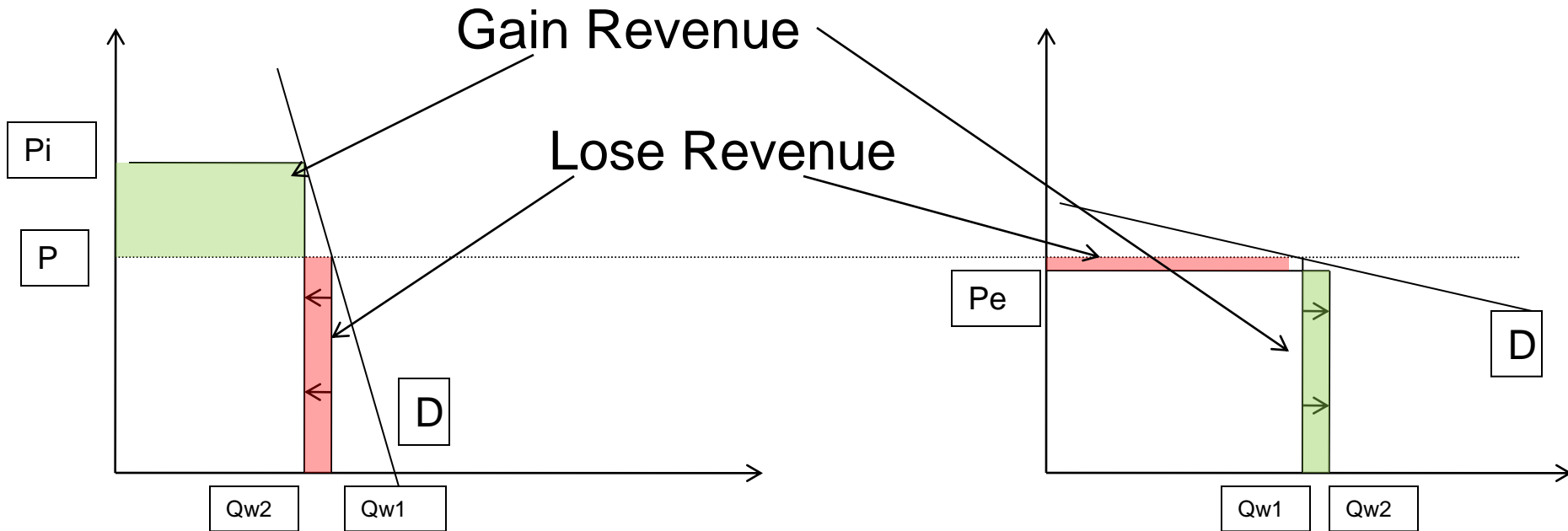# One Price

| Inelastic Market | Elastic Market |

- The difference in elasticity can be used by some marketers if they can set prices and segregate markets.

- Suppose two markets currently face the same price have different demand elastcity

Price Discrimination
Two Prices If Segregated

Inelastic Market

Elastic Market

Gain Revenue

Lose Revenue

Pi

P

Qw2   Qw1

Pe

D

Qw1   Qw2

• By reducing sales into the inelastic market and sending that quantity to an elastic market a marketer can increase total reveunes from the same quantity sold.