Supply and Demand

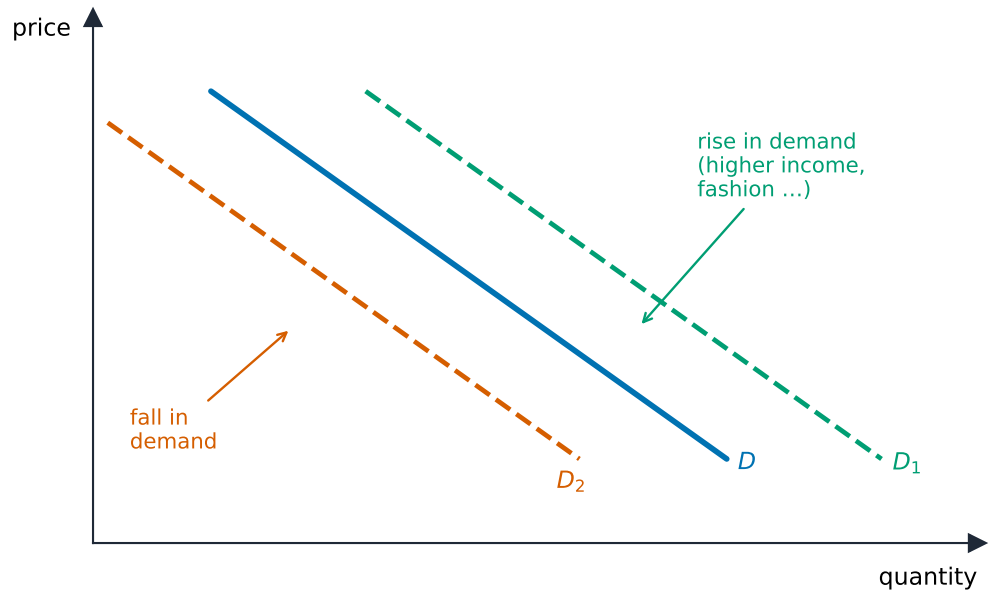
AP Microeconomics

Demand

Shoppers in a market: demand shows how quantity demanded responds to price

Well-defined **property rights** support exchange: owners can use, exclude others from, and trade their resources. Within that framework, the two forces are demand and supply.

Demand is the relationship between the price of a good and the quantity buyers are willing and able to buy. The **law of demand** says that, with other conditions held constant, price and quantity demanded move in **opposite** directions, so the demand curve slopes **downward**. Two reasons: the **substitution effect** (when a good gets pricier, buyers switch to alternatives) and the **income effect** (a higher price shrinks real purchasing power).



The demand curve slopes down; income, tastes, and related prices shift it

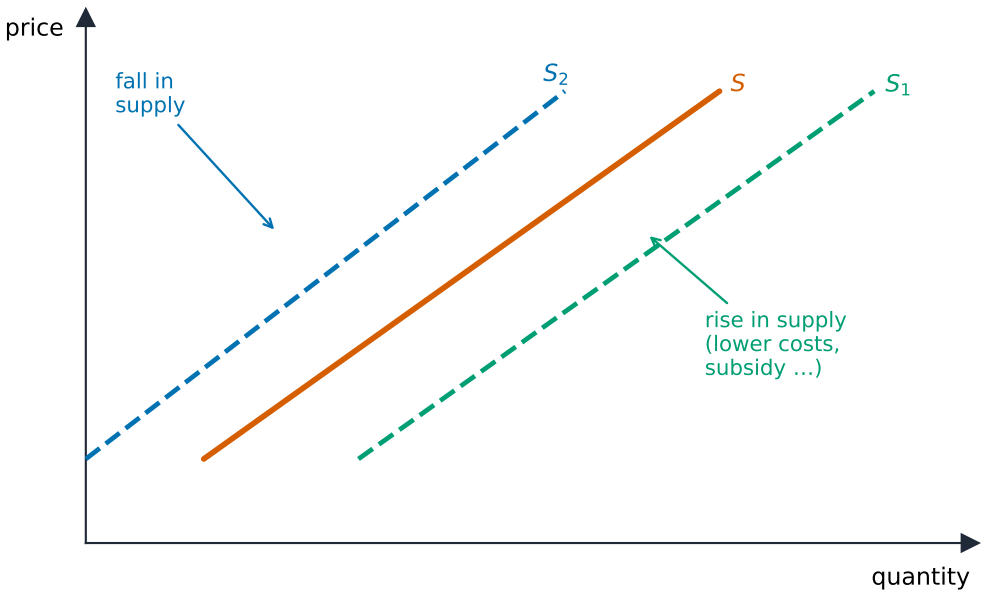
Distinguish a **change in quantity demanded** (a move *along* the curve, caused only by the good's **own price**) from a **change in demand** (a *shift* of the whole curve). Demand shifts with the **determinants** , remembered as **TRIBE**:

- **T**astes/preferences,
- **R**elated goods – a rise in the price of a **substitute** raises demand; a rise in the price of a **complement** lowers it,
- **I**ncome – for a **normal good** more income raises demand; for an **inferior good** it lowers it,
- **B**uyers (number of consumers),
- **E**xpectations of future price or income.

The **market demand curve** is the **horizontal summation** of every individual buyer's demand curve – at each price, add up the quantities all buyers want. That is why more buyers (the **B** above) shifts the whole market curve to the right.

Supply

Supply is the relationship between price and the quantity sellers will offer. The **law of supply** : with other conditions held constant, price and quantity supplied move in the **same** direction, so the supply curve slopes **upward** (higher prices cover higher marginal costs and reward more output).



The supply curve slopes up; costs, technology, tax, and subsidy shift it

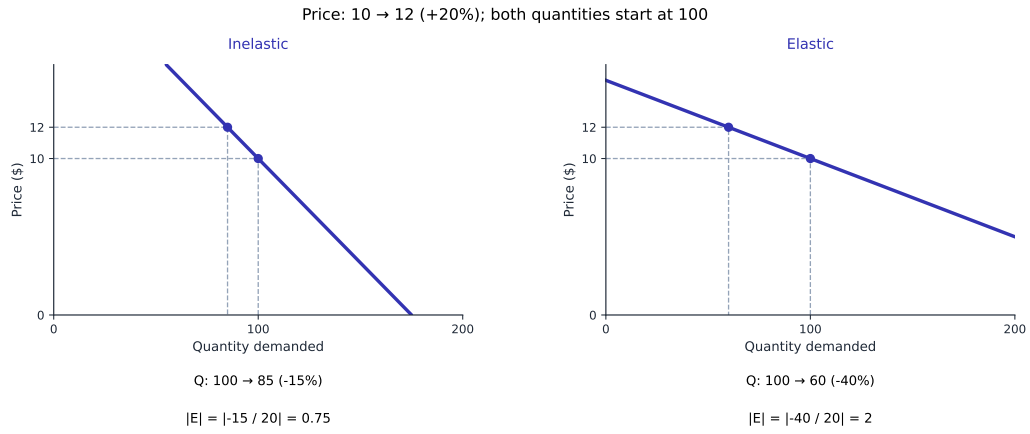
Again separate a **change in quantity supplied** (movement along the curve, from the good's own price) from a **change in supply** (a shift). Supply shifts with **input prices**, **technology**, taxes and **subsidies** , **prices of other goods** a firm could make, **number of sellers**, and **expectations**. Just like demand, the **market supply curve** is the horizontal sum of individual firms' supply curves – add the quantities all firms offer at each price – so more sellers shifts market supply to the right.

Exam skill: on the free-response section you must draw correctly labeled supply-and-demand graphs and shift the *right* curve in the *right* direction – decide first whether the event changes an "own price" (move along) or a determinant (shift).

Price Elasticity of Demand

Price elasticity of demand measures how responsive quantity demanded is to a price change:

$$E_d = \left| \frac{\% \ \Delta \text{ quantity demanded}}{\% \ \Delta \text{ price}} \right|.$$



Inelastic versus elastic demand: a small versus large response to a price change

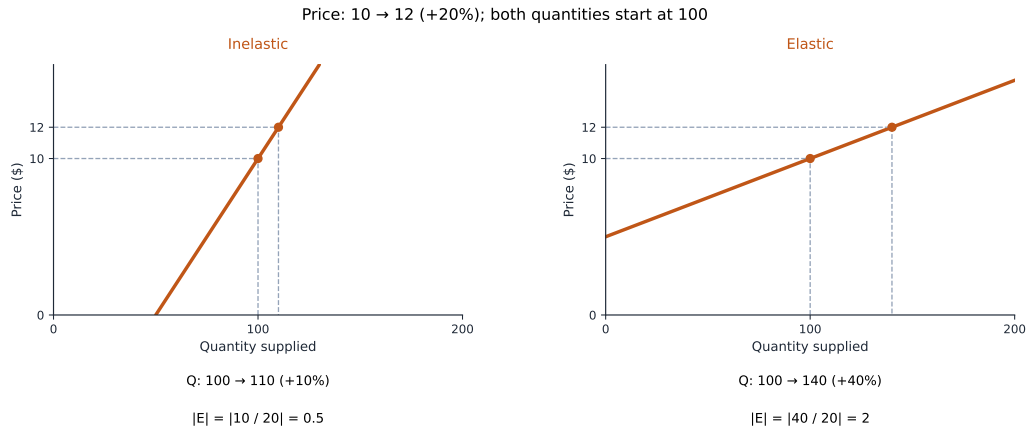
- $E_d > 1$: **elastic** (quantity responds strongly);
- $E_d < 1$: **inelastic** (quantity barely responds);
- $E_d = 1$: **unit elastic**.

Demand is more elastic when there are more **substitutes**, the good is a **luxury**, it takes a large share of income, or buyers have **more time** to adjust. Elasticity links to **total revenue** ($P \times Q$): if demand is elastic, a price cut *raises* revenue; if inelastic, a price cut *lowers* it. Elasticity compares **percentage changes**, not slope alone. Along a straight-line demand curve with positive intercepts, elasticity falls as you move down (elastic on top, inelastic at the bottom).

Worked example (percentage changes measured from the initial values). A price rise from \$10 to \$12 (a +20% change) cuts quantity demanded from 100 to 85 (a −15% change). Then $E_d = \left| \frac{-15\%}{20\%} \right| = 0.75 < 1$, so demand is **inelastic**. Because it is inelastic, the price rise *raises* total revenue: from $\$10 \times 100 = \$1000$ to $\$12 \times 85 = \$1020$.

Price Elasticity of Supply

Price elasticity of supply , $E_s = \frac{\% \ \Delta \ Q_s}{\% \ \Delta \ P}$, measures how responsive sellers are. Supply is more elastic when firms can adjust output easily – spare capacity, storable goods, **more time** usually gives firms more ways to adjust output; it does not guarantee a particular elasticity.



The same price rise gives a small supply response when PES is below 1, a large one above 1

Worked supply comparison. Both firms start at price \$10 and quantity 100. Price rises to \$12, a 20% rise from the initial price. Firm A increases supply to 110 units, a 10% rise; firm B to 140, a 40% rise. Using these initial-value percentage changes:

$$E_{s,A} = \frac{\%\Delta Q_s}{\%\Delta P} = \frac{10}{20} = 0.5, \qquad E_{s,B} = \frac{40}{20} = 2.$$

Firm A has inelastic supply; firm B has elastic supply. Horizontal supply is perfectly elastic; vertical supply is perfectly inelastic.

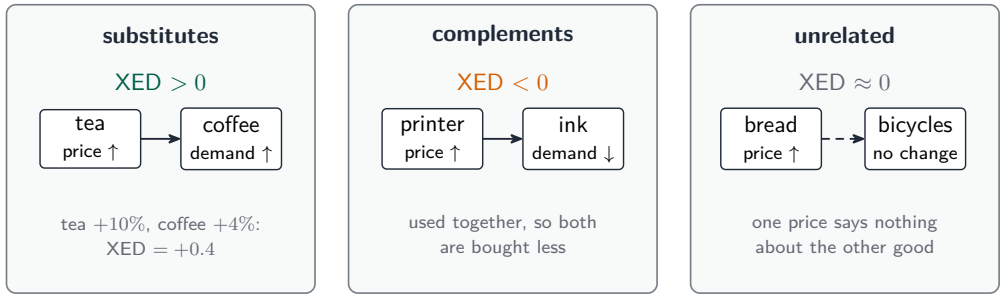
Other Elasticities

- **Cross-price elasticity** $= \dfrac{\%\ \Delta\ Q_x}{\%\ \Delta\ P_y}$: **positive** for substitutes, **negative** for complements – the sign tells you the relationship.
- **Income elasticity** $= \dfrac{\%\ \Delta\ Q}{\%\ \Delta\ \text{income}}$: **positive** for normal goods (and > 1 for luxuries), **negative** for inferior goods.

> **Worked example.** When the price of coffee rises 10%, the quantity of tea demanded rises 6%: cross-price elasticity $= \dfrac{+6\%}{+10\%} = +0.6$. The **positive** sign confirms coffee and tea are **substitutes**. If instead a 5% rise in incomes raised restaurant-meal demand 10%, income elasticity $= \dfrac{10\%}{5\%} = +2$ – a normal good, and a **luxury** since it exceeds 1.

Further practice and answers. Printer price rises 10% and ink quantity demanded falls 4%: $E_{ink,printer} = \frac{-4}{10} = -0.4$, so they are complements. Income rises 10% and bus-ticket quantity demanded falls 5%: $E_Y = \frac{-5}{10} = -0.5$, so bus travel is an inferior good **in this example**. Hold other determinants constant.

Official application: AP 2024 Set 1, Q1(e). Quinoa price rises 25%, its quantity demanded falls 5%, and tofu quantity demanded rises 10%. Own-price elasticity magnitude is $|E_d| = |-5/25| = 0.2$, so quinoa demand is inelastic. Cross-price elasticity is $E_{tofu,quinoa} = 10/25 = +0.4$, so the goods are substitutes. Neither value establishes whether tofu is normal or inferior; that requires an income change.

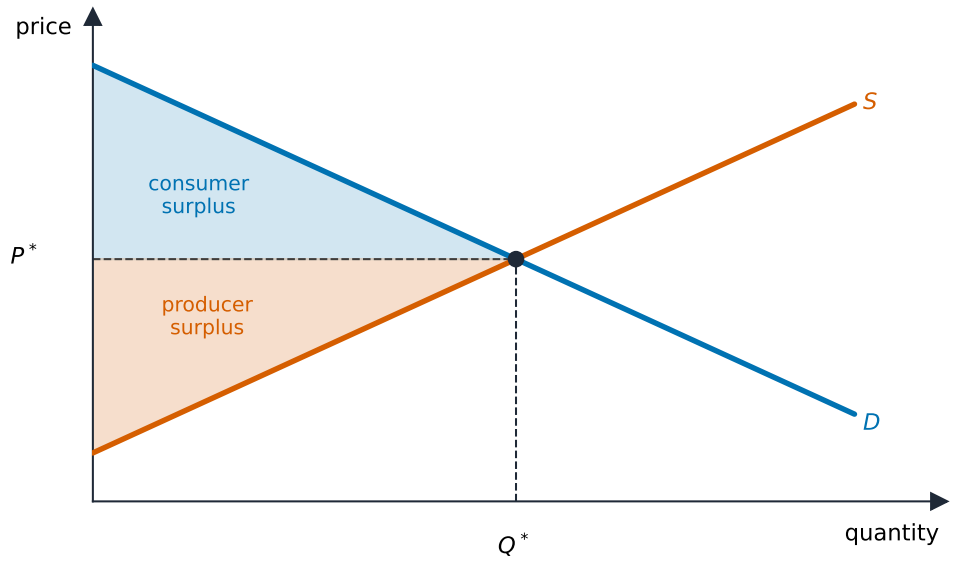


Cross elasticity: positive for substitutes, negative for complements

Exam skill: you are expected to compute an elasticity, classify it, and read a *sign* as evidence of substitute/complement or normal/inferior.

Market Equilibrium, Consumer Surplus, and Producer Surplus

Equilibrium is where supply meets demand: the **equilibrium price** clears the market, so quantity demanded equals quantity supplied and there is no shortage or surplus.



Consumer surplus and producer surplus at the market equilibrium

- **Consumer surplus** is the area **below the demand curve and above the price** – the gap between what buyers would pay and what they do pay.
- **Producer surplus** is the area **above the supply curve and below the price** – the gap between the price and sellers' minimum acceptable price.
- Their sum is **total surplus** , and a competitive equilibrium **maximizes** it when there are no market failures. Private benefits and costs must reflect social benefits and costs for this equilibrium to be **allocatively efficient** .

A fruit and vegetable stall: the photograph shows goods offered for sale, not an observed equilibrium

Worked market used below. Demand is $P_D = 20 - Q$ and supply is $P_S = 2 + Q$, with price in dollars and quantity in units. Equilibrium requires equal demand and supply prices:

$$P_D = P_S, \quad 20 - Q = 2 + Q, \quad Q^* = 9, \quad P^* = \$11.$$

For these straight-line curves, use triangle areas:

$$CS = \tfrac{1}{2}Q^*(P_{D,0} - P^*) = \tfrac{1}{2}(9)(20 - 11) = \$40.50.$$

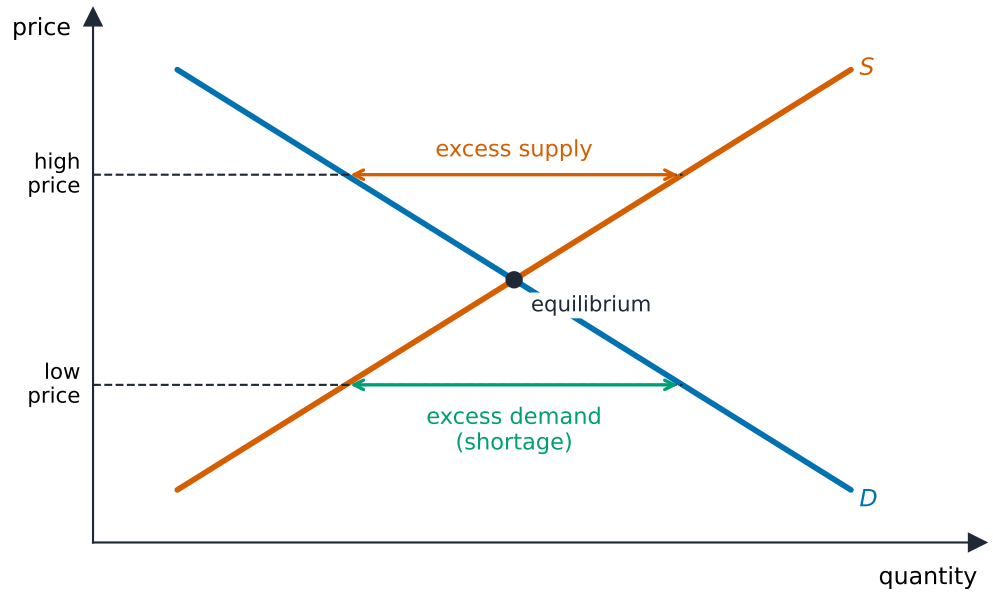
$$PS = \tfrac{1}{2}Q^*(P^* - P_{S,0}) = \tfrac{1}{2}(9)(11 - 2) = \$40.50.$$

$$TS = CS + PS = \$81.$$

Assume no external costs or benefits.

Market Disequilibrium and Changes in Equilibrium

Away from equilibrium the market self-corrects: above the equilibrium price there is a **surplus** (excess supply) that pushes price down; below it a **shortage** (excess demand) that pushes price up.

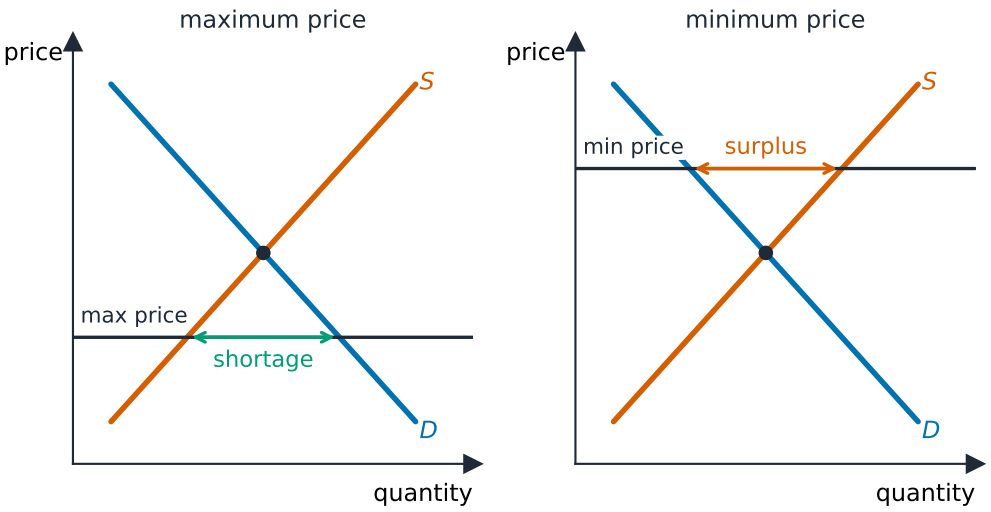


Above equilibrium there is excess supply; below it, excess demand

When a determinant shifts a curve, the equilibrium moves predictably. A **single** shift gives a definite result for both price and quantity. When **both** curves shift, one of price or quantity is **indeterminate** (depends on the relative sizes of the shifts) – a favorite exam trap. Work these out by drawing the shifts.

The Effects of Government Intervention in Markets

Start with an initially efficient competitive market. Binding interventions can reduce total surplus; a policy correcting a market failure can instead improve social welfare (Unit 6).



A binding price ceiling causes a shortage; a binding price floor causes a surplus

- A **price ceiling** (a legal maximum, like rent control) below equilibrium causes a persistent **shortage**.
- A **price floor** (a legal minimum, like a minimum wage) above equilibrium causes a persistent **surplus**.
- A per-unit **excise tax** on sellers shifts supply up by the tax; the burden (**tax incidence**) falls more heavily on whichever side is **more inelastic**.
- A per-unit producer **subsidy** shifts supply down, raising quantity.

Deadweight loss is lost total surplus. In this initially efficient model, a tax prevents some beneficial trades; a subsidy can encourage units whose cost exceeds their benefit. A nonbinding price control has no effect on the market outcome.

Worked controls. Use $P_D = 20 - Q$ and $P_S = 2 + Q$, so the original equilibrium is $P^* = \$11$, $Q^* = 9$. At a ceiling of \$8:

$$Q_d = 20 - P = 20 - 8 = 12, \qquad Q_s = P - 2 = 8 - 2 = 6.$$

$$\text{Shortage} = Q_d - Q_s = 12 - 6 = 6 \text{ units.}$$

At most six units trade without other supply. At a floor of \$14, $Q_d = 6$ and $Q_s = 12$, so the surplus is six units; without government purchases, buyers take at most six units.

Worked tax. A \$4 tax per unit creates a wedge between the buyer price P_b and seller receipt P_s:

$$P_b = P_s + t, \qquad 20 - Q = 2 + Q + 4.$$

$$Q_t = 7, \qquad P_b = \$13, \qquad P_s = \$9.$$

Tax incidence. Buyers pay \$2 more and sellers receive \$2 less than before; the burden is equal for these symmetric schedules. Generally, the relatively more inelastic side bears more.

$$\text{Tax revenue} = tQ_t = 4(7) = \$28.$$

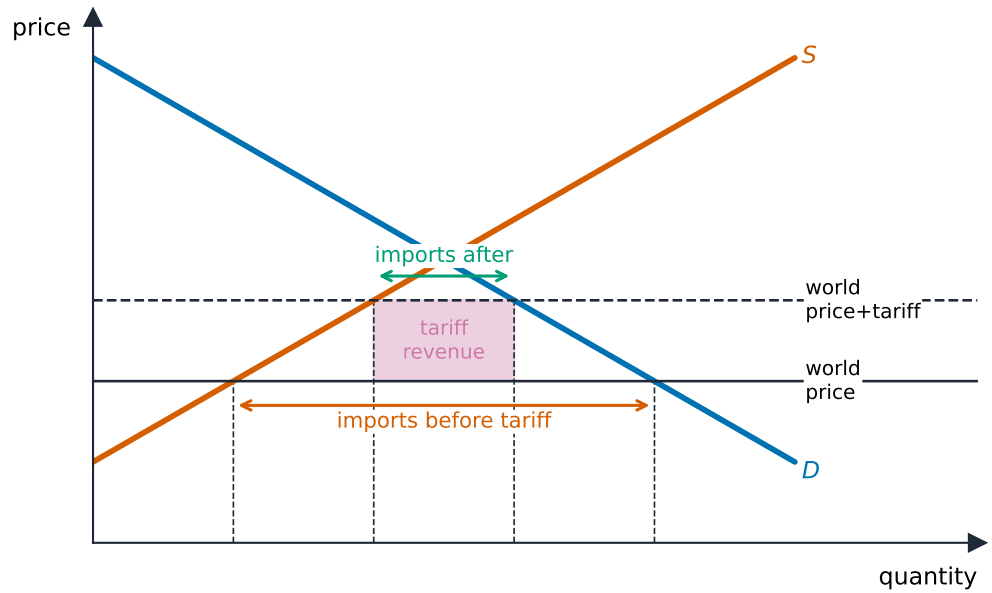
$$DWL = \tfrac{1}{2}t(Q^* - Q_t) = \tfrac{1}{2}(4)(9 - 7) = \$4.$$

Government revenue is a transfer, not the deadweight loss.

Exam skill: on a graph, be able to shade consumer surplus, producer surplus, government revenue from a tax, and deadweight loss, and say who bears the tax and why.

International Trade and Public Policy

In the competitive small-country model, the country takes the **world price** as given. Assume no external costs or benefits. Compare it with the domestic price before trade:



A tariff raises quantity supplied, lowers quantity demanded, and reduces imports; neither domestic curve shifts

- If the world price is **below** the domestic price, the country **imports** – consumers gain more than producers lose, so total surplus rises.
- If the world price is **above** the domestic price, the country **exports** – producers gain more than consumers lose.

A binding **tariff** (import tax) or **quota** (import limit) raises domestic price and reduces total surplus in this model. Domestic curves do not shift.

Worked imports and tariff. Keep $P_D = 20 - Q$ and $P_S = 2 + Q$. The world price is \$6, below the \$11 no-trade equilibrium.

$$Q_d = 20 - P_w = 14, \quad Q_s = P_w - 2 = 4, \quad M = Q_d - Q_s = 10.$$

A \$2 tariff raises the domestic price to \$8; imports continue because this is below \$11.

$$Q_{d,t} = 20 - 8 = 12, \quad Q_{s,t} = 8 - 2 = 6, \quad M_t = 12 - 6 = 6.$$

$$\text{Tariff revenue} = tM_t = 2(6) = \$12.$$

The production and consumption distortions each lose a triangle of surplus:

$$DWL = \tfrac{1}{2}t[(Q_{s,t} - Q_s) + (Q_d - Q_{d,t})] = \tfrac{1}{2}(2)[(6-4) + (14-12)] = \$4.$$

These are conditional model results, not a claim that every real-world trade policy has the same welfare effect.

Exam tips

- Separate a **movement along** a curve (own price) from a **shift** (a determinant); a single shift gives a definite result, a double shift leaves one variable indeterminate.
- Compute elasticity $E_d = |\%\Delta Q \div \%\Delta P|$; elastic ($> 1$) means a price cut raises total revenue, inelastic (< 1) lowers it.
- Read the sign of cross-price elasticity (substitutes $+$, complements $-$) and income elasticity (normal $+$, inferior $-$).
- Shade **consumer/producer surplus** and the **deadweight loss** from a tax or price control; incidence falls on the more **inelastic** side.
- A price ceiling below equilibrium causes a shortage; a price floor above causes a surplus.