Market failure and equity (2.8-2.9, 2.12)

International Baccalaureate · IB Diploma · Economics · SL

Market failure and equity

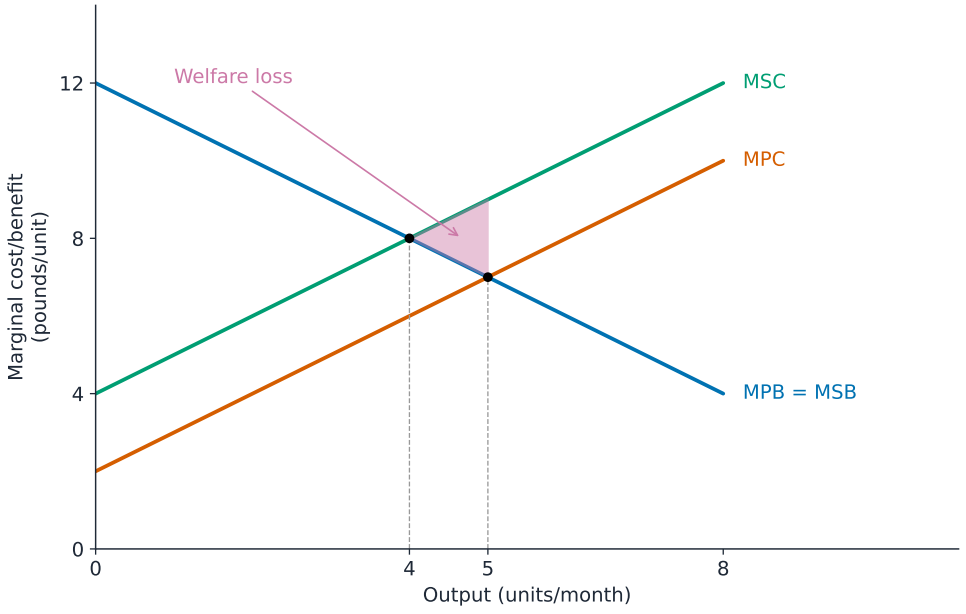
IB Diploma Programme Economics SL, Unit 2 *Microeconomics* (first assessment 2022). This topic covers syllabus sections 2.8 (market failure – externalities and common pool or common access resources) and 2.9 (public goods) in full, and the market's inability to achieve equity (listed as 2.12; at SL the same ground is assessed through 3.4, the economics of inequality and poverty). The externality model reuses the shared curves in inverse form – demand (marginal private benefit) $P = 70 - Q/2$, supply (marginal private cost) $P = Q/4 - 5$, market equilibrium $(100, 20)$ – with an external cost or benefit of 6 per unit. At SL the model is read as a labelled DIAGRAM; the areas quoted are illustrative, and computing them is HL Paper 3.

Must-know for this topic:

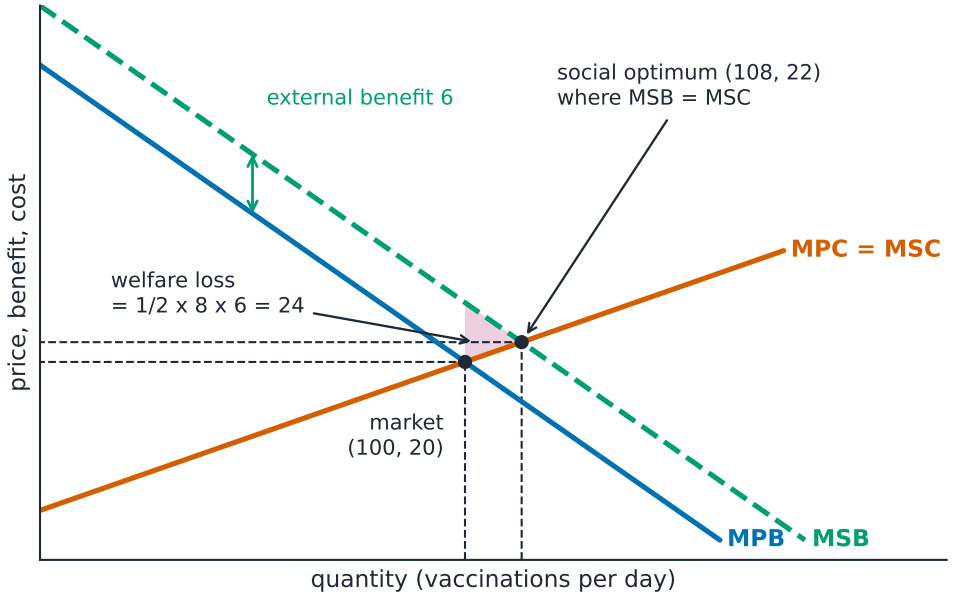
Family	Relationship
welfare	MSC = MPC + EC; MSB = MPB + EB; social optimum where MSB = MSC
externality	external cost 6 → optimum $(92, 24)$, market over-produces 8, welfare loss $\frac{1}{2} \times 8 \times 6 = 24$
public goods	non-rival + non-excludable → free-rider → non-provision
equity	market outcomes carry no guarantee of fairness; Lorenz/Gini measure it

Externalities and common pool resources

An **externality** is a cost or benefit falling on a THIRD PARTY not involved in the transaction (2.8). Negative production externalities – pollution, congestion – put the **marginal social cost** MSC above MPC; positive consumption externalities – vaccination, education – put the **marginal social benefit** MSB above MPB. The market trades at $(100, 20)$ where MPB = MPC; with an external cost of 6 per unit, MSC = MPC +6 crosses MSB at $(92, 24)$ – the market OVER-produces by 8 units and the deadweight welfare loss is $\frac{1}{2} \times 8 \times 6 = 24$ per day. With an external benefit of 6 on consumption, the social optimum moves to $(108, 22)$, where MSB $= 76 - Q/2$ meets MSC = MPC – the market UNDER-consumes by 8, again sacrificing 24 of welfare. Diagrams label MPB/MSB and MPC/MSC and shade the welfare-loss triangle between the curves over the gap – the drawing earns the marks.



Negative production externality: the market produces where MPC = MSB, more than the social optimum



Positive consumption externality on the shared model: the market stops at 100, but the social optimum is 108, where MSB = MSC

Policy responses follow the diagnosis: a Pigouvian TAX equal to the marginal external cost (6 here) shifts MPC to the social optimum; a SUBSIDY equal to the marginal external benefit does the reverse; regulation caps the quantity; tradable permits fix the total and let the market find the price. **Common pool or common access resources** (also 2.8) – fisheries, groundwater, the atmosphere – are RIVAL

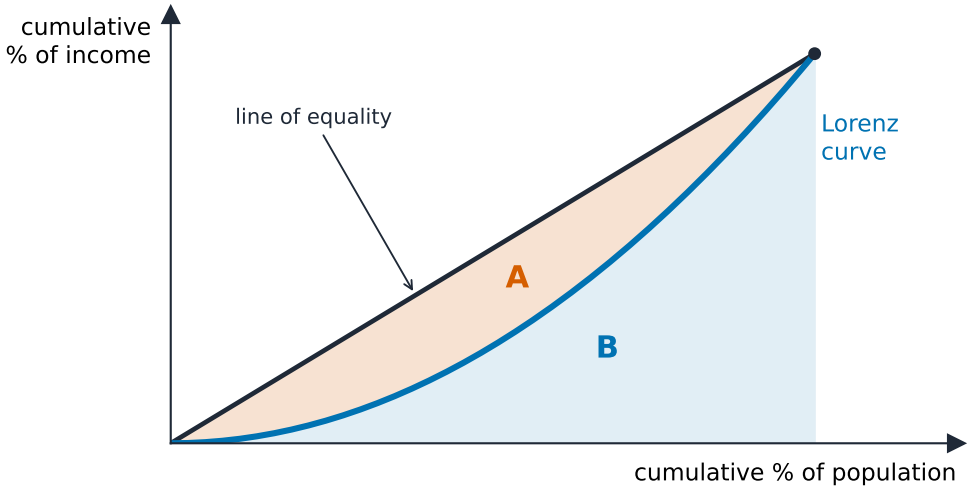
but NON-EXCLUDABLE: each user imposes costs on the others, so without property rights or quotas the resource is over-used (the tragedy of the commons), and sustainability – a Unit-1 key concept – frames the long-run evaluation.

Public goods

A **public good** (2.9) is NON-RIVAL (one person's consumption does not reduce another's) and NON-EXCLUDABLE (no one can be stopped from using it): street lighting, national defence, flood control. Non-excludability creates the **free-rider problem** – everyone can benefit without paying, so no private firm can collect revenue, so the market UNDER-provides or does not provide at all. The state provides public goods from taxation, valuing them at society's willingness to pay. The contrast pair: common pool resources are non-excludable but RIVAL (each fish caught is gone); public goods are non-excludable AND non-rival – the two exam cases travel together.

The market's inability to achieve equity

Markets reward scarcity of resources, not need (2.12): the price mechanism answers "for whom?" by willingness and ability to pay, so market outcomes can be efficient yet grossly UNEQUAL – the **equity** half of the efficiency-equity key-concept pair. IB measures: the LORENZ CURVE plots cumulative income against cumulative population (from the poorest); the GINI COEFFICIENT – area between the equality line and the Lorenz curve over the whole triangle – runs from 0 (perfect equality) to 1 (one person takes all). Original example: quintile shares $5, 10, 15, 20, 50$ percent give a Lorenz curve through $(20, 5), (40, 15), (60, 30), (80, 50)$; the area under it is 3000 of the 10000 square, so Gini $= 1 - 2 \times 0.30 = 0.40$. **Poverty** may be ABSOLUTE (basic needs unmet) or RELATIVE (deprivation against the social norm). Responses: progressive taxation, transfer payments, and access to education and health – each weighing equity gains against incentive and efficiency costs, the trade-off every Paper-1 essay must evaluate. The Gini arithmetic shown is a reading aid; SL is asked to interpret the coefficient and the curve, not to compute areas.



Gini $= A/(A+B)$ · 0 = equal, 1 = most unequal

The further the Lorenz curve bows from the diagonal, the more unequal income is; Gini = A/(A+B)

> **Worked example (original, on the shared model).** Production carries an external cost of 3 per unit, so a corrective tax of 3 shifts supply to Q_s = 20 + 4(P − 3). New equilibrium: 140 − 2P = 8 + 4P, so P = 22 and Q = 96. Consumers pay 2 of the 3 (20 → 22); producers keep 19 of the 22; the state collects 3 × 96 = 288 while the quantity shrinks toward the social optimum – incidence and internalisation in one set of numbers.

Data-response practice (Paper 2 style)

Extract. The European Union's Emissions Trading System (EU ETS) started in 2005. It sets a cap on the total carbon dioxide that power stations, factories and airlines inside the EU may emit, and firms must hold one permit for each tonne. Firms that cut emissions cheaply can sell spare permits; firms that pollute more must buy them. Too many permits were issued at first, so for much of 2012–2017 the price stayed below €10 per tonne and firms had little reason to change. After the EU removed surplus permits, the price passed €100 per tonne for the first time in February 2023. Because firms outside the EU pay no such price, the EU is adding a carbon charge on some imports such as steel and cement, with payments due from 2026. China's national carbon market began trading in July 2021. It covers the power sector and is the world's largest carbon market by emissions covered, but its permit price has been far below the EU's.

Firm K, an EU steel maker, emits 1.0 million tonnes of CO_2 a year but holds permits for only 0.8 million tonnes. It can cut 0.2 million tonnes at a cost of €60 per tonne, and the permit price is €90 per tonne.

Questions

- (a) Define *negative externality*. [2]
- (b) Using an externality diagram, explain why a market for electricity from coal produces more than the social optimum. [4]
- (c) Explain how a **cap and trade** scheme reduces emissions. [4]
- (d) Calculate the cost to Firm K of each way to cover its extra 0.2 million tonnes, and state which it will choose. [2]
- (e) Using information from the text and your knowledge of economics, evaluate the use of tradable permits, compared with a **carbon tax**, to reduce carbon emissions. [15]

Model answers

(a) A negative externality is a cost that falls on a third party, outside the transaction, and is not paid by the buyer or the seller. It makes marginal social cost greater than marginal private cost.

(b) Burning coal releases CO_2, which harms third parties through climate change. This external cost puts MSC above MPC (see the diagram above). The market produces where MPB = MPC, but the social optimum is where MSB = MSC, at a lower output and a higher price. Every unit between the two quantities costs society more than it is worth, so there is a welfare loss: the triangle between MSC and MSB over the extra output.

(c) The government sets a cap: the total number of permits, so total emissions cannot exceed it. Permits can be traded, which gives them a price. A firm that emits one more tonne must buy a permit or give one up, so pollution now has a private cost and MPC moves towards MSC. Firms that can cut emissions cheaply sell permits to firms for which cutting is expensive, so the total cut is reached at the lowest cost. Lowering the cap each year raises the permit price and cuts emissions further.

(d) Cutting costs $0.2 \times 60 = 12$, that is €12 million; buying permits costs $0.2 \times 90 = 18$, that is €18 million. Firm K cuts its own emissions and saves €6 million. A permit price above the firm's cost of cutting is what makes it cut.

(e) A strong answer explains both tools, uses the data, then weighs them.

- **Certainty of quantity.** A permit scheme fixes the total emissions (the cap), and the market finds the price. A carbon tax fixes the price, and the quantity is uncertain, because the government does not know how strongly firms will respond. For a climate target in tonnes, the cap is the more direct tool.
- **Cost-effectiveness.** Both tools give every firm the same price per tonne, so the cheapest cuts happen first: Firm K cuts, because €60 is below €90. Permits do this without the government needing to know each firm's costs.
- **Price instability.** The EU price stayed below €10 for years because too many permits were issued. That gave firms little reason to invest, and the price must be stable for firms to plan long-lived investments such as new furnaces. A carbon tax

gives a known, steady price. Sweden has used one since 1991, and it is now among the highest in the world. The EU had to remove permits to make its price work, which shows the risk of government failure in setting the cap.

- **Revenue and fairness.** Auctioned permits and a tax both raise revenue that could cut other taxes or help poor households with higher energy bills. Permits given away free reward existing polluters.
- **Carbon leakage** . If only one region prices carbon, production can move to places without a price, with no fall in world emissions. The EU's import charge tries to stop this, but it raises costs for trading partners and may cause trade disputes.
- **Monitoring.** Both tools need emissions to be measured accurately. Permits also need a working market. China's low permit price shows that the design (how tight the cap is, and the penalties) matters as much as the choice of tool.

Judgement: tradable permits are the better tool when the aim is a fixed emissions target and the cap is set tight and lowered over time; a carbon tax is better when price stability matters most and the government cannot judge the right cap. In practice the EU combined them: a tighter cap with a reserve that removes surplus permits gives a price floor, which is close to a tax. Either way, the result depends on a strict cap or a high enough rate, and on how other countries respond.

What examiners reward: a fully labelled externality diagram (MPB, MSB, MPC, MSC, both quantities, the welfare-loss triangle), the extract's own numbers (the €10 and €100 prices, Firm K's €60 and €90), at least two stakeholders, and a conclusion that compares the two tools.

Checklist

- Externality definition; MSC/MSB with the $(100, 20) \rightarrow (92, 24)$ negative-production and $(108, 22)$ positive-consumption optima; welfare loss 24 in each direction (2.8).
- Pigouvian tax and subsidy at the marginal external cost/benefit; regulation; tradable permits (2.8 policy, labelled diagrams).
- Common pool or common access resources: rival + non-excludable, tragedy of the commons, sustainability (2.8).
- Public goods: non-rival + non-excludable; the free-rider problem and non-provision; state provision (2.9).
- The market's "for whom" answer and its equity failure; Lorenz curve and Gini read at 0.40; absolute vs relative poverty; the three redistribution instruments and their trade-offs (2.12; SL assesses this through 3.4).

Boundary notes: SL Paper 1 essays on market failure want the labelled diagram (MPB/MSB/MPC/MSC, both optima, the shaded triangle), a policy with its mechanism, and evaluation of government failure against the market failure it corrects. The

key concepts sustainability, equity, efficiency and intervention frame this whole topic. All worked numbers are original on the shared model.