

Cambridge AS & A Level · Economics 9708

Economics 9708 formulas and definitions

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Basic economic ideas and resource allocation (AS Level)

Scarcity, choice and opportunity cost

Scarcity: unlimited wants, limited (finite) resources

Scarcity forces choice at every level: individuals, firms and governments

Opportunity cost: the next best alternative forgone when a choice is made

The three basic questions: what to produce, how to produce, for whom to produce

Opportunity cost in earnings = hourly pay $\times$ hours given up

On a PPC: opportunity cost of a move = amount of the other good given up

Opportunity cost of one more unit of X = $\frac{\text{units of Y given up}}{\text{units of X gained}}$

Concave PPC: increasing opportunity cost; straight-line PPC: constant opportunity cost

A free good has no opportunity cost

Economic methodology

Economics is a social science: it studies human behaviour using theories, models and evidence

Economics finds laboratory (controlled) experiments very difficult, so it uses *ceteris paribus*

Positive statement: about facts; can be tested against evidence; can be true or false

Normative statement: contains a value judgement (opinion); cannot be tested

Ceteris paribus: other things being equal; only the variable studied changes

Short run: at least one factor of production is fixed

Long run: all factors of production are variable (technology is given)

Very long run: technology (and factors outside the firm's control) can change

Factors of production

Land: natural resources (gifts of nature); reward **rent**

Labour: human effort, physical and mental; reward **wages**

Capital: man-made goods used to produce other goods; reward **interest**

Enterprise: organising the other factors and bearing risk; reward **profit**

Money, loans and shares are financial capital, not the factor capital

Human capital: workers' skills, knowledge and qualities; physical capital: machines, equipment, buildings

Profit = total revenue – all other costs, so it is the residual and the most variable reward

Labour productivity = $\frac{\text{total output}}{\text{number of workers}}$

Division of labour: a process is split into separate tasks, each done by different workers

Division of labour works best with large output of a standard product and stable demand

More or better factors shift the PPC outward; fewer or worse factors shift it inward

Resource allocation in different economic systems

Every economy must answer: what to produce, how to produce, for whom to produce

Market economy: private ownership, decisions by consumers and firms through the price mechanism, profit motive

Planned economy: state ownership, decisions by a central authority through plans and targets, no profit motive

Mixed economy: private sector and public sector together; price mechanism plus government intervention

Consumer sovereignty: consumers' spending decides what is produced (in a market economy)

Functions of price: rationing, signalling (transmission of preferences), incentive

Market weaknesses: no public goods, too few merit goods, too many demerit goods, externalities, monopoly, inequality

Planned weaknesses: no price signals (shortages and surpluses), weak incentives, little choice, bureaucracy

Towards the market: privatisation, prices set by demand and supply, fewer subsidies and price controls, deregulation

Privatisation: state-owned to private ownership; nationalisation: private to state ownership

Production possibility curves

PPC: the maximum combinations of two goods with all resources used efficiently and given technology

A PPC exists because resources are scarce and have alternative uses

Axes: two named goods; the curve touches both axes

On the curve: productive efficiency; inside: unemployed or inefficiently used resources; outside: unattainable

Opportunity cost of a move along the curve = amount of the other good given up

Opportunity cost of one more unit of X = $\frac{\text{units of Y given up}}{\text{units of X gained}}$

Straight-line PPC: constant opportunity cost; concave PPC: increasing opportunity cost (resources not equally suited)

Straight-line PPC: opportunity cost of one X = $\frac{\text{maximum Y}}{\text{maximum X}}$

Actual growth: from inside towards the curve; potential growth: the curve shifts outward

The PPC shifts only with the quantity or quality of resources or technology

A change affecting one good pivots the curve along that good's axis

Classification of goods and services

Free good: not scarce, uses no factors of production, zero opportunity cost; supply meets demand at zero price

Private (economic) good: uses scarce resources, rival and excludable

Rival: one person's consumption reduces what is left for others

Excludable: non-payers can be stopped from consuming it

Public good: non-rival and non-excludable (and non-rejectable); not supplied by the market because of free riders

Quasi-public good: partly rival and/or partly excludable, such as a road that can be congested or tolled

Merit good: benefits greater than people realise, under-consumed through imperfect information

Demerit good: harm greater than people realise, over-consumed through imperfect information

Merit and demerit goods are private goods

"Free of charge" is not a free good; "provided by the government" is not a public good

The price system and the microeconomy (AS Level)

Demand and supply curves

Effective demand: willingness **and ability** to pay

Axes: price (vertical), quantity (horizontal); curves labelled D and S

Law of demand: price falls → quantity demanded rises, ceteris paribus

Market demand (or supply) = sum of individual quantities at each price (horizontal summation)

Own-price change: movement along (extension or contraction); any other determinant: shift

Demand shifts right: income rises (normal good), income falls (inferior good), substitute's price rises, complement's price falls, tastes favour the good, population rises

Supply shifts right: costs fall, productivity or technology improves, more firms, subsidy, tax cut, good weather, joint product in greater demand

An increase in supply is a shift right, which is the same as a shift down

$$\text{Percentage change} = \frac{\text{new} - \text{old}}{\text{old}} \times 100$$

Price elasticity, income elasticity and cross elasticity of demand

$$\text{Percentage change} = \frac{\text{new} - \text{old}}{\text{old}} \times 100$$

$$\text{PED} = \frac{\% \Delta \text{ quantity demanded of the good}}{\% \Delta \text{ price of the good}}$$

$$\text{YED} = \frac{\% \Delta \text{ quantity demanded of the good}}{\% \Delta \text{ income}}$$

$$\text{XED} = \frac{\% \Delta \text{ quantity demanded of good X}}{\% \Delta \text{ price of good Y}}$$

Rearranged: $\% \Delta Q = \text{elasticity} \times \% \Delta (\text{cause})$, and $\% \Delta (\text{cause}) = \% \Delta Q \div \text{elasticity}$

Total expenditure (total revenue) = price $\times$ quantity

PED: 0 perfectly inelastic; 0–1 inelastic; 1 unit; > 1 elastic; ∞ perfectly elastic (by size)

YED < 0 inferior; 0–1 normal necessity; > 1 normal luxury

XED > 0 substitutes; < 0 complements; 0 unrelated; bigger size = closer relationship

Straight-line demand curve: unit elastic at the midpoint, elastic above, inelastic below

Inelastic: price and total expenditure move the same way; elastic: opposite ways; unit: no change

Price elasticity of supply

$$\text{PES} = \frac{\% \Delta \text{ quantity supplied of the good}}{\% \Delta \text{ price of the good}}$$

$$\text{Percentage change} = \frac{\text{new} - \text{old}}{\text{old}} \times 100$$

Rearranged: $\% \Delta Q_s = \text{PES} \times \% \Delta P$, and $\% \Delta P = \% \Delta Q_s \div \text{PES}$

$$\text{New quantity} = \text{old quantity} \times \left(1 + \frac{\% \Delta Q_s}{100} \right)$$

$$\text{For a straight supply curve: } \text{PES} = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

PES is normally positive: 0 perfectly inelastic; 0–1 inelastic; 1 unit elastic; > 1 elastic; ∞ perfectly elastic

Vertical supply curve: $PES = 0$; horizontal: $PES = \infty$; straight line through the origin: $PES = 1$ everywhere

Straight line from the price axis: elastic, PES falls towards 1 as price rises; from the quantity axis: inelastic, PES rises towards 1

The interaction of demand and supply

Equilibrium: $Q_d = Q_s$

Surplus (excess supply) = $Q_s - Q_d$ when price is above equilibrium

Shortage (excess demand) = $Q_d - Q_s$ when price is below equilibrium

From equations $Q_d = a - bP$ and $Q_s = c + dP$: $P = \frac{a - c}{b + d}$, then substitute to find Q

Supply rises by k units at every price: new $Q_s = \text{old } Q_s + k$ at each price

Percentage change = $\frac{\text{new} - \text{old}}{\text{old}} \times 100$

One shift: D right $\rightarrow$ P up, Q up; D left $\rightarrow$ P down, Q down; S right $\rightarrow$ P down, Q up; S left $\rightarrow$ P up, Q down

Two shifts: the variable both shifts move the same way is certain; the other is uncertain

Consumer and producer surplus

Consumer surplus on one unit = most the consumer is willing to pay – price paid

Producer surplus on one unit = price received – lowest price the producer would accept

Consumer surplus: area below the demand curve and above the price, up to the quantity bought

Producer surplus: area above the supply curve and below the price, up to the quantity sold

Straight-line curves: surplus = $\frac{1}{2} \times \text{quantity} \times \text{height of the triangle}$

Consumer expenditure = total revenue = $P \times Q$ (the rectangle below the price)

Total surplus = consumer surplus + producer surplus

Perfectly elastic demand: consumer surplus = 0; perfectly elastic supply: producer surplus = 0

Government microeconomic intervention (AS Level)

Reasons for government intervention in markets

Market failure: the market gives too much, too little or none of a good, so resources are misallocated

Public good: non-rival and non-excludable, so free riders stop firms charging and the market does not provide it

Public goods are financed by the government from taxation; private firms may still produce them under contract

More public goods have an opportunity cost and usually need higher taxes

Merit good: benefits underestimated through imperfect information, so under-consumed and under-produced

Demerit good: harm underestimated through imperfect information, so over-consumed and over-produced

Under-consumption (merit good) = quantity people would choose if fully informed – quantity bought

Over-consumption (demerit good) = quantity bought – quantity people would choose if fully informed

Maximum price below equilibrium: keeps goods affordable, causes a shortage = quantity demanded – quantity supplied

Minimum price above equilibrium: protects producers' incomes or cuts demerit-good use, causes a surplus = quantity supplied – quantity demanded

Methods and effects of government intervention in markets

Specific tax: supply shifts **up** by the tax per unit (parallel); ad valorem tax: supply pivots

Subsidy: supply shifts **down** by the subsidy per unit

Tax revenue = tax per unit $\times$ quantity after the tax

Consumers' share of a tax per unit = new price – old price

Producers' share of a tax per unit = old price – (new price – tax)

Government spending on a subsidy = subsidy per unit $\times$ quantity after the subsidy

Consumers' gain from a subsidy per unit = old price – new price; producers' gain = (new price + subsidy) – old price

The less elastic side (demand or supply) bears more of a tax and gets more of a subsidy

Shortage at a maximum price = $Q_d - Q_s$; surplus at a minimum price = $Q_s - Q_d$

Cost of buying up a surplus = minimum price $\times$ surplus

Buffer stock: buy $Q_s - Q_d$ at the floor; sell $Q_d - Q_s$ at the ceiling

$\% \Delta Q_d = PED \times \% \Delta P$ and $\% \Delta Q_s = PES \times \% \Delta P$

Consumer surplus (straight-line demand) = $\frac{1}{2} \times \text{quantity} \times (\text{top of demand curve} - \text{price})$

Addressing income and wealth inequality

Income is a flow (per period); wealth is a stock (value of assets at a point in time)

Wealth = total value of assets owned (property, savings, shares, businesses ...); interest, rent, dividends, wages and benefits are income

Gini coefficient: 0 = perfect equality, 1 = perfect inequality (or 0 to 100); higher means more unequal

Transfer payment: a payment with no good or service produced in return

Total transfer payments = sum of benefits, pensions, grants ... (not wages or spending on goods)

$$\text{Average rate of tax} = \frac{\text{tax paid}}{\text{income}} \times 100\%$$

Marginal rate of tax = the rate paid on each extra dollar of income

Progressive: average rate rises with income; proportional: constant; regressive: falls

Unemployment at a minimum wage above equilibrium = labour supplied – labour demanded

The macroeconomy (AS Level)

National income statistics

National output = national income = national expenditure

$$\text{GDP} = C + I + G + (X - M)$$

GNI = GDP + net primary (property, factor) income from abroad

Net income from abroad = income earned abroad by residents – income earned here by non-residents

NNI = GNI – capital consumption (depreciation); NDP = GDP – capital consumption

Basic prices = market prices – indirect taxes + subsidies

Market prices = basic prices + indirect taxes – subsidies

Counted: wages, salaries, overtime, rent, interest, dividends, retained profits

Not counted: transfer payments, second-hand sales, share sales, unpaid and non-market activity

Introduction to the circular flow of income

Leakages (withdrawals) $W = S + T + M$

Injectors $J = I + G + X$

Closed economy with government: equilibrium when $I + G = S + T$

Open economy: equilibrium when $I + G + X = S + T + M$

$(S - I) + (T - G) + (M - X) = 0$ at equilibrium

Households' income is consumed, saved or taxed: $Y = C + S + T$

National expenditure: $Y = C + I + G + (X - M)$

Budget surplus = $T - G$; trade (current account) surplus = $X - M$

Injectors > leakages: income rises; injectors < leakages: income falls

Aggregate Demand and Aggregate Supply analysis

$$AD = C + I + G + (X - M)$$

Net exports = $X - M$ (negative when imports exceed exports)

Equilibrium: $AD = AS$ (planned spending $C + I + G + X - M = \text{real output}$)

As shares of GDP: $C\% + I\% + G\% + X\% - M\% = 100\%$

Axes: price level (vertical), real output or real GDP (horizontal)

AD right: output $\uparrow$, employment $\uparrow$, price level $\uparrow$ (or unchanged in the horizontal section, only price level $\uparrow$ in the vertical section)

SRAS left: price level $\uparrow$, output $\downarrow$, employment $\downarrow$

AS right: price level $\downarrow$ (or rises less), output $\uparrow$, employment $\uparrow$

Economic growth

Growth rate = $\frac{\text{real GDP this period} - \text{real GDP last period}}{\text{real GDP last period}} \times 100$

Real GDP = nominal GDP $\times \frac{\text{price index in base year}}{\text{price index in current year}}$

Real growth $\approx$ nominal growth – inflation rate

Exact: $1 + \text{real growth} = \frac{1 + \text{nominal growth}}{1 + \text{inflation}}$

Real GDP per head = $\frac{\text{real GDP}}{\text{population}}$; growth per head $\approx$ real growth – population growth

Recession: two consecutive quarters of negative economic growth

$AD = C + I + G + (X - M)$

Actual growth: output rises (AD shifts right, move towards the PPC); potential growth: capacity rises (LRAS right, PPC out)

Unemployment

Unemployment rate = $\frac{\text{number unemployed}}{\text{labour force}} \times 100$

Labour force = employed + unemployed (not the whole population, not the working-age population)

Change in a rate in percentage points = new rate – old rate

Percentage change in a rate = $\frac{\text{new rate} - \text{old rate}}{\text{old rate}} \times 100$

Unemployed: able, available and willing to work at the current wage, actively seeking work, without a job

ILO / labour force survey: no job, looked for work in the past 4 weeks, can start within 2 weeks

Claimant count: people claiming unemployment-related benefits

$AD = C + I + G + (X - M)$; a fall in AD causes cyclical unemployment

Price stability

$$\text{Inflation rate} = \frac{\text{CPI}_{\text{new}} - \text{CPI}_{\text{old}}}{\text{CPI}_{\text{old}}} \times 100$$

$$\text{Weighted index} = \frac{\sum(\text{weight} \times \text{item index})}{\sum \text{weights}}$$

$$\text{Real value} = \text{nominal value} \times \frac{\text{base-year index}}{\text{current index}}$$

$$\text{Real interest rate} = \text{nominal interest rate} - \text{inflation rate}$$

$$\text{Real \% change} \approx \text{nominal \% change} - \text{inflation rate}$$

$$\text{Price level after } n \text{ years at rate } r\%: P_n = P_0 \left(1 + \frac{r}{100}\right)^n$$

$$AD = C + I + G + (X - M)$$

Inflation: sustained rise in the general price level. Deflation: sustained fall. Disinflation: fall in the rate of inflation (prices still rising)

Demand-pull: AD shifts right (near full capacity). Cost-push: SRAS shifts left

Government macroeconomic intervention (AS Level)

Government macroeconomic policy objectives

The three objectives: price stability (low, stable inflation), low unemployment, economic growth

$$AD = C + I + G + (X - M)$$

$$\text{Price index (GDP deflator)} = \frac{\text{money GDP}}{\text{real GDP}} \times 100$$

$$\text{Inflation rate} = \frac{\text{price index this year} - \text{price index last year}}{\text{price index last year}} \times 100$$

$$\text{Growth rate} = \frac{\text{real GDP this year} - \text{real GDP last year}}{\text{real GDP last year}} \times 100$$

$$\text{Unemployment rate} = \frac{\text{number unemployed}}{\text{labour force}} \times 100$$

Contractionary policy (higher interest rates, smaller deficit, higher exchange rate) shifts AD left: lower inflation, but less output and fewer jobs

Expansionary policy (lower interest rates, bigger deficit, lower exchange rate) shifts AD right: more output and jobs, but higher prices

Supply-side policy shifts LRAS right: more output, fewer unemployed and less inflationary pressure, but slowly

Fiscal policy

$$\text{Budget deficit} = \text{government spending} - \text{government revenue (when spending is larger)}$$

Budget surplus = government revenue – government spending (when revenue is larger)

$$\text{Deficit or debt as \% of GDP} = \frac{\text{deficit (or debt)}}{\text{GDP}} \times 100$$

National debt at end of year = debt at start + deficit (or – surplus used to repay)

$$\text{art} = \frac{\text{total tax paid}}{\text{total income}} \times 100$$

$$\text{mrt} = \frac{\text{change in tax paid}}{\text{change in income}} \times 100$$

Progressive: art rises with income (mrt > art); proportional: art constant (mrt = art); regressive: art falls (mrt < art)

$$AD = C + I + G + (X - M)$$

Expansionary: G up and/or taxes down, AD right; contractionary: G down and/or taxes up, AD left

Monetary policy

Real interest rate = nominal interest rate – inflation rate

Interest paid in a year = amount borrowed × interest rate

$$AD = C + I + G + (X - M)$$

Expansionary: interest rates down, money supply up, credit loosened; AD shifts right

Contractionary: interest rates up, money supply down, credit tightened; AD shifts left

Money supply up ⇒ interest rate down ⇒ C and I up ⇒ AD right

Supply-side policy

Labour productivity = output ÷ number of workers (or worker-hours)

Unit labour cost = wage ÷ output per worker (in the same time period)

$$\text{Percentage change} = \frac{\text{new} - \text{old}}{\text{old}} \times 100$$

Supply-side policy: productive capacity up ⇒ LRAS shifts right ⇒ real output up, price level down, employment up

Spending-based measures: AD right in the short run (prices up), LRAS right in the long run (prices down)

$$AD = C + I + G + (X - M)$$

International economic issues (AS Level)

The reasons for international trade

$$\text{Terms of trade} = \frac{\text{index of average export prices}}{\text{index of average import prices}} \times 100$$

$$\text{Opportunity cost of 1 unit of X} = \frac{\text{units of Y given up}}{\text{units of X gained}}$$

Absolute advantage: more output from the same resources (or fewer inputs per unit)

Comparative advantage: lower opportunity cost

Both countries gain if the exchange rate of the goods lies **between** their opportunity costs

$$\text{Percentage change} = \frac{\text{new} - \text{old}}{\text{old}} \times 100$$

Revenue = price × quantity, so % change in revenue ≈ % change in price + % change in quantity

Protectionism

Imports = domestic demand – domestic supply, at the domestic price

Price with a specific tariff = world price + tariff per unit

$$\text{Price with an ad valorem tariff of } t\% = \text{world price} \times \left(1 + \frac{t}{100}\right)$$

Tariff revenue = tariff per unit × imports **after** the tariff

Domestic producers' revenue = price × domestic supply

$$\text{Fall in consumer surplus} = \text{price rise} \times \frac{\text{old consumption} + \text{new consumption}}{2}$$

$$\text{Gain in producer surplus} = \text{price rise} \times \frac{\text{old domestic supply} + \text{new domestic supply}}{2}$$

Deadweight loss = the two triangles: fall in consumer surplus – gain in producer surplus – tariff revenue

Current account of the balance of payments

Balance of trade in goods = exports of goods – imports of goods

Balance of trade in services = exports of services – imports of services

Balance of trade in goods and services = goods balance + services balance

Net primary income = primary income credits – primary income debits (same for secondary income)

CAB = goods balance + services balance + net primary income + net secondary income

Current + capital + financial account + net errors and omissions = 0

$$\text{CAB as \% of GDP} = \frac{\text{CAB}}{\text{GDP}} \times 100$$

% change in a deficit (or surplus) = $\frac{\text{new size} - \text{old size}}{\text{old size}} \times 100$, using sizes without the minus sign; then say whether it **rose** or **fell**

Export revenue = export price × quantity exported; import spending = import price × quantity imported

Exchange rates

If 1 unit of A = e units of B, then 1 unit of B = $\frac{1}{e}$ units of A

% change in a currency's value = $\frac{\text{new value} - \text{old value}}{\text{old value}} \times 100$, with the value measured in the other currency

Price abroad = home-currency price $\times$ exchange rate (foreign currency per unit of home currency)

Price at home = foreign-currency price $\div$ exchange rate (foreign currency per unit of home currency)

$$AD = C + I + G + (X - M)$$

Floating rate rises (appreciation) when demand for the currency rises or supply of it falls

Floating rate falls (depreciation) when demand for the currency falls or supply of it rises

Policies to correct imbalances in the current account of the balance of payments

Value of imports = price paid to foreign sellers $\times$ quantity imported (a tariff is paid to the home government, so it is not part of import spending)

% change in quantity demanded = PED $\times$ % change in price

Tariff revenue = tariff per unit $\times$ quantity imported

Current account balance = goods balance + services balance + net primary income + net secondary income

The price system and the microeconomy (A Level)

Utility

Marginal utility of the n th unit: $MU_n = TU_n - TU_{n-1}$

Total utility = sum of the marginal utilities of every unit consumed

Average utility = $TU \div$ quantity consumed

MU per dollar of a good = $MU \div$ its price

Equi-marginal principle: $\frac{MU_A}{P_A} = \frac{MU_B}{P_B}$, with all income spent

Equi-marginal principle rearranged: $\frac{MU_A}{MU_B} = \frac{P_A}{P_B}$, or $MU_A \times P_B = MU_B \times P_A$

Market demand at a price = sum of every consumer's quantity demanded at that price

Indifference curves and budget lines

Budget line: $P_X X + P_Y Y = M$, where M is income

Budget line intercepts: at most $\frac{M}{P_X}$ of X, or at most $\frac{M}{P_Y}$ of Y

Slope of the budget line, with X on the horizontal axis: $-\frac{P_X}{P_Y}$ (the opportunity cost of one unit of X in units of Y)

Marginal rate of substitution of X for Y = the gradient of the indifference curve (without the sign) = $\frac{MU_X}{MU_Y}$

Consumer equilibrium: the budget line is tangent to the highest reachable indifference curve, so

$$MRS = \frac{P_X}{P_Y}, \text{ equivalent to } \frac{MU_X}{P_X} = \frac{MU_Y}{P_Y}$$

Price effect = substitution effect + income effect

Efficiency and market failure

Allocative efficiency (no externalities): $P = MC$, the value of the last unit to consumers equals the cost of making it

Allocative efficiency with externalities: $MSB = MSC$

Productive efficiency for a firm: output at the lowest point of AC, where $MC = AC$

Productive efficiency for an economy: production on the production possibility curve

Marginal social cost: $MSC = MPC + \text{marginal external cost}$

Marginal social benefit: $MSB = MPB + \text{marginal external benefit}$

Welfare loss of an externality

$$= \frac{1}{2} \times (\text{market output} - \text{efficient output}) \times (\text{gap between MSC and MSB at the market output})$$

Profit maximisation: $MR = MC$ (perfect competition long run: $P = MR = MC = \text{minimum AC}$)

Private costs and benefits, externalities and social costs and benefits

Social cost: $SC = PC + EC$

Social benefit: $SB = PB + EB$

Marginal social cost: $MSC = MPC + MEC$

Marginal social benefit: $MSB = MPB + MEB$

Marginal value from totals: marginal cost (or benefit) of a unit = change in the total when that unit is added

Free-market output: $MPB = MPC$ (demand meets supply)

Socially optimal (allocatively efficient) output: $MSB = MSC$

Marginal external cost at the free-market output: the vertical gap $MSC - MPC$ at Q_1

Deadweight welfare loss = $\frac{1}{2} \times |Q_1 - Q^*| \times (\text{gap between MSC and MSB at } Q_1)$

Net social benefit = $SB - SC$; cost-benefit rule: go ahead if $SB > SC$

Types of cost, revenue and profit, short-run and long-run production

$$\text{Average product: } AP = \frac{TP}{L}$$

$$\text{Marginal product: } MP = \frac{\Delta TP}{\Delta L}$$

$$\text{Total cost: } TC = TFC + TVC$$

$$\text{Average fixed cost: } AFC = \frac{TFC}{Q}$$

$$\text{Average variable cost: } AVC = \frac{TVC}{Q}$$

$$\text{Average total cost: } ATC = \frac{TC}{Q} = AFC + AVC$$

$$\text{Marginal cost: } MC = \frac{\Delta TC}{\Delta Q} = \frac{\Delta TVC}{\Delta Q}$$

$$\text{Cost-product link with one variable factor at wage } W: MC = \frac{W}{MP}, AVC = \frac{W}{AP}$$

$$\text{Total revenue: } TR = P \times Q$$

$$\text{Average revenue: } AR = \frac{TR}{Q} = P$$

$$\text{Marginal revenue: } MR = \frac{\Delta TR}{\Delta Q}; \text{ for a price taker } MR = AR = P$$

$$\text{Supernormal (or subnormal) profit} = TR - TC = (AR - ATC) \times Q$$

$$\text{Normal profit: } TR = TC, \text{ that is } AR = ATC$$

$$\text{Profit-maximising output: } MC = MR$$

$$\text{Short-run shutdown rule: produce only if } P \geq AVC \text{ (} TR \geq TVC \text{); long run: stay only if } P \geq ATC$$

Different market structures

$$\text{Profit maximisation in every structure: } MC = MR \text{ (MC rising)}$$

$$\text{Perfect competition: } P = AR = MR; \text{ long run } P = MC = \text{minimum AC}$$

$$\text{Supernormal profit} = (AR - AC) \times Q; \text{ normal profit when } AR = AC$$

$$\text{Short-run shutdown price} = \text{lowest AVC}; \text{ long-run shutdown price} = \text{lowest AC}$$

$$\text{Perfectly competitive firm's supply curve: MC above the lowest AVC}$$

$$\text{Monopolistic competition, long run: } AR = AC \text{ (tangency) at the output where } MC = MR$$

$$\text{Allocative efficiency: } P = MC; \text{ productive efficiency: output at lowest AC}$$

$$\text{Natural monopoly: } MC < AC \text{ at every output; } P = MC \text{ gives a loss, } P = AC \text{ gives normal profit}$$

$$n\text{-firm concentration ratio} = \text{sum of the market shares of the } n \text{ largest firms}$$

Growth and survival of firms

Profit maximisation: $MC = MR$; revenue maximisation: $MR = 0$; sales maximisation (normal profit): $AR = AC$

Supernormal profit = $(AR - AC) \times Q$

Merger cost saving = $(AC \text{ before} - AC \text{ after}) \times Q$

Percentage change = $\frac{\text{new} - \text{old}}{\text{old}} \times 100$

Extra profit from cheating on a cartel quota = area between the cartel price and MC, from the quota to the output where $MC = P$

Differing objectives and policies of firms

Profit maximisation: $MC = MR$ (with MC rising through MR)

Revenue maximisation: $MR = 0$, where $PED = -1$

Sales maximisation (normal profit): $AR = AC$

Total revenue = $P \times Q$; profit = $TR - TC = (AR - AC) \times Q$

A straight-line demand $P = a - bQ$ has $MR = a - 2bQ$

$PED = \frac{\% \Delta Q}{\% \Delta P}$; elastic: TR moves the opposite way to price; inelastic: the same way

The change in TR between two outputs is the area under MR between them

Third-degree price discrimination: $MR_A = MR_B = MC$; the market with the less elastic demand pays the higher price

Government microeconomic intervention (A Level)

Government policies to achieve efficient resource allocation and correct market failure

Allocative efficiency: $MSB = MSC$; with no externalities, $P = MC$

Corrective (Pigouvian) tax per unit = marginal external cost at the optimum output

Corrective subsidy per unit = marginal external benefit at the optimum output

Tax revenue = tax per unit $\times$ quantity sold after the tax

Cost of a subsidy = subsidy per unit $\times$ quantity sold after the subsidy

Welfare loss removed = $\frac{1}{2} \times |Q_1 - Q^*| \times (\text{gap between social cost and social benefit at } Q_1)$

Percentage change in quantity = $PED \times \text{percentage change in price}$

Monopoly profit maximum: $MR = MC$; welfare maximum: $P = AR = MC$; break-even: $P = AC$

Firm's cost of polluting with permits = permits needed $\times$ permit price; cut pollution while cutting a tonne costs less than a permit

Equity and redistribution of income and wealth

Gini coefficient = $\frac{A}{A+B}$, from 0 (perfect equality) to 1 (perfect inequality); a rise means more inequality

Effective marginal tax rate = marginal income tax rate + other deductions rate + benefit withdrawal rate

Extra net income kept = extra gross earnings $\times$ (1 – EMTR)

Negative income tax, income Y below threshold T : payment = $t \times (T - Y)$; above T : tax = $t \times (Y - T)$

Disposable income = original (gross) income – direct taxes + cash benefits

Final income = disposable income – indirect taxes + benefits in kind (free education, health care)

Relative poverty line = chosen fraction (often 60% or 50%) $\times$ median income

Progressive tax: share of income paid rises with income; regressive: falls; proportional: constant

Labour market forces and government intervention

MRP = MPP $\times$ MR; in a perfectly competitive product market MRP = MPP $\times$ P

MPP of the n th worker = total product with n workers – total product with $n - 1$

Profit-maximising employment: MRP = MCL; in a perfect labour market MCL = ACL = W , so MRP = W

Marginal cost of labour = new total wage bill – old total wage bill

Monopsony: employ where MCL = MRP; pay the wage on the supply (= ACL) curve

Linear supply $W = a + bL$ gives MCL = $a + 2bL$

Transfer earnings = area under the supply curve up to employment; economic rent = total earnings – transfer earnings

One worker: transfer earnings = least pay that keeps them in the job; economic rent = pay – that minimum

Unemployment from a wage floor = quantity supplied – quantity demanded at that wage

Elasticity of demand for labour = $\frac{\% \text{ change in labour demanded}}{\% \text{ change in the wage}}$

The macroeconomy (A Level)

The circular flow of income

Aggregate demand: $AD = C + I + G + (X - M)$

Consumption function $C = a + bY$: a is autonomous consumption, b is the MPC

$$APC = \frac{C}{Y}, APS = \frac{S}{Y}, APM = \frac{M}{Y}, ART = \frac{T}{Y}$$

$$MPC = \frac{\Delta C}{\Delta Y}, MPS = \frac{\Delta S}{\Delta Y}, MPM = \frac{\Delta M}{\Delta Y}, MRT = \frac{\Delta T}{\Delta Y}$$

Income only consumed or saved: $APC + APS = 1$ and $MPC + MPS = 1$

$$\text{Multiplier, closed economy without government: } k = \frac{1}{1 - MPC} = \frac{1}{MPS}$$

$$\text{Multiplier, closed economy with government: } k = \frac{1}{MPS + MRT}$$

$$\text{Multiplier, open economy with government: } k = \frac{1}{MPS + MRT + MPM}$$

Change in national income: $\Delta Y = k \times \Delta J$ (or $\times$ the change in any autonomous spending)

Equilibrium national income: $Y = C + I + G + (X - M)$, or withdrawals = injections,
 $S + T + M = I + G + X$

Deflationary or inflationary gap = full employment income – AD at full employment income (positive: deflationary; negative: inflationary)

$$\text{Change in injections needed to reach full employment} = \frac{\text{full employment income} - \text{equilibrium income}}{k}$$

Accelerator: net investment = capital-output ratio $\times$ change in output

Economic growth and sustainability

Output gap = actual output – potential output (negative: spare capacity; positive: over-used capacity)

$$\text{Output gap as a percentage} = \frac{\text{actual} - \text{potential}}{\text{potential}} \times 100$$

Recession: real GDP falls for two or more consecutive quarters

Real growth $\approx$ nominal growth – inflation

Growth of real GDP per head $\approx$ real growth – population growth

$$\text{Real GDP} = \text{nominal GDP} \times \frac{100}{\text{price index}}$$

Automatic stabilisers: progressive taxes and means-tested benefits; in a downturn tax revenue falls, benefit spending rises and the budget deficit widens

Employment/unemployment

Labour force = employed + unemployed (the economically active)

$$\text{Unemployment rate} = \frac{\text{unemployed}}{\text{labour force}} \times 100$$

$$\text{Employment rate} = \frac{\text{employed}}{\text{working-age population}} \times 100$$

$$\text{Participation rate} = \frac{\text{labour force}}{\text{working-age population}} \times 100; \text{ inactivity rate} = 100 - \text{participation rate}$$

$$\text{Change in percentage points} = \text{new rate} - \text{old rate}; \text{percentage change} = \frac{\text{new} - \text{old}}{\text{old}} \times 100$$

Natural (equilibrium) unemployment = labour force – workers willing to accept a job, at the equilibrium real wage

$$\text{Multiplier } k = \frac{1}{\text{marginal propensity to withdraw}}; \text{change in income} = k \times \text{change in injections}$$

Money and banking

Quantity theory: $MV = PT$ (M money supply, V velocity of circulation, P price level, T volume of transactions)

With V and T constant, P changes in proportion to M

$$\% \text{ change in } P \approx \% \text{ change in } M + \% \text{ change in } V - \% \text{ change in } T$$

$$\text{Bank credit multiplier} = \frac{1}{\text{reserve ratio}}; \text{maximum change in deposits} = \text{new deposit} \times \text{multiplier}$$

$$\text{Reserve ratio} = \frac{\text{cash and balances at the central bank}}{\text{deposits}}$$

$$\text{Capital ratio} = \frac{\text{bank capital (equity)}}{\text{risk-weighted assets}}$$

Keynesian demand for money: $L = L_1(Y) + L_2(r)$; L_1 transactions and precautionary (income), L_2 speculative (interest rate)

$$\text{Bond yield} = \frac{\text{fixed annual payment}}{\text{bond price}} \times 100: \text{bond prices and interest rates move in opposite directions}$$

Government macroeconomic intervention (A Level)

Government macroeconomic policy objectives

The seven macroeconomic objectives: low stable inflation, a sustainable balance of payments, low unemployment, sustained growth, development, sustainability, a fairer distribution of income and wealth

$$\text{Growth of real GDP per head} = \left(\frac{1+g}{1+n} - 1 \right) \times 100 \approx \text{real GDP growth} - \text{population growth (\%)}$$

$$\text{Current account balance as \% of GDP} = \frac{\text{current account balance}}{\text{GDP}} \times 100$$

With spare capacity, a rise in AD raises output and employment with little inflation; near full capacity it mostly raises prices

Expansionary policy: more growth and jobs, but risks inflation and a bigger current account deficit

Contractionary policy: lower inflation and a smaller current account deficit, but less growth and fewer jobs

Supply-side policy shifts LRAS right: growth, jobs and stable prices together, but slowly

Links between macroeconomic problems and their interrelatedness

Internal value of money = what money buys at home; inflation is a fall in it. % change = $\left(\frac{P_{\text{old}}}{P_{\text{new}}} - 1 \right) \times 100$

External value of money = the exchange rate (foreign currency per unit of home currency)

Faster inflation than abroad → exports less competitive → current account worse → currency depreciates (floating rate)

A fall in the exchange rate → dearer imports (cost-push) and more net exports (demand-pull) → higher inflation

Change in imports = marginal propensity to import × change in income

Direct effect of dearer imports on the price index ≈ share of imports in the basket × % rise in import prices

Traditional Phillips curve: inflation rate (vertical) against unemployment rate (horizontal), sloping down: a short-run trade-off

Expectations-augmented: inflation = expected inflation + a short-run effect that is positive when unemployment is below the natural rate

Long-run Phillips curve: vertical at the natural rate of unemployment (NAIRU); holding unemployment below it means accelerating inflation

Demand-led growth near capacity → inflation and a bigger current account deficit; supply-led growth → growth with lower inflation

Effectiveness of policy options to meet all macroeconomic objectives

Multiplier $k = \frac{1}{MPW} = \frac{1}{MPS + MPT + MPM}$; with no government or trade, $k = \frac{1}{1 - MPC}$

Change in national income = $k \times$ change in injections

Net injection after crowding out = extra government spending – private investment crowded out

Debt (or deficit) as % of GDP = $\frac{\text{debt (or deficit)}}{\text{GDP}} \times 100$

Tax revenue = tax rate × tax base; Laffer curve: revenue rises with the rate up to a peak, then falls

Percentage change = $\frac{\text{new} - \text{old}}{\text{old}} \times 100$

Marshall–Lerner condition: a devaluation improves the current account if PED for exports + PED for imports > 1 (ignoring signs)

Demand-side policy moves output and the price level in the same direction; supply-side policy raises output and lowers the price level

International economic issues (A Level)

Policies to correct disequilibrium in the balance of payments

Current account + capital account + financial account + net errors and omissions = 0

Change in imports = MPM $\times$ change in national income ($\Delta M = \text{MPM} \times \Delta Y$)

Fall in national income needed to cut imports by ΔM through expenditure-reducing policy = $\frac{\Delta M}{\text{MPM}}$

Import spending (current account debit) = price paid to foreign sellers $\times$ quantity imported; a tariff goes to the home government and is not part of it

Tariff revenue = tariff per unit $\times$ quantity imported after the tariff

Marshall–Lerner condition: a fall in the exchange rate improves the current account if PED for exports + PED for imports (ignoring signs) > 1

% change in quantity demanded = PED $\times$ % change in price

Exchange rates

Real exchange rate = nominal exchange rate $\times \frac{\text{home price index}}{\text{foreign price index}}$; a rise means home goods are less price competitive

% change in a trade-weighted exchange rate = $\sum (\text{trade weight} \times \% \text{ change against each currency})$, with the weights adding to 1

Reserves needed to hold a fixed rate = excess supply of the home currency at the fixed rate $\times$ the fixed rate

Marshall–Lerner condition: a fall in the exchange rate improves the current account if PED for exports + PED for imports (ignoring signs) > 1 ; a rise then worsens it

Export revenue in home currency after a depreciation = old revenue $\times (1 + \text{PED}_X \times f)$, where f is the fall in the foreign-currency price of exports as a decimal

Import spending in home currency after a depreciation = old spending $\times (1 + r)(1 - \text{PED}_M \times r)$, where r is the rise in the home-currency price of imports as a decimal

Economic development

GNI = GDP + net primary income from abroad

NNI = GNI – depreciation (capital consumption)

GDP at factor cost = GDP at market prices – indirect taxes + subsidies

Income per head = $\frac{\text{national income}}{\text{population}}$

% Δ real income per head $\approx$ % Δ money income – inflation rate – % Δ population

Exact real income per head growth = $\frac{1+g}{(1+\pi)(1+n)} - 1$, with g money income growth, π inflation, n population growth (as decimals)

PPP rate = $\frac{\text{cost of a basket in local currency}}{\text{cost of the same basket in US dollars}}$

HDI: life expectancy at birth; mean and expected years of schooling; GNI per head at PPP; scale 0 to 1

MEW = GNP + leisure + unpaid work – regrettable necessities – environmental damage

MPI = $H \times A$ (share of people poor $\times$ average intensity of their deprivation); poor if weighted deprivations $\geq \frac{1}{3}$

Kuznets curve: inequality (vertical) against income per head (horizontal), an inverted U

Characteristics of countries at different levels of development

Crude birth rate = $\frac{\text{live births in a year}}{\text{population}} \times 1000$

Crude death rate = $\frac{\text{deaths in a year}}{\text{population}} \times 1000$

Infant mortality rate = $\frac{\text{deaths of babies under one year old}}{\text{live births in the year}} \times 1000$

Net migration rate = $\frac{\text{immigrants} - \text{emigrants}}{\text{population}} \times 1000$

Population growth (%) = $\frac{\text{birth rate} - \text{death rate} + \text{net migration rate}}{10}$, with all three rates per 1000

Dependency ratio = $\frac{\text{people aged 0–14} + \text{people aged 65 and over}}{\text{people aged 15–64}} \times 100$

Level of urbanisation (%) = $\frac{\text{urban population}}{\text{total population}} \times 100$

Optimum population: the population at which real output per head is at its maximum, given resources, capital and technology

Gini coefficient = $\frac{A}{A+B}$: A is the area between the line of perfect equality and the Lorenz curve, B the area below the Lorenz curve; 0 is perfect equality, 1 perfect inequality

Gini coefficient = $2A$ when both Lorenz axes run from 0 to 1 (the triangle under the diagonal has area $\frac{1}{2}$)

Area under a Lorenz curve from fifths: $B = \sum 0.2 \times \frac{L_{\text{left}} + L_{\text{right}}}{2}$, with L the cumulative income share as a decimal

Relationship between countries at different levels of development

Aid: a transfer from a government or official institution on better than market terms (grants, soft loans, goods, skills); NGO money, FDI and portfolio investment are not official aid

Tied aid: aid that must be spent on goods or services from a named source, usually the donor

Bilateral aid: from one government to another; multilateral aid: through an international body funded by many governments

MNC: a firm that owns or controls production in more than one country

FDI: investment by a firm to set up, buy or expand a business it controls in another country

Debt service = interest payments + repayments of principal

Debt service ratio = $\frac{\text{debt service}}{\text{export earnings}} \times 100$

Local-currency cost of a foreign debt payment = payment in foreign currency $\times$ exchange rate (local currency per unit of foreign currency)

A loan-financed project adds to income only if its rate of return $>$ the interest rate

FDI in the balance of payments: capital inflow is a financial account credit; repatriated profits are a primary income debit

Globalisation

Globalisation: growing integration and interdependence of national economies through freer cross-border flows of goods, services, capital, labour, technology and information

Free trade area: no tariffs or quotas between members; each member sets its own tariffs on non-members

Customs union: free trade between members plus a common external tariff on non-members

Monetary union: members share a single currency, one central bank and one monetary policy

Full economic union: single market and single currency plus harmonised fiscal and other economic policies

Trade creation: higher-cost domestic output replaced by lower-cost imports from a partner (welfare rises)

Trade diversion: imports switched from a lower-cost non-member to a higher-cost member (welfare falls)

Imports at a price = quantity demanded – domestic quantity supplied at that price

Tariff revenue = tariff per unit $\times$ imports from outside the bloc

Net welfare effect of joining a bloc = production triangle + consumption triangle – trade diversion rectangle

Trade diversion loss = (partner's price – world price) $\times$ quantity once imported from outside
