GCE AS/A LEVEL

S24-2520U20-1

2520U20-1

MONDAY, 20 MAY 2024 – MORNING

ECONOMICS – AS unit 2
Economics in Action

2 hours

2520U201
01

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- a calculator;
- a WJEC pink 16-page answer booklet.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.
You may use a pencil for graphs and diagrams only.
Answer **all** questions.
Write your answers in the separate answer booklet provided.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.
You are reminded of the necessity for good English and orderly presentation in your answers.

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Answer **all** questions.

1. REDUCING THE THREAT OF CLIMATE CHANGE

In April 2019, the Welsh Government declared a climate emergency. A government minister said: “Tackling climate change is not an issue which can be left to the free market. It requires collective action and the government has a central role in making that collective action possible.”

Climate change is causing severe weather and rising sea levels which are affecting people and their property in developed and developing countries. It can also worsen the threat of food and water scarcity.

Governments have been implementing measures to reduce climate change for many years. The UK’s carbon emissions fell by 47.3% between 1990 and 2021. The main reason for this downward trend has been lower emissions from power stations. The UK is increasingly using gas and renewable energy sources. As a result, carbon dioxide emissions from the energy sector fell by 66.9% between 1990 and 2021.

In 2022, more than a third (34.7%) of the UK’s electricity was generated by renewable energy sources including wind farms, solar panels and hydroelectric power plants. Wind power alone generated 28.9% of the UK’s electricity over the year.

In December 2022, the UK Government promised to remove restrictions on building onshore wind farms in England. However, producing wind power does have some drawbacks. The production process for wind turbines involves large amounts of steel and concrete, which some say has caused extensive water and soil pollution in countries where they are produced. Additionally, large numbers of birds are killed by the operation of wind turbines.

The European Union’s emissions trading system (EU ETS) began in 2005. The EU ETS limits carbon dioxide emissions from more than 11 000 high energy-using power stations, industries and airlines operating within the EU. The EU ETS works in the same way as a system of tradeable pollution permits.

On leaving the EU, the UK had two main options as to how it could continue to reduce carbon emissions:

- Create its own emissions trading scheme (UK ETS).
- Replace the EU ETS with a carbon tax, where firms are charged a set amount per tonne of carbon dioxide emissions they produce.

A carbon tax would rely on data supplied by emitters of carbon dioxide. Firms could be fined if they failed to comply with the carbon tax requirements.

Some carbon taxes introduced in other countries have been controversial. Many people say that they have led to rising fuel prices and a higher cost of living, because firms have passed on the carbon tax to consumers. The tax’s burden also falls more on lower-income households, and those who have fossil fuel-based heating for their homes, or who live outside of city centres and rely on a car. Perhaps for these reasons, the UK chose not to introduce a carbon tax and instead an emissions trading scheme (UK ETS) went live on 1st January 2021.

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(a) 'Tackling climate change is not an issue which can be left to the free market' (line 2). Briefly outline **one** reason why the free market has led to climate change. [2]

(b) To what extent do the external benefits of wind power outweigh the external costs? [10]

(c) Discuss the likely effectiveness of a tradeable carbon emissions permits scheme, (EU ETS or UK ETS), in reducing carbon emissions. [8]

(d) Explain how a carbon tax could correct the market failure caused by carbon emissions. Illustrate your answer with an appropriate diagram. [8]

(e) To what extent might UK Government policies to tackle climate change cause conflicts with their macroeconomic policy objectives? [12]

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2. A NEW COAL MINE IN THE UK

In September 2022, the UK Government gave permission for a new coal mine at Whitehaven in Cumbria. This will be the first new coal mine in the UK for 30 years. It will mean:

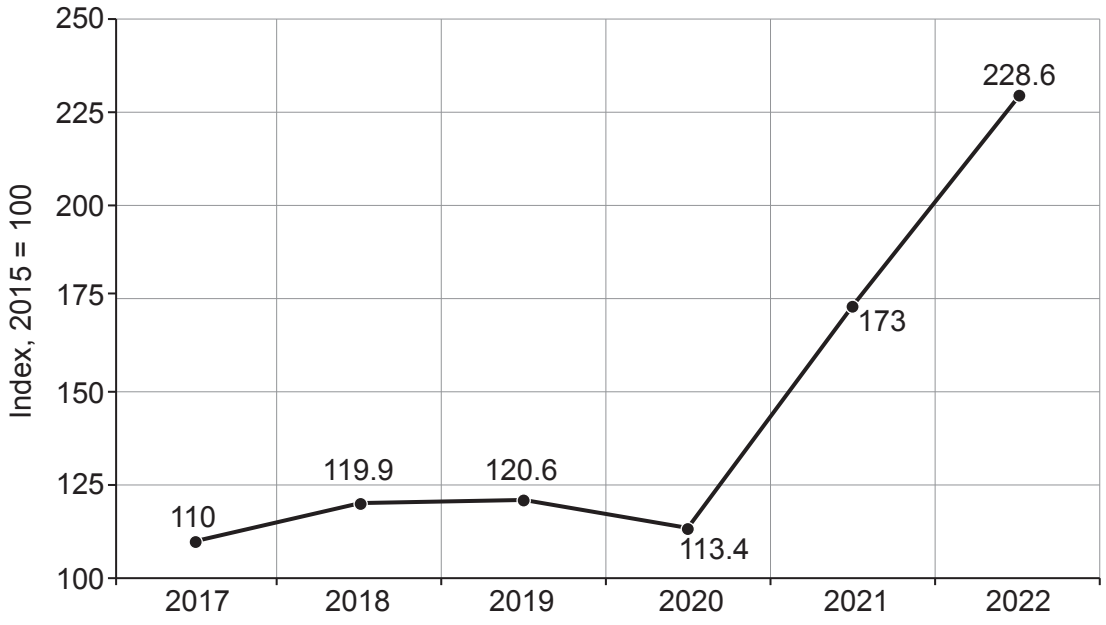
- an estimated private sector investment of £165 million
- the creation of about 500 direct jobs and an additional 1500 jobs in the wider community
- the production of 2.8 million tonnes of coal a year

Most of the coal from the mine will provide fuel for steelmaking. In 2021, UK steelmakers sourced nearly half of their coal from Russia. However, the UK no longer imports coal from Russia. This led to a significant increase in the price of steel in the UK.

Steel production

- Most steel production involves heating coal to high temperatures and combining it with iron.
- It takes about 770 kg of coal to make one tonne of steel.
- In 2022, the UK produced 7.4 million tonnes of steel.

Chart 1: Steel price index in the UK, 2017 to 2022 (2015 = 100)



However, the UK Government's advisory Climate Change Committee has said that 85% of the coal produced by the new mine is likely to be exported to the EU. This is because most UK steelmakers have rejected the use of this type of coal for their steel-making processes. Two of the largest steel producers in the UK said that they had already found alternatives to Russian coal supplies from mines in Wales, the USA and Canada. A former CEO of British Steel said the UK steel industry should invest instead in green alternatives to coal, such as hydrogen.

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Indeed, many European steelmakers are turning away from the use of coal and adopting green production methods instead, such as using electric furnaces and hydrogen. In 2022, 41% of European steel was produced using electric furnaces, while hydrogen was used in 10% of global production.

The company building the mine said that it will add £1.5 billion to UK GDP and provide £2.4 billion worth of exports over the first ten years of the mine's operation. It is forecast to pay more than £800 million in corporation tax to the UK Government over the mine's lifetime.

The average salary for workers at the coal mine is expected to be £43 875 per year, which is approximately £10 000 more than the UK's median salary. Economic analysis has shown that a very large proportion of employees' income will be spent locally. The company has committed to filling 80% of the jobs in the mine with people living within a 30 km radius. It has also promised to source all major equipment and machinery from within the UK.

(a) Describe the likely impact of the new coal mine on the UK Government's budget/fiscal balance. [4]

(b) Outline how the 'estimated private sector investment of £165 million' (line 4) to build the new coal mine will create a multiplier process in the UK economy. [4]

(c) With reference to the data and Chart 1, discuss the possible effects of the new coal mine on the steel market in the UK. [10]

(d) Assess the likely impact of the new coal mine on the exchange rate of the pound to the euro. Illustrate your answer with an exchange rate diagram. [10]

(e) Evaluate the view that the new coal mine will 'add £1.5 billion to UK GDP … over the first ten years of the mine's operation' (lines 27 and 28). Illustrate your answer with an aggregate demand and aggregate supply (AD/AS) diagram. [12]

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Surname	StemUp Model Solution
Answer booklet	Write the question number in the left-hand margin at the start of each answer.

Question number

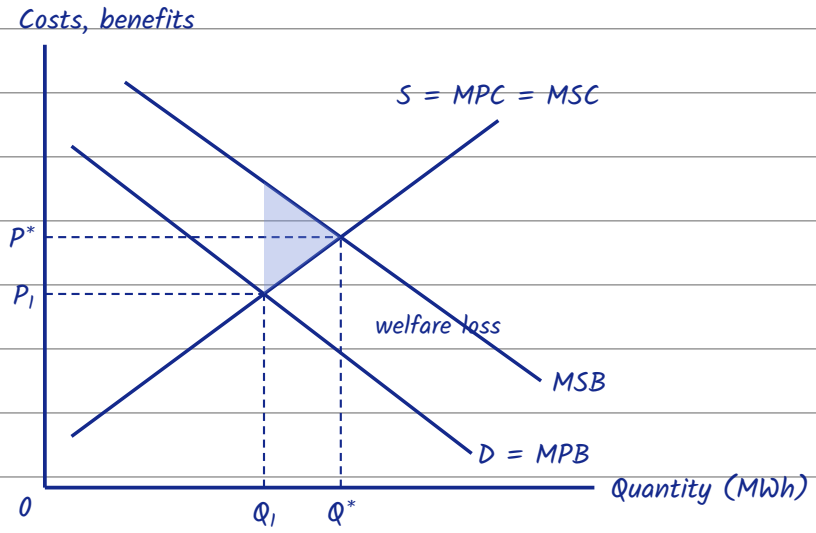
1 (a) In a free market, resources are allocated only by the price mechanism. Firms and consumers burning fossil fuels consider only their private costs and ignore the external costs of carbon emissions on third parties, because nobody owns the atmosphere (no property rights). So fossil fuel energy is over-produced and over-consumed, a market failure that causes climate change.

1 (b) External benefits are benefits to third parties who are not part of the transaction (external benefits = social benefits – private benefits). External costs are costs imposed on third parties that are not reflected in the price (external costs = social costs – private costs). Wind power creates both.

The main external benefit is lower carbon emissions. Electricity from wind replaces fossil fuel power stations, and lower emissions from power stations were the main reason UK carbon emissions fell by 47.3% between 1990 and 2021 (line 9). Wind alone generated 28.9% of UK electricity in 2022 (line 15). Less CO_2 slows climate change, so there is less severe weather and a smaller rise in sea levels (line 5). Third parties in coastal and low-lying areas face less risk of their homes and workplaces flooding, farmers' crops are less likely to be damaged by drought and storms, and the threat of food and water scarcity (line 7) falls for people in both developed and developing countries. Burning less gas and coal also cuts local air pollution, reducing respiratory illness and NHS costs.

Electricity buyers do not pay for these benefits, so MSB is above MPB. As the diagram shows, the free market produces only Q_1 wind power instead of the social optimum Q^*, so there is under-production and a welfare loss.

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However, there are external costs. Making turbines uses large amounts of steel and concrete, which has caused water and soil pollution in producing countries (lines 18 to 20), harming the health of local people and the fertility of their land. Large numbers of birds are killed by turbines (line 20), which may damage biodiversity and the food chain, and residents near onshore farms suffer noise and visual pollution, which may grow now that restrictions on onshore wind are being removed (line 16).

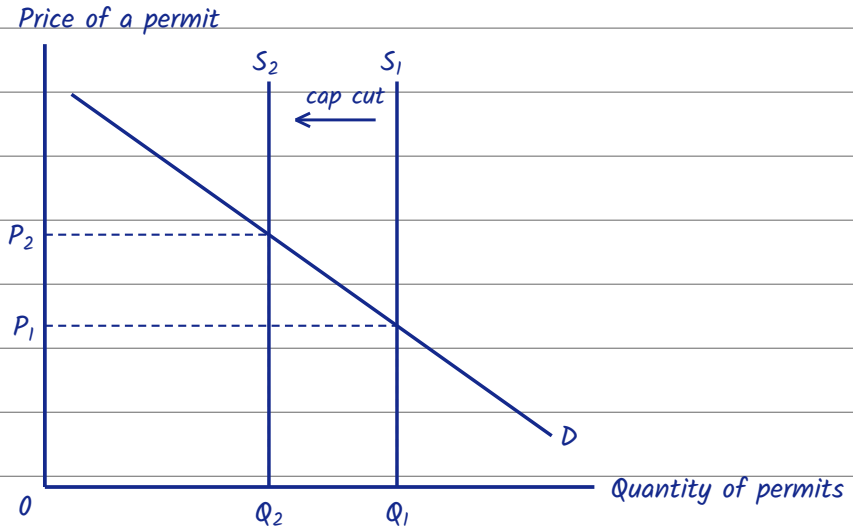
The benefits may also be smaller than they appear. Wind supplies only 28.9% of electricity, and part of the fall in emissions came from switching from coal to gas (line 11), not from renewables. Because wind is intermittent, gas power stations are still needed as back-up.

Overall, it depends on the time scale and who is affected. The external costs are mostly one-off and local, arising when turbines are built, whereas the benefits of avoided emissions are global and continue for a turbine's 20 to 25 year life, so in the long run the benefits are likely to be far greater. Bird deaths are also small compared with the habitat loss climate change would cause. Climate damage is also irreversible, which adds weight to the benefits. However, the costs fall mainly on the countries producing turbines, so for them the answer may be different. On balance, the external benefits outweigh the external costs, especially if pollution in steel production is regulated and turbines are sited away from bird migration routes.

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1 (c)

Under the EU ETS (since 2005) and the UK ETS (live from 1st January 2021, line 38), the authorities set a cap on total emissions from more than 11 000 power stations, industries and airlines (line 23) and issue that number of permits, each allowing one tonne of CO_2. Permits can be traded. 'Clean' firms that cut emissions below their allowance can sell surplus permits for profit, while 'dirty' firms that emit more must buy extra permits, raising their costs. This gives a profit incentive to invest in green technology, such as switching to renewable energy. Dirty firms that do not adapt make lower profits and may exit, leaving cleaner, more competitive firms. Because the firms that can cut emissions most cheaply do so, emissions fall at the lowest total cost, and firms that exceed their permits are fined. As the diagram shows, cutting the cap each year shifts supply of permits from S_1 to S_2, raising the permit price from P_1 to P_2 and strengthening the incentive.



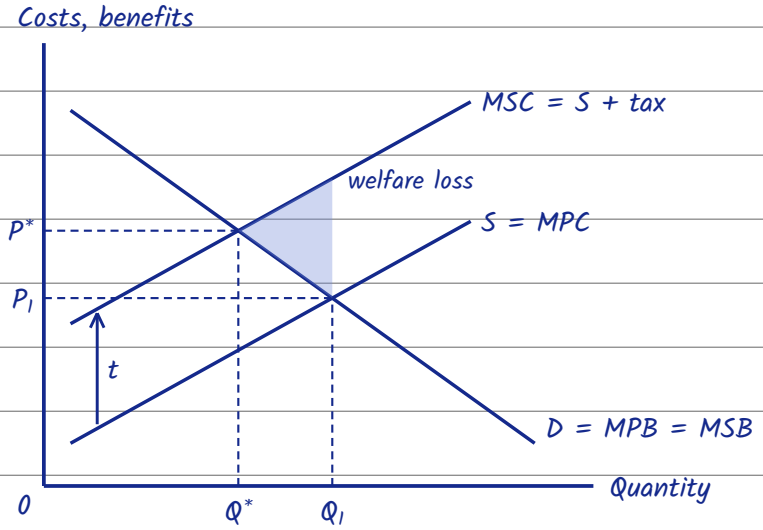
However, effectiveness depends on the permit price. In the early years of the EU ETS too many free permits were issued and the price fell below €10 a tonne, too low to change firms' behaviour. There is asymmetric information: firms may under-report emissions, and monitoring creates high administration costs. Firms may relocate to countries with no scheme (carbon leakage), so global emissions may not fall, a government failure. Coverage matters too: only large emitters are included, not cars or home heating. In the short run

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firms may simply pay for permits, with investment in green technology coming only in the long run.

Overall, the scheme is likely to be effective because the cap guarantees the level of emissions in covered sectors, which have fallen considerably since 2005, provided the cap is tightened so that the permit price stays high.

1 (d) Market failure occurs when the price mechanism fails to allocate resources efficiently. Carbon emissions are a negative production externality: firms consider only their marginal private cost (MPC), but the marginal social cost (MSC) also includes the external cost of climate change on third parties. As the diagram shows, the free market produces where MPC = MPB at Q_1 and P_1, above the social optimum Q^*, where MSC = MSB. There is over-production and a welfare loss (shaded).



A carbon tax is a specific indirect tax: firms are 'charged a set amount per tonne of carbon dioxide emissions they produce' (lines 29 to 30). This raises their costs of production, so supply shifts left from S = MPC to S + tax. If the tax per unit (t) equals the marginal external cost at the social optimum, the new equilibrium is at Q^* and P^*. The externality has been internalised: the polluter pays the full social cost, output falls to the socially optimal level and the welfare loss is removed.

The tax also gives firms a continuing incentive to cut emissions per unit, for

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	example by switching from coal to renewable energy, to reduce their tax bills. Compliance is enforced because firms must supply emissions data and could be fined if they do not comply (lines 31 to 32). The tax revenue could be used to compensate those affected by climate change, for example by funding flood defences.
1 (e)	The UK's main macroeconomic objectives are low and stable inflation (the 2% CPI target), low unemployment, sustainable economic growth and equilibrium on the current account of the balance of payments. Policies such as the UK ETS or a carbon tax may conflict with several of these. Inflation: buying extra permits or paying a carbon tax raises firms' costs of production. If firms pass this on, as with carbon taxes abroad that 'led to rising fuel prices and a higher cost of living' (line 34), SRAS shifts left and cost-push inflation pushes CPI above 2%, at a time when UK inflation peaked at 11.1% in 2022. The burden also falls most on lower-income households (line 35), widening inequality. Unemployment and growth: higher costs squeeze profits, so firms may invest less, slowing growth in productive capacity (LRAS). Some may relocate to countries without carbon pricing or cut their workforce to protect margins, causing structural unemployment in carbon-intensive regions such as steel towns. Current account: if costs are passed on, UK goods become less price competitive, so exports fall and imports rise, worsening a current account that is already in deficit. However, the size of these conflicts depends on the price of a permit or the rate of tax: if it is low, the inflationary effect is small. Firms selling products with price elastic demand can pass on less of the cost. If inflation is below target, as in 2020, a small rise could even help meet the 2% objective. Relocation is costly, so most firms are unlikely to move, and job losses may be short term if workers are occupationally and geographically mobile,

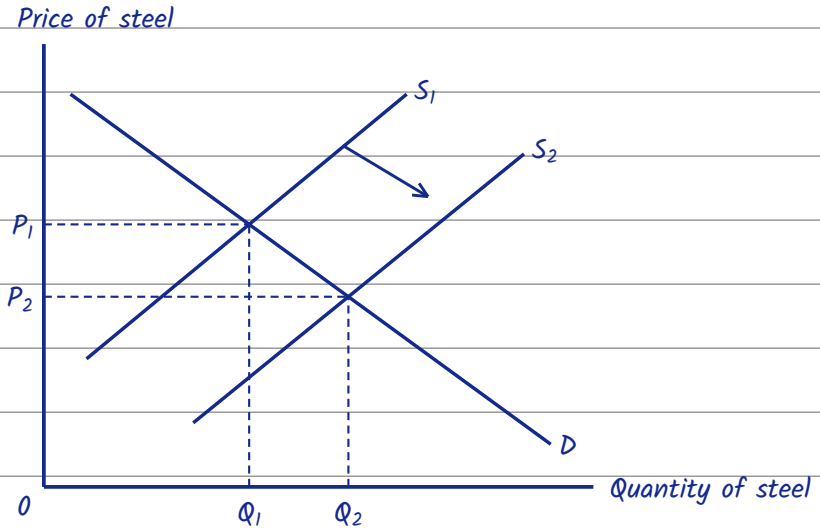
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	especially as new jobs are created in renewables, which already supply over a third of UK electricity (line 13). In the long run, cutting emissions makes growth more sustainable by reducing climate damage that would lower future output. Ceteris paribus may not hold: a depreciation of the pound, or other countries using similar schemes such as the EU ETS, would mean the UK does not lose competitiveness. Overall, the conflicts are real in the short run, especially with inflation and in carbon-intensive industries, which may be why the UK chose an ETS rather than a carbon tax (line 37). In the long run they are limited and can be reduced by raising the carbon price gradually and returning revenue to low-income households.
2 (a)	The budget (fiscal) balance is the difference between government revenue and government spending in a year. The mine should improve the balance, reducing any deficit. Tax revenue will rise: the mine is forecast to pay more than £800 million in corporation tax (line 29), and the 500 direct and 1500 wider jobs, with mine wages averaging £43 875 (about £10 000 above the median), will raise income tax and National Insurance receipts. VAT revenue will also rise because much of this income is spent locally (line 33). Spending on unemployment and means-tested benefits should fall as people move into work.
2 (b)	Investment is an injection into the circular flow of income. The £165 million spent building the mine becomes income for construction firms and UK suppliers, as all major machinery will be sourced from within the UK (line 35). They re-spend part of it, so one person's spending becomes another's income. Mine workers earning £43 875 will spend 'a very large proportion' locally (line 33), creating further jobs and incomes in Cumbria. Each round is smaller because of withdrawals (saving, tax, imports), but the final rise in national income is larger than £165 million: multiplier $k = 1/MPW$, so if MPW

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= 0.6, $k \approx 1.67$ and income rises by about £275 million.

2 (c) Chart 1 shows the UK steel price index rose from 113.4 in 2020 to 228.6 in 2022: (228.6 − 113.4)/113.4 × 100 = 101.6%, so the price roughly doubled, with a 32.1% rise in 2022 alone after the UK stopped importing Russian coal, which had supplied nearly half of steelmakers' coal (line 9).

Coal is a key raw material: it takes about 770 kg of coal to make one tonne of steel (line 14). The mine will increase the supply of coal by 2.8 million tonnes a year, lowering the price of coal. This reduces steelmakers' costs of production, so the supply of steel shifts right from S_1 to S_2 in the diagram.



The price of steel falls from P_1 to P_2, reversing some of the 2020 to 2022 rise, and the equilibrium quantity rises from Q_1 to Q_2. Consumer surplus increases, benefiting buyers such as construction firms and car makers.

Producer surplus also rises, and as output expands UK steelmakers will hire more workers and earn higher profits, and become more competitive against imported steel. The effect could be large: 2.8 million tonnes of coal ÷ 0.77 = 3.6 million tonnes of steel, about 49% of the 7.4 million tonnes the UK produced in 2022.

However, 85% of the coal is likely to be exported to the EU (line 16) because UK steelmakers have rejected this type of coal. Only about 0.42 million tonnes would stay in the UK, enough for about 0.55 million tonnes of

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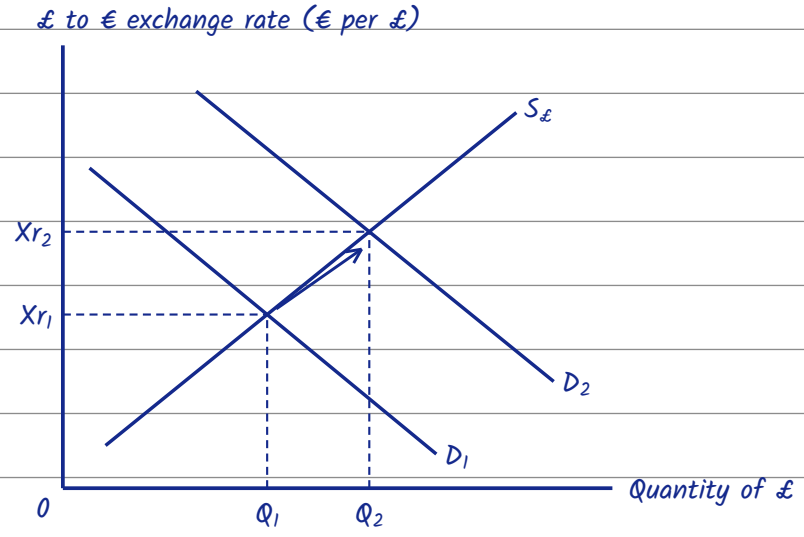
steel (around 7% of output), so the effects are much smaller. The largest producers have already found alternatives from Wales, the USA and Canada (line 20), so coal supply was not a binding constraint. As steelmakers adopt green methods (41% of European steel uses electric furnaces, line 25), demand for coal becomes more price elastic, so a rise in supply lowers its price less, and coal matters less to steel costs. There is also a time lag before the mine reaches full output, and steel prices depend on world energy prices and events in Russia.

Overall, the mine is likely to have only a small effect on the UK steel market, at most a modest fall in price in the long run, because most of its coal is unsuitable for UK steelmakers.

2 (d)

The exchange rate is the value of one currency in terms of another, here the number of euros one pound buys. In a floating system it is set by demand for and supply of pounds on the foreign exchange market.

85% of the coal is likely to be exported to the EU (line 16), bringing £2.4 billion of exports over ten years (line 28). EU buyers must buy pounds to pay UK producers, so demand for the pound increases from D_1 to D_2. As the diagram shows, the pound appreciates from Xr_1 to Xr_2, so £1 buys more euros. If UK firms also use domestic coal instead of imports, fewer pounds are supplied to buy foreign currency, adding to the appreciation.



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However, not all EU countries use the euro: sales to Sweden, Poland or Denmark do not affect the £ to € rate, and coal is often priced in US dollars. The demand may not materialise, as many European steelmakers are turning away from coal towards electric furnaces and hydrogen (lines 23 to 26). Higher incomes in Cumbria (average salary £43 875) may increase imports from the eurozone, raising the supply of pounds and offsetting the appreciation.

Most importantly, the size of the change matters: £2.4 billion over ten years is about £240 million a year, tiny compared with the hundreds of billions of pounds traded on currency markets every day. Ceteris paribus will not hold, as interest rate differences between the Bank of England and the ECB, speculation and other trade and investment flows will have much larger effects.

Overall, the mine puts slight upward pressure on the pound against the euro, but the impact is likely to be negligible.

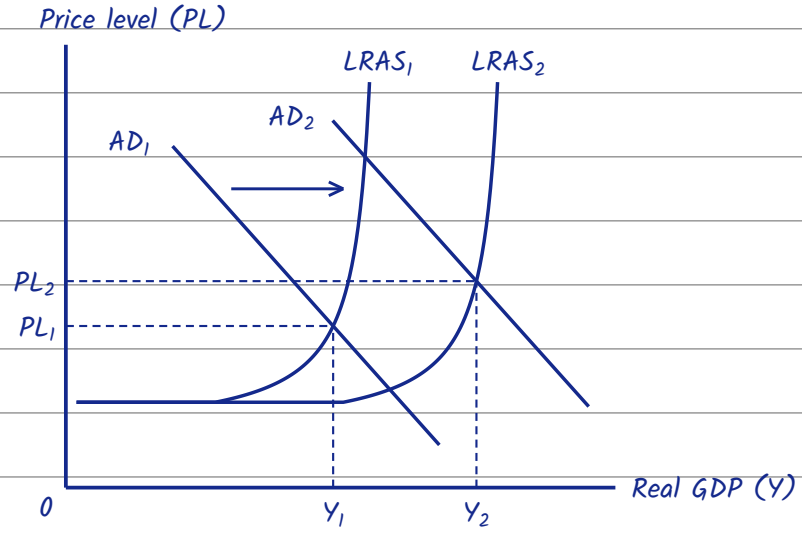
2 (e)

GDP is the value of output produced in an economy in a year, and AD = C + I + G + (X − M). The £165 million investment (line 4) directly raises I, while £2.4 billion of coal exports over ten years (line 28) raises X. If some UK steelmakers buy this coal instead of importing from the USA and Canada, M falls. AD shifts right from AD_1 to AD_2 and real GDP rises from Y_1 to Y_2.

There is a multiplier effect, since the 500 direct jobs paying £43 875 lead to spending locally and machinery will be sourced in the UK (line 35), creating the 1500 wider jobs.

The mine also adds to productive capacity, producing 2.8 million tonnes of coal a year, so LRAS shifts right from $LRAS_1$ to $LRAS_2$, and SRAS may increase if cheaper coal reduces steelmakers' costs, allowing GDP to grow without much inflation.

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However, the figure comes from the company building the mine, which has an incentive to exaggerate the benefits. Even if achieved, £1.5 billion over ten years is about £150 million a year, roughly 0.006% of UK GDP of about £2.5 trillion, so it is small.

The £2.4 billion of exports is doubtful: European steelmakers are switching to electric furnaces and hydrogen (lines 23 to 26), so demand for coal may fall and the mine could become a stranded asset. Import substitution is also limited, as most UK steelmakers have rejected this coal (line 18). There are time lags in building the mine, so little GDP will be added in the early years. The multiplier may be small, as corporation tax of over £800 million and income tax are withdrawals, although local spending and UK machinery will increase it.

The effect also depends on spare capacity. If the economy is near full employment, as the UK was with unemployment around 4%, the AD increase occurs on the vertical part of the LRAS curve and mainly raises the price level rather than real GDP; in the classical view there is no long-run growth without a rise in LRAS. Workers and capital may also be diverted from other industries, so the net addition is smaller.

Overall, the mine is likely to add to UK GDP, but £1.5 billion is optimistic and depends mainly on EU demand for coal; even if achieved, its effect on the UK economy will be small.