

Sustainable Development

## Final class Revision questions

- 1. How do we know if we have a good model? (The Lucas critique.)
- 2. Why does resource and energy use track GDP whereas emissions of individual pollutants may decline steeply?
- 3. Can we combine economic growth and improved environmental quality? How?
- 4. Find the elasticity of substitution in the Cobb–Douglas production function by setting up the profit-maximization problem of a representative producer. Discuss the significance of the result.
- 5. What is the resource price given an 'open access' resource that is costless to extract?
- 6. Set up a DHSS-style model with technological progress, capital depreciation, and a resource in infinite supply with costly extraction (extraction function  $R = \phi X$ ). Solve for the b.g.p.
- 7. Explain the Hotelling rule. What does it imply about the rate of resource consumption in a DHSS economy with a limited resource, free to extract. How does this fit with historical data?
- 8. Assume that you are building a general equilibrium model of natural resource demand and supply. Inputs will be augmented labour  $A_L L$  and augmented resources  $A_R R$ .
  - (a) You must choose between the following three production functions. Write each of them down, and discuss advantages and disadvantages.
    - i. The Cobb–Douglas.
    - ii. Leontief.
    - iii. CES.
  - (b) Assuming Cobb–Douglas, suggest a value for  $\alpha$ . And assuming CES, suggest a value for the elasticity of substitution between the inputs.
- 9. Explain why DTC tends to hold the factor share of resources constant in the long run. Is this the whole story?
- 10. Explain what happens to demand for alternative resources which are relatively good substitutes for each other given independent knowledge stocks.
- 11. Do rich people like energy-intensive stuff? To the extent that they do, what are the implications for rebound and energy efficiency?
- 12. How big are rebound effects? Discuss theory and evidence.
- 13. Assume that you are part of the EU government, and you want all air travel in the EU to be electric by 2035. How do you best achieve this?

- 14. Assume that the price of coal goes up steeply. What happens to the factor share of coal (i) in the short run, and (ii) in the long run?
- 15. Consider the following pollutants. How well can the simple EKC model explain what has happened, and predict the future? Would adding DTC improve the performance of the model? What else could be added?
  - (a) Sulphur to air in Europe.
  - (b) CFCs globally.
  - (c) Lead to air.
  - (d) Nitrates and phosphates to water.
  - (e) Neonicotinoids.
  - (f)  $CO_2$  to air.
- 16. Are subsidies to clean-energy research a good substitute for a price on carbon emissions? (Think about DTC!)
- 17. Look at Shapiro and Walker, AER (2018).<sup>a</sup> Why is pollution from US manufacturing firms declining? Discuss links to our models.
- 18. Are consumption externalities driving up labour supply? Is this necessarily a problem for the environment? What is the policy prescription?
- 19. Are consumption externalities distorting our choices about how to spend our income? Is this necessarily a problem for the environment? What is the policy prescription?

<sup>&</sup>lt;sup>a</sup> https://www.aeaweb.org/articles?id=10.1257/aer.20151272.