

Chapter 5

DTC and resource efficiency

Study questions

1. 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 α . And assuming CES, suggest a value for the elasticity of substitution between the inputs.
2. In the trees and houses question, what happens if they find a house design that requires half the number of planks?
3. Assume an island economy with 100 people in 1800. Everything they need to live on is buried deep underground, and to get it out they need motive power and labour. Luckily 100 kg of coal washes up on the beach every day, and they have a Newcomen steam engine. Given this technology, their production function is

$$Y = [(A_L L)^\epsilon + (A_R R)^\epsilon]^{1/\epsilon},$$

where $\epsilon = -1$, $A_L = 1$, and $A_R = 0.1$.

- (a) What is the elasticity of substitution between L and R ?
- (b) Find GDP, the prices of labour and coal, and the factor shares of labour and coal.

Now assume that it is the year 2000 and someone designs and builds a modern coal-fired electric turbine.

- (c) Suggest values for A_L and A_R , and find prices and factor shares based on these values.

Go back to 1800 and assume that 11 more people arrive who are researchers by nature. The knowledge production functions are $A_{Lt} = A_{Lt-1} Z_{Lt}/100$ and $A_{Rt} = A_{Rt-1}/10$, where periods are 10 years.

- (d) Assuming that research effort is in proportion to the factor shares, describe what happens. What is the long-run balanced growth path?
 - (e) What happens if the flow of coal doubles?
4. The model of Q2 predicts constant long-run factor shares. What is the problem?