

ECN 275/375 Environmental and natural resource economics

Exercise set 5

Exercise 5.1 – Resource allocation mechanisms

Resource allocation mechanisms (RAMs) are the modern variant of principal-agent models.

- Write the three necessary criteria for a RAM to yield a predictable outcome, and explain what the three criteria are.
- Why is incentive compatibility (IC) and Pareto optimality (PO) necessarily not jointly achievable?
- Which is most important – incentive compatibility or Pareto optimality. Explain your answer.

Exercise 5.2 – Cost effectiveness and optimality in emissions space

Emissions space implies that the polluter's choice variable is emissions.

- Write down the mathematical definition for cost effectiveness emissions space. Explain the terms in the definition.
- Write down the mathematical definition for social optimality (efficiency). Explain the terms in the definition, and write the verbal definition for optimality.
- Why is cost effectiveness necessary for optimality?

Exercise 5.3 – Cost effectiveness and optimality in public goods space

Emissions space implies that the polluter's choice variable in public goods space, q .

- Write down the mathematical definition for cost effectiveness public goods space. Explain the terms in the definition.
- Write down the mathematical definition for social optimality (efficiency). Explain the terms in the definition, and write the verbal definition for optimality.

Exercise 5.4 – Graphical demonstration that fixed emission permits may not be cost effective while tradable permits are

- Draw a graph showing why non-tradable (fixed) emission permits in general are not cost effective.
- Under what conditions would fixed permits be cost effective? Why is this an unlikely situation?

Exercise 5.5 – Bath tub diagram where the resulting quota price is zero

Draw a bath tub diagram showing a situation where the tradable permit price is zero.

Exercise 5.6 next page

Exercise 5.6 – Bath tub diagram for two sectors – the optimal solution

The required total reduction in emissions equals $z_{A+B} = 100$ for two sectors such that $z_A + z_B = 100$.

Sector A's marginal cost function of supplying emissions reductions is $MC_A(z_A) = z_A$, while sector B's marginal cost function is $MC_B(z_B) = z_B/3$.

- (a) Which of the two sectors do you expect needs to reduce emissions the most for a least cost (cost effective) distribution of emissions reductions? Briefly explain why.
- (b) Find the least cost distribution of emissions reductions for the two sectors with a bath tub diagram.
- (c) Solve mathematically for the optimal distribution of emissions reductions supplied for A and B. What are the marginal costs at the optimal distribution?