

1. Coase

Suppose each of firm 1 and firm 2 benefits $B(g_i) = 4g_i - g_i^2/2$ units by emitting g_i , where $i = 1$ for firm 1, and $i = 2$ for firm 2. A representative consumer is harmed $2g_1 + 2g_2$ by the pollution. The firms and the consumer have a payoff function that is linear in money

(a) What is a Coasian solution to the environmental problem?

ANSWER KEY: Coase predicts that the parties bargain towards the efficient solution, which is $g_i = 2$, by letting one party compensate the other.

(b) Suppose the consumer has the right to clean air. The consumer can, however, reach out to the firms, and the consumer. What will the consumer propose?

ANSWER KEY: The consumer ensures $g_i = 2$ by suggesting $g_i = 2$ and asks for the transfer $B(2) = 6$ from each firm.

(c) Suppose, instead, that the firms have the right to emit, but that each firm can reach out to the consumer. What will each firm propose?

ANSWER KEY: Each firm ensures $g_i = 2$ by suggesting $g_i = 2$, instead of $g^M := \max_g B(g) = 4$, and asks for the transfer $(4 - 2)2 = 4$.

(d) What is the Pigouvian solution to the environmental problem?

ANSWER KEY: Each firm pays the Pigou tax 2.

(e) If the environmental policy, (a), (b), or (c) can be determined in a political process, then how does the consumer rank the three options? How will the firms rank the three alternative policies?

ANSWER KEY: Each firm prefers (c) over (d) over (b). The sum of surplus is constant, since g is the same, so the consumer has the opposite ranking of preference.

2. Emission tax vs. quota

Suppose the consumer and the government do not know whether each firm's benefit from emission is $B(g_i) = 4g_i - g_i^2/2$ or $B(g_i) = 6g_i - g_i^2/2$. The harm, in any case, is 2 units for each unit of emission.

(a) Show in a figure the marginal benefit and the marginal harm, and show and explain in this figure what the Pigou tax implements the first best (efficient) outcome.

(b) In the same figure investigate whether an emission quota for each firm implements the efficient (first best) emission level. Explain why or why not.

ANSWER KEY: Straightforward weitzman figure with downward sloping B' and flat/horizontal social marginal damage function.