

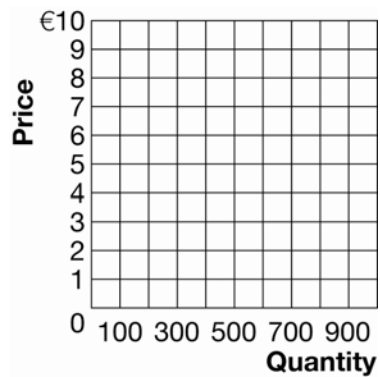
## Chapter 10

1. The information below provides the prices and quantities in a hypothetical market for automobile antifreeze.

Price per Gallon	Quantity Demanded	Quantity Supplied
€1	700	300
2	600	400
3	500	500
4	400	600
5	300	700
6	200	800
7	100	900
8	0	1,000

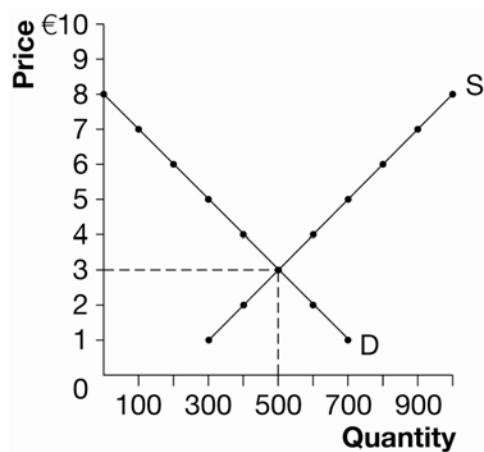
- a. Plot the supply and demand curves for antifreeze in Exhibit 1.

Exhibit 1



Answer:  
See Exhibit 3.

Exhibit 3



- b. What is the equilibrium price and quantity generated by buyers and sellers in the market?

Answer:

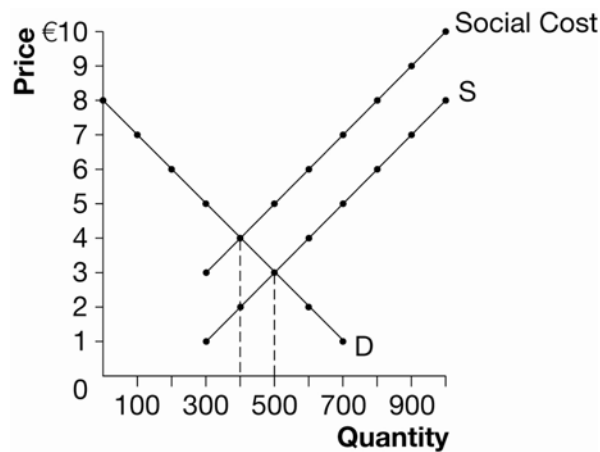
Price = €3, quantity = 500 units.

- c. Suppose that the production of antifreeze generates pollution in the form of chemical runoff and that the pollution imposes a €2 cost on society for each gallon of antifreeze produced. Plot the social cost curve in Exhibit 1.

Answer:

See Exhibit 4.

#### Exhibit 4



- d. What is the optimal quantity of antifreeze production? Does the market overproduce or under produce antifreeze?

Answer:

400 units. The market overproduces because the market quantity is 500 while the optimal quantity is 400 units.

- e. If the government were to intervene to make this market efficient, should it impose a Pigovian tax or a subsidy? What is the value of the appropriate tax or subsidy?

Answer:

The government should impose a Pigovian tax of €2 per unit.

2. Suppose citizens living around Metropolitan Airport value peace and quiet at a value of €3 billion.
- a. If it costs the airlines €4 billion to make their planes quieter (the airlines value noise at €4 billion), is it efficient for the government to require that the planes be muffled? Why?

Answer:

No, because the cost of correcting the externality exceeds the value placed on it by the affected parties.

- b. If it costs the airlines €2 billion to make their planes quieter, is it efficient for the government to require that the planes be muffled? Why?

Answer:

Yes, because the value placed on peace and quiet exceeds the cost of muffling the planes.

- c. Suppose there are no transaction costs and suppose that people have the right to peace and quiet. If it costs the airlines €2 billion to make their planes quieter, what is the private solution to the problem?

Answer:

The airlines could spend €2 billion and make their planes quieter or buy the right to make noise for €3 billion, so they will choose to make the planes quieter for €2 billion.

- d. Suppose there are no transaction costs and suppose that airlines have the right to make as much noise as they please. If it costs the airlines €2 billion to make their planes quieter, what is the private solution to the problem?

Answer:

The affected citizens must pay at least €2 billion and are willing to pay up to €3 billion to the airlines to have the planes made quieter.

- e. Compare your answers to (c) and (d) above. What are the similarities and what are the differences? What general rule can you make from the comparison?

Answer:

Similarities: the planes will be made quieter regardless of the original property rights because it is efficient. Differences: if the citizens have the right to quiet, citizens gain and airlines lose. If the airlines have the right to make noise, airlines gain and citizens lose.

- f. Suppose it costs the airlines €2 billion to make their planes quieter. If a private solution to the noise problem requires an additional €2 billion of transaction costs (due to legal fees, the large number of affected parties, and enforcement costs) can there be a private solution to the problem? Why?

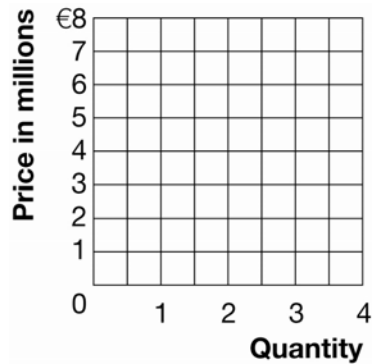
Answer:

No, because the transaction costs exceed the potential gains from trade. (The potential gains are the €3 billion value of quiet minus the €2 billion cost to quiet the planes, or €1 billion.)

3. Suppose there are four firms that each wish to dump one barrel of waste chemicals into the river. Firm 1 produces a product that is so valued by society and sells for such a high price that it is willing to pay €8 million to dump a barrel. Firm 2 produces a somewhat less valuable product and is only willing to pay €6 million to dump a barrel. In similar fashion, suppose firm 3 is willing to pay €4 million to dump a barrel and firm 4 will pay €2 million.

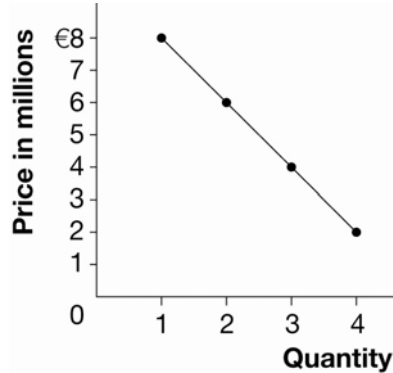
- a. Draw the demand for the right to pollute in Exhibit 2.

Exhibit 2



Answer:  
See Exhibit 5.

Exhibit 5



- b. Suppose the government's environment protection directorate estimates that the safe level of pollutants in the river is 3 barrels. At what value should they set a Pigovian tax?

Answer:  
€4 million per barrel.

- c. Suppose the government's environment protection directorate estimates that the safe level of pollutants in the river is 3 barrels. How many tradable pollution permits should they allocate? At what price will the permits trade?

Answer:  
3 permits should be sold. They will trade at a price of €4 million per permit.

- d. Compare part (b) and (c) above. How many barrels are dumped in each case? What is the price paid to pollute in each case? Is there an advantage to one method of internalizing the externality compared to the other?

**Answer:**

3 barrels. €4 million per barrel. Yes, with the tradable pollution permits the regulator does not need to know anything about the demand for pollution in this market in order to target pollution at 3 barrels and the initial allocation of pollution permits will not have an impact on the efficient solution.