

SOLUTIONS TO TEXT PROBLEMS:

Quick Quizzes

1. Examples of negative externalities include pollution, barking dogs, and consumption of alcoholic beverages (many others are possible). Examples of positive externalities include restoring historic buildings, research into new technologies, and education (many others are possible). Market outcomes are inefficient in the presence of externalities because markets produce a larger quantity than is socially desirable when there is a negative externality and a smaller quantity than is socially desirable when there is a positive externality.
2. Examples of private solutions to externalities include moral codes and social sanctions, charities, relying on the self-interest of the relevant parties, and entering contracts.

The Coase theorem is the proposition that if private parties can bargain without cost over the allocation of resources, they can solve the problem of externalities on their own.

Private economic actors are sometimes unable to solve the problems caused by an externality because of transactions costs, because bargaining breaks down, or when the number of interested parties is large so that coordinating everyone is costly.

3. The town government might respond to the externality from the smoke in three ways: (1) regulation; (2) Pigovian taxes; or (3) tradable pollution permits.

Regulation prohibiting pollution beyond some level is good because it is often effective at reducing pollution. But doing so successfully requires the government to have a lot of information about the industries and about the alternative technologies that those industries could adopt.

Pigovian taxes are a useful way to reduce pollution because the tax can be increased to get pollution to a lower level and because the taxes raise revenue for the government. The tax is more efficient than regulation because it gives factories economic incentives to reduce pollution and to adopt new technologies that pollute less. The disadvantage of Pigovian taxes is that the government needs to know a lot of information to pick the right amount to tax.

Tradable pollution permits are similar to Pigovian taxes but allow the firms to trade the right to pollute with each other. As a result, the government does not need as much information about the firms' technology. The government can simply set a limit on the total amount of pollution, issue permits for that amount, and allow the firms to trade the permits, thus reducing pollution while allowing economic efficiency. The disadvantage of pollution permits is that the government may not set the right overall level of pollution.

Questions for Review

1. Examples of negative externalities include pollution, barking dogs, and consumption of alcoholic beverages (many others are possible). Examples of positive externalities include restoring historic buildings, research into new technologies, and education (many others are possible).
2. Figure 1 illustrates the effect of a negative externality. The equilibrium quantity provided by the

market is Q_{market} . Because of the externality, the social cost of production is greater than the private cost of production, so the social-cost curve is above the supply curve. The optimal quantity for society is Q_{optimum} . The private market produces too much of the good, as Q_{market} is greater than Q_{optimum} .

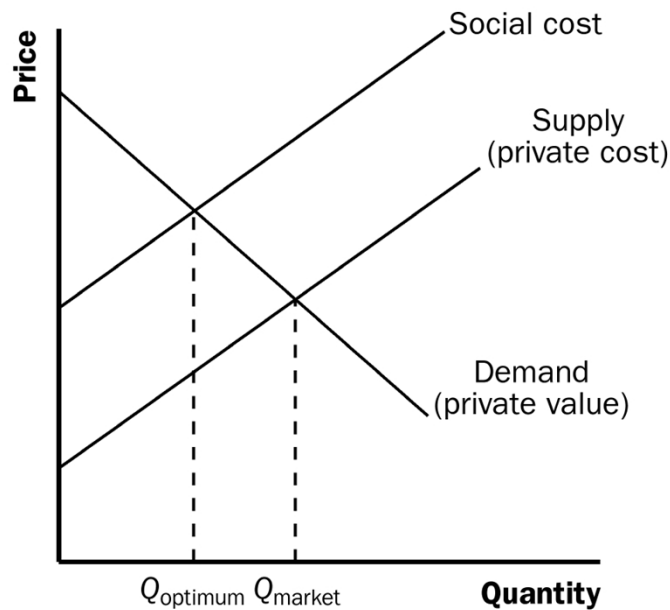


Figure 1

3. The patent system helps society solve the externality problem from technology spillovers. By giving inventors exclusive use of their inventions for a period of time, the inventor can capture much of the economic benefit of the invention. In doing so, the patent system encourages research and technological advance, which benefits society through spillover effects.
4. Externalities can be solved without government intervention through moral codes and social sanctions (which tell us to internalize externalities, such as not to litter), charities (donations to organizations like the Sierra Club to protect the environment or to universities to support education), merging firms whose externalities affect each other (for example, the apple grower and the beekeeper), or by contract.
5. According to the Coase theorem, you and your roommate will bargain over whether your roommate will smoke in the room. If you value clean air more than your roommate values smoking, the bargaining process will lead to your roommate not smoking. But if your roommate values smoking more than you value clean air, the bargaining process will lead to your roommate smoking. The outcome is efficient as long as transaction costs do not prevent an agreement from taking place. The solution may be reached by one of you paying off the other either not to smoke or for the right to smoke.
6. Pigovian taxes are taxes enacted to correct the effects of a negative externality. Economists prefer Pigovian taxes over regulations as a way to protect the environment from pollution because they can reduce pollution at a lower cost to society. A tax can be set to reduce pollution to the same level as a regulation. The tax has the advantage of letting the market determine the least expensive way to reduce pollution. The tax gives firms incentive to develop cleaner technologies to reduce the taxes they have to pay.

Problems and Applications

1. The Club conveys a negative externality on other car owners because car thieves will not attempt to steal a car with The Club visibly in place. This means that they will move on to another car. The Lojack system conveys a positive externality because thieves do not know which cars have this technology. Therefore, they are less likely to steal any car. Policy implications include a subsidy for car owners that use the Lojack technology and a tax on those who use the Club.
2.
 - a. The statement, "The benefits of Pigovian taxes as a way to reduce pollution have to be weighed against the deadweight losses that these taxes cause," is false. In fact, Pigovian taxes reduce the inefficiency of pollution by reducing the quantity of the good being produced that has pollution as a by-product. So, Pigovian taxes reduce deadweight loss, they do not increase it.
 - b. The statement, "When deciding whether to levy a Pigouvian tax on consumers or producers, the government should be careful to levy the tax on the side of the market generating the externality" is inaccurate. It does not matter on whom the tax is imposed—the incidence of the tax will be identical. So whether the externality is caused by the seller or the buyer of a good, a tax on either producers or consumers will lead to the same reduction of quantity and change in the prices producers receive or consumers pay.

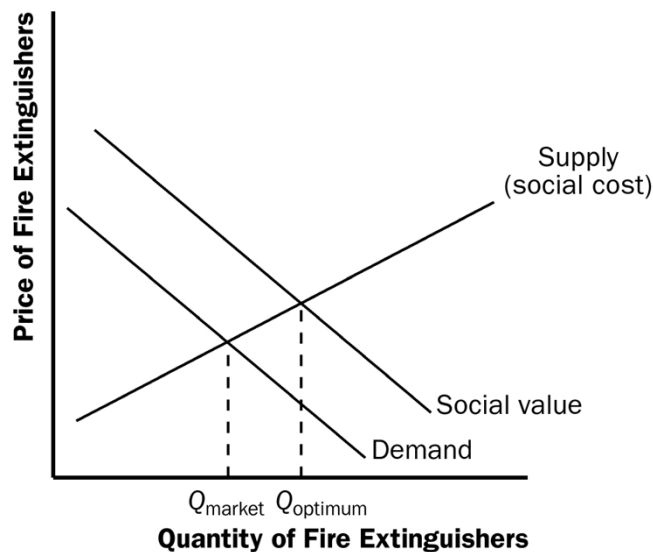


Figure 2

3.
 - a. Fire extinguishers exhibit positive externalities because even though people buy them for their own use, they prevent may fire from damaging the property of others.
 - b. Figure 2 illustrates the positive externality from fire extinguishers. Notice that the social value curve is above the demand curve and the social cost curve is the same as the supply curve.

- c. The market equilibrium level of output is denoted Q_{market} and the efficient level of output is denoted Q_{optimum} . The quantities differ because in deciding to buy fire extinguishers, people don't account for the benefits they provide to other people.
 - d. A government policy that would result in the efficient outcome would be to subsidize people \$10 for every fire extinguisher they buy. This would shift the demand curve up to the social value curve, and the market quantity would increase to the optimum quantity.
4. Charitable organizations are most often organized to deal with externalities. By letting charitable contributions be deductible under the federal income tax, the government provides a tax subsidy to charity, thus encouraging private solutions to the externality. People can give to the organization that they feel provides the most benefit to society, so the tax subsidy may be more effective than if the government itself tried to solve the externality. For example, churches may be better at helping the needy than government welfare programs.
5.
 - a. The externality is noise pollution. Ringo's consumption of rock and roll music affects Luciano, but Ringo does not take that into account in deciding how loud he plays his music.
 - b. The landlord could impose a rule that music could not be played above a certain decibel level. This could be inefficient because there would be no harm done by Ringo playing his music loud if Luciano is not home.
 - c. Ringo and Luciano could negotiate an agreement that might, for example, allow Ringo to play his music loud at certain times of the day. They might not be able to reach an agreement if the transactions costs are high or if bargaining fails because each holds out for a better deal.
5. If the Swiss government subsidizes cattle farming, it must be because there are externalities associated with it. Since tourists come to Switzerland to see the beautiful countryside, encouraging farms, as opposed to industrial development, is important to maintaining the tourist industry. Thus farms produce a positive externality by keeping the land beautiful and unspoiled by development. The government's subsidy thus helps the market provide the optimal amount of farms.
6.
 - a. The market for alcohol is shown in Figure 3. The social value curve is below the demand curve because of the negative externality from increased motor vehicle accidents caused by those who drink and drive. The free-market equilibrium level of output is Q_{market} and the efficient level of output is Q_{optimum} .
 - b. The triangular area between points A, B, and C represents the deadweight loss of the market equilibrium. This area shows the amount by which social costs exceed social value for the quantity of alcohol consumption beyond the efficient level.

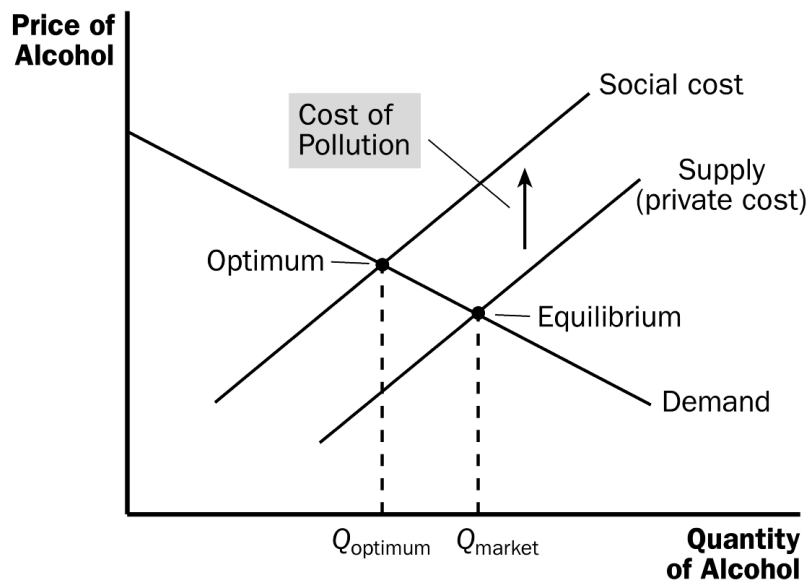


Figure 3

8.
 - a. It is efficient to have different amounts of pollution reduction at different firms because the costs of reducing pollution differ across firms. If they were all made to reduce pollution by the same amount, the costs would be low at some firms and prohibitive at others, imposing a greater burden overall.
 - b. Command-and-control approaches that rely on uniform pollution reduction among firms give the firms no incentive to reduce pollution beyond the mandated amount. Instead, every firm will reduce pollution by just the amount required and no more.
 - c. Pigovian taxes or tradable pollution rights give firms greater incentives to reduce pollution. Firms are rewarded by paying lower taxes or spending less on permits if they find methods to reduce pollution, so they have the incentive to engage in research on pollution control. The government does not have to figure out which firms can reduce pollution the most—it lets the market give firms the incentive to reduce pollution on their own.
9.
 - a. If the government knew the cost of reduction at each firm, it would have Acme eliminate all its pollution (at a cost of \$10 per ton times 100 tons = \$1,000) and have Creative eliminate half of its pollution (at a cost of \$100 per ton times 50 tons = \$5,000). This minimizes the total cost (\$6,000) of reducing the remaining pollution to 50 tons.
 - b. If each firm had to reduce pollution to 25 tons (so each had to reduce pollution by 75 tons), the cost to Acme would be $75 \times \$10 = \750 and the cost to Creative would be $75 \times \$100 = \$7,500$. The total cost would be \$8,250.

- c. In part *a*, it costs \$6,000 to reduce total pollution to 50 tons, but in part *b* it costs \$8,250. So it is definitely less costly to have Acme reduce all of its pollution and have Creative cut its pollution in half. Even without knowing the costs of pollution reduction, the government could achieve the same result by auctioning off pollution permits that would allow only 50 tons of pollution. This would ensure that Acme reduced its pollution to zero (since Creative would outbid it for the permits) and Creative would then reduce its pollution to 50 tons.
10. A Pigouvian tax can be used when an externality is present to force the parties to internalize the externality. This, in effect, is a fine for doing something "wrong" (that generates a negative externality). On the other hand, individuals and firms who do something "right" (such as work more hours, earn a higher income, earn greater profits) are generally taxed more. This is, in effect, a fine for succeeding. Unlike the Pigouvian tax, this type of taxation reduces the efficiency of the market.
11. a. An improvement in the technology for controlling pollution would reduce the demand for pollution rights, shifting the demand curve to the left. Figure 4 illustrates what would happen if there were a Pigouvian tax, while Figure 5 shows the impact if there were a fixed supply of pollution permits. In both figures, the curve labeled D_1 is the original demand for pollution rights and the curve labeled D_2 is the new demand for pollution rights after the improvement in technology.

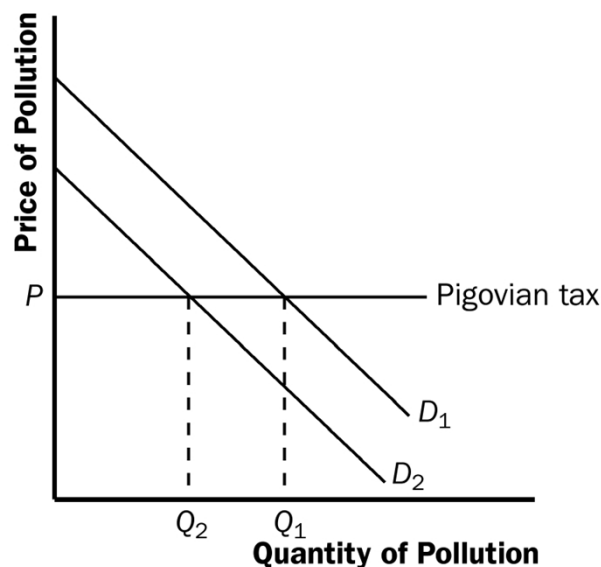


Figure 4

- b. With a Pigouvian tax, the price of pollution remains unchanged and the quantity of pollution declines, as Figure 4 shows. With pollution permits, the price of pollution declines and the quantity of pollution is unchanged, as Figure 5 illustrates.

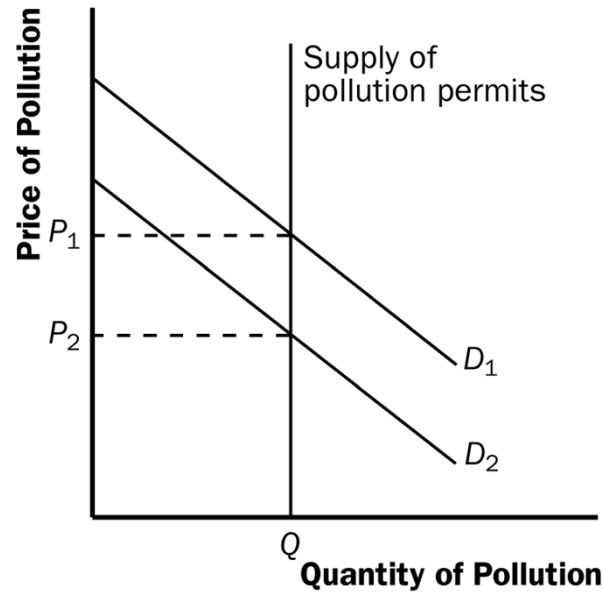


Figure 5

12.
 - a. In terms of economic efficiency in the market for pollution, it does not matter if the government distributes the permits or auctions them off, as long as firms can sell the permits to each other. The only difference would be that the government could make money if it auctioned the permits off, thus allowing it to reduce taxes, which would help reduce the deadweight loss from taxation. There could also be some deadweight loss occurring if firms use resources to lobby for additional permits.
 - b. If the government allocated the permits to firms who did not value them as highly as other firms, the firms could sell the permits to each other so they would end up in the hands of the firms who value them most highly. Thus the allocation of permits among firms would not matter for efficiency. But it would affect the distribution of wealth, since those who got the permits and sold them would be better off.
13.
 - a. International cooperation is needed because the externality from global warming is worldwide, so the benefits from solving the problem are worldwide. Further, the efficient solution to the problem involves minimizing the costs to society; in this case, society means the entire world.
 - b. Since it would be efficient to reduce carbon dioxide most in countries where the costs of reducing carbon dioxide emissions are low, some compensation scheme needs to be put in place to encourage the reduction of emissions. One possibility would be to monitor emissions, taxing those countries whose emissions are high and using the proceeds to subsidize those who reduce their emissions. This gives the incentive to reduce emissions in those areas where the cost of doing so is the least. In countries where the cost of reducing emissions is high, they will just pay the tax. A system of uniform emission reductions would impose high costs on some countries and low costs on others, and would not give anyone the incentive to reduce emissions beyond the mandated amount.
14. All activities, including reducing pollution, involve opportunity costs. Under command-and-control policies, there is an opportunity cost in terms of the resources that firms must use to reduce pollution. Using market-based methods merely recognizes that fact and gives firms

economic incentives to reduce pollution, thus reducing the costs of reducing pollution. Since market-based methods can be priced to reduce pollution by the same amount as command-and-control policies, they can achieve the same results at lower costs.

13.
 - a. A permit is worth \$25 to firm B, \$20 to firm A, and \$10 to firm C, since that is the cost of reducing pollution by one unit. Since firm B faces the highest costs of reducing pollution, it will keep its own 40 permits and buy 40 permits from the other firms, so that it can still pollute by 80 units. That leaves 40 permits for firms A and C. Since firm A values them most highly, it will keep its own 40 permits. So it must be that firm C sells its 40 permits to firm B. Thus firm B does not reduce its pollution at all, firm A reduces its pollution by 30 units at a cost of $\$20 \times 30 = \600 , and firm C reduces its pollution by 50 units at a cost of $\$10 \times 50 = \500 . The total cost of pollution reduction is \$1,100.
 - b. If the permits could not be traded, then firm A would have to reduce its pollution by 30 units at a cost of $\$20 \times 30 = \600 , firm B would reduce its pollution by 40 units at a cost of $\$25 \times 40 = \$1,000$, and firm C would reduce its pollution by 10 units at a cost of $\$10 \times 10 = \100 . The total cost of pollution reduction would be \$1,700. That is \$600 higher than in the case in which the permits could be traded.