CHAPTER 34

EXTERNALITIES

We say that an economic situation involves a **consumption externality** if one consumer cares directly about another agent's production or consumption. For example, I have definite preferences about my neighbor playing loud music at 3 in the morning, or the person next to me in a restaurant smoking a cheap cigar, or the amount of pollution produced by local auto-

sibilities of one firm are influenced by the choices of another firm or consumer. A classic example is that of an apple orchard located next to a beekeeper, where there are mutual positive production externalities—each firm's production positively affects the production possibilities of the other firm. Similarly, a fishery cares about the amount of pollutants dumped into its fishing area, since this will negatively influence its catch.

The crucial feature of externalities is that there are goods people care about that are not sold on markets. There is no market for loud music at 3 in the morning, or drifting smoke from cheap cigars, or a neighbor who

keeps a beautiful flower garden. It is this lack of markets for externalities that causes problems.

Up until now we have implicitly assumed that each agent could make consumption or production decisions without worrying about what other agents were doing. All interactions between consumers and producers took place via the market, so that all the economic agents needed to know were the market prices and their own consumption or production possibilities. In this chapter we will relax this assumption and examine the economic consequences of externalities.

In earlier chapters we saw that the market mechanism was capable of achieving Pareto efficient allocations when externalities were *not* present. If externalities are present, the market will not necessarily result in a Pareto efficient provision of resources. However, there are other social institutions such as the legal system, or government intervention, that can "mimic" the market mechanism to some degree and thereby achieve Pareto efficiency. In this chapter we'll see how these institutions work.

34.1 Smokers and Nonsmokers

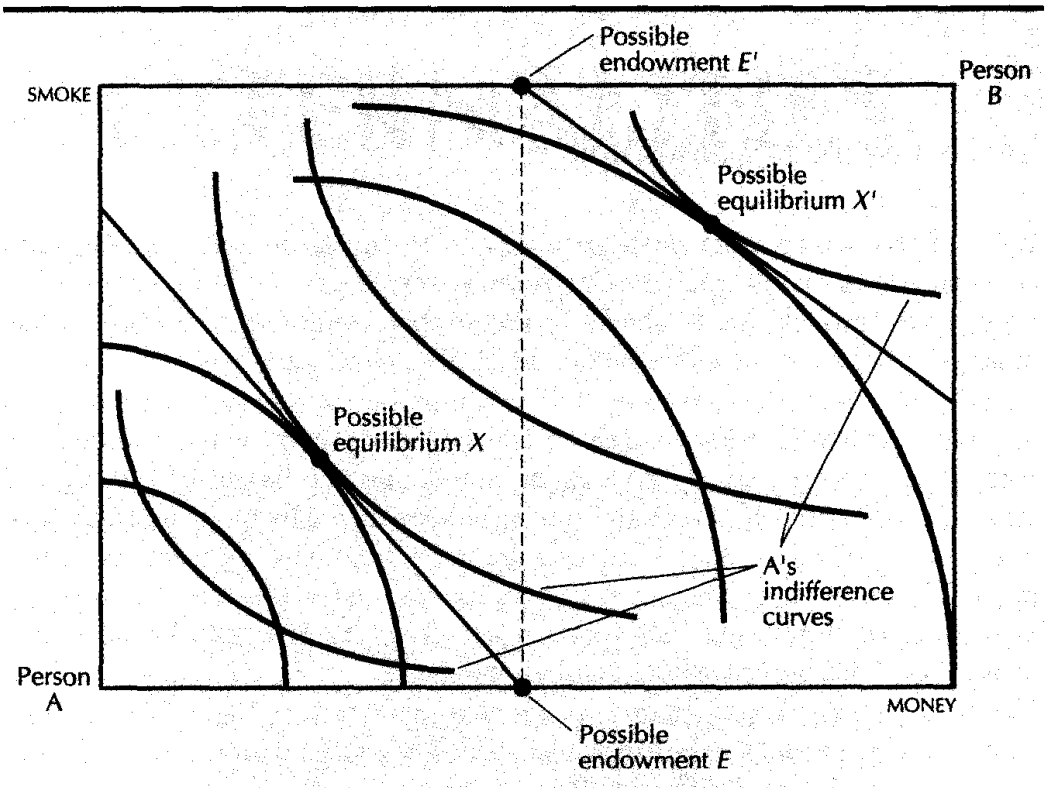
It is convenient to start with an example to illustrate some of the main considerations. We'll imagine two roommates, A and B, who have preferences over "money" and "smoke." We suppose that both consumers like money, but that A likes to smoke and B likes clean air.

We can depict the consumption possibilities for the two consumers in an Edgeworth box. The length of the horizontal axis will represent the total amount of money the two agents have, and the height of the vertical axis will represent the total amount of smoke that can be generated. The preferences of agent A are increasing in both money and smoke, while agent B's preferences are increasing in money and clean air—the absence of smoke. We'll measure smoke on a scale from 0 to 1, where 0 is no smoke at all, and 1 is the proverbial smoke-filled room.

This setup gives us a diagram like that depicted in Figure 34.1. Note that the picture looks very much like the standard Edgeworth box, but the interpretation is quite different. The amount of smoke is a good for A and a bad for B, so that B is moved to a more preferred position as A consumes less smoke. Be sure to note the difference in the way things are measured on the horizontal and vertical axes. We measure A's money horizontally from the lower left-hand corner of the box, and B's money horizontally from the upper right-hand corner. But the total amount of smoke is measured vertically from the lower left-hand corner. The difference occurs because money can be divided between the two consumers, so there will always be two amounts of money to measure, but there is only one amount of smoke that they must both consume.

In the ordinary Edgeworth box diagram B is made better off when A reduces his consumption of good 2—but that is because B then gets to consume more of good 2. In the Edgeworth box in Figure 34.1 B is also better off when A reduces his consumption of good 2 (smoke), but for a very different reason. In this example, B is better off when A reduces his consumption of smoke since both agents must consume the same amount of smoke and smoke is a bad for agent B.

We've now illustrated the consumption possibilities of the two roommates and their preferences. What about their endowments? Let's assume that they both have the same amount of money, say \$100 apiece, so that their endowments will lie somewhere on the vertical line in Figure 34.1. In order to determine exactly where on this line the endowments lie, we must determine the initial "endowment" of smoke/clean air.



Preferences for money and smoke. Smoke is a good for person A but a bad for person B. Which equilibrium we end up at depends on which endowment we start at.

The answer to this question depends on the legal rights of smokers and nonsmokers. It may be that A has a right to smoke as much as he wants, and B just has to put up with it. Or, it could be that B has a right to

clean air. Or the legal right to smoke and clean air could be somewhere between these two extremes.

The initial endowment of smoke depends on the legal system. This is not so different from the initial endowment of ordinary sorts of goods. To say that A has an initial endowment of \$100 means that A can decide to consume the \$100 himself, or he can give it away or trade it to any other individual. There is a legal definition of property involved in saying that a person "owns" or "has a right to" \$100. Similarly if a person has a property right to clean air, it means that he can consume clean air if he wants to, or he can give it away or sell that right to someone else. In this way, having a property right to clean air is no different from having a property right to \$100.

Let's start by considering a legal situation where person B has a legal right to clean air. Then the initial endowment in Figure 34.1 is labeled E; it is where A has $(100, 0)$ and B has $(100, 0)$. This means that both A and B have \$100, and that the initial endowment—what there would be in the absence of trade—is clean air.

Just as before, in the case with no externalities, there is no reason why the initial endowment is Pareto efficient. One of the aspects of having a property right to clean air is having the right to trade some of it away for other desirable goods—in this case, for money. It can easily happen that B would prefer to trade some of his right to clean air for some more money. The point labeled X in Figure 34.1 is an example of such a case.

As before, a Pareto efficient allocation is one where neither consumer can be made better off without the other being made worse off. Such an allocation will be characterized by the usual tangency condition that the marginal rates of substitution between smoke and money should be the same between the two agents, as illustrated in Figure 34.1. It is easy to imagine A and B trading to such a Pareto efficient point. In effect, B has the right to clean air, but he can allow himself to be "bribed" to consume some of A's smoke.

Of course, other assignments of property rights are possible. We could imagine a legal system where A had a right to smoke as much as he wanted, and B would have to bribe A to reduce his consumption of smoke. This would correspond to the endowment labeled E' in Figure 34.1. Just as before, this would typically not be Pareto efficient, so we could imagine the agents trading to a mutually preferred point such as the one labeled X'.

Both X and X' are Pareto efficient allocations; they just come from different initial endowments. Certainly the smoker, A, is better off at X' than at X, and the nonsmoker, B, is better off at X than at X'. The two points have different distributional consequences, but on grounds of efficiency they are equally satisfactory.

In fact, there is no reason to limit ourselves to just these two efficient points. As usual there will be a whole contract curve of Pareto efficient allocations of smoke and money. If agents are free to trade both of these

goods, we know that they will end up somewhere on this contract curve. The exact position will depend on their property rights involving smoke and money and on the precise mechanism that they use to trade.

One mechanism that they could use to trade is the price mechanism. Just as before we could imagine an auctioneer calling out prices and asking how much each agent would be willing to buy at those prices. If the initial endowment point gave A the property rights to smoke, he could consider selling some of his smoking rights to B in exchange for B's money. Similarly, if the property rights for clean air were given to B, he could sell some of his clean air to A.

When the auctioneer manages to find a set of prices where supply equals demand everything is fine: we have a nice Pareto efficient outcome. If there is a market for smoke, a competitive equilibrium will be Pareto efficient. Furthermore, the competitive prices will measure the marginal rate of substitution between the two goods, just as in the standard case.

This is just like the usual Edgeworth box analysis, but described in a slightly different framework. As long as we have well-defined property rights in the good involving the externality—no matter who holds the property rights—the agents can trade from their initial endowment to a Pareto efficient allocation. If we want to set up a market in the externality to encourage trade, that will work as well.

The only problem arises if the property rights are *not* well defined. If A believes that he has the right to smoke and B believes that he has the right to clean air, we have difficulties. *The practical problems with externalities generally arise because of poorly defined property rights.*

My neighbor may believe that he has the right to play his trumpet at 3 in the morning, and I may believe that I have the right to silence. A firm may believe that it has the right to dump pollutants into the atmosphere that I breathe, while I may believe that it doesn't. Cases where property rights are poorly defined can lead to an inefficient production of externalities—which means that there would be ways to make both parties involved better off by changing the production of externalities. If property rights are well defined, and mechanisms are in place to allow for negotiation between people, then people can trade their rights to produce externalities in the same way that they trade rights to produce and consume ordinary goods.

34.2 Quasilinear Preferences and the Coase Theorem

We argued above that as long as property rights were well defined, trade between agents would result in an efficient allocation of the externality. In general, the amount of the externality that will be generated in the efficient solution will depend on the assignment of property rights. In the case of the two roommates, the amount of smoke generated will depend on whether the smoker has the property rights or the nonsmoker has them.