Leseaufträge «Mikroökonomik I»
Modul 5: Externe Effekte

Unit 1:

– Externe Effekte und Coase Theorem

Quellen:

– **Chapter 18 – Externalities, Property Rights, and the Coase Theorem**
Frank, Robert H, & Cartwright, Edward. (2016). *Microeconomics and Behaviour (2nd European ed.)*. London: McGraw-Hill Education.

– **Forced Errors**
The Economists, May 2nd 2015

CHAPTER

18

EXTERNALITIES, PROPERTY RIGHTS AND THE COASE THEOREM

I n 2015 a Dutch court ordered the government to cut greenhouse gas emissions by at least 25 per cent by 2020. The ruling was immediately hailed as a pivotal moment in the fight against global warming. Marjan Minnesma, who initiated the case, said that 'states can no longer afford inaction. States are meant to protect their citizens, and if politicians will not do this of their own accord, then the courts are there to help.'

But to what extent is the Dutch *government* responsible for climate change? At an obvious level the Netherlands is small enough that its impact is relatively light. The more important point, though, is that *citizens* and not governments are the ones who pollute. If emissions are too high it is because too many people drive to work, leave electronic devices switched on, fly half way around the world for business conferences, buy cheap imports from China (manufactured with the help of coal-fired power stations), consume non-seasonal fruit flown all the way from New Zealand and South Africa, and so forth.

It is easy to come up with policies that would dramatically cut emissions. Why not increase the price of electricity by 20 per cent, restrict the number of short-haul flights or ban cars in central Amsterdam? The problem with these policies, and others, is that they are unlikely to be popular with the average Dutch voter.

For insight on these issues we can turn to the somewhat unlikely source of George W. Bush. In 2001 the United States rejected the Kyoto Pact on global warming, prompting consternation amongst environmental campaigners, particularly in Europe. Bush said that the Pact would 'have a negative economic impact, with layoffs of workers and price increases for consumers'. In short, the American public was not willing to reduce emissions and so better to face reality than pretend otherwise.

Depressing though it may be, this viewpoint at least puts things in perspective. Climate change begins at home and cutting emissions will come at a cost. Are people willing to pay this cost? Are they willing to vote for politicians who would force them to cut emissions? Probably not. Which is why the Dutch ruling is a fresh and interesting development. In forcing the government to act, whether voters like it or not, it offers a potential solution. How successful it proves, only time will tell.

CHAPTER PREVIEW

Our subjects in this chapter are externalities and property rights. We will begin with a definition of externalities and explanation of why they can lead to market inefficiency. We shall then give a series of examples illustrating what happens when parties are able to negotiate costlessly with one another. Next, we will consider a related set of examples in which negotiation is costly.

We will then apply the principles that emerge from these examples to a variety of questions regarding the design of property rights. When should a person be allowed to exclude others from walking across his land? Should pastureland be owned privately or in common? The answers to such questions, we will see, depend on the kinds of accommodations people would reach among themselves if they were free to negotiate costlessly with one another.

Next, we will apply the theory of property rights and externalities to the topic of contests for relative position. We will conclude this chapter with an examination of taxation as a possible solution to the problem of negative externalities.

EXTERNALITIES AND MARKET EFFICIENCY

In Chapter 1 we looked at a simple decision rule for optimal decision making. The rule concerned whether or not to do activity x. If $B(x)$ and $C(x)$ denote the benefit and cost of doing the activity, the rule is:

If $B(x) > C(x)$, do x; otherwise don't.

private benefit and cost of activity x: the maximum monetary amount a person would be willing to pay to do activity x and the cost to that person of doing activity x.

In stating this rule we took $B(x)$ and $C(x)$ to denote the **private benefit and cost**. That is, we took it to mean the benefits and costs that accrue directly to the person doing the activity.

In Chapter 3 we already recognized that an activity may have *external* benefits and costs for others. Our task now is to explore the role of external effects in more detail. We begin with an example (that builds on Example 1.1) that shows how the simple decision rule stated above can lead to inefficient outcomes if there are external costs.

EXAMPLE 18.1   Will your stereo annoy the neighbours?

Imagine, once again, that you are settled into a comfortable chair and are listening to your stereo when you realize that the next two tracks are ones you dislike. You need to decide whether or not to get up and turn the music down or stay put and wait it out.

The private benefit of turning the music down is the monetary value you are willing to pay to avoid listening to these two tracks. The private cost is the monetary amount you would need to be paid to get out of your comfortable chair. For discussion's sake, suppose your price for

getting out of the chair is €1 and the benefits of turning the music down are €0.75. A simple cost–benefit calculation suggests you should remain in your chair because the private benefit is less than the private cost.

But suppose that your stereo is very loud, and your neighbour would also rather not listen to the next two songs. By playing your stereo loud you are imposing an *external cost* on someone else, your neighbour. Similarly, by turning down the volume you would create an *external benefit* for your neighbour. For illustration's sake, suppose that your neighbour is willing to pay €1 for the volume to be turned down. Then the cost of turning the music down is still €1. The total benefit, however, of turning the music down is €1.75—your €0.75 plus your neighbour's €1. This means it is efficient to turn the music down. ◆

In general, the **social benefit** of an activity is the private benefit plus any external benefit. The **social cost** of an activity is the private cost plus any external cost. It is often up to personal preference whether we count things as benefits or costs. For instance, we could count loud music as a cost for the neighbour, or count the lack of loud music as a benefit for the neighbour. We just need to make sure we do not double count.

> *social benefit and cost* of activity x: the combined monetary amount people would be willing to pay for activity *x* and the combined cost of activity *x*.

Once we know the social benefit and cost of an activity it is a simple matter to determine what is *efficient*. If $SB(x)$ and $SC(x)$ denote the social benefit and cost of doing the activity, efficiency requires:

If $SB(x) > SC(x)$, do x; otherwise don't.

If an activity has no external benefits or costs the optimal rule for the individual is the same as that required for efficiency. As Example 18.1 makes abundantly clear (and we already saw in Chapter 3), if an activity has external benefits and costs then the optimal rule for the individual may differ from that required for efficiency.

Listening to a loud stereo, and disturbing the neighbours, is an example of a **negative externality**. It is an activity that imposes external costs on others. There will be a tendency (as in Example 18.1) for a person to do such an activity when it is not efficient to do so. Turning down the volume, and pleasing the neighbours, is an example of a **positive externality**. It is an activity that creates external benefits for others. There will be a tendency for a person to not do such an activity when it is efficient to do so.

> *negative externality* and *positive externality* if an activity imposes costs on others or creates benefits for others that are not captured in private costs and benefits.

Our focus so far has been on the question of whether or not to do activity x. It is a simple matter, however, to extend concepts to answer the question of whether to do more or less of activity x. If $MB(x)$ and $MC(x)$ denote the marginal private benefit and cost of doing the activity, we know that the optimal rule for the individual is to increase the level of activity as long as $MB(x) > MC(x)$. Let $MSB(x)$ and $MSC(x)$ denote the marginal social benefit and cost of doing the activity. It is efficient to increase the level of activity as long as $MSB(x) > MSC(x)$. Again, any divergence between private and social marginal benefit and cost is likely to lead to inefficiency. In this context, the inefficiency will be to do too much or too little of the activity.
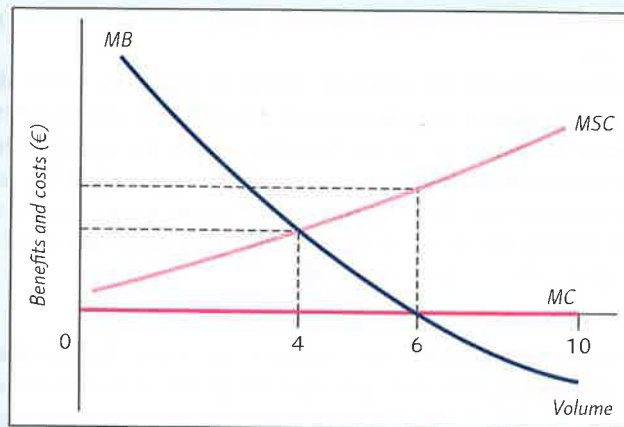
EXAMPLE 18.2   How loud should Anders play his stereo?

Anders is deciding how loud to play his stereo. The volume can be anything from 0 to 10. Figure 18.1 depicts Anders' marginal benefit curve. Suppose the marginal private cost of increasing the volume is zero. Then Anders' optimal rule is to find the volume x where $MB(x) = 0$. We can see in Figure 18.1 that this is where the volume is set at level 6.

Anders has a neighbour, Lars, who is trying to get to sleep. The louder the music, the more annoying it is for Lars. Figure 18.1 depicts the marginal social cost, which takes account of Lars' preferences. The efficient point is where the MSC and MB curves cross. (In this example, social benefits coincide with private benefits.) We can see in Figure 18.1 that this gives an efficient volume of 4. ◆

FIGURE 18.1

How Loud to Play Music
It is optimal for Anders to set the volume where marginal private benefits are zero. This, though, fails to take account of the negative externality Anders imposes on Lars. The efficient point is where marginal social costs equal marginal private benefits.

Note that in the preceding example we captured Lars' preferences in social costs. So, the marginal social costs of loud music were higher than marginal private costs. We could equivalently have captured Lars' preferences in social benefits. Then we would have had marginal social benefits lower than marginal private benefits. Either way leads to the equivalent prediction that the volume will be higher than efficient because of the negative externality Anders imposes on Lars.
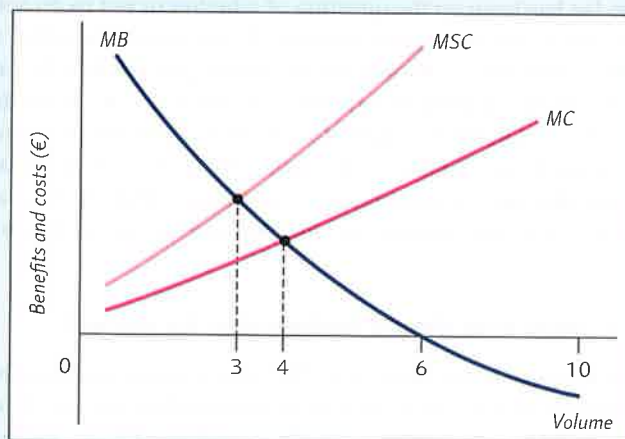
You might think that the inefficiency in Example 18.2 is primarily caused by Anders' selfishness. If Anders dislikes annoying Lars then surely things would be better? Maybe not, as our next example illustrates.

EXAMPLE 18.3   How loud should Anders play the stereo if he feels guilty about annoying Lars?

Everything is the same as Example 18.2 except that Anders now feels guilty about keeping Lars awake. Suppose that the amount of guilt Anders feels exactly matches Lars' annoyance. Then Anders' marginal private cost of loud music would be equivalent to the marginal social cost of Example 18.2. This is depicted in Figure 18.2. We see that the optimal volume for Anders is now 4.

FIGURE 18.2

Guilt at Causing an Externality Does Not Result in Efficiency
Anders feels guilty at keeping Lars awake and so reduces the volume from 6 to 4. But, at a volume of 4 the marginal social cost still exceeds marginal social benefit. This is because social costs include Anders' guilt and Lars' annoyance.

A volume of 4 was efficient in the scenario where Anders did not feel guilty about keeping Lars awake (Example 18.2). But, it is *not* efficient in the setting where Anders does feel guilty. This is because social marginal cost is given by Anders' guilt plus Lars' annoyance. We can see in Figure 18.2 that the efficient volume is now 3. ◆

Example 18.3 shows that non-egoistic preferences are not enough to eliminate the inefficiency that results from externalities. Anders' guilt means that he turns down the volume (from 6 to 4) but a volume of 4 still annoys Lars. So, we now have two costs—Anders' feeling of guilt and Lars being kept awake. In a similar way, someone's guilt at dropping litter may reduce the amount they drop but it does not make the litter that remains any less disturbing to others.

Externalities in Markets

The examples so far have involved one person affecting one other person. But we are primarily going to be interested in market environments where there are many people involved. In general, to determine the social benefit and cost of an activity (or market outcome) we simply sum up the benefits and costs of everyone who can be affected.[1] Similarly, to determine private benefit and cost we sum up the benefits and costs of everyone directly involved.

In a perfectly competitive market private cost and private benefit are given by the supply and demand curves. To appreciate why, recall that in a perfectly competitive market the supply curve is the summation of marginal costs across firms (see Chapter 12). This means the supply schedule tells us marginal private cost (aggregated over all firms). In an analogous way, the demand curve tells us marginal private benefit (aggregated over all consumers). Note this means that at a market equilibrium, where demand equals supply, we have marginal private cost equals marginal private benefit.

EXAMPLE 18.4   **Consider a perfectly competitive market for electricity. The demand curve for electricity is given by $Q^d = 2,000 - 20P$ where Q^d is the quantity demanded in megawatt hours (MWhr) at price P. The supply curve is given by $Q^s = 20P$. How much electricity will be produced? Electricity is produced using coal-fired power stations. Scientists estimate that production Q causes marginal environmental damage equivalent to €$Q/40$. What is the efficient amount of electricity?**

Given that the market is perfectly competitive we know that the market equilibrium is found where $Q^s = Q^d$. Setting $2,000 - 20P = 20P$ and rearranging, we get $P = €50$/MWhr and $Q = 1,000$ MWhr. The demand and supply curve together with the equilibrium price and quantity are depicted in Figure 18.3.

To obtain marginal private costs we need to rearrange the supply curve to get P as a function of Q^s. Then we see that marginal private costs are $MC = €Q/20$. Scientists have estimated the
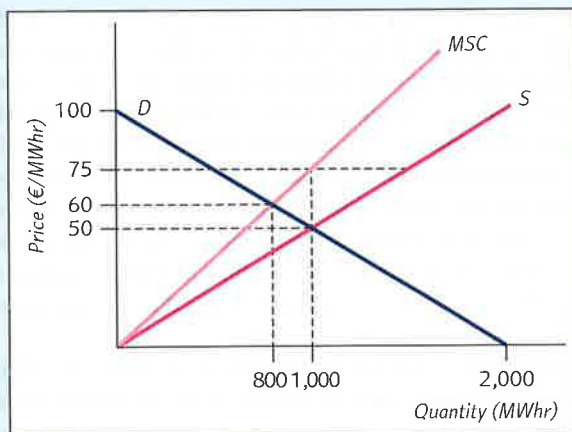

FIGURE 18.3
Excess Production in the Electricity Market
Market equilibrium is given where supply equals demand with an output of 1,000MWhr. Electricity production causes an external cost. When this negative externality is taken into account the efficient amount of output is 800MWhr.

[1]Another way to think of this is to imagine that everyone is affected by the activity but the cost and benefit to many is €0. For example, someone living a kilometre away from your house would be willing to pay €0 for you to turn down the volume on your stereo. The advantage of framing things this way is to remind us that all external costs and benefits should be included in the social cost and benefit.

marginal external cost at €Q/40 per MWhr. So, marginal social costs are $MSC = €Q/20 + Q/40 = 3Q/40$. Rearranging the demand curve gives us marginal private benefits of $MB = €100 - Q/20$. In this example marginal private benefits and marginal social benefits are equivalent. So, setting $MSC = MSB$, we get

$$\frac{3Q}{40} = 100 - \frac{Q}{20} \tag{18.1}$$

Solving Equation 18.1 for Q gives the efficient level of output of $Q = 800$MWhr. The efficient price is €60/MWhr. As we can see in Figure 18.3, the market equilibrium results in too much production and too low a price. This is because producers (and consumers) do not take into account the negative externality that electricity production imposes on the environment. ◆

The distinction between private and external benefits and costs may seem relatively simple. In market environments, however, some care is needed (see Economic Naturalist 18.1). Consider, for example, the purchase of this book. The price you (or whoever bought the book) paid included a very welcome contribution to our disposable income. This does not, though, count as a positive externality.

More specifically, for every person who buys the book we receive a monetary payment (from royalties) and have the psychological satisfaction of knowing that our work is read. But, in writing the book we also, obviously, incurred costs. The price of the book should reflect the cost–benefit calculation we went through in deciding to be authors. We would not, for instance, have decided to write the book if we received zero monetary payment in return for doing so. If the price of the book reflects our private costs and benefits then you indirectly must take them into account when deciding whether to buy the book. This means there is no external effect.

More generally, the interaction between a buyer and seller does not count as an externality because the price should reflect all the private costs and benefits of both buyer and seller. For an externality to occur there must be an effect not captured by the market. In Example 18.4 the price of electricity takes into account the private costs and benefits of buyers and sellers. But it fails to take account of the environmental cost of coal-fired power stations.

ECONOMIC NATURALIST 18.1

Why are footballers paid so much?

Mario Gotze's extra time goal meant that Germany beat Argentina to be 2014 World Cup Winners. In a game watched by over 900 million people this surely is an event with huge external effects?

Let us first look at the private costs and benefits of scoring that goal. In terms of costs, there was no doubt a lot of hard work involved in having the talent and fitness to be able to score. On the benefit side, Gotze had the enjoyment of scoring but also a likely increase in salary, sponsorship, etc. Clearly the potential benefits exceeded the costs otherwise Gotze would not have been there to score. And it would be naive to think that love of the game was benefit enough. The potential financial rewards are a big incentive to become a top professional footballer.

Now let us look at the external effects. The goal made most Germans happy. This effect, though, should be reflected in the private benefits of Gotze. In particular, Germany's desire to win the World Cup will indirectly be reflected in the willingness of fans to attend football matches, buy football merchandise, endorse products advertised by footballers, and so on. Seen in this light, the high financial rewards received by top footballers are due, in large part, to their potential to make a *lot* of people happy.

This is not to say that Gotze's goal did not generate any externalities. If nothing else, it made a lot of Argentinians (and Dutch) unhappy. Anyone, though, who can make a lot of people happy, whether it be a footballer, film star or inventor, should be able to reap high rewards. ■

Example 18.4 concerned a perfectly competitive market. In this setting external effects generate inefficiency. It is interesting to note that this can partly undermine the rationale for perfect competition. The following example illustrates that in the presence of externalities it may be efficient to have a monopoly producer. Efficiency increases because a monopolist has an incentive to reduce output.

EXAMPLE 18.5   The demand curve for electricity is given by $Q^d = 2,000 - 20P$. There is a monopoly supplier with marginal cost curve MC = 50. How much electricity will be produced? Scientists estimate that production Q causes marginal environmental damage equivalent to €Q/20. What is the efficient amount of electricity?

The monopolist will produce where marginal revenue equals marginal cost. The marginal revenue curve is $MR = 100 - Q/10$. Setting $MR = MC$, we have $100 - Q/10 = 50$. This yields the profit-maximizing quantity $Q^* = 500$MWhr. Plugging $Q^* = 500$ back into the demand curve, we get the profit-maximizing price, $P^* = €75$. This solution is shown graphically in Figure 18.4.
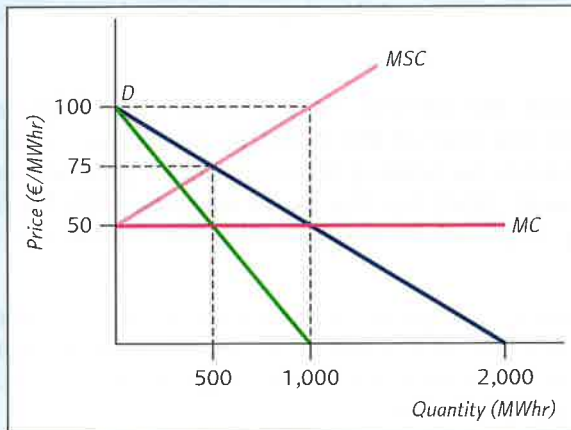
FIGURE 18.4
Efficiency May Be Higher with Monopoly than Perfect Competition
A monopolist produces where marginal revenue equals marginal cost. In the absence of any external costs this results in too little output. If there are external costs then output may be closer to the efficient level.

Marginal social costs are $MSC = €50 + Q/20$. As in Example 18.4, marginal private benefits are $MB = €100 - Q/20$ per MWhr. Setting $MSC = MSB$, we have $50 + Q/20 = 100 - Q/20$, which yields efficient level of output $Q = 500$MWhr. Note that this is equivalent to the output with the monopolist. ◆

EXERCISE 18.1   What would happen to efficiency in Example 18.4 if there was a monopoly supplier? So, the demand curve for electricity is given by $Q^d = 2,000 - 20P$, the marginal cost curve of the monopolist is $MC = Q/20$, and scientists estimate that marginal environmental damage is €Q/40.

THE RECIPROCAL NATURE OF EXTERNALITIES

If externalities lead to inefficiency then it is natural to ask how that inefficiency could be alleviated or reduced. Current thinking on this matter is largely shaped by the work of Ronald H. Coase. Coase, who was awarded the Nobel Prize in Economics in 1991, is the author of the most influential and widely cited economics paper of the postwar era. Titled 'The Problem of Social Cost',[2] this paper profoundly changed the way economists, legal scholars, political philosophers and others think about externalities and the legal and social institutions that have evolved to deal with them.

Coase began with an example not too dissimilar to that of loud stereos and neighbours. His example involved a doctor whose ability to examine patients was disrupted by the noise of machinery operated by a confectioner in an adjacent building. Historically, the economic and legal view towards such a situation was simple and clear: the confectioner's noise was harming

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the doctor and it ought to be restrained. Coase's seminal insight was that this view completely overlooks the reciprocal nature of the problem. True enough, the confectioner's noise does harm the doctor. *But if we prevent the noise, we harm the confectioner.* After all, the confectioner makes the noise, not for the purpose of harming the doctor, but in pursuit of his own livelihood. In such situations, there will be harm to *someone*, no matter what happens. Whether the harm caused to the doctor by the noise is greater than the harm that would be caused to the confectioner if he were prohibited from making it is strictly an empirical question. The common interest of each party, Coase recognized, is to avoid the larger of these two unpleasant outcomes.

The earlier, one-sided view of externalities led to a legal tradition in which the confectioner was generally held liable for any damage his noise caused to the doctor. Coase pointed out, however, that if the doctor and the confectioner were able to negotiate costlessly with one another, the most efficient outcome would occur regardless of whether the confectioner was liable. His simple and elegant argument in support of this claim is illustrated in the following series of numerical examples.

EXAMPLE 18.6   Suppose the benefit to the confectioner of continuing to make noise is 40, while the cost of the noise to the doctor is 60.[3] If the confectioner's only alternative to making the noise is to produce nothing, what will happen if he is made liable for the noise damage? (To be liable for the damage means being required to compensate the doctor for any damage caused by the noise.)

The confectioner will examine his two options—shutting down or compensating the doctor—and choose the one that makes him best off. If he stays open, he will earn 40, but will have to pay 60 to the doctor, for a net loss of 20. If he shuts down, his net gain is 0, and since this is clearly better than losing 20, he will discontinue operation.

Alternatively, suppose the confectioner had not been liable for noise damage. That is, suppose the law grants him the right to continue operating without compensation to the doctor. Coase argued that in this case the doctor will pay the confectioner to shut down. If the confectioner stays open, he will gain only 40 while the doctor will lose 60. But the doctor can compensate the confectioner for the loss of shutting down and still have enough left over to be better off than if the confectioner had stayed open. Suppose, for example, the doctor pays the confectioner 50 to shut down. The confectioner's net gain will now be 10 more than if he had stayed open. And the doctor's net gain of 10 is 10 more than if the noise had continued.

If P denotes the payment the doctor makes to the confectioner to compensate him for shutting down, we know that P must be at least 40 (what the confectioner would get by staying open) and no larger than 60 (what the doctor would get if there were no noise). The net results under the two legal regimes (confectioner liable versus confectioner not liable) are summarized in Table 18.1. ◆

Note that because the gain to the confectioner of operating his machinery (40) is smaller than the noise damage it imposes on the doctor (60), the most efficient outcome is for the confectioner to shut down. The social benefit of shutting down exceeds the social cost. Example 18.6 makes clear that if both the doctor and confectioner are rational and can negotiate costlessly with one another, this will happen regardless of whether the confectioner is liable for noise damage. On efficiency grounds, the legal regime is thus a matter of complete indifference here. On distributional grounds, however, the parties will be anything but neutral about liability. If the confectioner is not liable, his gain is $P \geq 40$, whereas he will be forced to shut down and earn nothing if he is liable. The doctor's net gain will be 60 if the confectioner is liable, but only $60 - P$ if the confectioner is not liable.

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[3]The numerical cost and benefit values used in this and in the following examples represent the present values of all current and future costs and benefits to the parties in question.

TABLE 18.1
Outcome and Payoff Summary for Example 18.6

Legal regime	Outcome	Net benefit		
		Doctor	Confectioner	Total
Liable	Confectioner shuts down to avoid liability payment	60	0	**60**
Not liable	Doctor pays confectioner P to shut down, $40 \leq P \leq 60$	$60 - P$	P	**60**

The gain to the confectioner from operating is 40. The loss to the doctor from the noise is 60. The efficient outcome is for the confectioner to shut down, and this happens under both legal regimes.

EXAMPLE 18.7   Same as Example 18.6, except now the benefit to the confectioner of operating is 60, the benefit to the doctor in a noise-free environment only 40. Assume that the doctor must shut down if the noise continues.

This time the efficient outcome is for the confectioner to continue operating, since his gain exceeds the cost he imposes on the doctor. If he is not liable for noise damages, the confectioner will stay open and the doctor's best option will be to shut down. Alternatively, if the confectioner is liable for noise damage, he will again continue to operate and pay the doctor 40 to compensate him for his losses. The net results for this example are summarized in Table 18.2. Note that, as in Example 18.6, both legal regimes lead to the most efficient outcome, but have very different distributional consequences. ◆

TABLE 18.2
Outcome and Payoff Summary for Example 18.7

Legal regime	Outcome	Net benefit		
		Doctor	Confectioner	Total
Liable	Confectioner stays open and pays doctor 40	40	20	**60**
Not liable	Confectioner stays open; doctor shuts down	0	60	**60**

The gain to the confectioner from operating is 60. The loss to the doctor from the confectioner's noise is 40. The efficient outcome is for the confectioner to continue operating, and this happens under both legal regimes.

The preceding examples assumed that the only alternatives open to two parties were either to continue operations in the current form or to shut down entirely. In practice, however, one or both parties often face a broader range of alternatives. As the following examples will illustrate, here too the ability to negotiate costlessly leads to efficient outcomes.

EXAMPLE 18.8   Same as Example 18.6, except now the *confectioner* has access to a soundproofing device that will completely eliminate the noise from his machines. The cost of the device is 20, which means that if he installs it, his net gain from operating will fall from 40 to 20. As in Example 18.6, the doctor will gain 60 if there is no noise, 0 if there is noise.

If the confectioner is liable for noise damage, his best option will be to install the sound-proofing. His alternatives are either to shut down or to pay the doctor 60 in noise damages, and each of these is clearly worse. If the confectioner is not liable, it will be in the doctor's interest to pay the confectioner to install the soundproofing. His alternative, after all, is to shut down or to endure the noise damage. The minimum payment that would be acceptable to the confectioner to install the soundproofing is 20, its cost. The most the doctor would be willing to pay for him to install it is 60, the amount the doctor would lose if it weren't installed. Again letting P denote the payment from the doctor to the confectioner, the outcomes and payoffs for the two legal regimes are as summarized in Table 18.3. ◆

TABLE 18.3
Outcome and Payoff Summary for Example 18.8

Legal regime	Outcome	Net benefit			
		Doctor	Confectioner	Total	
Liable	Confectioner installs soundproofing at own expense	60	20	**80**	The gain to the confectioner from operating without soundproofing is 40. Soundproofing costs 20. The loss to the doctor from the confectioner's noise is 60. The efficient outcome is for the confectioner to install soundproofing and to continue operating, and this happens under both legal regimes.
Not liable	Doctor pays confectioner P to install soundproofing, $20 \leq P \leq 60$	$60 - P$	$20 + P$	**80**	

EXERCISE 18.2 Smith and Jones are trying to decide whether to share a two-bedroom apartment or to live separately in one-bedroom apartments. The rental fees are €300/mo for one-bedroom and €420/mo—or €210/mo per person—for two-bedroom apartments. Smith is a smoker and would be willing to give up €250/mo rather than give up being able to smoke at home. Jones, however, is a non-smoker and would sacrifice up to €150/mo rather than live with a smoker. Apart from the issues of smoking and rent, the two find joint living neither more nor less attractive than living alone. Neither has an alternative room-mate available. Will they live together or separately?

Coase Theorem

The patterns revealed in the preceding examples may be stated formally as:

The Coase Theorem: When the parties affected by externalities can negotiate costlessly with one another, an efficient outcome results no matter how the law assigns responsibility for damages.

In the wake of its publication, Coase's classic paper became a subject of great controversy. Many took him to be saying that there is no real role for government in solving problems related to pollution, noise and other externalities. By this interpretation, Coase's message seemed to be that if government stays out of the way, people will always come up with efficient solutions on their own. And yet Coase stated clearly that this conclusion holds only for a world in which parties can negotiate with one another at relatively low cost. He recognized that for many important externalities this assumption is not satisfied.

At the simplest level, time and energy are required for negotiation, and when the potential benefits are small, it may simply not be worth it. Alternatively, there are situations in which a

single polluter causes damage to a large number of people. Negotiating with large groups is inherently difficult and costly, and each person in the group faces strong incentives to escape these costs. If negotiations are often costly then it can matter very much indeed which legal regime we choose, as the following example illustrates.

EXAMPLE 18.9   As in Example 18.7, suppose that the gain to the doctor in a noise-free environment is 40, while the gain to the confectioner from unfettered operations is 60. Suppose also that the doctor has the option of avoiding the noise by rearranging his office, which will cost him 18. And suppose, finally, that it costs the doctor and confectioner 25 to negotiate a private agreement between themselves. For negotiation to be a worthwhile alternative, they must be able to share this cost in some way that makes each of them better off than if they did not negotiate.

If the confectioner is not liable for noise damage, the doctor will rearrange his office. But if the confectioner is liable, the cost of negotiation now stands in the way of his paying the doctor to rearrange his office. The sum of negotiating costs (25) and rearrangement costs (18) comes to 43, which is 3 more than the 40 that will be saved by avoiding the noise. So if he is liable, the best option available to the confectioner is simply to continue operating and pay the doctor 40 for the noise damage.[4] Here we get the efficient outcome when the confectioner is not liable. The data for Example 18.9 are summarized in Table 18.4. ◆

TABLE 18.4
Outcome and Payoff Summary for Example 18.9

Legal regime	Outcome	Net benefit		
		Doctor	**Confectioner**	**Total**
Liable	Confectioner operates and pays doctor 40 for noise damage	40	20	**60**
Not liable	Doctor rearranges his office at his own expense	22	60	**82**

The gain to the confectioner from operating is 60. The loss to the doctor from the confectioner's noise is 40. The doctor can escape the noise by rearranging his office at a cost of 18. The cost of negotiating a private agreement is 25. The efficient outcome is for the doctor to rearrange his office, but this happens only when the confectioner is not liable for noise damage.

EXERCISE 18.3   How would the entries in Table 18.4 be affected if the cost of negotiation were 20 instead of 25?

Another serious barrier to negotiation is the problem of how to divide the surplus. Recall from Example 18.8 that the efficient outcome was for the doctor to pay the confectioner to install soundproofing. The minimum payment acceptable to the confectioner was 20, the cost of the soundproofing. The most the confectioner could hope to extract from the doctor was 60, the value to the doctor of eliminating the noise. The doctor would naturally like to pay only 20, and the confectioner would like to get 60. If each takes a hard line in the discussion, animosities may emerge and the possibility of a deal may break down altogether.

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[4]Again, making a liability payment does not require the parties to incur the costs of negotiation.

ECONOMIC NATURALIST 18.2

Why did it take 6 years to build the Channel Tunnel and over 11 years to build the Channel Tunnel rail link?

NIMBY, an acronym for 'not in my back yard', is used to describe residents who think an activity is worthwhile, as long as it happens well away from them. Berliners, for instance, might agree on the need for a new airport but disagree where it should be built. Or Europeans might recognize the need to accept refugees from Syria but disagree where they should be located.

In principle NIMBYism could seem relatively simple to solve. Residents near a new airport, for example, could be compensated or helped to relocate. Similarly, cities that take in refugees could be given additional resources to help cope with any resultant demands on health care, education and social services. In practice, the parties involved typically struggle to reach any form of agreement. Projects that would be efficient become blocked in animosity.

If a way forward is found then it is often through the courts. Which is why Berliners will get their new airport (eventually). A court ruled that Berlin Brandenburg Airport could be built provided the number of people under the flight path would be lower than at Berlin's existing three airports. By contrast, only partial agreement has ever been reached on Syrian refugees. In this case the supranational nature of the EU means there is no court to credibly enforce agreement.

As for the Channel Tunnel—while the Tunnel itself is one of the greatest feats of modern engineering there are not many NIMBYs living on La Manche. The Tunnel was, therefore, completed in relatively quick time. In stark contrast, the 100 km rail link between the Tunnel and London inevitably had to pass through beautiful Kent countryside and densely populated urban areas. That meant plenty of NIMBYs and inevitable delay. Which is why the Tunnel opened in 1994 but it was not until 2007 that a high-speed link extended all the way to London. ■

Coase's observation that people will reach efficient outcomes when they can negotiate costlessly has widespread application. In many situations, after all, the costs of negotiation are small relative to the benefits of reaching agreements about externalities. But the more far-reaching implications of Coase's work lie in the pattern illustrated in Example 18.9, where we find the seeds of a powerful theory of law and social institutions. Boiled down to its essence, the theory can be stated as the following rule: *Efficient laws and social institutions are the ones that place the burden of adjustment to externalities on those who can accomplish it at least cost.*

One of the immediate implications of this rule is that the best laws regarding harmful effects cannot be identified unless we know something about how much it costs different parties to avoid harmful effects. If the emitter of noise has lower costs, we get an efficient outcome by making him liable for damages. But if the person adversely affected by the noise has a lower cost of avoidance, as in Example 18.9, we do better by not making the noisemaker liable. The efficiency rule finds application in a rich variety of situations, several of which we examine in the sections that follow.

ECONOMIC NATURALIST 18.3

Why can Austrians not avoid nuclear power?

Austrians narrowly voted in 1978 against the use of nuclear power. Ever since Austria has remained a non-nuclear country. A number of other European countries, including Denmark and Italy, have subsequently followed suit. To ban nuclear power within a country does not, however, prohibit nuclear power just across the border.

In the 1980s Austria found itself surrounded by nuclear power plants. Two of these plants, located just 50 kilometres from the Austrian border with Slovakia, shared important design features with the ill-fated Chernobyl plant that in 1986 experienced the worst nuclear accident in history. The citizens of Austria were understandably concerned about their vulnerability to a similar mishap.

In a remarkably bold application of the reasoning Coase suggested, Austrian officials offered in January 1991 to provide Slovakia (then part of Czechoslovakia) with free electric power as an inducement to shut down the two Soviet-designed reactors.[5] Austrian Economics Minister Wolfgang Scheussel estimated that the cost of the replacement power would be the equivalent of around €350 million annually.

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[5] See Michael Z. Wise, 'Prague Offered Payoff to Shut Nuclear Plant', *The Washington Post*, 30 January 1991.

Czech Premier Marian Calfa expressed interest in the Austrian offer and pledged that a working group would study it. But no agreement was ever reached to implement it. Only as a condition for joining the EU were the plants finally closed (although newer plants remain). This experience is a further illustration that the costs of negotiation sometimes stand in the way even of agreements that would substantially benefit both parties. And arguments concerning the use of nuclear power are set to continue in the EU for a long while yet. ■

Positive Externalities

The Coase theorem applies not only to negative externalities but also to positive ones. When a beekeeper and an apple grower operate on adjacent properties, the activities of each confer positive externalities on the other. If the beekeeper adds an additional hive, the apple trees in the adjacent orchard will be more fully pollinated, ensuring a larger crop. If the orchard owner plants additional trees, the beekeeper's output of honey will rise. These positive externalities, if ignored, will result in suboptimally small levels of both apple and honey production. But if negotiation between them is costless, the beekeeper can offer to subsidize the orchard owner for planting more trees. The orchard owner, likewise, can offer payments to induce the beekeeper to enlarge his apiary. With either positive or negative externalities, inefficiencies result only if it is costly or otherwise impractical to negotiate agreements about how to correct them.

EXAMPLE 18.10   There are four students on a microeconomics course preparing for a test. With their current state of knowledge each student will get a mark of 6 out of 10. If one of them asks the lecturer a question then her marks will increase to 8 out of 10. Each student values this increase in mark as equivalent to €10. The costs for a student, in terms of going to campus, waiting for the lecturer, etc. are €12. What agreement could they negotiate?

It is not in the interests of any one student to act unilaterally because it would cost her €12 to ask the question but the benefit is only €10. Clearly, however, the group of students benefit from someone asking the question because the total benefit of €40 exceeds the cost of €12. If negotiation is costless then one student could go and ask the question while the other three students each pay her €3. This results in a net benefit of €7 to every student. Note that the €3 payment may come in the form of a drink at the bar while they all celebrate their high marks. ◆

PROPERTY RIGHTS

The Coase Theorem states that an efficient outcome can be reached (if negotiation is costless) no matter how the law assigns responsibility for damages. It is crucial, though, that responsibility for damages is assigned in some way. Otherwise the parties involved would simply disagree on who is responsible for the damage. This brings to the fore the importance of property rights.

No free-market economy can function successfully without laws that govern the use of private property. Among other things, these laws describe how people can lawfully acquire different types of property—by inheriting it, purchasing it or receiving it as a gift, but not by theft or other means that entail the use of force. They also impose bounds on the use of property—stereos cannot be too loud, cows cannot be kept in inner-city gardens, drivers must obey speed limits, firms cannot pollute rivers, etc.

The laws governing private property are the means by which we determine who is responsible for damage. We have seen that in the presence of negotiation costs it is important that the burden of adjustment should be placed on those who can accomplish adjustment at least cost. This, in turn, means that property rights should be given to the parties for whom it is most costly to adjust. To illustrate this point, consider again Example 18.9. Recall that because the doctor has the least cost of adjustment it is efficient for the confectioner to not be liable. This means it is efficient for the confectioner to have the property right to make a loud noise.

In most cases the laws governing private property grant owners of property the right to exclude others from using it without permission. Yet many detailed exceptions sharply limit this right to exclude. As the following Economic Naturalist examples suggest, these exceptions are not random. Rather, they follow a systematic pattern, one that the insights of Coase help us to understand.

ECONOMIC NATURALIST 18.4

Why does the law permit airlines to operate flights over private land without permission?

If a developer wanted to build a hotel in the airspace above someone's house, he must first secure her permission, which she will grant only in return for a substantial payment. But the law permits commercial airliners to fly over that house without payment whenever they choose. Why this distinction?

The crucial distinction is that individual negotiation is much more practical in the case of the developer than in the case of the airlines. In the former case, there are only two parties involved, and the benefits from an efficient outcome are likely to be large enough to justify the costs of negotiation. So in this case, we can feel confident of achieving an efficient outcome most of the time if we define property rights to exclude developers from building in the airspace above our houses. In the airline case, by contrast, the benefits of flying over any single house are small, and in any event, the cost of negotiating with all the potentially affected parties would be prohibitive. Because the total benefits of overflight are large relative to the total costs imposed on homeowners, we get an efficient outcome here if property rights do not permit landowners to exclude planes from flying overhead.

There are exceptions to this general principle, however, and these too provide an illuminating illustration of the Coasian efficiency rule. The most conspicuous exception involves approach- and take-off lanes to and from airports near major cities. In these situations, landings and take-offs are prohibited during the hours when it is most costly (difficult) for property owners to adjust to noise—namely, the hours when most of them are sleeping. Here again, negotiation on an individual basis is impractical, and the best we can do is define rights to achieve the lowest cost of adjustment. ■

ECONOMIC NATURALIST 18.5

Why does the law of trespass not apply in the mountains?

Another exception to the right to exclude others from one's land is provided by free access to mountains and moorlands. In the UK this issue has a long and eventful history with sometimes violent confrontation between landowners and hikers. The latest entry in the saga is the 2000 Countryside and Rights of Way Act that enshrines in law the right to roam on any area of mountain and moorland. A similar freedom to roam exists in many other European countries, including Norway, Sweden, Finland, Iceland, Switzerland and Austria.

Again, negotiation on an individual basis between landowner and hiker would be impractical. The key issue is whether the benefits to hikers of free access are greater than the costs to farmers and landowners. Confrontation reached its height in the UK during the 1930s when thousands of working-class people began leaving big industrial cities like Manchester for weekend recreation in the nearby moorlands. The benefits of free access became clear, and the law gradually changed to withhold the right of landowners to exclude hikers from their land. Landowners, though, still retain the right to exclude hikers at certain times of year, like lambing season, when it would be costly for them to adjust. ■

ECONOMIC NATURALIST 18.6

Why are property laws often suspended during storms?

On 13 November 1804, the Ploof family went sailing on Vermont's Lake Champlain. A sudden violent storm came up, making it impossible for them to get back to their home port. In desperation, they took refuge by tying up at a dock on an island in the lake. The dock was owned by a Mr Putnam, who sent his servant down to order the Ploofs off his property. The Ploofs cast off into

the storm, and shortly thereafter their sloop was destroyed, injuring several family members. The Ploofs later filed a successful damage suit against Putnam. The court decided that although Putnam would ordinarily have the right to exclude people from using his dock, the circumstances of the storm created an exception. Note that in deciding the case this way, the Vermont court was mimicking the result that dock owners and boat owners would generally reach for themselves if it were possible to negotiate costlessly and dispassionately during a storm. The value of the dock to a boater in distress is almost certainly higher than the value to the owner of being able to exclude him, and the Vermont court chose to define the state's laws of property with this observation in mind. █

Most people who grow up in market economies like Western Europe take the institution of private property rights for granted. But as the preceding examples have made clear, the details of our various property laws have a great deal of economic structure. They embody sophisticated, if often implicit, calculations about how to reach the most efficient solutions to practical problems involving externalities. Indeed, as the following section illustrates, the very existence of private property may be traced to early attempts to deal with externalities.

THE TRAGEDY OF THE COMMONS

To explore the origins of the institution of private property, it is instructive to consider, as in the next example, what would happen in a society that lacked a well-developed institution of property rights.

EXAMPLE 18.11   A village has six residents, each of whom has wealth of 100. Each resident may either invest his money in a government bond, which pays 12 per cent per year, or use it to buy a year-old cow, which will graze on the village commons (there being no individually owned grazing land in this village). Year-old cows and government bonds each cost exactly 100. Cows require no effort to tend and can be sold for a price that depends on the amount of weight they gain during the year. Yearly weight gain, in turn, depends on the number of cows that graze on the commons. The prices of 2-year-old cows are given in Table 18.5 as a function of the total number of cows. If village residents make their investment decisions independently, how many cows will graze on the commons?

TABLE 18.5
Cow Prices as a Function of Grazing Density

Number of cows	Price per 2-year-old cow
1	120
2	118
3	114
4	111
5	108
6	105

As more cows graze on the commons, each cow gains less weight, resulting in a lower price per cow.

As long as each villager cannot control access to the commons by cattle owned by others, the income-maximizing strategy will be to send an extra cow out onto the commons if and only if its price next year will be at least 112. (At that price, the gain from owning a cow is equal to the gain from buying a bond.) By this reckoning, there will be 3 cows sent onto the commons, and the rest of the villagers' money will be invested in government bonds. With this pattern of investment, village income from investment will be 14 from each of the 3 cows and 12 from each of the 3 bonds, for a total of 78.

Free exchange | Forced errors

Making rules about compulsory purchases of land is especially tricky in developing countries

WHEN Tata Motors wanted to build a factory for the Nano, a cheap "people's car", the Indian state of West Bengal seized 1,000 acres (400 hectares) of farmland on its behalf at Singur, just up the motorway from Kolkata. The state government invoked a colonial-era law to forcibly acquire the plot in 2006 from 13,000 landholders, many of them unwilling sellers. Protests against the purchase continued even as the factory was being built. Tata eventually fled. Narendra Modi, then the chief minister of Gujarat, offered it a way out by providing it a factory-ready plot there.

The Singur protests have come back to haunt Mr Modi, who is now India's prime minister. They led to a new law in 2013 which set arduous terms for coercive land purchases. Mr Modi is trying to relax these rules for certain categories of project, such as rural infrastructure, industrial parks and low-cost housing. It is now his government that faces protests from farmers. Yet if India is to become richer, it needs to be able to build roads and factories.

The economic case for allowing the state to acquire property by coercion starts with the Coase theorem, named for Ronald Coase, a Nobel prize-winning economist, which says that private bargaining should produce ideal results for society if property rights are well defined.* Yet the costs of such bargaining—verifying the quality of the asset, say, or legal fees to make the transaction official—are rarely low enough to allow for an efficient outcome, as Coase himself emphasised. This is all the more so where property is fragmented, as it was at Singur.

The problem is not restricted to land or other physical goods. New medicines and electronic gadgets can also be delayed or never made because of "patent thickets", a term coined in the 1970s to denote clusters of intellectual-property rights. Such logjams long predate the electronic age. In the early years of aviation it was nearly impossible to build an aeroplane in America because of the number of different patent-holders involved, writes Michael Heller in his book, "The Gridlock Economy".

Economists and legal scholars have justified forced purchases when the transaction costs of stitching together many small properties are too high for a deal to be reached by consensus. More precisely, it can be used to overcome the power of so-called holdouts. A theoretical model set out in a paper published in 2011 by Thomas Miceli and Kathleen Segerson of the University of Connecticut shows that when a buyer has to negotiate in sequence with sellers of contiguous plots of land, the price at each successive sale will rise. Landholders know the project cannot proceed unless the buyer acquires all the plots he needs. The more he acquires, the greater the cost of abandoning the project. The ransom those yet to sell can demand increases accordingly.

Because of the holdout problem, investments that have big public benefits will often be stymied unless a sale is forced. Laws in many countries, therefore, allow for the compulsory purchase of property (known as "eminent domain" in America), as long as those affected are justly compensated. But in developing countries, where markets for land in particular are often more regulated, less liquid and more corrupt than in the rich world, determining the appropriate compensation can be difficult.

Moreover, an optimal law would have at least one more safeguard. A transaction is efficient in the strictest sense only if it makes some better off while leaving no one worse off. Forced sellers presumably place a higher value on their property than the market price: were that not so, they might already have sold it voluntarily. Ideally, compensation should reflect this additional value. In company takeovers, after all, shareholders are usually paid a premium to give up their rights. Such a premium would discourage excessive use of eminent domain.

India's current land-acquisition law is simultaneously too strict to pave the way for desirable projects and too lax to protect property owners. Forced land purchase requires the consent of at least 70% of affected landholders and must also pass a social-impact test. Compensation must be twice the market value for urban plots and four times for rural land. Mr Modi wants to ditch the consent and social-impact clauses for certain projects because of the delays involved. He has a point. As Maitreesh Ghatak of the London School of Economics and Parikshit Ghosh of the Delhi School of Economics point out, if farmers are adequately compensated, consent is largely irrelevant.

The price is wrong

Yet compensation in India is based on recent land sales, which are likely to be far lower than the true value of a property due to India's distorted market. The direct sale of farmland to industry is banned in several states and tricky in many others; instead, land is often sold by a farmer in distress to another farmer. Prices are under-recorded to escape high stamp duty. Appraisal is often crude, if not corrupt. A study of the Singur purchase by Mr Ghatak and others found that, though compensation was on average close to market value, landowners with superior plots were offered too little.

As long as farmers in India believe they might be ripped off, protests against land purchases by the state are likely to continue. A way to counter this, say Messrs Ghatak and Ghosh, is to invite offers to sell from landholders in a plot required for development, but also from landholders close by. A farmer within the bounds of the development who did not accept the price determined by such an auction could instead be given a nearby plot as compensation. These nearby plots would not be subject to the holdout problem as they are not essential to the project. It is not a perfect solution to India's land-acquisition issue. But it is a better one. ■