

Law & Economics
Lecture 2: Externalities

I. The Pigouvian Approach

An externality is a cost or benefit that is experienced by someone who is not a party to the transaction that produced it. A negative externality is a cost experienced by someone who is not a party to the transaction that produced it. A positive externality is a benefit experienced by someone who is not a party to the transaction that produced it.

Examples of negative externalities: the installation of my new pool causes your yard to get flooded; the production of steel causes smoke to fill the air of surrounding communities; the sound of my stereo keeps you up at night, etc.

Most of the traditional analysis of externalities, which I will outline now, can be traced to the work of A. C. Pigou.

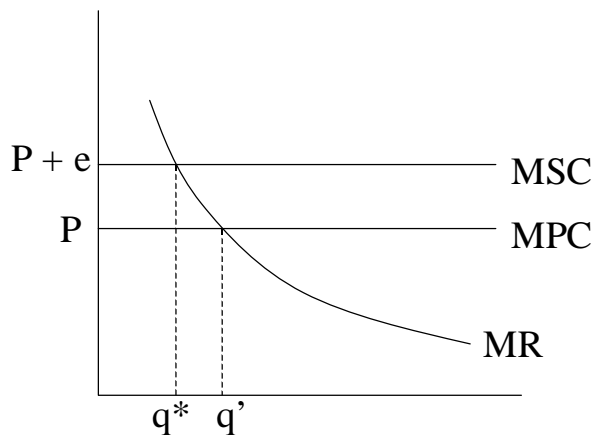
Why are externalities important? Because they can create incentives to engage in too much or too little of an activity, from an efficiency perspective. When all of the costs and benefits of a transaction are internal, meaning that all costs and benefits are experienced by someone directly involved, we expect the transaction to take place only if the benefits are greater than the costs. Say I want to buy a bicycle from your bicycle store. I will only buy it if the value of the bicycle to me is greater than the price. And you'll only produce the bike and sell it if the price you expect to get is greater than what it cost to produce the bike. So if the value of the bike is greater than the cost of producing it, then we'll be able to agree on a price. As a result, wealth will be created: the bike is worth more to me than the resources it cost to make it. On the other hand, if the bike is worth less to me than the resources it costs to make it, then we won't be able to agree on a price, so the bike won't get produced – and it shouldn't be.

But externalities throw a kink in this logic. What if, in making the bike, you dumped all your garbage in your neighbor's yard without paying for it? In that case, the fact that you and I reach a deal doesn't necessarily mean that wealth was created. To know for sure, we'd have to find out the dollar value of the damage done to your neighbor. Say that the bike is worth \$200 to me, and it costs you \$175 to make it. By exchanging the bike at any price between \$175 and \$200, it might seem that we create \$25 of wealth. But what if your garbage did \$30 worth of damage to your neighbor? Then it would be better for that bike not to have been produced after all, because we're collectively \$5 poorer than we would have been.

In general, the problem is that externalities create a divergence between private costs and social costs.

$$\begin{aligned}\text{social cost} &= \text{private cost} + \text{external cost} \\ \text{marginal social cost} &= \text{marginal private cost} + \text{marginal external cost} \\ \text{MSC} &= \text{MPC} + \text{MEC}\end{aligned}$$

Suppose a particular factor of production (say, coal) has a price of p . This is the marginal cost to a firm of buying coal. The firm has a marginal revenue curve for coal, which slopes downward. The firm's optimal choice of coal is given by q' . This is efficient if the price of coal takes into account all the costs of using coal. But it probably doesn't, because burning the coal will pollute the air, doing damage to people who live nearby. So the MC is really the MPC (marginal private cost). The MSC (marginal social cost) is higher, at say $p + e$. This means the efficient level of coal use is q^* . Thus, the externality implies that the firm uses too much coal. Each pound of coal beyond the efficient level produces greater costs than benefits, and that means losses in wealth overall. The loss in wealth is given by the triangle between q' and q^* , above MR, and below MSC.



What can be done to fix this situation? Pigou proposed the idea of a per-unit tax. The tax would be set equal to the marginal external cost, which in this case is e . In effect, this is making the firm pay to use one more factor of production, clean air, that previously had not been priced. So now, whenever the firm uses a pound of coal, it has to pay p to the coal producer and e to the government, for a total price of $(p + e)$, making the firm's MC the same as the MSC. As a result, the firm reduces its coal use to the efficient level.

II. The Coasean Approach

And that was the story until 1960, when Ronald Coase came along and said Pigou was all wrong. Why?

Coase and the Reciprocal Nature of Externalities. Coase observed that Pigou had missed out on another key feature of externalities: that they are reciprocal in nature. What I mean by this is that externalities are not simply the result of one person's action, but rather result from the combined actions of two or more parties.

In the case of the bike shop, the existence of a garbage externality is attributable not just to the seller's production of bikes, but to the neighbor's having located in a place where garbage is being dumped. If this seems counterintuitive, suppose the bike maker had been dumping garbage in a pit there for the last 20 years before the neighbor showed up and built his house. Does it make sense to say that the bike maker is the sole cause of the

externality? No – the externality is the result of the joint actions of the bike maker and neighbor.

Why is this important? Because sometimes, it makes more sense for the “victim” to change his behavior than for the “polluter” to do so. Let’s take DDF’s example. A steel factory causes \$200,000 of damage per year to a ski lodge downwind. It would cost the factory \$100,000 per year to use other production methods or move elsewhere. Or, the ski lodge’s owners could shut down and use their land for another use (timber) that is unaffected by the pollution, at a cost of \$50,000 per year. So which solution makes more sense – having the factory or the ski lodge change its behavior? From an efficiency perspective, it makes more sense for the ski lodge to do so, because it can prevent the damage at lower cost. We call the ski lodge the lowest cost avoider. The least-cost avoider in any situation is the party that can achieve a given reduction in damage or risk of damage at the lowest cost (in dollar terms).

Once you realize that both parties can take actions to prevent the damage, it turns out that a Pigou tax could actually lead to a worse outcome. Suppose the factory is taxed \$200,000 per year for continuing its current production methods. Then the factory will switch over at a cost of \$100,000, even though it would have made more sense for the ski lodge to change. Without the tax, and without any liability of the factory to the lodge, that’s exactly what would have happened.

This is what DDF calls the “nothing works” story. A better name for it would be the “anything could fail” story, because any regime (tax or no tax) could be inefficient, depending on the numbers.

Coase and Opportunity Cost. Coase also observed that Pigou’s analysis of externalities had ignored one of the most basic notions of economics: opportunity cost. We defined an externality as a cost or benefit imposed on someone who is not a party to the transaction. But why isn’t he a party to the transaction? Take your neighbor, on whom you’ve been dumping your garbage. Let’s say he has no legal remedy, because the courts say you can dump as you please. If you were that neighbor, what would you do? You’d be willing to pay as much as \$25 to avoid the dumping. Every time the bike maker dumps garbage in the neighbor’s yard, he forgoes whatever payment the neighbor would make to prevent the dumping. This is not an explicit cost, because it’s not money leaving the bike maker’s pocket. But it’s still an opportunity cost, because it’s money he could have had by acting differently.

As a result, there’s no particular reason – yet – to think that external costs won’t be internalized. People who wish to avoid external costs can make payments to prevent them. If those payments are large enough to deter the activity, great. If not, then the activity is efficient after all.

Take DDF’s example of the steel mill and ski lodge. Suppose that the steel mill has a legal right to pollute. Then it will do so, and the ski lodge’s owners will switch to timber. Now suppose that the ski lodge has a right to prevent pollution. Then the steel mill will

pay the ski lodge's owners to switch, with a payment between \$50,000 (the minimum the lodge will accept) and \$100,000 (the maximum the mill will pay). Either way, the efficient result happens. Prove for yourself that this is still true if the steel mill is the least-cost avoider -- that is, prove that the least-cost avoider will always be the party induced to take action.

DDF calls this the case of "everything works," or better yet, "nothing fails."

Coase and Transaction Costs. But there is one factor we've left out of this analysis, which throws a monkey wrench in the works: transaction costs.

A transaction cost is the cost of making a transaction, which is not received as a payment by a party to the transaction. Examples include the lawyer fees, time and effort spent on negotiation, organizing the parties to the transaction, etc. These can be quite substantial, sometimes high enough to thwart what would otherwise be a beneficial transaction.

Take DDF's example again, and suppose there is only one steel mill, but there are 100 ski lodges (each of which suffers \$2000 of damage). Also suppose that the mill has a right to pollute, but that doing so is inefficient, because the mill can change over at a cost of \$50,000 versus the lodge owners' \$100,000 [note: these numbers are different from the original example]. The lodge owners need to contribute \$500 each. But some of the lodge owners may try to free ride on the contributions of others. If 90 of the lodges paid \$600, that would be more than enough to pay off the mill, so the other 10 could refuse to pay and let the others pick up the slack. This is a public good problem. It occurs because it's socially rational for everyone to contribute, but it's individually rational for each lodge owner to try to free ride. This is one source of transaction costs that could thwart the deal, leading to an inefficient outcome.

Now turn the example around. Suppose that the lodges have a right to prevent pollution, but that doing so is inefficient, because the lodge owners can switch over at a cost of \$50,000 versus the mill's \$100,000. The mill needs to make a payment of at least 500 to each lodge owner to get him to switch over. But he cannot start producing until he gets permission from each and every lodge owner. So a single lodge owner might ramp up his demand to, say, \$600. Other lodge owners follow suit. Lodge owners have an incentive to hold out for a larger share of the money the mill will pay to be allowed to pollute. This is called a holdout problem, and it's another source of transaction costs.

So what should the legal rule be in these cases, if the transaction costs (from the public good and holdout problems) are too great for efficient bargaining to take place? The Coasean analysis suggests that the best legal rule depends on the facts of the situation. Efficiency tells us to pick the legal rule that places the burden on the party that is the lowest cost avoider. If the mill is the least-cost avoider, then a legal rule allowing the lodge owners to prevent pollution is efficient. The mill won't be able to pay off the lodge owners (even if transaction costs are low), so it will change over instead. If the lodge owners are the least-cost avoiders, then a legal rule allowing the mill to pollute is

efficient. The lodge owners won't be able to pay off the mill (even if transaction costs are low), so the mill will pollute and the lodge owners will change over.

This is what DDF calls the "it all depends (on transaction costs)" scenario. The efficient rule depends on the facts of the situation, including transaction costs.

The Coase Theorem. We are now in a position to state what has come to be known as the Coase Theorem. Coase never articulated it this clearly, and it's been stated many different ways, but this is my version. The Coase Theorem states that externality problems will be solved efficiently through private transactions if the following three conditions hold:

- Property rights are well defined.
- Property rights are transferable.
- Transaction costs are sufficiently small.

It is when one or more of these conditions fails that we should expect externalities to be a problem. Public good and holdout problems are two major ways in which the third condition can fail.

How this relates to the standard approach. Now we can look back at our diagram that distinguishes private from social cost with a different point of view. It's now apparent that the external costs, which drive a wedge between private and social cost, may actually be included in the private cost if transaction costs don't prevent it. They will be different only insofar as transaction costs prevent the exposure of the firm to the payments others would be willing to make.

III. Property Rules and Liability Rules

In the example above, I assumed there were only two possible legal rules: either the mill has a right to pollute, or the lodge has a right to prevent pollution unless his consent is obtained. But there are actually many types of rules that can be used.

There are two basic ways in which to enforce an entitlement: property rules and liability rules. Before explaining the difference between these two, I want to point out that this is a narrower definition of the word "property" than I was using to define the Coase Theorem. In that context, property rights are any and all rules that define people's control over the use of resources. But when we contrast property rules with liability rules, that's a narrower use of the word "property," because both property rules and liability rules are means of enforcing property rights in the broader sense.

A property rule is one that is designed to prevent any involuntary violation of the right being protected. A liability rule, on the other hand, allows for violations of the right so long as compensation is paid.

DDF gives the example of how your rights to your car are protected. Your right not to have your car stolen is protected with a property rule: someone who steals your car can

be thrown in jail. On the other hand, your right not to have your car damaged is protected with a liability rule: someone who dents your car has to pay to fix it.

You can think of it like this: Under a property rule, the asset owner's permission is required to use the asset. Under a liability rule, permission is not necessary, but damages must be paid.

Of course, no rule can actually deter all violations of a right. The criminal penalties for stealing your car obviously don't deter all car thefts. But to simplify, we can think of them that way. Also, some acts are punished by both types of rule.

Another example: Speeding violations used to be punished almost entirely by monetary fines. You could speed as much as you wanted, so long as you were willing to pay the price. But more and more, states are imposing harsher penalties, such as revoking your license if you get caught speeding more than three times. This represents a move in the direction of property rules rather than liability rules.

What is the justification for the different types of rule? From an economic perspective, liability rules are desirable when we wish to encourage "efficient violations" of the rule. An efficient violation occurs when the monetary value to an agent of doing something is greater than the damage done, and therefore the agent chooses to do it. [Use example of breach of contract.] Property rules are desirable when we wish to encourage direct bargaining over the rights in question. More on this later.

IV. The Spaghetti Diagram

The purpose of this exercise is to demonstrate the applicability of the Coasean approach when we expand our analysis to include both property rules and liability rules. Also, we will elucidate some of the advantages and disadvantages of the different rules.

Suppose a railroad travels past a stretch of farmland where 100 farmers have plots. When the railroad passes, it throws sparks on the nearby wheat crops. There are two ways in which this damage can be avoided: the railroad can install spark catchers on its engines, or the farmers can plant clover instead of wheat. (Note that we are simplifying the situation by assuming that each party only has one means of reducing the damage. If we allow other options, such as shutting down the railroads or not farming at all, the analysis gets more complex.)

Any legal rule must answer two questions: Who decides whether the railroad throws sparks? And who must bear the cost? The answers to these questions lead to four different rules:

	Railroad decides	Farmers decide
Railroad bears cost	Liability right by farmers (3)	Property right by farmers (2)
Farmers bear cost	Property right by railroad (1)	Liability right by railroad (4)

There are also four possible outcomes, corresponding to the actions of the railroad and farmers (spark catcher versus no spark catcher, wheat versus clover). Which of the four outcomes is efficient depends on the parameters of the situation: the value of wheat, the value of clover, the cost of the spark catcher. Note, however, that one of these four outcomes can be ruled out immediately: spark catcher plus clover. If the farmers are planting clover, there's no need for a spark catcher. So, we have three outcomes that might be efficient: no spark catcher + wheat, no spark catcher + clover, and spark catcher + wheat.

The object is to figure out which rule does the best job of getting an efficient outcome. Unfortunately, the answer depends crucially on which outcome is efficient.

Look first at rule (1), the property right by the railroad. We've really already talked about this case in the previous section.

- This rule is fine when no method of avoiding fires is worth the cost (the damage done by fires is less than the cost of a spark catcher or the loss in revenues from switching to clover). We get "no spark catcher + wheat," with no need for bargaining.
- This rule is also fine when switching to clover is cheaper than installing spark catchers and also cheaper than the damage done by fires. We get "no spark catcher + clover," again without bargaining.
- But this rule may fail when installing spark catchers is the cheapest route. To get "spark catcher + wheat," the farmers must pay off the railroads; but the public good problem may get in the way of arranging this outcome.

Now look at rule (2), the property right by the farmers. Again, we've really already covered this case in the previous section.

- This rule is fine when installing spark catchers is the cheapest route. We get "spark catcher + wheat," with no need for bargaining.
- But this rule may fail when letting fires occur is the cheapest route. To get "no spark catcher + wheat," the railroad must obtain the permission of all the farmers to throw sparks; but the holdout problem may get in the way.
- This rule may also fail when switching to clover is the cheapest route, for the very same reason: to get "no spark catcher + clover," the railroad must pay off the farmers, which means overcoming holdouts.

Now look at rule (3), the liability right by farmers. This case we haven't considered before. Under the liability rule, if the railroad throws sparks, it must pay the railroad for whatever damage it causes to crops.

- This rule is fine when installing spark catchers is the cheapest route. We get "spark catcher + wheat."
- This rule is just okay when letting fires occur is the cheapest route. The railroad throws the sparks and then pays the farmers after they sue. This is an imperfect outcome because there are litigation costs.
- This rule is also just okay when switching to clover is the cheapest route. The farmers' best choice is to grow wheat, let it burn, and demand compensation from the

railroad. To get around this inefficient outcome, the railroad again must pay off the farmers not to sue, raising the holdout problem once more. This is a mild holdout problem, fortunately, because the railroad can pay some farmers to switch to clover and pay damages to the others. The liability rule makes it so that no farmer can unilaterally stop the bargain. (DDF talks about a variant in which the courts require compensation for the loss from switching to clover, realizing that the switching was a response to the tortious action of the railroad. This works better, so long as the courts have enough information.)

V. How Smart Are the Courts?

At this point, it's worth pointing out another salient difference between property rules and liability rules. A property rule only involves a social decision about who has an entitlement, but not about the value of the entitlement. In the railroad example above, rule (1) assigns an entitlement to the railroad, and the parties are expected to bargain from there. Rule (2) assigns an entitlement to the farmers, and the parties are expected to bargain from there. A liability rule, however, involves a social decision about who has an entitlement and about the value of the entitlement. Rule (3) assigns an entitlement to the farmers, and it also puts the court in the position of deciding how much the farmers are owed if the entitlement is transferred to the railroad without the farmers' consent.

Clearly, a liability rule demands greater information on the part of the courts when applying it. Rules (1) and (2) only require the courts to identify whether or not sparks have been thrown and fires have occurred. Rule (3) requires the courts to do that, and also to determine the monetary damage caused by the fires. What happens if the courts cannot be trusted to make an accurate determination of the damages? Let's go through the different scenarios again to see how easily they can be achieved if the courts set damages too high.

- Suppose installing spark catchers is the efficient route. There's no problem here, because even the lower, correct damages are enough to induce the railroad to do the right thing. Higher damages will make it that much more worthwhile to install the spark catcher.
- Suppose letting fires occur is the cheapest route. If the courts set damages too high, the railroad may choose to install the spark catcher instead. To get around this inefficient outcome, the railroad would have to pay off the farmers not to sue – and that raises the holdout problem again. It is a limited holdout problem, though, because the court's damage assessment puts a cap on the amount any one farmer could successfully demand.
- Suppose switching to clover is the cheapest route. As discussed earlier, there's a holdout problem even when the court's assessment is not too high. It's a mild problem, though, because the railroad can pay some farmers to switch to clover while paying damages to the others. What happens if the court's assessment is too high? The problem gets worse, because each farmer can demand a higher amount than he could have under a correct assessment of damages.

These are all problems that arise from the courts' lack of information-gathering competence. If the court is very competent at gathering information, it could avoid some or all of these problems. By the way, we've only considered the case of too-large damage assessments. Somewhat different problems arise from too-small damage assessments. (Try to figure them out yourself.)

Of course, the courts must also be smart. Consider the situation where switching to clover is efficient. Even with correct damages, there was a problem arising from farmers letting their crops burn and collecting damages. If the court were smart enough and had sufficient information, it could award damages to farmers who switched to clover, on the grounds that the railroads' sparks forced the farmers to make the change. In other words, the courts shouldn't have to see a fire to recognize that damage has been done. The farmers who failed to switch to clover would only be awarded damages equal to what they would have suffered by switching to clover, not the total damage done by fire.

All of the informational problems discussed so far relate to the application of a given rule. But which rule should be applied? What rule should the courts adopt? The answer depends on (a) the distribution of cases over the efficient outcomes, and (b) the magnitude of the problems associated with getting from each rule to each outcome. For instance, if the court knew that in 99% of all cases it were efficient to have fires, then it would be wise to adopt a property right by the railroads. This would lead directly to the efficient outcome 99% of the time, without even any litigation costs. On the other hand, if the court knew that in 99% of all cases it were efficient to install the spark catcher, it would be wise to adopt a property right by the farmers.

But how does the court know what the distribution of cases is? Courts are in a reasonably good position to find out information about the particular cases before them, but they are in a poor position to find out characteristics of the entire population. Asking the courts to decide the most efficient rule puts them in the position of having to look at the universe of cases, not just the cases before them.

To make things more complicated, even if the courts share information, they cannot simply look at the set of all cases appearing before the court system to find out the population's distribution. Why not? Because the rule in effect determines which cases will actually appear in court. Suppose the court system is currently applying a liability rule by the farmers. Under this rule, the courts are likely to see cases in which throwing sparks is efficient, because those will be the instances in which the railroad chooses not to install the spark catcher to avoid paying damages. The courts will not, in general, see the cases in which installing the spark catcher is efficient, because in those cases the railroad will install the spark catcher to avoid going to court. Thus, the courts won't know how many such cases there are, or how many there are relative to cases in which fires are efficient. As a result, the court gets a skewed view of the population. It lacks the appropriate information to decide whether another rule might be more appropriate.

VI. Property vs. Liability Rules: Which to Use?

What is the justification for having two different sorts of rule, property rules and liability rules? Why not have just one?

The problems with having a property rule in all cases should be apparent from the discussion above, in the spaghetti diagram. If polluters have a property right and pollutees are numerous, a public good problem could deter the pollutees from paying off the polluter not to pollute (even if that's efficient). On the other hand, if pollutees have a property right and polluters are numerous, a holdout problem could deter the polluter from paying off the pollutees to let him pollute (even if that's efficient). The transaction costs are very high in these cases, so a liability rule makes sense.

But in that case, why not use liability rules for everything? Why throw car thieves in jail, when we could just have them pay you for the value of your car?

As we saw earlier, there can be substantial costs associated with enforcing a liability rule, especially when the courts can't assess damages accurately. With a property rule, most cars are transferred privately with no intervention by the courts. With a liability rule, a very large number of car sales would essentially take place in the courts, with the judge deciding what would be an appropriate price. Not only is this expensive to administer, it can also lead to many inefficient exchanges. When a buyer and a seller agree on a price, we know they are creating wealth (the price lies below the buyer's and above the seller's evaluation). When the court sets a price, we can't be so sure.

DDF's bottom line is like so: "Property rules are attractive when the cost of allocating rights by market transactions is low. Liability rules are attractive when the cost of allocating rights by litigation is low." I would just add one thing: that what really matters is the relative size of these costs. There may be hard cases where both means of allocation are expensive, but if one means is much more expensive than the other, we still have a means (in principle) of deciding the appropriate type of rule.

DDF's examples (these are nice illustrations):

- Buying a car versus denting a car. In the case of denting a car, the problem is that I don't know in advance whose car I will dent. So to arrange the transaction under a property rule, I'd have to negotiate with everyone whose car I might dent before getting behind the wheel.
- Trespass by people versus trespass by cattle. A human being can control his own actions in crossing property. But he cannot precisely control whose property a stray cow will cross. To arrange a transaction under a property rule, the cattleman would have to negotiate with all the nearby property owners before acquiring a cow.