

ECONOMICS SECTION 14

MICROECONOMICS SECTION 8

MARKET FAILURE AND THE ROLE OF GOVERNMENT

MODULE 74 / 38: INTRODUCTION TO EXTERNALITIES

The purpose of this module is to introduce the concept of external costs and benefits. Specifically, the module shows that the unregulated market for a polluting product will produce more pollution, the external cost, than is socially optimal.

Student learning objectives:

- What externalities are and why they can lead to inefficiency in a market economy.
- Why externalities often require government intervention.
- The difference between negative and positive externalities.
- The importance of the Coase theorem, which explains how private individuals can sometimes remedy externalities.

Key Economic Concepts For This Module:

- Production of goods generates pollution, which is a cost upon society. But those goods provide benefit to the consumers who enjoy utility from them.
- Each additional unit of pollution emitted imposes a cost to society called the marginal social cost (*MSC*). As more pollution is emitted, the *MSC* rises.
- Each additional unit of pollution emitted provides a benefit to society called the marginal social benefit (*MSB*). As more pollution is emitted, the *MSB* falls.
- The socially optimal amount of pollution is the quantity where the $MSC=MSB$.
- The unregulated marketplace does not consider the social cost of pollution, only the benefit, so a maximum amount of pollution will be emitted to the point where $MSB=0$.
- Efficiency can be gained if pollution can be reduced from the quantity produced by the unregulated market to the point where $MSC=MSB$.
- Economist Ronald Coase (1960) wrote that, so long as property rights are clearly defined, and transaction costs are minimal, a private solution can be found to a situation such as this.

Common Student Difficulties:

- More and more students are interested in environmental issues and so the discussion of pollution and externalities is somewhat familiar. It might increase their level of interest even more if the instructor chooses, as an ongoing example, a local industry that has been the source of a negative externality.

- Many people think that the optimal quantity of pollution is zero. It is important to remind students that, while we agree that pollution is harmful, we would not have many useful goods if we mandated that pollution be reduced to zero.
- It is difficult to conceive of a marginal benefit to pollution. Try to get the students to think of the steps that must be taken, and the resources that must be used, to avoid pollution. These measures are called “pollution abatement” and if \$1 million is required to reduce pollution by one ton, \$1 million is not being used in its next best alternative. Thus if the one ton of pollution is allowed to exist, society receives \$1 million of marginal benefit.
- It’s easy to come up with examples of negative externalities that could be solved by the Coase theorem, and that relate to students. You might discuss how one sibling’s behavior (loud music, irritating friends, sloppy habits) create a negative externality for the rest of the family. Ask students if they have ever had a friend who had a significant other that created a negative externality for the student. How could the Coase theorem be used to produce private solutions to these problems?

In-Class Presentation of Module and Sample Lecture

Suggested time: This module can be covered in up to two one-hour class sessions.

- I. The Economics of Pollution
 - A. Costs and Benefits of Pollution
 - B. Pollution: An External Cost
 - C. The Inefficiency of Excess Pollution
 - D. Private Solutions to Externalities

I. The Economics of Pollution

Most of the electricity produced in the U.S. is produced by burning coal. Electricity is an economic good that provides, quite literally, utility to the nation. However, the burning of coal creates pollutants in the air, water and soil.

There is a trade off, and a debate, going on here.

- Environmentalists argue that there is too much pollution because electricity producers, if not regulated, fail to consider the harmful effects of the pollution.
- Producers of the electricity argue that governmental regulation unnecessarily burdens their ability to produce electricity at the lowest possible cost.
- Economists see the pollution issue as a topic for cost-benefit analysis and argue that there is an efficient quantity of pollution where the needs of both the environment and the consumer of electricity are considered.

A. Costs and Benefits of Pollution

Pollution, like so many things, has both costs and benefits attached to it.

Marginal social cost (MSC): the additional costs imposed on society as a result of one more unit of pollution. These costs include those borne mostly by humans (cancers, asthma, and other illnesses) or by nature (loss of species, degradation of water, soil, air or climate).

What does the *MSC* curve look like?

It is upward sloping. When pollution levels are small, nearly zero, the next ton of pollution imposes very little damage to society. Nature can readily absorb it. However at very high levels of pollution, the next ton of pollution can cause a much larger cost to society as nature's capacity for absorbing it has greatly diminished.

Marginal social benefit (MSB): the additional benefits received by society as a result of one more unit of pollution.

How can there be benefit from pollution? Think about what it takes to *prevent* a ton of pollution. Industries must use scarce resources (labor, capital, land) to install new technologies to prevent the pollution. These scarce resources have value (benefit) in alternative uses, so if we *don't* use them to prevent a ton of pollution and allow the ton of pollution to exist, we receive that benefit elsewhere in society.

What does the *MSB* curve look like?

It is downward sloping. Assume that pollution is completely unabated and pollution levels are very high. At this point, to reduce one ton of pollution is very easy. This means that the value of the necessary abatement resources is fairly small, so the benefit of *not* using them to reduce pollution is small.

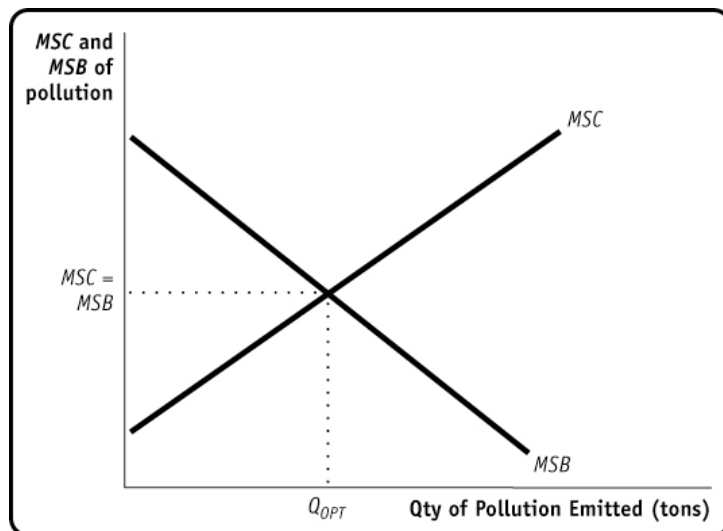
Suppose we reduce pollution to the point where there is only one ton of pollution left in society. We have used all of the easy (low cost) abatement methods to this point and all that remains is the most costly

method we have. The necessary resources are extremely valuable in other uses to society, so if we *don't* use them to reduce pollution, we will enjoy a great deal of benefit in those other uses.

So it is very easy to reduce the first ton of pollution and very difficult to reduce the last ton of pollution. This means that the benefit of the first ton of pollution is very high, and the benefit of the last ton of pollution is very low.

The socially optimal amount of pollution is shown in the graph below as Q_{OPT} where the $MSB=MSC$ of the last ton of pollution emitted. This is the quantity of pollution that makes society as well-off as possible, when all of the costs and benefits of pollution are considered.

Will society, left unregulated, come to the optimal amount of pollution Q_{OPT} ? No.



B. Pollution: An External Cost

Pollution creates both benefits and costs to society. Those who benefit are the producers and consumers of polluting goods, like most forms of electricity. The costs of pollution, however, are imposed upon everyone, and the natural environment.

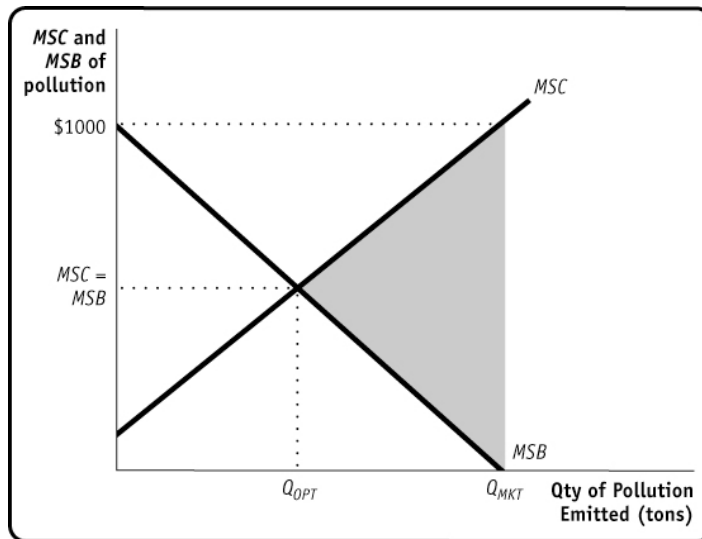
So a consumer of electricity in the Ohio River Valley certainly benefits from it. The power plant producing the electricity certainly benefits from it. And since pollution is a byproduct of burning coal, the benefits of the pollution accrue to the consumers and power plants.

But there are people living to the east of the Ohio River Valley who are receiving the pollution from the coal-burning power plants. Some of the particulate matter that comes out of a smoke stack in Ohio ends up landing in Canada or northern Europe. These people, and their environments, are not benefiting from that electricity, but they are incurring some of the cost of that pollution.

These costs are known as external costs.

Because the unregulated market doesn't much care about the costs of pollution, the polluting good (electricity in this case) will be produced until the marginal social benefit of the pollution emissions is equal to zero.

The graph below shows that this quantity of pollution, Q_{MKT} , is going to be greater than Q_{OPT} . This tells us that the unregulated market will produce more pollution than is socially optimal.



In the next module we will study these external costs, also known as negative externalities in more detail. There are also positive externalities when third parties receive benefit from the consumption or production of a good or service.

C. The Inefficiency of Excess Pollution

How could society do better with less pollution? Take a look at the graph again.

- At Q_{MKT} , suppose we could reduce pollution by one ton.
- What would we lose? Since MSB is zero, one less ton of pollution would come at almost \$0 of sacrifice to society.
- What would we gain? Since MSC is \$1000, if we reduced pollution by one ton we would avoid nearly \$1000 of harmful costs.
- Society would gain nearly \$1000 of net benefit from reducing pollution by just one ton. This is true of the entire range between Q_{OPT} and Q_{MKT} .

Society would gain the shaded area of the triangle between MSC and MSB if pollution could be reduced from Q_{MKT} to Q_{OPT} .

D. Private Solutions to Externalities

Suppose you had a house in a lovely neighborhood that was worth \$200,000 in the real estate market. The house next door is sold and a new neighbor Bob moves in. Bob proceeds to install a pig pen in the backyard and fills it with pigs. Pigs do what pigs do, and before you know it your property value declines so that it is worth \$150,000 in the real estate market. You are the victim of a negative externality.

What can you do? You could call the police or some other government office, but is there a way to handle this privately with Bob?

Ronald Coase (1960) wrote that, so long as property rights are clearly defined, and transaction costs are minimal, a private solution can be found to a situation such as this.

What is meant by property rights?

Scenario 1

Suppose Bob has the legal right to have pigs in his backyard. What could you do about the negative externality?

After the pigs have moved in, your property values have fallen by \$50,000. This tells us that you would be willing to pay up to \$49,999 to get Bob to not raise pigs next door to you. So you invite Bob over for coffee, you discuss how much money you would need to pay him to not have pigs and the government doesn't need to get involved.

For example, if Bob is willing to accept \$20,000 to not raise pigs, you are only out \$20,000 instead of \$50,000. Bob doesn't get to raise his pigs, but now he has \$20,000 cash to shop for bacon and ham at the grocery store.

Scenario 2

Suppose that you have the legal right to a house that doesn't smell like pigs. Bob really wants to raise pigs in his backyard and not being able to raise pigs is creating a hardship for him. What could be done? We know that if Bob has pigs it will harm you in the amount of \$50,000 so Bob could offer you \$50,000 cash (or more) to compensate you for the damages. Again, there is no need for the government to get involved.

What are transaction costs? These might be the costs of negotiating a settlement with Bob and exchanging the cash. In this scenario, these transaction costs don't amount to much.

Regardless of whether we are dealing with scenario 1 or 2, Coase would say that these private solutions internalize the externality. The party that is imposing the hardship on the other is required to compensate the victim.

In reality there might be situations where transaction costs are too high to make a private solution easy to negotiate.

1. High communication costs between affected parties. Suppose that Bob's pigs are polluting not just your property, but dozens of other people in the community are feeling the negative impact. Now the costs of negotiating a settlement between dozens of people and Bob are much higher.
2. High legal costs. Negotiations and legally binding agreements might require lots of attorneys and a huge stack of legal bills.
3. Costly delays involved in bargaining. Suppose that Bob is fully aware that you are the victim of the negative externality and decides to delay negotiations and postpones every meeting you have scheduled. Maybe he thinks that you will eventually get tired of these delays and move.

In-Class Activities and Demonstrations

Dr. Seuss knows about externalities.

If the instructor has 30 minutes of flexibility in the schedule, they might consider showing The Lorax and using it to discuss the economics of pollution, negative externalities, and the potential for using the Coase theorem to solve the pollution presented in the movie.

Get to know your local environment.

<http://www.epa.gov/myenvironment/>

Direct students to the Environmental Protection Agency's website "MyEnvironment". At this page the students can enter their home zip code and receive pollution information about their community. This could be part of a homework assignment or group project to build awareness of the quality of their local environment.