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Economics and the Environment

September 2014

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Common Core Standards (see page 10)

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NEWSLETTER

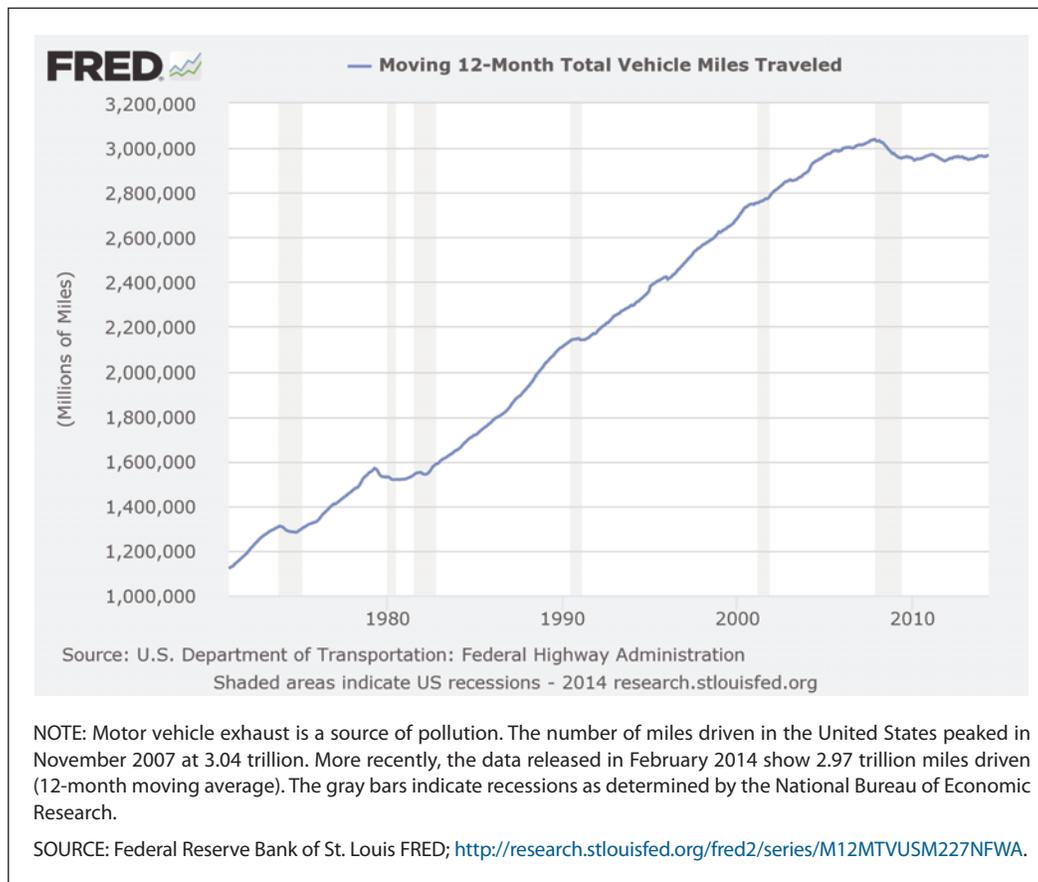
September ■ 2014

Economics and the Environment

Scott A. Wolla, *Senior Economic Education Specialist*

*“Don’t it always seem to go
That you don’t know what you’ve got till it’s gone”*
—Joni Mitchell, “Big Yellow Taxi”

For many environmentalists, protecting the environment is a matter of ethics, morality, and stewardship. For others, the environment is just one of many daily concerns. And, while many people might prefer a cleaner environment, nearly all economic activity results in some pollution. So, if society wants goods and services, it must accept some pollution. Less pollution will likely require less production (and consumption) of goods and services, higher costs for firms (and higher prices for consumers), or some combination of the two (see the graph). This highlights the underlying trade-off: A clean environment imposes costs.



Government regulation is one approach to protecting the environment. The government may mandate certain technologies (e.g., catalytic converters for cars or smokestack scrubbers for factories), ban certain goods (e.g., most traditional incandescent light bulbs), or stipulate a target level of efficiency and then let firms determine how they will meet the requirements.¹ Such government regulations achieve environmental goals, but in many cases they may not be the most cost-effective or efficient methods of doing so.

Property Rights and Externalities

From an economic perspective, firms that dump large amounts of waste into the air or water are shifting some of their production costs to society. The firms that pollute benefit from paying lower production costs (compared with using cleaner technology or fuels or installing pollution-control equipment). Society bears the costs of pollution through diminished opportunities to enjoy outdoor activities, potential long-term damage to ecosystems, as well as pollution-related health issues and their associated medical costs. Economists refer to this shifting of costs to third parties as a **negative externality**.

Economists generally attribute the existence of negative externalities to the lack of clear property rights.² When people own property, they have an incentive to protect it, care for it, and ensure that it lasts. For example, if you owned the air that you breathe, you would likely take action to stop others from polluting it or require compensation for the use of your property. But when property is not owned—such as air or water in a river—no one has a vested interest to be responsible for its welfare.

The Environment as the “Commons”

William Forster Lloyd wrote about the connection between property rights and externalities in 1832. In the England of his day, herders could graze their animals on lands owned “in common,” or essentially by everyone. Lloyd noticed that these areas were overgrazed by animals to the point of barrenness. In economic terms, individual herders benefited from grazing their animals on the common, but the cost to each individual herder was near zero because the common grazing area was shared by all. As a result, the herders kept adding more animals to the common that became overgrazed and unproductive, which was harmful to the entire group. Lloyd’s story is known to economists as the **tragedy of the commons**. In essence, the herders using the commons were gaining the benefits of their animals’ growth, but by grazing their animals on the common, they were shifting much of their production costs to their neighbors collectively. In other words, there was a negative externality.

Economists understand the lesson from the tragedy of the commons: When resources are not owned or the property rights are poorly defined, individuals have little incentive to monitor its use or overuse. In such cases, economists suggest property rights can be granted to ensure custodianship of the resource. However, granting property rights over some resources (e.g., the environment) can be difficult or unpopular. When granting property rights is not feasible or acceptable, the government can act as the custodian.

Economic Solutions to Pollution

According to economic models, firms that produce negative externalities by shifting some of their production costs will produce a greater quantity of the pollution-producing good or service than the **socially optimal quantity**, which (in this context) is the quantity of goods

produced that takes both the private and social (or external) costs into account. In short, in the case of the environment, this means that the free market, left alone, will *overproduce* pollution. How is this dilemma resolved?

Economist Arthur Pigou was an early advocate of using taxes to correct for negative externalities. He suggested negative externalities could be reduced by imposing a cost that reflects the extra cost shifted to society on the producer of the externality. To accomplish this, the government (acting as custodian) could impose a corrective **Pigovian tax** (named after Pigou) on the firm. For example, if a firm's production of widgets shifted \$10 of the production cost per widget to society in the form of pollution, the government (representing society) could impose a \$10 per widget tax on the firm. This action would force the firm to make its production decisions based on a cost that accounts for the negative externality, which is called **internalizing the externality**. Given the higher cost of production, the firm would probably reduce its production of widgets—and the amount of pollution created. Alternatively, the government could directly tax each unit of pollution emitted instead of each widget produced, thereby setting a fixed price for polluting and creating a direct incentive for firms to reduce the amount of pollution emitted. For example, firms might adopt technology that produces less pollution.

Economists view these types of policies as effective and efficient methods of reducing pollution because they use market forces and economic incentives to correct for negative externalities.³ They also give firms the freedom to choose the least-costly method of pollution reduction. In economic terms, this allows firms to “pick the low-hanging fruit” by pursuing the options with the lowest **opportunity cost** first. Economists also note that such tax policies create government revenue, which can be used to reduce other taxes, pay debt, or fund infrastructure, education, or social programs.⁴ This is the underlying concept for many carbon tax policy proposals.

Because taxes require direct payment by firms (and therefore indirect payment by their customers), some economists consider using tradable pollution permits a more acceptable alternative.⁵ In this scenario, the government can issue a specific (total) number of permits, which are allocated to firms based on a sustainable use of the resource (in this case, the atmosphere). Firms can emit only as much pollution as their permits allow. Because the government determines the number of permits, it can set a cap on the total amount of pollution emitted. Firms can buy and sell the permits in an established market at a price determined in the market. Firms that emit a great deal of pollution must buy permits, and firms that emit less can sell their permits in excess of those needed to cover their emissions. This provides an economic incentive for firms to reduce pollution in cost-effective ways. In practical terms, this serves as a subsidy to firms that use clean energy and production methods and a tax on those that pollute excessively.⁶

The total number of permits issued by the government can be reduced over time, thereby reducing the total amount of pollution emitted. Further, individuals or groups that wish to reduce pollution can have a direct impact by buying the permits and taking them off the market. The Clean Air Act Amendments of 1990 used tradable pollution permits to cost-effectively reduce sulfur dioxide pollution, which was causing acid rain. At the time, the concept of the government issuing a permit to pollute did not sit well with some environmentalist groups; many criticized them as “licenses to pollute.” The permits were given to firms, and they were allowed to trade them. This technique, known popularly as “cap and trade,” is still controversial, but the successful use of pollution permits in reducing sulfur dioxide pollution and acid rain has made them more acceptable.

Conclusion

Economists generally do not regard environmental cleanliness as an **absolute good**. Instead, they consider environmental quality as an economic decision with trade-offs. Individuals or firms that pollute are shifting some of their costs to society. And, because some costs are shifted, the market, left alone, will produce too much pollution. In these cases, the government can use regulations, taxes, or tradable permits to protect environmental resources from overuse. While each of these methods can be effective in achieving environmental goals, economists generally favor methods such as pollution taxes or tradable pollution permits over government mandates because these two methods create incentives for firms to reduce pollution in the most efficient, cost-effective way.⁷ ■

NOTES

¹ For example, auto manufacturers must meet Corporate Average Fuel Economy (CAFE) and emission standards, which may become more stringent and require further engineering and technology changes over time.

² Stavins, Robert N. "The Problem of the Commons: Still Unsettled after 100 Years." *American Economic Review*, February 2011, 101(1), pp. 81-108.

³ Milliman, Scott R. and Prince, Raymond. "Firm Incentives to Promote Technological Change in Pollution Control." *Journal of Environmental Economics and Management*, November 1989, 17(3), pp. 247-65.

⁴ Goulder, Lawrence H. "Environmental Taxation and the Double Dividend: A Reader's Guide." *International Tax and Public Finance*, August 1995, 2(2), pp. 157-83.

⁵ Stavins, Robert N. "What Can We Learn from the Grand Policy Experiment? Lessons from SO₂ Allowance Trading." *Journal of Economic Perspectives*, Summer 1998, 12(3), pp. 69-88.

⁶ Cowen, Tyler and Tabarrok, Alex. *Modern Principles of Economics*. Second Edition. New York: Worth Publishers, 2012.

⁷ A 2011 survey of American Economic Association members asked respondents to reply to the following statement: "Pollution taxes or marketable pollution permits are a more efficient approach to pollution control than emission standards." Of the 568 respondents, 58.5 percent agreed, another 29.1 percent agreed with conditions, and only 10.9 percent disagreed. See Fuller, Dan and Geide-Stevenson, Doris. "Consensus Among Economists—An Update." *Journal of Economic Education*, 2014, 45(2), pp. 131-46.

GLOSSARY

Absolute good: A value that cannot be traded off against other things that are highly valued by individuals. Many moral or ethical laws are considered to be absolute goods by the supporters (or advocates) of such laws.

Internalizing the externality: Altering the incentives so that individuals and firms incorporate the costs and benefits that have been shifted to third parties into their decisionmaking.

Negative externality: A negative side effect that occurs when the production or consumption of a good or service affects the welfare of individuals who are not the parties directly involved in a market exchange. A company that pollutes imposes a negative externality on those harmed by the pollution.

Opportunity cost: The value of the next-best alternative when a decision is made; it's what is given up.

Pigovian tax: A tax used to correct for a negative externality.

Socially optimal quantity: The quantity of goods produced that takes private and social costs into account.

Tragedy of the commons: The overuse of a resource, such as water, land, or air, due to poorly defined property rights.

Page One Economics Newsletter from the Federal Reserve Bank of St. Louis provides an informative, accessible economic essay written by our economic education specialists, who also write the accompanying classroom edition and lesson plan. The newsletter and lesson plans are published 5 times per year: January, March, May, September, and November.

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Teacher's Guide

Federal Reserve Bank of St. Louis *Page One Economics Newsletter*: "Economics and the Environment"

After reading the article, answer the following questions.

1. How is pollution an example of a negative externality?

Firms that pollute benefit from paying lower production costs because they have actually shifted some of their production costs to society. These costs come in the form of diminished opportunities to enjoy outdoor activities, potential long-term damage to ecosystems, as well as pollution-related health issues and their associated medical costs.

2. Explain how negative externalities and, more specifically, pollution often result from a lack of clear property rights.

When people own property, they have an incentive to protect it, care for it, and ensure that it lasts. When property is not owned—such as air or water in a river—no one has a vested interest to be responsible for its welfare.

3. The *Page One* essay identifies three methods for correcting negative externalities. Summarize and describe how each solution reduces pollution compared with the level that would be produced by the free market.

Pigovian tax	A Pigovian tax is a tax used to correct for a negative externality. More specifically, the tax attempts to make the firm pay a tax equal to the cost that has been shifted to society. This action forces the firm to make its production decisions based on costs of production that include <i>all</i> costs, including those on society. This is called internalizing the externality.
Pollution tax	The government directly taxes each unit of pollution emitted, thereby setting a fixed price for polluting and creating an economic incentive for firms to reduce the amount of pollution emitted. A firm can decrease its costs and thus increase its profits by decreasing the quantity of pollution it emits.
Tradable pollution permits	The government can issue a specific (total) number of permits, which are allocated to firms based on a sustainable use of the resource. Firms can emit only as much pollution as their permits allow. This sets a cap on the total amount of pollution emitted. Firms can buy and sell the permits based on their needs. This creates economic incentives for firms to emit less pollution.

4. Why do economists generally prefer Pigovian taxes or tradable pollution permits to government mandates?

Economists often prefer these methods because they use market forces and economic incentives to correct for negative externalities. They also give firms the freedom to choose the least-costly method of pollution reduction. In economic terms, this allows firms to "pick the low-hanging fruit" by pursuing options with the lowest opportunity cost.

For Further Discussion

Review the following or distribute the handout to your students; then lead a classroom discussion on externalities.

Economic models suggest that when markets are left to themselves (unregulated), they usually produce results that benefit both buyers and sellers and allocate economic resources efficiently. However, sometimes unregulated markets fail to produce an economically efficient outcome; these occurrences are called *market failures*. Externalities are one type of market failure because some of the costs or benefits of a transaction are shifted to a bystander, or third party.

As the *Page One* essay describes, a *negative externality* results when some costs of a transaction are shifted to a third party. A *positive externality* results when some benefits of a transaction are shifted to a third party. In both cases, the government can use economic solutions to *internalize the externality*. Use the *Economic Lowdown Externalities* video and the following outline to develop the concept of externalities more fully for your students.

1. Before showing the video, tell the students that after the video they will be asked to
 - describe the difference between positive externalities and negative externalities
 - describe how the government can correct a negative externality
 - describe how the government can encourage the production of goods and services that generate positive externalities.
2. Show Episode 5 of the *Economic Lowdown Video Series—Externalities* (located at http://www.stlouisfed.org/education_resources/economic-lowdown-video-companion-series/episode-5-externalities/).
3. Ask the students the following questions:
 - What is the difference between positive externalities and negative externalities?
A negative externality occurs when a cost spills over to a third party. A positive externality occurs when a benefit spills over to a third party.
 - How can the government correct a negative externality?
The government can tax goods or services when their production generates spillover costs. For example, the government can impose a tax that approximates the cost that is shifted. This tax increases the cost of production. The higher cost of production will result in the firm reducing its production of the good or service.
 - How can the government encourage the production of goods and services that generate positive externalities?
The government can provide subsidies for goods and services that generate positive externalities. The subsidy effectively lowers the cost of production for the firm. The lower cost of production will result in the firm increasing its production of the good or service.

4. Ask students to use the information from the essay and the video to write a short response for each of the following scenarios.

Scenario 1

Imagine the Spew Inc. factory near your town (Anytown) produces Gadgets. Gadgets are a popular consumer item, and the Spew factory provides many good-paying jobs for people in your community. However, the Spew factory also emits many pollutants into the water and air, which has resulted in a loss of environmental quality for nearly everyone and respiratory problems for many. Because you are an economist at the local college (Anytown University), community leaders have requested your input. Write a short analysis of the problem and a description of proposed solutions. Make sure you use the correct economic terminology in your description (after all, you are an economist).

The pollution that Spew Inc. emits represents a shifting of costs from the firm to society. In economic terms this is a negative externality, which can be internalized. A possible solution is to impose a tax on the Gadgets that Spew produces that is equal to the size of the shifted cost. For example, if each Gadget results in \$0.25 of cost shifted to society, the government could tax Spew \$0.25 for each Gadget produced. Because Spew must pay this tax on production, it would reduce its production of Gadgets. The result of lower Gadget production would be a reduction in the amount of pollution Spew emits.

Scenario 2

The local college (Anytown University) has a flu outbreak every January despite the availability of an effective vaccine for \$25. When surveyed, students and staff indicate that they do know about the treatment but are not interested in being vaccinated for \$25. Local doctors note that the risk to students and the others in the community would be considerably lower if the students were vaccinated. Because you are an economist at the college, they have requested your input. Write a short analysis of the problem and a description of proposed solutions. Make sure you use the correct economic terminology in your description (after all, you are an economist).

Flu vaccinations produce positive externalities because as the number of people vaccinated increases (and thus there are fewer people likely to contract or spread the virus), even those who have not been vaccinated are less likely to contract the virus. The government can encourage vaccinations by subsidizing the production of the vaccine. Such a subsidy would lower the cost of producing the vaccine, which would likely result in a greater quantity of the vaccine supplied and a lower price for consumers, including the students at Anytown University. The lower cost would benefit not only those who receive the vaccine but also those who are not vaccinated but less likely to contract the flu because the vaccinated people are immune and the risk of spreading the flu is lower. Alternatively, the university could subsidize the students' costs by offering to pay for student vaccinations. In this case, at a price of \$0, more students would likely receive the vaccine and reduce the chances of other students contracting the flu.

5. As an alternate assignment, assign students multiple-choice questions based on the content in the video via the *Econ Lowdown* Instructors Management Panel. For more information about the process, visit the *Econ Lowdown* Online Learning website (http://www.stlouisfed.org/education_resources/econ-ed-online-learning/).

Handout

Name _____ Period _____

Use the information from the essay and the video (http://www.stlouisfed.org/education_resources/economic-lowdown-video-companion-series/episode-5-externalities/) to write a short response to the following scenarios.

Scenario 1

Imagine the Spew Inc. factory near your town (Anytown) produces Gadgets. Gadgets are a popular consumer item, and the Spew factory provides many good-paying jobs for people in your community. However, the Spew factory also emits many pollutants into the water and air, which has resulted in a loss of environmental quality for nearly everyone and respiratory problems for many. Because you are an economist at the local college (Anytown University), community leaders have requested your input. Write a short analysis of the problem and a description of proposed solutions. Make sure you use the correct economic terminology in your description (after all, you are an economist).

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Common Core State Standards

Grades 6-12 Literacy in History/Social Studies and Technical Subjects

- **Key Ideas and Details**

RH.11-12.1: Cite specific textual evidence to support analysis of primary and secondary sources, connecting insights gained from specific details to an understanding of the text as a whole.

RH.11-12.2: Determine the central ideas or information of a primary or secondary source; provide an accurate summary that makes clear the relationships among the key details and ideas.

- **Craft and Structure**

RH.11-12.4: Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text (e.g., how Madison defines *faction* in *Federalist* No. 10).