GLOBAL EDITION

Foundations of Economics

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9th Edition

Foundations of
ECONOMICS

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NINTH EDITION, GLOBAL EDITION

Greenhouse gas emission is "the greatest market failure the world has ever seen."

To avoid the risk of catastrophic climate change, the upward CO_2 trend must be stopped.

Nicholas Stern

2. Keep global temperatures "well below" 2°C above pre-industrial levels and to "endeavor to limit" them to 1.5°C above by 2100.
3. Provide "climate finance" payments by rich countries of at least $100 billion a year starting in 2020 and more by 2025 to help poorer countries leapfrog fossil fuels and move straight to renewables.
4. Review each country's voluntary contribution to cutting emissions every five years.

  If carbon emissions are to be cut, incentives must change. The cost of carbon-emitting activities must rise and the cost of alternative clean-energy technologies must fall. Disagreement centers on how to change incentives.

Should countries use carbon taxes or should they cap emissions and introduce carbon trading? Should clean energy and the research to develop new green technologies be subsidized?

Carbon Taxes

The Canadian province of British Columbia, Ireland, and the United Kingdom are among those making their carbon footprints smaller by taxing carbon-emitting activities. British Columbia has a tax of $30 per ton of carbon emitted. Ireland and the United Kingdom have steep taxes on gasoline. Figure 3 shows the large U.K. gas tax and contrasts it with the very low U.S. gas tax.

Cap-and-Trade

Cap-and-trade—capping emissions and issuing tradeable emissions permits—has been used successfully by the EPA to cut local air pollutants, particularly lead. The system is also in use in Europe, but the cap is too large and the price is too low.

Subsidize Green Alternatives

Many countries provide subsidies to power utilities when they install wind farms or arrays of solar panels. The cost of these technologies is falling and they provide an increasing percentage of energy demand.

"For little environmental benefit, we could end up sacrificing growth, jobs, and opportunities for the big majority, especially in the developing world."

Bjørn Lomborg

Why Isn't More Being Done?

Why don't we have more aggressive caps and stronger incentives to encourage a larger reduction in carbon emissions? Four reasons are

1. Developing economies want to develop *and* want low-cost energy. With the currently available technologies, coal is an attractive choice for them.
2. Getting global agreement is hard. Paris 2015 was the first time that every country signed onto a plan.
3. The costs of lowering emissions are certain and are borne now while most of the benefits come in the future. Bjørn Lomborg, author of *The Skeptical Environmentalist*, says that "For little environmental benefit, we could end up sacrificing growth, jobs, and opportunities for the big majority, especially in the developing world."
4. Technology is advancing and the cost of cleaner energy is falling, so there is a temptation to rely on this trend continuing. An example is replacing coal with gas, which halves the carbon emissions from electricity generation and which fracking technology has made a cost-effective option.
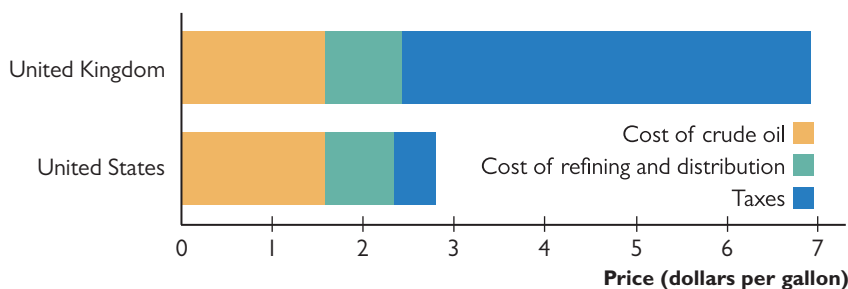

Figure 3 Gasoline Taxes

Sources of data: Energy Information Administration, Automobile Association, and authors' assumptions.

CHECKPOINT 10.1

Explain why negative externalities lead to inefficient overproduction and how government actions can achieve a more efficient outcome.

Practice Problems

Figure 1 illustrates the unregulated market for a pesticide. When factories produce pesticide, they also create waste, which they dump into a lake on the edge of the town. The marginal external cost of the dumped waste is equal to the marginal private cost of producing the pesticide (that is, the marginal social cost of producing the pesticide is double the marginal private cost).

1. What is the quantity of pesticide produced if no one owns the lake and what is the efficient quantity of pesticide? What is the deadweight loss?

2. If the town owns the lake, what is the quantity of pesticide produced and how much does the town charge the factories to dump waste?

3. If the pesticide factories own the lake, how much pesticide is produced?

4. If no one owns the lake and the government levies a pollution tax, what is the tax per ton of pesticide that achieves the efficient outcome?

In the News

China expects first trade in national emissions scheme in 2020
China has spent two years planning the details of a nationwide emissions trading scheme to reduce greenhouse gas emissions. The first trade is expected in 2020.
Source: Reuters, March 30, 2019

Explain the inefficiency in China's market for energy and contrast it with the U.S. market. How can cap-and-trade achieve an efficient outcome?

Solutions to Practice Problems

1. In Figure 2, production is 30 tons a week, the efficient quantity is 20 tons a week, and the deadweight loss is the area of the gray triangle.

2. The quantity of pesticide produced is the efficient quantity, 20 tons a week, and the town charges the factories $50 a ton of pesticide, which is the marginal external cost of the pollution produced by that quantity.

3. The factories produce the efficient quantity: 20 tons a week.

4. A pollution tax of $50 a ton paid by the factories achieves the efficient quantity of pesticide because the pollution tax equals the external cost.

Solution to In the News

China's market for energy is inefficient because it has a large external cost arising from carbon (and other) emissions from coal-powered generators. The marginal social cost of energy exceeds its marginal benefit by a large amount. The U.S. market for energy is also inefficient but less so than China's. Cap-and-trade can achieve an efficient outcome by confronting carbon emitters with the marginal social cost of their production.

FIGURE 1

FIGURE 2
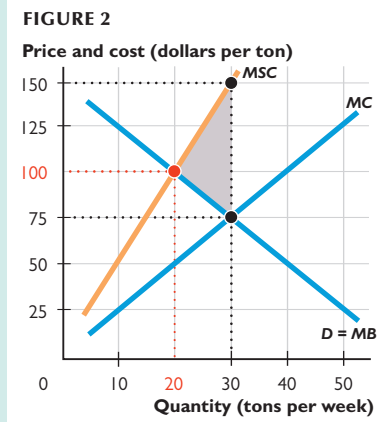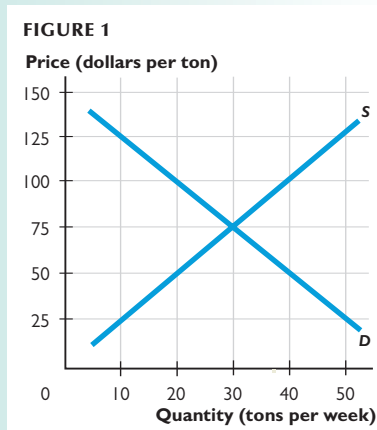
10.2 POSITIVE EXTERNALITIES: EDUCATION

Education benefits the students who receive it, and the many other people with whom a well-educated person interacts. To study the economics of education, we must distinguish between its private benefits and its social benefits.

■ Private Benefits and Social Benefits

A *private benefit* is a benefit that the consumer of a good or service receives. The **marginal private benefit** (*MB*) is the benefit of an additional unit of a good or service that the consumer of that good or service receives.

An *external benefit* is a benefit of a good or service that someone other than the consumer receives. A **marginal external benefit** is the benefit of an additional unit of a good or service that people other than the consumer enjoy.

Marginal social benefit (*MSB*) is the marginal benefit enjoyed by society—by the consumers of a good or service (marginal private benefit) and by everyone else who benefits (the marginal external benefit). That is,

$$MSB = MB + \text{Marginal external benefit}$$

Figure 10.5 illustrates these benefit concepts. It uses college education as an example, but the same principles apply to all levels of education. The marginal benefit curve, *MB*, describes the marginal private benefit—such as expanded job opportunities and higher incomes—enjoyed by college graduates. Marginal private benefit decreases as the quantity of education increases.

Marginal private benefit
The benefit from an additional unit of a good or service that the consumer of that good or service receives.
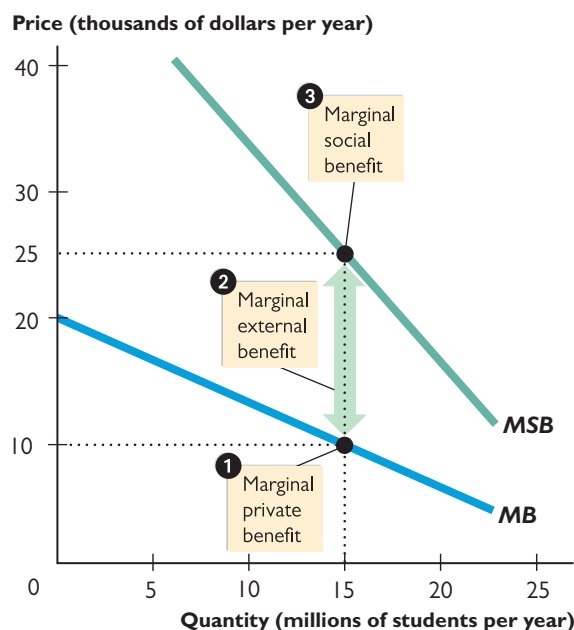
Marginal external benefit
The benefit from an additional unit of a good or service that people other than the consumer of that good or service enjoy.

Marginal social benefit
The marginal benefit enjoyed by society—by the consumer of a good or service and by everyone who benefits from it. It is the sum of marginal private benefit and marginal external benefit.

■ **FIGURE 10.5**

An External Benefit

The *MB* curve shows the marginal private benefit enjoyed by the people who receive a college education. The *MSB* curve shows the sum of marginal private benefit and marginal external benefit.

When 15 million students attend college

❶ Marginal private benefit is $10,000 per year.

❷ Marginal external benefit is $15,000 per year.

❸ Marginal social benefit is $25,000 per year.

But college graduates generate external benefits. On the average, college graduates communicate more effectively with others and tend to be better citizens. Their crime rates are lower, and they are more tolerant of the views of others. A society with a large number of college graduates can support activities such as high-quality music, theater, and other organized social activities.

In the example in Figure 10.5, the marginal external benefit is $15,000 per year when 15 million students enroll in college. Marginal social benefit is the sum of marginal private benefit and marginal external benefit. For example, when 15 million students a year enroll in college, the marginal private benefit is $10,000 per year and the marginal external benefit is $15,000 per year, so the marginal social benefit is $25,000 per year.

The marginal social benefit curve, *MSB,* is the sum of marginal private benefit and marginal external benefit. It is steeper than the *MB* curve because marginal external benefit diminishes for the same reasons that *MB* diminishes.

When people make decisions about how much schooling to undertake, they consider only its private benefits and if education were provided by private schools that charged full-cost tuition, there would be too few college graduates.

Figure 10.6 shows the underproduction that would occur if all college education were left to the private market. The supply curve is the marginal cost curve of the private schools, *S* = *MC*. The demand curve is the marginal private benefit curve, *D* = *MB*. Market equilibrium is at a tuition of $15,000 per year and 7.5 million students enroll per year. At this equilibrium, the marginal social benefit is $38,000 per year, which exceeds the marginal cost by $23,000 per year. Too few students enroll in college. The efficient number of students is 15 million per year, with marginal social benefit equal to marginal cost. The gray triangle shows the deadweight loss created by the underproduction.

◼ FIGURE 10.6

### Underproduction with an External Benefit

The market demand curve is the marginal private benefit curve, *D* = *MB*. The supply curve is the marginal cost curve, *S* = *MC*.

❶ Market equilibrium is at a tuition of $15,000 per year with 7.5 million students per year enrolled.

The marginal social benefit curve is *MSB,* so the market equilibrium is inefficient because ❷ marginal social benefit exceeds ❸ marginal cost.

❹ The efficient number of students is 15 million a year.

❺ The gray triangle shows the deadweight loss created because too few students enroll in college.
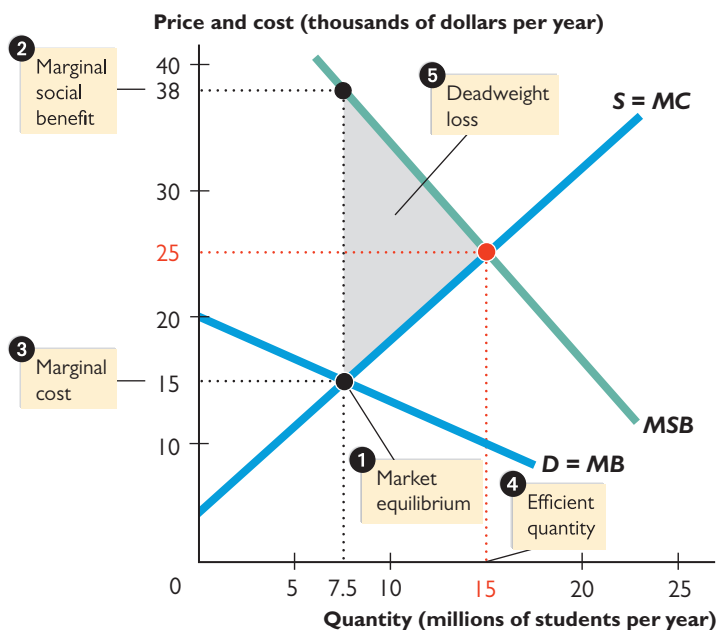
■ Government Actions in the Face of External Benefits

To get closer to producing the efficient quantity of a good or service that generates an external benefit, we make public choices through governments and modify the market outcome. To achieve a more efficient allocation of resources in the presence of external benefits, such as those that arise from education, governments can use three devices:

- Public provision
- Private subsidies
- Vouchers

Public Provision

Public provision is the production of a good or service by a public authority that receives most of its revenue from the government. Education services produced by public universities, colleges, and schools are examples of public provision.

Figure 10.7 shows how public provision might overcome the underproduction that arises in Figure 10.6. Public provision cannot lower the cost of production, so marginal cost is the same as before. Marginal private benefit, marginal external benefit, and marginal social benefit are also the same as in Figure 10.6.
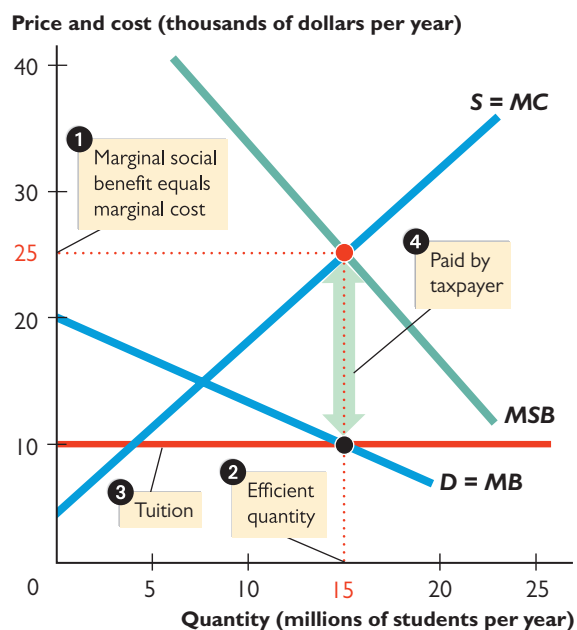
The efficient quantity occurs where marginal social benefit equals marginal cost. In Figure 10.7, this quantity is 15 million students per year. Tuition is set to ensure that the efficient number of students enroll. That is, tuition is set at the level that equals the marginal private benefit at the efficient quantity. In Figure 10.7, tuition is $10,000 a year. The rest of the cost of the public college is borne by the taxpayers and, in this example, is $15,000 per student per year.

Public provision
The production of a good or service by a public authority that receives most of its revenue from the government.

■ FIGURE 10.7

Public Provision to Achieve an Efficient Outcome

Price and cost (thousands of dollars per year)

❶ Marginal social benefit equals marginal cost with 15 million students enrolled in college.

❷ The efficient quantity is 15 million students per year.

❸ Tuition is set at $10,000 per year.

❹ Taxpayers cover the remaining $15,000 of marginal cost per student per year.

Private Subsidies

Subsidy

A payment by the government to a producer to cover part of the costs of production.

A **subsidy** is a payment by the government to a producer to cover part of the costs of production. By giving producers a subsidy, the government can induce private decision makers to consider external benefits when they make their choices.

Figure 10.8 shows how a subsidy to private colleges works. In the absence of a subsidy, the marginal cost curve is the market supply curve of private college education, $S = MC$. The marginal benefit is the demand curve, $D = MB$. In this example, the government provides a subsidy to colleges of $15,000 per student per year. We must subtract the subsidy from the marginal cost of education to find the colleges' supply curve. That curve is $S = MC - subsidy$ in the figure. The equilibrium tuition (market price) is $10,000 per year, and the equilibrium number of students is 15 million per year. To educate 15 million students, colleges incur a marginal cost of $25,000 per student per year. The marginal social benefit is also $25,000 per student per year. So with marginal cost equal to marginal social benefit, the subsidy achieves an efficient outcome. The tuition and the subsidy just cover the colleges' marginal cost of a student per year.

Public Provision Versus Private Subsidy   In the two methods we've just studied, the number of students who enroll and the tuition are the same. So are these two methods of providing education services equally good? This question is difficult to resolve. The bureaucrats that operate public schools don't have as strong an incentive to minimize costs and maximize *quality* as those who run private schools. But for elementary and secondary education, charter schools might be an efficient compromise between traditional public schools and subsidized private schools.

FIGURE 10.8

Private Subsidy to Achieve an Efficient Outcome

With ❶ a subsidy of $15,000 per student per year, the supply curve is $S = MC - subsidy$.

❷ The equilibrium tuition is $10,000 per year and 15 million students per year enroll in college.

❸ The market equilibrium is efficient because with 15 million students enrolled in college, ❹ marginal social benefit equals marginal cost.