

Externalities, Public Goods, and Common Resources

When market incentives get the answer wrong, too much pollution, too few lighthouses, too little restraint, and the policies to address them.

What this chapter covers



18.2–18.4 Externalities

- Private vs. social cost
- Taxes, subsidies, permits
- The Coase theorem



18.5–18.6 The commons

- Public goods & free riding
- Common resources
- Tragedy of the commons



18.7–18.9 Evidence

- Case: congestion pricing
- Empirical: acid rain
- Behavioral: public goods

THE BIG IDEA

Every failure here shares one root: a gap between private and social costs or benefits, so self-interested choices no longer serve the common good.

18.1

Introduction

- Smoke, lighthouses, and fisheries
- Where competitive markets fail
- A gap between private and social

Three cases where the market gets it wrong



Too much pollution

A factory's smoke imposes costs on everyone downwind, costs it does not necessarily pay.



Too few lighthouses

A lighthouse protects every ship, yet no shipowner wants to pay for one others can use for free.



Too little restraint

A fishery open to all is fished to collapse, though every fisher would gain by holding back.

WHY IT MATTERS

Chapter 10's competitive markets were efficient because each party bore the full costs and reaped the full benefits of their choices. These failures break that link.

18.2

Externalities: When Private and Social Costs Diverge

- What an externality is
- Negative externalities & overproduction
- Positive externalities & underproduction

A cost or benefit that falls on a bystander

■ Externality

A cost or benefit that falls on someone who is not a party to a transaction.

■ Negative externality

Like pollution: social cost exceeds the private cost the producer pays.

■ Positive externality

Like vaccination or education: social benefit exceeds the private benefit the buyer enjoys.

18.2 EXTERNALITIES

A polluting factory: the market overproduces

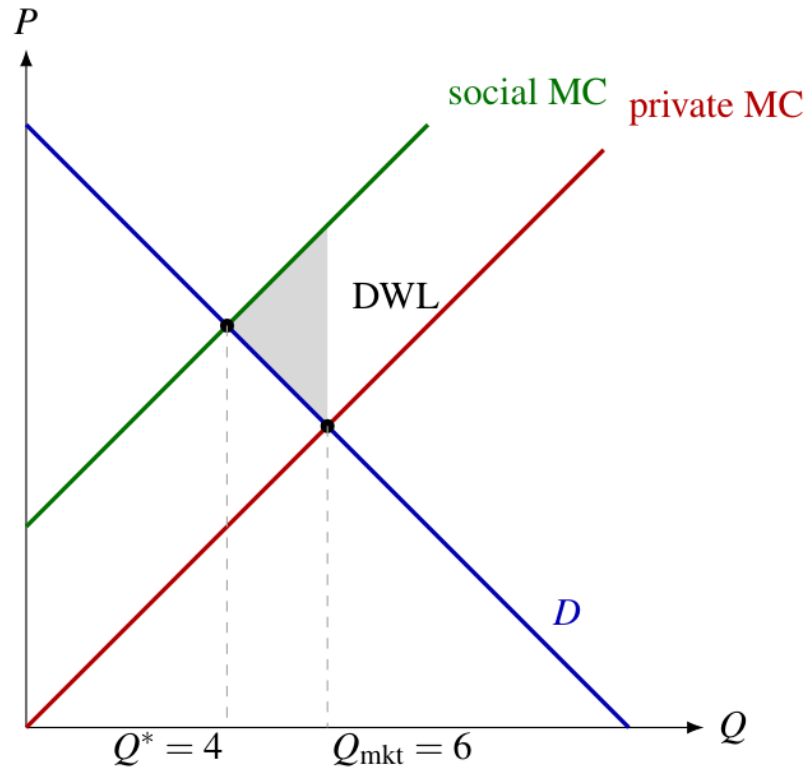
- The firm weighs only its private cost, so it produces where demand meets private marginal cost, say 6 units.
- But each unit imposes \$4 of harm downstream, so the true social marginal cost lies above the private one.
- The efficient quantity, where demand meets SOCIAL marginal cost, is lower, only 4 units.

THE RESULT

Units 4 to 6, whose social cost exceeds their value, generate a deadweight loss. Pollution is too cheap, so we get too much of it.

18.2 EXTERNALITIES

A negative externality, drawn



- Social marginal cost lies above private marginal cost by the external harm.
- Market quantity (6) exceeds the efficient quantity (4).
- The shaded triangle is the deadweight loss.

Figure 18.1 Because social cost exceeds private cost, the market overproduces, creating a deadweight loss.

18.2.1 POSITIVE EXTERNALITIES

Beneficial spillovers: the market underproduces

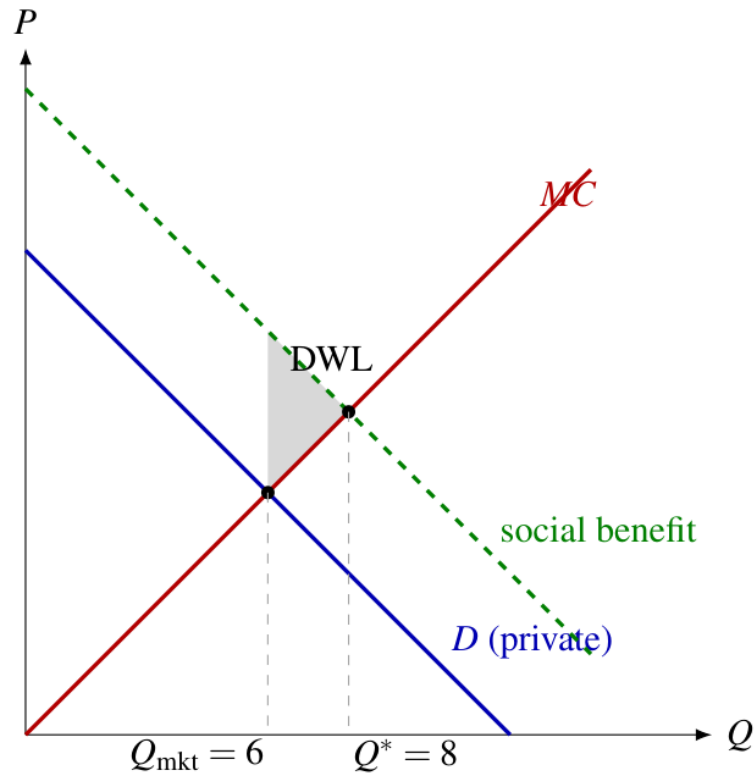
- A vaccinated homeowner protects everyone she might have infected; an educated person becomes a better-informed voter and colleague; a beekeeper's bees pollinate the neighbor's orchard.
- Social benefit exceeds the private benefit buyers capture, so demand (private benefit) lies below the social-benefit curve.
- Guided by private benefit alone, the market produces too little, too few vaccinations, too little education, too little research.

THE MIRROR IMAGE

Where a negative externality calls for a tax to discourage the activity, a positive externality calls for a subsidy to encourage it.

18.2.1 POSITIVE EXTERNALITIES

A positive externality, drawn



- The social-benefit curve lies above private demand.
- The market stops at $Q(\text{mkt})$, short of the efficient Q^* .
- A subsidy that closes the gap moves production to the efficient level.

Figure 18.2 Because social benefit exceeds private benefit, the market underproduces; the triangle is deadweight loss.

18.3

Correcting Externalities: Taxes, Subsidies, and Permits

- Internalize the externality
- Pigouvian taxes & subsidies
- Tradable permits (cap and trade)

Three tools to internalize the externality



Corrective (Pigouvian) tax

Set equal to the external harm, \$4 per unit, it raises private cost to social cost, cutting output to the efficient 4 units. (Cigarettes, carbon.)



Subsidy

The reverse for positive externalities: it pays for the extra social benefit, as with vaccines or education (Chapter 4).



Tradable permits

Cap and trade: set a legal limit on total emissions and let firms buy and sell the right to pollute.

THE UNIFYING IDEA

The policy is to make decision makers face the full social cost or benefit, to internalize the externality. (Named for the economist Arthur Pigou.)

Two ways to put a price on pollution



Tax: fixes the PRICE

The government sets the charge per ton and firms decide how much to emit, the regulator knows the price but not the quantity.



Cap & trade: fixes the QUANTITY

The government sets total allowed emissions and issues that many permits, it knows the outcome but not the price firms pay.

THEIR SHARED VIRTUE

Both beat rigid command-and-control: because firms choose how to respond, reductions happen wherever they are cheapest, so society hits its goal at the lowest total cost. A tax gives price certainty; a cap gives quantity certainty.

18.3.2

Carbon and Pollution Pricing Around the World

No longer theoretical, governments across the income spectrum now price pollution.

18.3.2 PRICING AROUND THE WORLD

Four schemes, four approaches

Country / region	Scheme	Detail
Sweden	Carbon tax (1991)	Began ~\$25/ton, now ~\$130/ton, among the highest anywhere; emissions fell as the economy grew
European Union	Emissions Trading System (2005)	Cap-and-trade over power and heavy industry across the continent
China	National ETS (2021)	~2,200 power plants, ~5 bn tons CO2 (>40% of emissions), world's largest carbon market
India (Gujarat/Surat)	Particulate cap-and-trade (2019)	World's first market for particulate (soot) air pollution

Selected carbon and pollution-pricing schemes worldwide.

India's Surat market: evidence from an RCT

99%

factories in the market met pollution limits (vs. $\leq 66\%$ under conventional regulation)

20–30%

cut in particulate emissions, while lowering firms' compliance costs

THE FINDING

Greenstone, Pande, Ryan & Sudarshan (2025) ran a randomized controlled trial, the gold standard of evidence. A striking demonstration that market-based instruments introduced in wealthy countries can work, and work cheaply, against the pollution that burdens the developing world.

Self-check: the right corrective tax

QUESTION

A factory's production imposes a \$3-per-unit pollution cost on neighbors that it ignores. What is the efficient corrective (Pigouvian) tax, and what does it do to output?

SELF-CHECK

A tax of \$3 per unit, equal to the external cost, makes the firm face the full social cost of what it produces. The firm then cuts output to the efficient level, where marginal social benefit equals marginal social cost.

18.4

The Coase Theorem: Bargaining to the Solution

- Sometimes no government action is needed
- Clear rights + low-cost bargaining
- Powerful, but limited

Private bargaining can reach efficiency

THE COASE THEOREM

If property rights are clearly defined and people can bargain at low cost, the parties to an externality will negotiate their way to the efficient outcome on their own, and they reach the SAME efficient quantity regardless of who holds the right.

- Ronald Coase, "The Problem of Social Cost" (1960), 1991 Nobel Prize in Economics.
- The assignment of rights determines who PAYS WHOM, but not what actually gets produced.
- So private negotiation can substitute for government action when the setting allows it.

18.4 THE COASE THEOREM

A pig farmer and a neighbor: both rights lead to the same outcome

THE SETTING

A pig farmer's manure costs a neighboring family \$300/month; the farmer's benefit from keeping the pigs where they are is \$150/month. Moving the pigs is efficient: family gains \$300, farmer loses \$150, net \$150 gain.



Right to clean air with the family

Farmer needs permission. The pigs are worth only \$150 to him but cost the family \$300, she refuses any offer below \$300, he will not pay more than \$150. No deal. The pigs move.



Right to raise pigs with the farmer

Family needs permission. Cleaner air is worth \$300 to them, moving costs him \$150, they pay somewhere between \$150 and \$300 for him to move. Deal is struck. The pigs move.

COASE'S INSIGHT

Different rights mean different payments, but the SAME efficient outcome.

18.4 THE COASE THEOREM

Powerful, but limited



Too many parties

Millions affected by climate change cannot all sit at one table to negotiate, nor can millions of emitters.



Costly bargaining

Lawyers, hold-outs, information asymmetries, or strategic behavior all raise the cost of reaching and enforcing a deal.

WHEN GOVERNMENT STEPS IN

When either hypothesis fails, climate change, urban air pollution, fisheries with hundreds of boats, the government tools of Section 18.3 (Pigouvian taxes, subsidies, tradable permits) become necessary.

18.5

Public Goods and Free Riding

- Rival and excludable
- The four types of goods
- Public goods & the free-rider problem

Two properties that decide who can supply a good

■ Rival

One person's use leaves less for others, a sandwich.

■ Excludable

Non-payers can be kept from using it, a ticketed concert.

WHY IT MATTERS

Crossing these two properties gives four types of goods. Whether a good is rival and whether it is excludable determines whether markets can supply it.

The four types of goods (Figure 18.3)

	Excludable	Non-excludable
Rival	Private good (a sandwich)	Common resource (an ocean fishery)
Non-rival	Club good (cable TV)	Public good (national defense, a lighthouse)

Figure 18.3 Four types of goods, by whether they are rival and whether they are excludable.

Public goods and the free-rider problem

■ Public good

Both non-rival and non-excludable, national defense, a lighthouse, clean air, basic research.

THE FREE-RIDER PROBLEM

Markets undersupply public goods because of the free-rider problem: since no one can be excluded, each person hopes to enjoy the good without paying, so too little is provided. This is why public goods are typically financed by government through taxes, which compel everyone to contribute.

18.6

Common Resources and the Tragedy of the Commons

- Rival but non-excludable
- Why they are overused
- Property, regulation, community

Rival but non-excludable, so overused

■ Common resource

Rival but non-excludable, ocean fisheries, public grazing land, a congested road, the atmosphere's capacity to absorb carbon.

The Tragedy of the Commons

Each fisher who takes one more fish gains the whole fish but bears only a sliver of the cost of a depleted stock, so all fish too much and the fishery collapses, the tragedy of the commons.

Three broad policies to address the commons

1

Property rights

Divide the resource into tradable catch quotas so each owner has reason to conserve the stock she now captures, New Zealand's Quota Management System (1986), Iceland's cod ITQs (1990), Chile's territorial user-rights fisheries (TURFs).

2

Government regulation

Catch limits, seasons, gear restrictions, or congestion charges, Pacific halibut season limits, U.S. Endangered Species Act, EU Common Fisheries Policy, Singapore's Vehicle Quota System.

3

Community self-governance

Users craft and enforce their own rules, the Swiss Törbel pastures (charter of 1483), Valencian huertas water tribunals, Maine lobster gangs, Japanese iriaichi common woodlands.

THE CENTRAL IDEA

The common thread: someone, somehow, must make each user bear the cost their use imposes on everyone else.

Elinor Ostrom: communities can solve it themselves

THE MOST SURPRISING CURE

Elinor Ostrom, who won the 2009 Nobel Prize, documented hundreds of cases, mountain pastures, irrigation systems, coastal fisheries, in which the users themselves crafted and enforced rules to manage a shared resource sustainably, without either privatizing it or handing it to the state.

- The tragedy of the commons, while real, is not inevitable.
- Communities with the right institutions, monitoring, and trust can solve it on their own.

18.7

Case Study: Pricing Congestion and Pollution

Two of the largest applications: congestion pricing and carbon markets.

18.7 CASE STUDY

A crowded road is a common resource

- Each driver who enters slows everyone else but pays nothing for the delay he causes, so the road is overused.
- The cure is to charge for it, a price does what exhortation could not.

~1/5

drop in traffic entering
London's zone after the 2003
congestion charge

~30%

fall in peak-period congestion
delays

AND ELSEWHERE

Revenue funded public transport. Stockholm adopted a similar scheme after a 2006 trial; Singapore has priced road use since the 1970s.

18.7 CASE STUDY

Carbon markets: cap and trade for greenhouse gases

THE EU ETS

The European Union's Emissions Trading System, launched in 2005, is the world's largest, capping the emissions of thousands of power plants and factories and letting them trade allowances so that cuts occur where they are cheapest.

Both policies put a price on something once free to dump or to crowd, the core prescription of Section 18.3.

18.8

Empirical Evidence: The U.S. Acid Rain Program

The clearest proof that market-based environmental policy works.

18.8 EMPIRICAL EVIDENCE

The world's first large-scale cap-and-trade

- 1990 amendments to the Clean Air Act targeted the sulphur dioxide from power plants that was acidifying lakes and forests.
- The government capped total emissions and issued tradable allowances.
- Utilities that could cut cheaply sold allowances to those that could not.

The results vindicated the theory

>40%

fall in sulphur-dioxide emissions from regulated sources by 2006,
ahead of schedule

low cost

a small fraction of what command-and-control would have required

THE LESSON

Because the market directed reductions to wherever they were cheapest, costs were far below what regulation would have required. The acid-rain program became the model for later carbon markets: putting a price on pollution yields large environmental gains at low cost.

18.9

A Look into Behavioral Economics: Public-Good Experiments

The free-rider problem, tested in the laboratory many times.

The public-goods game

THE SETUP

Participants each receive a sum of money and may contribute any part of it to a common pot that is multiplied and shared equally. Pure self-interest predicts everyone contributes nothing and free-rides on others.

- Real people are more generous than that, but only up to a point.
- Fehr & Gächter (2000): participants initially contributed 40–60% of their money, more than the selfish prediction.
- Cooperation steadily eroded with repetition, until in the final round most contributed nothing, exactly as free-riding predicts.

The twist: let players punish free-riders

A PARTIAL HUMAN SOLUTION

When players were allowed to punish free-riders at a cost to themselves, cooperation no longer collapsed but held at high levels, with most participants eventually contributing their entire endowment.

People will sacrifice to punish those who do not pull their weight, and the threat of that punishment sustains cooperation.

What the experiments have found

Study	Setting	Method	Key result
Ledyard (1995) (survey)	Voluntary contributions to a public good	Many repeated-round lab games	Contributions start near half the efficient level, then decline toward zero with repetition
Isaac & Walker (1988)	Effect of group size and return	Vary group size and the payoff per contribution	Cooperation depends mainly on the return to contributing, less on group size
Fehr & Gächter (2000)	Public good with punishment	Players can pay to punish free-riders	Cooperation collapses without punishment but holds at high levels with it
Chaudhuri (2011) (survey)	Two decades of voluntary-contribution experiments	Meta-analysis of >100 studies	Contributions rise with communication, punishment, and reward; identity and framing matter as much as monetary incentives

Table 18.1 Experimental tests of public-good provision and the free-rider problem.

Key takeaways

1

Externalities

A gap between private and social cost or benefit: negative ones overproduce, positive ones underproduce.

2

Three policies

Pigouvian taxes, subsidies, and tradable permits internalize the externality at lowest cost.

3

Coase theorem

With clear rights and cheap bargaining, parties reach efficiency on their own, but not for climate change.

4

Four types of goods

Rival $\times$ excludable: private, club, common resource, and public goods.

5

Commons

Common resources are overused; policies are property rights, regulation, or community (Ostrom).

6

Evidence

Congestion charges, the acid-rain program, and public-goods experiments, where punishment sustains cooperation.