Externalities

Chapter 10

Hussain Hadah
University of Houston | 26 July 2022

Table of contents

Extra Credit Game!

Rules

- Each student should have a paper with their name and student ID on it
- Each student will get **four** cards, two red and two black
- Only the color of the cards matter
- Each student should hand me two of the cards they have
- This is when the game kicks in:
    - If you keep a black card with you, it will be worth 1 point each
    -
    - If you hand me a black card, it will be worth 0.1 points
    - A red card is worth zero point with you and in the group
    - Example: if 10 students handed me one black card, then the class points will be worth 1 point (10*0.1)
- We will play four rounds
- Students cannot talk to each other during the first two rounds
- Students can talk to each other during the last two rounds

Your Paper

Jane Doe (Student ID)

1. First round: Number of black cards + class points = total points

2. Second round: Number of black cards + class points = total points

3. Third round: Number of black cards + class points = total points

4. Fourth round: Number of black cards + class points = total points

Example

1. First round: 2 black cards + 3 = 5

2. Second round: 1 black card + 3 = 4

3. Third round: 0 black cards + 3 = 3

4. Fourth round: 0 black cards + 2 = 2

Introduction

Do transactions only affect buyers and sellers?

- We learned that in a free market we can achieve an efficient outcome

- Free markets can do many things right, but not everything

- Markets fail sometimes and we call this a *market failure*

- The first market failure we are going to study is called *externalities*

Externalities

To understand *externalities*, consider the following example

- In the market for papers, buyers and sellers reach an equilibrium price and quantity demanded and supplied

- Through the production of papers, producers emit a toxic chemical called *dioxin*

- Dioxin is bad for the environment and it raised the risk of cancer, birth defects and other health problems

- So when buyers and sellers are participating in the market, a third party (those that aren't directly involved) are negatively affected

- The free market, in this case, cannot prevent the production of the toxin

- The benefit to society in this scenario goes beyond consumer and producer surplus

- We will need to account for the costs to the third parties

- At equilibrium with externalities, we do not reach an outcome that maximizes the well-being of everyone in the economy

Governemnt internvention

- When the market does not achieve an outcome that maximizes the well-being of society, the government should intervene

- When the government corrects the market failure, we will end up with an efficient outcome

- We examine why markets sometimes fail to allocate resources efficiently, how government policies can potentially improve upon the market's allocation, and what kinds of policies are likely to work best

Examples

Here are some examples of externalities and government interventions

- Drivers will not consider how the exhaust from their cars affects other people. So they drive at a level that is higher than what is optimal. In this case, the government intervenes and introduces emission standards for cars and taxes gasoline to reduce the amount of driving

- Research into new technologies provides a positive externality because it creates knowledge that other people can use. If individual inventors, firms, and universities cannot capture the benefits of their inventions, they will devote too few resources to research. The federal government addresses this problem partially through the patent system, which gives inventors exclusive use of their inventions for a while

Externalities and Market Inefficiency

Welfare economics: A recap


Figure 1 **The Market for Steel**

The demand curve reflects the value to buyers, and the supply curve reflects the costs of sellers. The equilibrium quantity, Q_{MARKET}, maximizes the total value to buyers minus the total costs of sellers. In the absence of externalities, therefore, the market equilibrium is efficient.
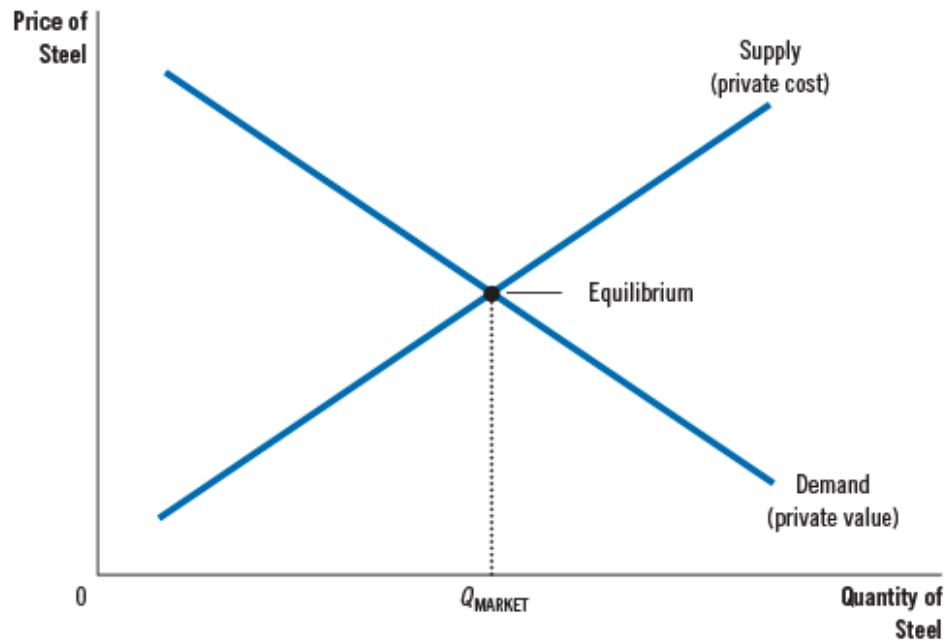
Negative Externalities
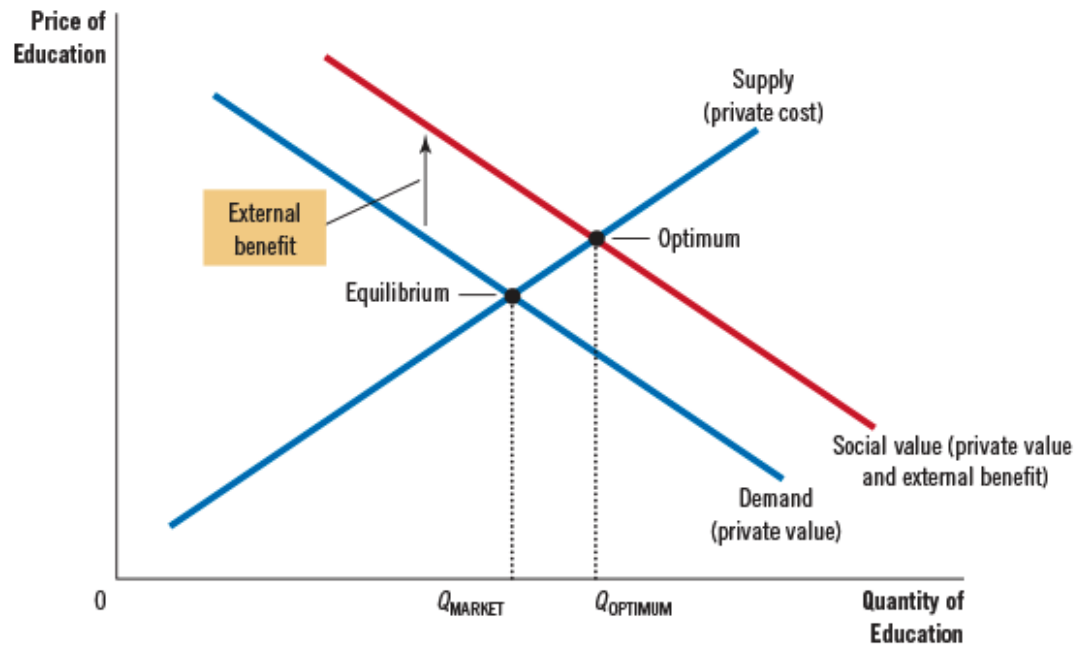

Figure 2 **Pollution and the Social Optimum**

In the presence of a negative externality, such as pollution, the social cost of the good exceeds the private cost. The optimal quantity, $Q_{OPTIMUM}$, is therefore smaller than the equilibrium quantity, Q_{MARKET}.
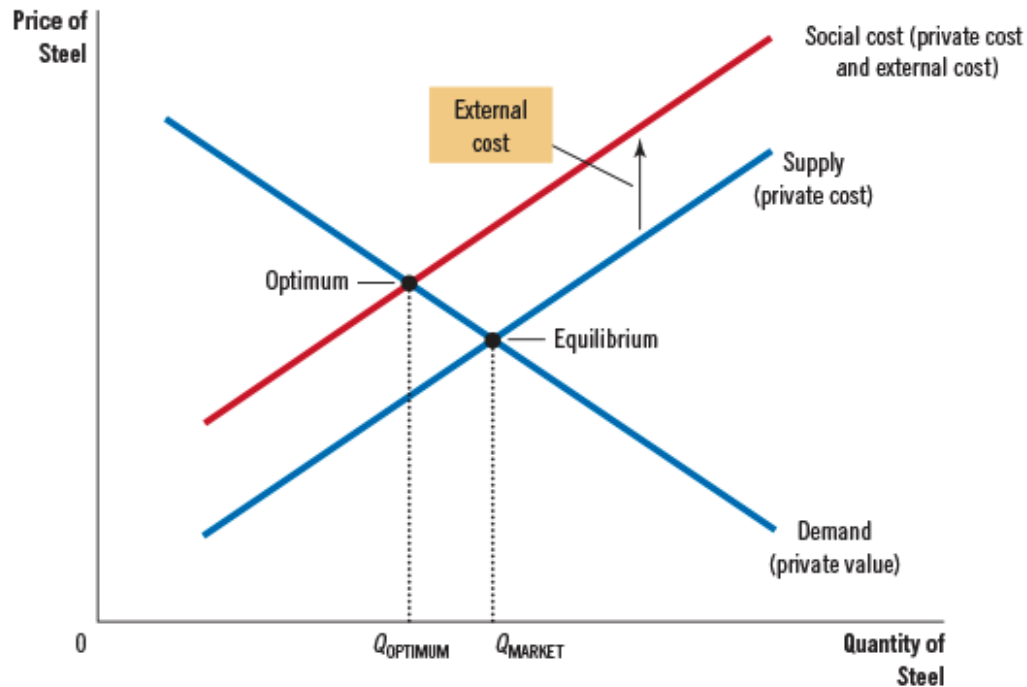
Positive Externalities

Figure 3 **Education and the Social Optimum**

In the presence of a positive externality, the social value of the good exceeds the private value. The optimal quantity, Q_{OPTIMUM}, is therefore larger than the equilibrium quantity, Q_{MARKET}.

- Price of Education
- Supply (private cost)
- External benefit
- Optimum
- Equilibrium
- Social value (private value and external benefit)
- Demand (private value)
- Q_{MARKET}
- Q_{OPTIMUM}
- Quantity of Education

Public Policies toward Externalities

Government solutions to externalities

In the presence of externalities, markets reach an inefficient equilibrium

Governments can respond to externalities in one of two ways:

1. *Command-and-control policies* that regulate behavior directly

2. *Market-based policies* that incentives private agents to choose a socially optimum outcome

Command-and-control policies

- The government can neutralize the effects of externalities by forbidding certain behaviors
- Example: The external cost of dumping toxic chemicals in the water out weights the benefits to polluters. The government prohibits the act
- Most of the time, the solution is not as simple
- It is impossible to ban all polluting activity
- In the US, the Environmental Protection Agency (EPA) is the government agency tasked with developing and enforcing regulations aimed at protecting the environment

Environmental regulations can take many forms

- EPA dictates the maximum level of pollution that a factory may emit
- EPA requires that firms adopt a particular technology to reduce emissions

Vaccines and negative externalities

Ask the Experts | **Vaccines**

"Declining to be vaccinated against contagious diseases such as measles imposes costs on other people, which is a negative externality."

What do economists say?

0% disagree   0% uncertain

100% agree
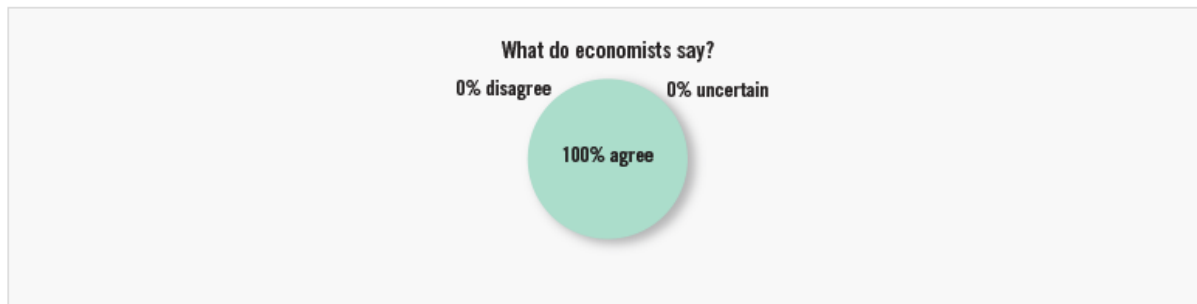
"Considering the costs of restricting free choice, and the share of people in the US who choose not to vaccinate their children for measles, the social benefit of mandating measles vaccines for all Americans (except those with compelling medical reasons) would exceed the social cost."

What do economists say?

6% disagree —   — 5% uncertain

89% agree
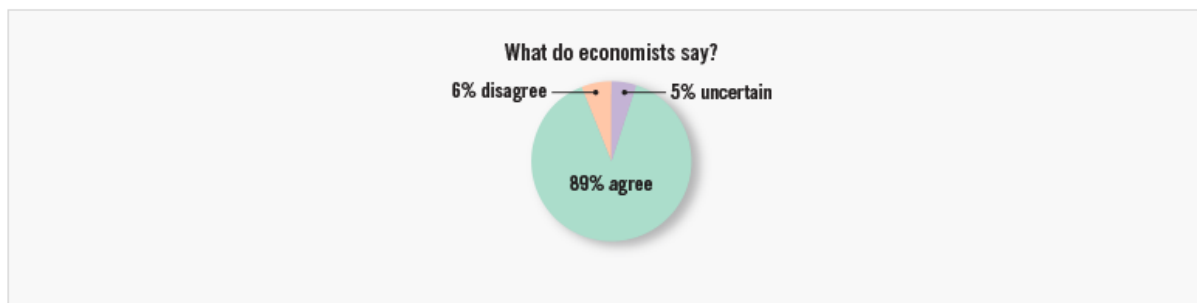
Source: IGM Economic Experts Panel, March 10, 2015.

Market-based policy 1

Corrective taxes and subsidies

- The government, by imposing taxes or subsidizing, can internalize the costs of externalities

- Taxes introduced to deal with externalities are called *corrective taxes*

- Another name is *Pigovian taxes*

- Economists prefer corrective taxes to regulations to deal with pollution because they reduce pollution at lower costs

Example

Suppose there are two factories, paper and steel mills

Each factory dumps 500 tons of glop into a rive each year

The EPA wants to reduce this pollution to 600 tons and considers the following solutions

EPA could instruct the factories to reduce their pollution to a specific level (regulation)

Or EPA can impose a tax of $50,000 for each ton of pollution they emit

Which solution is better?

Example (cont.)

- Economists prefer taxes because they are a market-based solution

- A tax is as effective as a regulations

- A tax, however, achieves a goal of reducing emissions more efficiently

- Regulations require all producers to reduce pollution by the same amount

- Taxes could also be better for the environment because polluters have the incentive to lower emissions as much as possible

Market-based policy 1

Tradable pollution permits

- The EPA imposes a regulation that no factory can produce more than 300 tons of pollutants

- The steel mill wants to increase its emission to 400

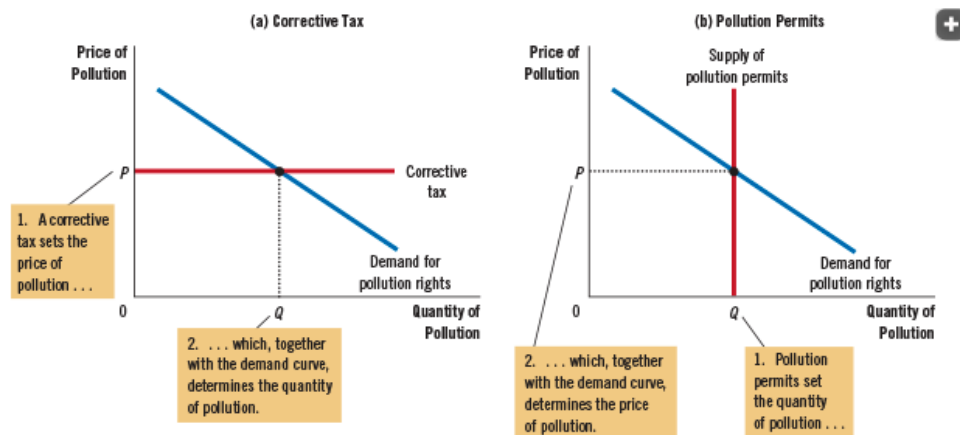- The paper mill would decrease its emission to 200 if the steel mill pays it $5 million

Should the EPA allow this?

- Yes it should because both plants will reach a more desirable outcome

Corrective tax and pollution permits

Figure 4 **The Equivalence of Corrective Taxes and Pollution Permits**

In panel (a), the EPA sets a price on pollution by levying a corrective tax, and the demand curve determines the quantity of pollution. In panel (b), the EPA limits the quantity of pollution by limiting the number of pollution permits, and the demand curve determines the price of pollution. The price and quantity of pollution are the same in the two cases.

(a) Corrective Tax

Price of
Pollution

P — Corrective tax

1. A corrective tax sets the price of pollution . . .

Demand for
pollution rights

0   Q   Quantity of Pollution

2. . . . which, together with the demand curve, determines the quantity of pollution.

(b) Pollution Permits

Price of
Pollution

Supply of
pollution permits

P

Demand for
pollution rights

0   Q   Quantity of Pollution

2. . . . which, together with the demand curve, determines the price of pollution.

1. Pollution permits set the quantity of pollution . . .

Private Solutions to Externalities

Types of private solutions

There are laws against littering

These laws aren't strongly enforced

People still don't litter

The Coase Theorem

- How effective is the private market in dealing with externalities?

- Ronald Coase, suggests that it can be very effective in some circumstances

- If private parties can bargain over the allocation of resources at no cost, then the private market will always solve the problem of externalities and allocate resources efficiently

- Suppose that Emily owns a dog named Clifford

- Clifford barks and disturbs Horace, Emily's neighbor

The Coase Theorem (cont.)

- Emily gets a benefit from owning the dog, but the dog confers a negative externality on Horace

- Should Emily be forced to find Clifford a new home, or should Horace have to suffer sleepless nights because of Clifford's barking?

- A social planner, considering the two alternatives

- If the benefits of keeping the dog are greater than the cost, then Emily keeps the dog

- If the costs of keeping the dog are greater than the benefits, then Emily has to give Clifford up

The Coase Theorem (cont.)

- According to Coase Theorem, Emily and Horace can privately bargain and reach an efficient outcome

- Horace can offer Emily money to get rid of Clifford

- Emily accepts the offer if the amount Horace is offering is greater than the benefit of keeping Clifford

- Say that Emily's benefit is equal to $500

- The cost to Horace is $800

- Emily and Horace can reach a bargain

- It is also possible that Emily's benefits are greater than Horace's cost

- Even if Emily doesn't accept Horace's, the outcome is still efficient

Private solutions don't always work

- Bargaining does not always work because of transaction costs

- Transaction costs are the costs the parties incur in the process of bargaining

- Reaching an efficient bargain increases in difficulty as the number of parties increases

Problems and Applications

Question 1

Consider two ways to protect your car from theft. The Club (a steering wheel lock) makes it difficult for a car thief to take your car. Lojack (a tracking system) makes it easier for the police to catch the car thief who has stolen it. Which of these methods conveys a negative externality on other car owners? Which conveys a positive externality? Do you think there are any policy implications of your analysis?

- **The Club conveys a negative externality on other car owners because car thieves will not attempt to steal a car with The Club visibly in place**
- **The Lojack system conveys a positive externality because thieves do not know which cars have this technology**
- **Therefore, they are less likely to steal any car**
- **Policy implications include a subsidy for car owners that use the Lojack technology or a tax on those who use The Club**
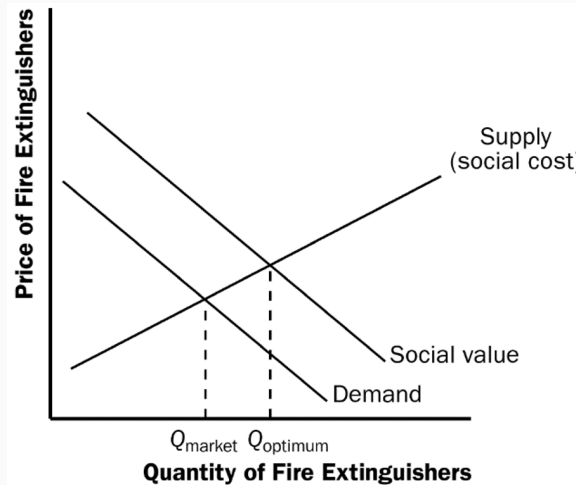
Question 2

Consider the market for fire extinguishers.

a. Why might fire extinguishers exhibit positive externalities?

Fire extinguishers exhibit positive externalities because even though people buy them for their own use, they may prevent fire from damaging the property of others.

b. Draw a graph of the market for fire extinguishers, labeling the demand curve, the social-value curve, the supply curve, and the social-cost curve. Indicate the market equilibrium level of output and the efficient level of output. Give an intuitive explanation for why these quantities differ.
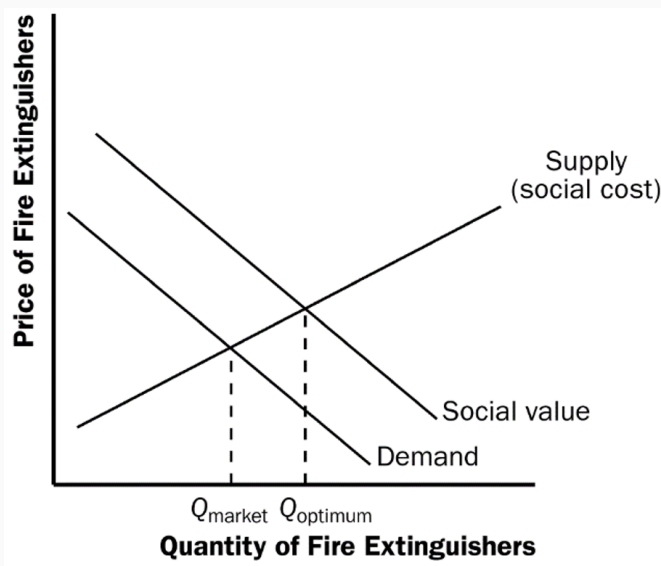
Question 2

Consider the market for fire extinguishers.

c. If the external benefit is $10 per extinguisher, describe a government policy that would yield the efficient outcome.

Government should subsidze people $10 for each extinguisher they buy, shifting the demand curve up to the social-value curve
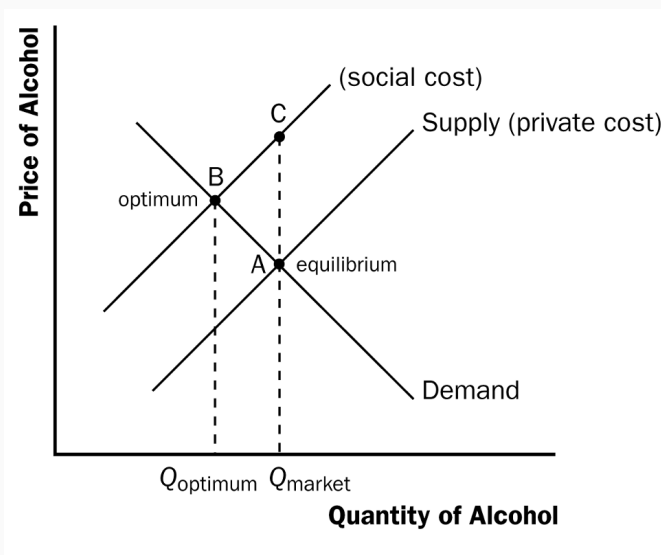
Question 3

Greater consumption of alcohol leads to more motor vehicle accidents and, thus, imposes costs on people who do not drink and drive

a. Illustrate the market for alcohol, labeling the demand curve, the social-value curve, the supply curve, the social-cost curve, the market equilibrium level of output, and the efficient level of output.

b. On your graph, shade the area corresponding to the deadweight loss of the market equilibrium. (Hint: The deadweight loss occurs because some units of alcohol are consumed for which the social cost exceeds the social value.) Explain.

Question 4

Many observers believe that the levels of pollution in our society are too high.

a. If society wishes to reduce overall pollution by a certain amount, why is it efficient to have different amounts of reduction at different firms?

It's efficient because different firms have different costs of reducing pollution. If all firms were made to reduce pollution by the same amount, the cost would be low at some firms and prohibitively high at other

b. Command-and-control approaches often rely on uniform reductions among firms. Why are these approaches generally unable to target the firms that should undertake bigger reductions?

Command-and-control approaches that rely on uniform pollution reduction among firms give the firms no incentive to reduce pollution beyond the mandated amount. Instead, every firm will reduce pollution by just the amount required and no more

c. Economists argue that appropriate corrective taxes or tradable pollution rights will result in efficient pollution reduction. How do these approaches target the firms that should undertake bigger reductions?

Corrective taxes or tradable pollution rights give firms greater incentives to reduce pollution. Firms are rewarded by paying lower taxes or spending less on permits if they find methods to reduce pollution, so they have the incentive to engage in research on pollution control. The government does not have to figure out

Question 5

The many identical residents of Whoville love drinking Zlurp. Each resident has the following willingness to pay for the tasty refreshment:

First bottle	$5
Second bottle	$4
Third bottle	$3
Fourth bottle	$2
Fifth bottle	$1
Further bottles	$0

a. The cost of producing Zlurp is $1.50, and the competitive suppliers sell it at this price. (The supply curve is horizontal.) How many bottles will each Whovillian consume? What is each person's consumer surplus?

At P = 1.5, each Whovillian will buy 4 bottles—supply is horizontal and that's where the intersection with demand occurs. Each consumer's total willingness to pay is 14 (= 5 + 4 + 3 + 2), total spent on Zlurp is 6 (1.5 $\times$ 4), and cosumer surplus is 8 (14 - 6)

Question 5

b. Producing Zlurp creates pollution. Each bottle has an external cost of $1. Taking this additional cost into account, what is total surplus per person in the allocation you described in part (a)?

Total surplus would fall by 4 to 4

c. Cindy Lou Who, one of the residents of Whoville, decides on her own to reduce her consumption of Zlurp by one bottle. What happens to Cindy's welfare (her consumer surplus minus the cost of pollution she experiences)? How does Cindy's decision affect total surplus in Whoville?

If Cindy Lou only consumes 3 bottles of Zlurp, her consumer surplus is 4.50. Her willingness to pay for 3 bottles is 5 + 4 + 3 = 12. She pays 1.50 x 3 = 4.50 and the externality is 1 x 3 = 3. Thus, Cindy Lou's consumer surplus is 12 - 4.50 - 3.00 = 4.50. Cindy's decision increases consumer surplus in Whoville by 0.50 (4.50-4.00)

d. Mayor Grinch imposes a $1 tax on Zlurp. What is consumption per person now? Calculate consumer surplus, the external cost, government revenue, and total surplus per person. e. Based on your calculations, would you support the mayor's policy? Why or why not?

The 1 tax raises the price of a bottle of Zlurp to 2.50. (The entire tax will be borne by consumers because supply is perfectly elastic.) Each resident will purchase only 3 bottles at the higher price and each consumer's total willingness to pay is now 12 (= 5 + 4 + 3). Each resident pays 7.50 (= 2.50 x 3). Therefore, each resident receives 4.50 (12-7.50) in consumer surplus. Because each bottle has an external cost of 1, the per-resident external cost is 3 (1 per bottle x 3 bottles). The government collects 3 per resident in revenue. Total surplus with the tax is equal to 4.50 - 3.00 + 3.00 = 4.50. I would support because total surplus is now higher than before the tax

Question 6

Bruno loves playing rock 'n' roll music at high volume. Placido loves opera and hates rock 'n' roll. Unfortunately, they are next-door neighbors in an apartment building with paper-thin walls.

a. What is the externality here?

The externality is noise pollution. Bruno's consumption of rock and roll music affects Placido, but Bruno does not consider that in deciding how loudly he plays his music

b. What command-and-control policy might the landlord impose? Could such a policy lead to an inefficient outcome?

The landlord could impose a rule that music could not be played above a certain decibel level. This could be inefficient because there would be no harm done by Bruno playing his music loud if Placido is not home

c. Suppose the landlord lets the tenants do whatever they want. According to the Coase theorem, how might Bruno and Placido reach an efficient outcome on their own? What might prevent them from reaching an efficient outcome?

Bruno and Placido could negotiate an agreement that might, for example, allow Bruno to play his music loudly at certain times of the day. They might not be able to reach an agreement if the transaction costs are high or if bargaining fails because each holds out for a better deal

Question 7

Figure on slide 42 shows that for any given demand curve for the right to pollute, the government can achieve the same outcome either by setting a price with a corrective tax or by setting a quantity with pollution permits. Suppose there is a sharp improvement in the technology for controlling pollution.

a. Using graphs similar to those on slide 42, illustrate the effect of this development on the demand for pollution rights.

b. What is the effect on the price and quantity of pollution under each regulatory system? Explain.
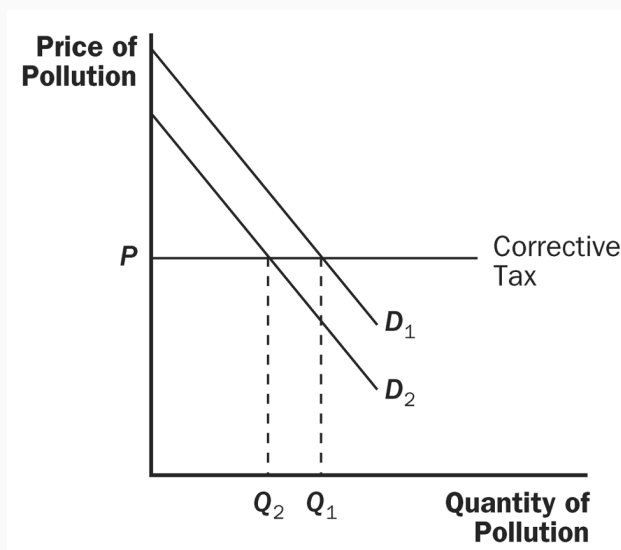
Question 8

Suppose that the government decides to issue tradable permits for a certain form of pollution.

a. Does it matter for economic efficiency whether the government distributes or auctions the permits? Why or why not?

In terms of efficiency in the market for pollution, it doesn't matter as long as terms are allowed to trade permits. The government could make money if permits were auctioned, allowing it to reduce taxes (i.e. lower DWL from taxes). Distributing permits could lead to political rent through political favors or lobbying

b. If the government chooses to distribute the permits, does the allocation of permits among firms matter for efficiency? Explain.

Allocation of permits does not matter for efficiency. Firms that have a low value for permits will trade them to those that have high valuations. The allocation would affect distribution of wealth, because those that got the permits and sold them would be better off

Question 9

There are three industrial firms in Happy Valley

The government wants to reduce pollution to 60 units, so it gives each firm 20 tradable pollution permits.

Firm	Initial Pollution Level	Cost of 1 unit reduction
A	30 units	$20
B	40 units	$30
C	20 units	$10

a. Who sells permits and how many do they sell? Who buys permits and how many do they buy? Briefly explain why the sellers and buyers are each willing to do so. What is the total cost of pollution reduction in this situation?

The total cost of pollution reduction is $400

b. How much higher would the costs of pollution reduction be if the permits could not be traded?

The total cost of pollution reduction would be $800, $400 higher than in the case in which the permits could be traded