Market Failure: Imperfect Information, External Benefits, and External Costs
APPLYING THE CONCEPTS

1. Why does a new car lose about 20 percent of its value in the first week?
   The Resale Value of a Week-Old Car

2. How can government solve the adverse-selection problem?
   Regulation of the California Kiwifruit Market

3. Does the market for baseball pitchers suffer from the adverse-selection problem?
   Baseball Pitchers Are Like Used Cars

4. How can we respond to the free-rider problem?
   Free Riders and the Three-Clock Tower

5. What happens when external benefits spill across international borders?
   Global Weather Observation

6. How do we determine the optimum level of pollution?
   Reducing Methane Emissions

7. What is the economic approach to global warming?
   The Effects of a Carbon Tax

8. What are the benefits of giving firms options for reducing greenhouse gases?
   Chicago Climate Exchange

9.1 | THE LEMONS PROBLEM

- asymmetric information
  A situation in which one side of the market—either buyers or sellers—has better information than the other.

- mixed market
  A market in which goods of different qualities are sold for the same price.
Uninformed Buyers and Knowledgeable Sellers

How much is a consumer willing to pay for a used car that could be either a lemon or a plum? To determine a consumer's willingness to pay in a mixed market with both lemons and plums, we must answer three questions:

1. How much is the consumer willing to pay for a plum?
2. How much is the consumer willing to pay for a lemon?
3. What is the chance that a used car purchased in the mixed market will be of low quality?

Consumer expectations play a key role in determining the market outcome when there is imperfect information.

THE LEMONS PROBLEM

Equilibrium with All Low-Quality Goods

<table>
<thead>
<tr>
<th>Table 9.1: Equilibrium with All Low-Quality Goods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buyers Initially Have 50-50 Expectations</td>
</tr>
<tr>
<td>Demand Side of Market</td>
</tr>
<tr>
<td>Amount buyer is willing to pay for a lemon</td>
</tr>
<tr>
<td>Amount buyer is willing to pay for a plum</td>
</tr>
<tr>
<td>Assumed chance of getting a lemon</td>
</tr>
<tr>
<td>Assumed chance of getting a plum</td>
</tr>
<tr>
<td>Amount buyer is willing to pay for a used car in mixed market</td>
</tr>
<tr>
<td>Supply Side of Market</td>
</tr>
<tr>
<td>Number of lemons supplied</td>
</tr>
<tr>
<td>Number of plums supplied</td>
</tr>
<tr>
<td>Total number of used cars supplied</td>
</tr>
<tr>
<td>Assumed chance of getting a lemon</td>
</tr>
</tbody>
</table>
Equilibrium with All Low-Quality Goods

- **adverse-selection problem**
  A situation in which the uninformed side of the market must choose from an undesirable or adverse selection of goods.

The asymmetric information in the market generates a downward spiral of price and quality:
- The presence of low-quality goods on the market pulls down the price consumers are willing to pay.
- A decrease in price decreases the number of high-quality goods supplied, decreasing the average quality of goods on the market.
- The decrease in the average quality of goods on the market pulls down the price consumers are willing to pay again.

**THE LEMONS PROBLEM**

A Thin Market: Equilibrium with Some High-Quality Goods

- **thin market**
  A market in which some high-quality goods are sold but fewer than would be sold in a market with perfect information.

![Figure 9.2](image_url)

The Market for High-Quality Cars (Plums) Is Thin

If buyers are pessimistic and assume that only lemons will be sold, they are willing to pay $2,000 for a used car. At this price, 5 plums are supplied (point a), along with 45 lemons (point b). This is not an equilibrium because 10 percent of consumers get plums, contrary to their expectations.

If consumers assume that there is a 25 percent chance of getting a plum, they are willing to pay $2,500 for a used car. At this price, 20 plums are supplied (point c), along with 60 lemons (point d). This is an equilibrium because 25 percent of consumers get plums, consistent with their expectations. Consumer expectations are realized, so the equilibrium is shown by points c and d.
9.1 THE LEMONS PROBLEM

A Thin Market: Equilibrium with Some High-Quality Goods

<table>
<thead>
<tr>
<th>TABLE 3.2 A THIN MARKET FOR HIGH-QUALITY GOODS</th>
<th>Initial Perfective Expectations</th>
<th>Equilibrium 75-25 Expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demanded Side of Market</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount buyer is willing to pay for a lemon</td>
<td>$2,000</td>
<td>$2,000</td>
</tr>
<tr>
<td>Amount buyer is willing to pay for a plum</td>
<td>$4,000</td>
<td>$4,000</td>
</tr>
<tr>
<td>Assumed chance of getting a lemon</td>
<td>10%</td>
<td>15%</td>
</tr>
<tr>
<td>Assumed chance of getting a plum</td>
<td>9%</td>
<td>25%</td>
</tr>
<tr>
<td>Amount buyer is willing to pay for a used car in mixed market</td>
<td>$2,000</td>
<td>$2,000</td>
</tr>
<tr>
<td>Supply Side of Market</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of lemons supplied</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Number of plums supplied</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Total number of used cars supplied</td>
<td>52</td>
<td>60</td>
</tr>
<tr>
<td>Actual chance of getting a lemon</td>
<td>99%</td>
<td>51%</td>
</tr>
</tbody>
</table>

Evidence of the Lemons Problem

The lemons model makes two predictions about markets with asymmetric information.

First, the presence of low-quality goods in a market will at least reduce the number of high-quality goods in the market and may even eliminate them.

Second, buyers and sellers will respond to the lemons problem by investing in information and other means of distinguishing between low-quality and high-quality goods.

RESPONDING TO THE LEMONS PROBLEM

Buyers Invest in Information

The more information a buyer has, the greater the chance of picking a plum from the cars in the mixed market. Consumer Reports publishes information on repair histories of different models and computes a "Trouble" index, scoring each model on a scale of 1 to 5. By consulting these information sources, a buyer improves the chances of getting a high-quality car.

Another information source is Carfax.com, which provides information on individual cars, including their accident histories.
RESPONDING TO THE LEMONS PROBLEM

Consumer Satisfaction Scores from ValueStar and eBay
How can a high-quality service provider distinguish itself from low-quality providers?
ValueStar is a consumer guide and business directory that uses customer satisfaction surveys to determine how well a firm does relative to its competitors in providing quality service.
Online consumers help each other by rating online sellers.

Guarantees and Lemons Laws
Sellers can identify a car as a plum in a sea of lemons by offering one of the following guarantees:

- Money-back guarantees.
- Warranties and repair guarantees.

THE RESALE VALUE OF A WEEK-OLD CAR
APPLYING THE CONCEPTS #1: Why does a new car lose about 20 percent of its value in the first week?
If you buy a new car for $20,000 today and then try to sell it a week later, you probably won’t get more than $16,000 for it. The car will lose about 20 percent of its value in the first week. Why does the typical new car lose so much of its value in the first week?
- A potential buyer of a week-old car might believe that a person who returns a car after only one week could have discovered it was a lemon and may be trying to get rid of it. Alternatively, the seller could have simply changed his or her mind about the car.
- The problem is that buyers don’t know why the car is being sold. As long as there is a chance the car is a lemon, they won’t be willing to pay the full-as-new price for it.
- In general, buyers are willing to pay a lot less for a week-old car, and so the owners of high-quality, week-old cars are less likely to put them on the market.
- This downward spiral ultimately reduces the price of week-old cars by about 20 percent.
Kiwifruit is subject to imperfect information because buyers cannot determine its sweetness—its quality level—by simple inspection. There is asymmetric information because producers know the maturity of the fruit, but fruit wholesalers and grocery stores, who buy fruit at the time of harvest, cannot determine whether a piece of fruit will ultimately be sweet or sour.

Before 1987, kiwifruit from California suffered from the "lemons" problem. Maturity levels of the fruit varied across producers. On average, the sugar content at the time of harvest was below the industry standard, established by kiwifruit from New Zealand.

In 1987, California producers implemented a federal marketing order to address the lemon–kiwi problem. The federal order specified a minimum maturity standard, and as the average quality of California fruit increased, so did the price. Within a few years, the gap between California and New Zealand prices had decreased significantly.

Professional baseball teams compete with each other for players. After six years of play in the major leagues, a player has the option of becoming a free agent. A player is likely to switch teams if the new team offers him a higher salary. One of the puzzling features of the free-agent market is that, on average, pitchers who switch teams spend 28 days per season on the disabled list, compared to only 5 days for pitchers who do not switch teams.

This puzzling feature of the free-agent market for baseball players is explained by asymmetric information and adverse selection.

Suppose the market price for pitchers is $1 million per year, and a pitcher who is currently with the Detroit Tigers is offered this salary by another team.

- If the Tigers think the pitcher is likely to spend a lot of time next season recovering from injuries, they won't try to outbid the other team for the pitcher.
- If the Tigers think the pitcher will be injury-free and productive, he will be worth more than $1 million to them, so they will outbid other teams.

9.4 INSURANCE AND MORAL HAZARD

- moral hazard
  A situation in which one side of an economic relationship takes undesirable or costly actions that the other side of the relationship cannot observe.

Insurance Companies and Moral Hazard

Insurance companies use various measures to decrease the moral-hazard problem. Many insurance policies have a deductible—a dollar amount that a policy holder must pay before getting compensation from the insurance company. Deductibles reduce the moral-hazard problem because they shift to the policy holder part of the cost of a claim on the policy.
Deposit Insurance for Savings and Loans

When you deposit money in a Savings and Loan (S&L), the money doesn’t just sit in a vault. The S&L will invest the money, loaning it out and expecting to make a profit when loans are repaid with interest. Unfortunately, some loans are not repaid, and the S&L could lose money and be unable to return your money.

To protect people, the Federal Deposit Insurance Corporation (FDIC) insures the first $100,000 of your deposit, so if the S&L goes bankrupt, you’ll still get your money back. The government enacted the federal deposit insurance law in 1933 in response to the bank failures of the Great Depression.

External Benefits and Public Goods

- **external benefit**
  A benefit from a good experienced by someone other than the person who buys the good.

- **public good**
  A good that is available for everyone to consume, regardless of who pays and who doesn’t, a good that is nonrival in consumption and nonexcludable.

- **private good**
  A good that is consumed by a single person or household; a good that is rival in consumption and excludable.

- **free rider**
  A person who gets the benefit from a good but does not pay for it.

In the days before inexpensive wristwatches, many towns built clock towers to help their citizens keep track of time.

- Towns paid for the clock towers with voluntary contributions from citizens.
- One town built a four-sided tower but put clock faces on only three sides of the tower.
- One of the town’s wealthy citizens refused to contribute money to help build the clock tower.
- Town officials decided not to put a clock face on the side of the tower facing this citizen’s house.

Problem:
- Other citizens on the same side of town also suffered from not seeing the clock.
- Preventing a free ride by one citizen caused problems for other citizens.
Overcoming the Free-Rider Problem

Successful organizations use a number of techniques to encourage people to contribute:

- Giving contributors private goods such as coffee mugs, books, musical recordings, and magazine subscriptions.
- Arranging matching contributions.
- Appealing to a person’s sense of civic or moral responsibility.

Asteroid Diversion as a Public Good

The diversion of asteroids is a public good in the sense that it is available for everyone’s benefit, regardless of who pays and who doesn’t. As with any public good, the key to developing an asteroid-diversion program is to collect money to pay for the program.

As another example of a public good, consider global weather observation. In this case, information gathered by one country generates external benefits when it is shared with other countries.

- Satellites, nomadic buoys, and weather stations monitor weather in different parts of the world, but no single organization gathers all the information to reveal the big weather picture.
- Another problem is that the uninhabited parts of the world, in particular the vast oceans of the southern hemisphere, receive little monitoring.

In recent years, the United States has taken the lead in encouraging cooperation and the sharing of data collected by different organizations around the world. According to the National Oceanic and Atmospheric Administration (NOAA), early warnings of a change in the current in 1997–98 reduced damage to the California economy by about $1.1 billion.

Using the Marginal Principle

From society’s perspective, there are many benefits from pollution abatement:

- Better health.
- Increased enjoyment of the natural environment.
- Lower production costs.
Example: The Optimal Level of Sulfur Dioxide

The optimum level of pollution abatement is shown by point a, where the marginal benefit of abatement equals its marginal cost.

The marginal benefit curve is horizontal at $3,500, because for each additional ton of SO₂ discharged into the atmosphere, the costs increase by about $3,500. The marginal cost curve is positively sloped, because the more pollution we abate, the higher the marginal cost of abatement.

9.6 THE OPTIMAL LEVEL OF POLLUTION

APPLYING THE CONCEPTS #6: How do we determine the optimum level of pollution?

What is the optimal level of methane abatement? It depends on the marginal benefit of abatement. If, for example, the marginal benefit is $10, the optimum level is about 36 million metric tons. But if the marginal benefit is much higher, say $150, the optimum level of abatement is about 69 million metric tons.

► FIGURE 9.4

The Marginal Cost of Reducing Methane Emissions

The marginal cost of reducing methane emissions increases with the volume reduced. What is the optimal level of methane abatement? It depends on the marginal benefit of abatement. If, for example, the marginal benefit is $10, the optimum level is about 36 million metric tons. But if the marginal benefit is much higher, say $150, the optimum level of abatement is about 69 million metric tons.

9.7 TAXING POLLUTION

- private cost of production
  The production cost borne by a producer, which typically includes the costs of labor, capital, and materials.

- external cost of production
  A cost incurred by someone other than the producer.

- social cost of production
  Private cost plus external cost.

- pollution tax
  A tax or charge equal to the external cost per unit of pollution.
A Firm’s Response to a Pollution Tax

**FIGURE 9.5**
The Firm’s Response to an SO\(_2\) Tax

From the perspective of a firm subject to a pollution tax, the marginal benefit of abatement is the $3,500 pollution tax that can be avoided by cutting pollution by one ton. The firm satisfies the marginal principle at point c, with six tons of abatement, leaving two tons of SO\(_2\) discharged into the atmosphere.

The Market Effects of a Pollution Tax

The production of electricity generates two major pollutants:

- Sulfur dioxide.
- Nitrogen oxides (NO\(_x\)).

**FIGURE 9.6**
The Effects of SO\(_2\) and NO\(_x\) Taxes on the Electricity Market

The pollution tax increases the cost of producing electricity, shifting the market supply curve up. The equilibrium moves from point a to point b. The tax increases the equilibrium price from $64.90 to $67.60 per megawatt-hour and decreases the equilibrium quantity.
APPLYING THE CONCEPTS #7: What is the economic approach to global warming?

A carbon tax would reduce greenhouse emissions in several ways:

- The price of gasoline would increase, causing people to drive less and buy more energy-efficient vehicles.
- The tax would increase the price of electricity, decreasing the quantity of electricity demanded and the quantity of fossil fuels burned.
- The higher price of home heating would cause people to turn down their thermostats and improve the heating efficiency of their homes, perhaps by installing energy-efficient windows or more insulation.
- Some electricity producers would switch from coal to natural gas, which has a lower carbon content, and thus a lower carbon tax. Others would switch to noncarbon energy sources such as wind power, solar power, and geothermal sources.

**FIGURE 9.7**

Responses to SO$_2$ and NO$_x$ Taxes on Electricity Generation

Taxes on SO$_2$ and NO$_x$ cause electricity generators to switch to low-sulfur coal and to alternative energy sources that generate less SO$_2$ and NO$_x$.

Consider an area with two electricity generators, firm L (for low cost) and firm H (for high cost). Suppose that in the absence of pollution-abatement efforts, each firm would discharge five tons of pollution per hour. The government sets a target abatement level of two tons of SO$_2$ per hour, divided equally between the two firms. Under this uniform abatement policy, the government will issue four pollution permits to each firm, forcing each firm to cut pollution from five tons to four tons.
Command and Control

The problem with this approach is that the mandated abatement technology—the control part of the policy—is unlikely to be the most efficient technology for two reasons:

- The regulatory policy specifies a single abatement technology for all firms. Because the producers of a polluting good often use different materials and production techniques, an abatement technology that is efficient for one firm may be inefficient for others.
- The regulatory policy decreases the incentives to develop more efficient abatement technologies. The command part of the policy specifies a maximum volume of waste for each firm, so there is no incentive to cut the volume of waste below the maximum allowed.

Market Effects of Pollution Regulations

How do the market effects of pollution regulation compare to the effects of a pollution tax?

Recall that the uniform abatement policy achieves the same reduction in pollution at a higher cost because it doesn’t exploit differences in abatement costs across firms. In addition, the control part of command and control may lead to relatively costly abatement techniques because there’s no incentive to develop better ones. This will cause the supply curve for the polluting good to shift upward by a larger amount than it would with a tax.

A larger supply shift causes a larger increase in the equilibrium price and a larger reduction in quantity. The inefficiency of regulations is passed on to consumers, who pay higher prices.

One advantage of the command-and-control policy is its predictability. The policy specifies how much waste each firm can produce, so we can predict the total volume of waste. In contrast, we don’t know exactly how firms will respond to the pollution tax—they could pollute a little or a lot, depending on the tax and the cost of abating pollution—so it is difficult to predict the total volume of waste that will be emitted.

Lesson from Dear Abby: Options for Pollution Abatement

The readers of “Dear Abby” offered the following suggestions to Dreading Winter:

- Buy the neighbors a catalytic add-on for the wood stove or a wood-chip gasifier for an oil furnace. In either case, there would be much less air pollution from burning wood.
- Soak a towel in water, swish it around the room, and watch the smoke disappear.
- Leave a saucer of vinegar in each room to eliminate the smoke odor.
- Pay your neighbors to hire a chimney sweep to clean their flue.
- Seal and caulk your windows to keep the smoke outside at a cost of less than $500.
- Use the $500 to purchase an air purifier for your home.

There is usually more than one way to deal with a pollution problem.
MARKETABLE POLLUTION PERMITS

- Marketable pollution permits
  A system under which the government picks a target pollution level for a particular area, issues just enough pollution permits to meet the pollution target, and allows firms to buy and sell the permits; also known as a cap-and-trade system.

Voluntary Exchange and Marketable Permits

Making pollution permits marketable is sensible because it allows mutually beneficial exchanges between firms with different abatement costs.

PRINCIPLE OF VOLUNTARY EXCHANGE

A voluntary exchange between two people makes both people better off.

Supply, Demand, and the Price of Marketable Permits

- FIGURE 9.8
  The Market for Pollution Permits
  The equilibrium price of permits is shown by the intersection of the demand curve and the vertical supply curve. The supply curve is vertical because each year the government specifies a fixed number of permits. A decrease in the number of permits shifts the supply curve to the left, increasing the equilibrium price.
APPLYING THE CONCEPTS #8: What are the benefits of giving firms options for reducing greenhouse gases?

The Chicago Climate Exchange (CCX) allows firms to cut their emissions of greenhouse gases in different ways:

1. Cutting its own emissions.
2. Paying for extra reductions by other firms.
3. Paying for projects such as reforestation that offset the firm’s emissions.

The experience of American Electric Power (AEP), the nation’s largest electricity producer, illustrates how CCX works. AEP bought 10,000 acres of fallow land and planted walnut trees, which each year will withdraw about 71,000 tons of carbon dioxide from the air and convert it into solid wood. As long as the wood doesn’t burn or decompose, AEP can use the trees to offset some of its carbon emissions.

KEY TERMS

- adverse-selection problem
- asymmetric information
- experience rating
- external cost of production
- external benefit
- marketable pollution permits
- free rider
- mixed market
- marketable pollution permits
- moral hazard
- pollution tax
- private cost of production
- private good
- public good
- social cost of production
- thin market
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