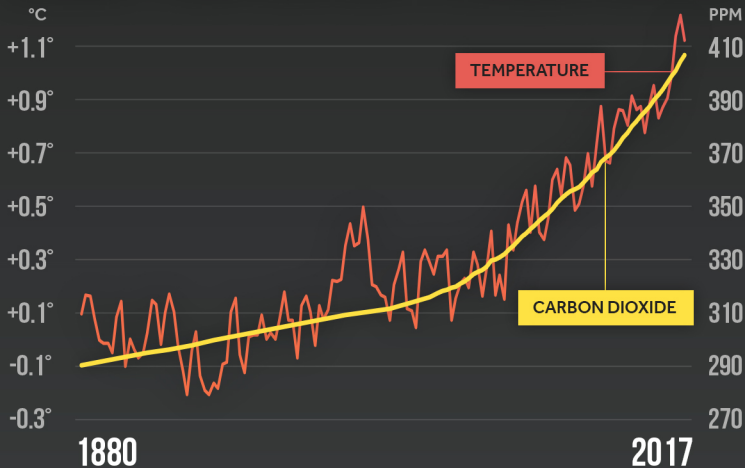


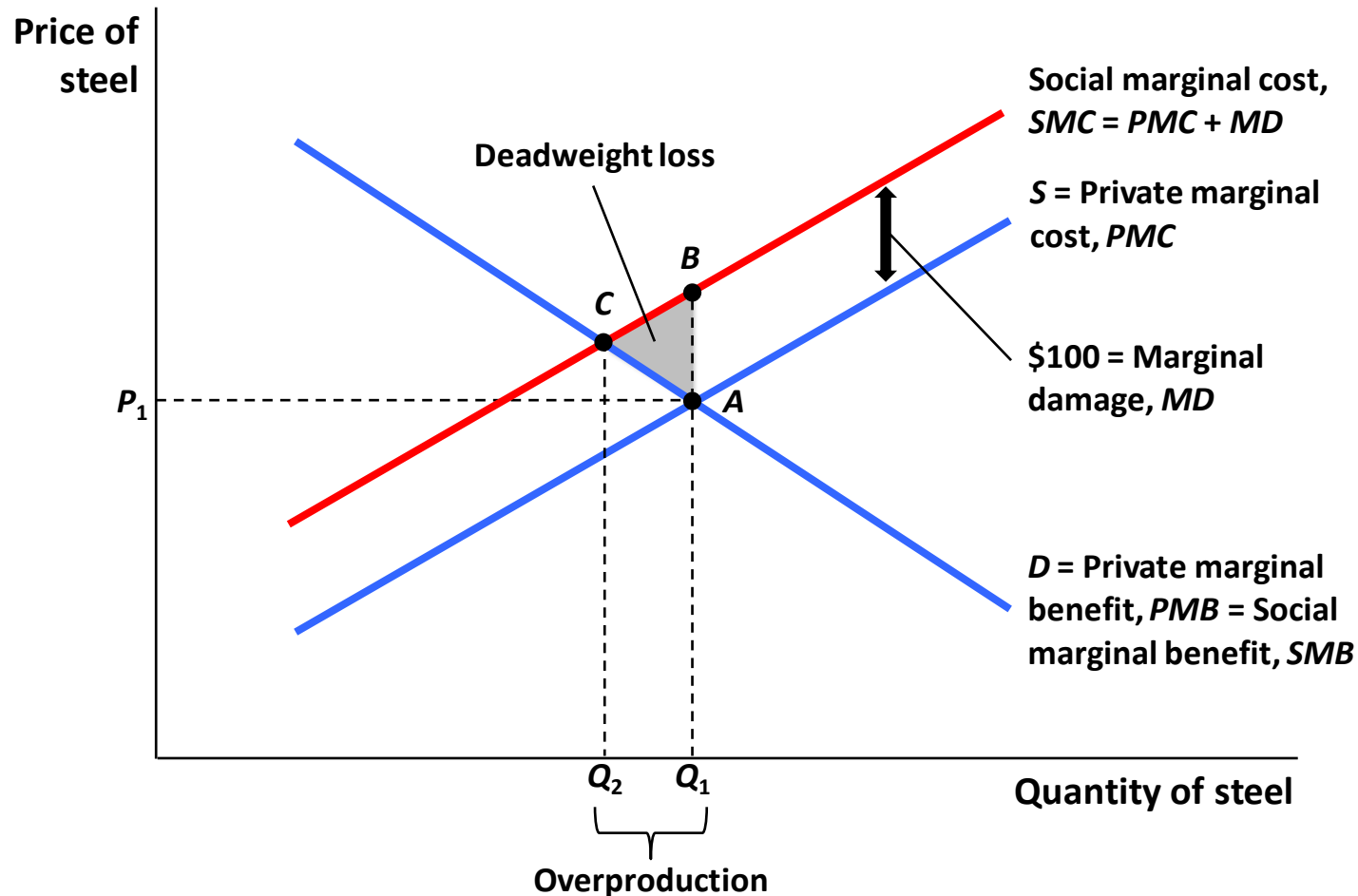
GLOBAL TEMPERATURE & CARBON DIOXIDE



Global temperature anomalies averaged and adjusted to early industrial baseline (1881-1910)
Source: NASA GISS, NOAA NCEI, ESRL

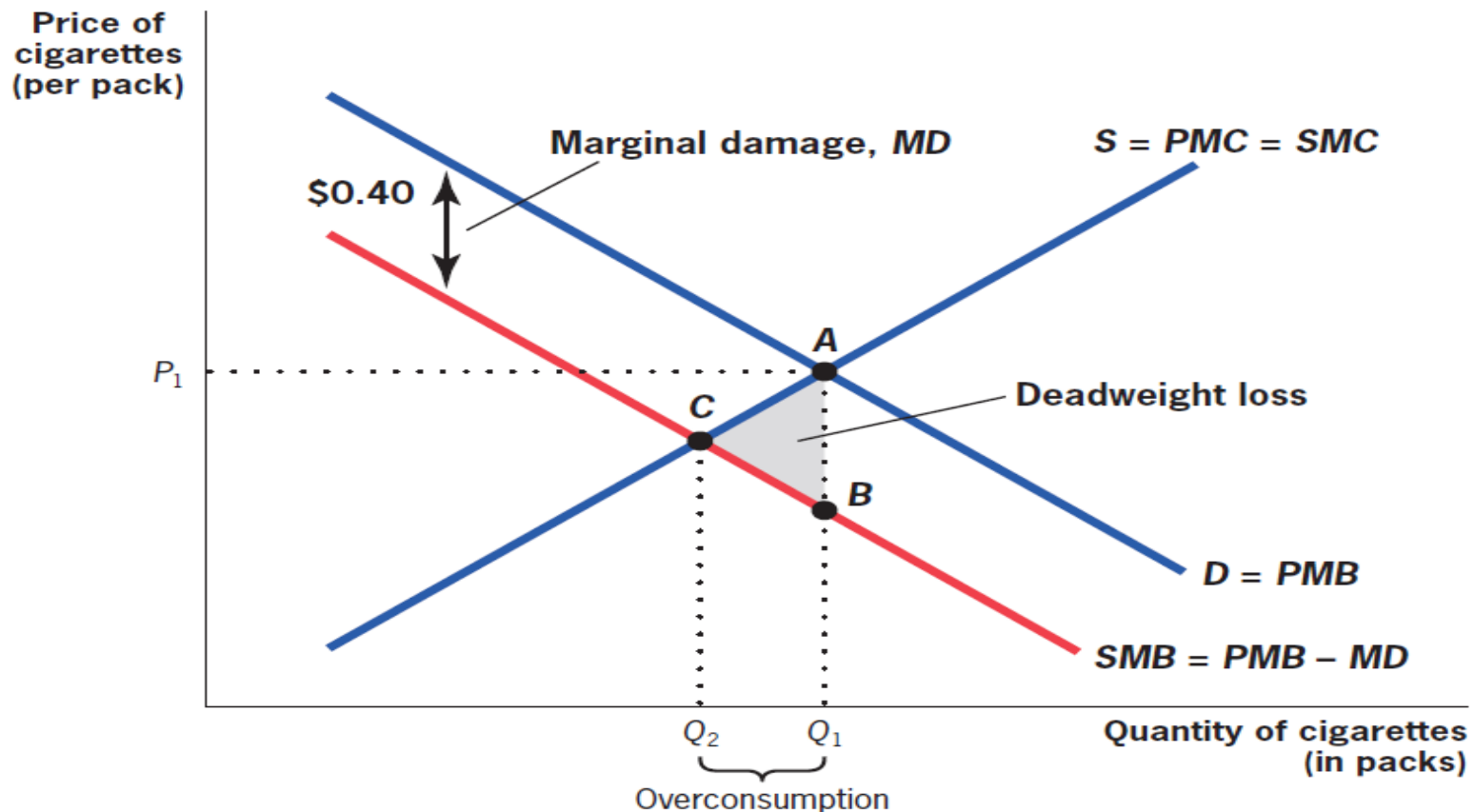
5.1

Economics of Negative Production Externalities: Steel Production



5.1

Economics of Positive Production Externalities: Oil Exploration



APPLICATION: The Externality of SUVs

The consumption of large cars such as SUVs produces three types of negative externalities:

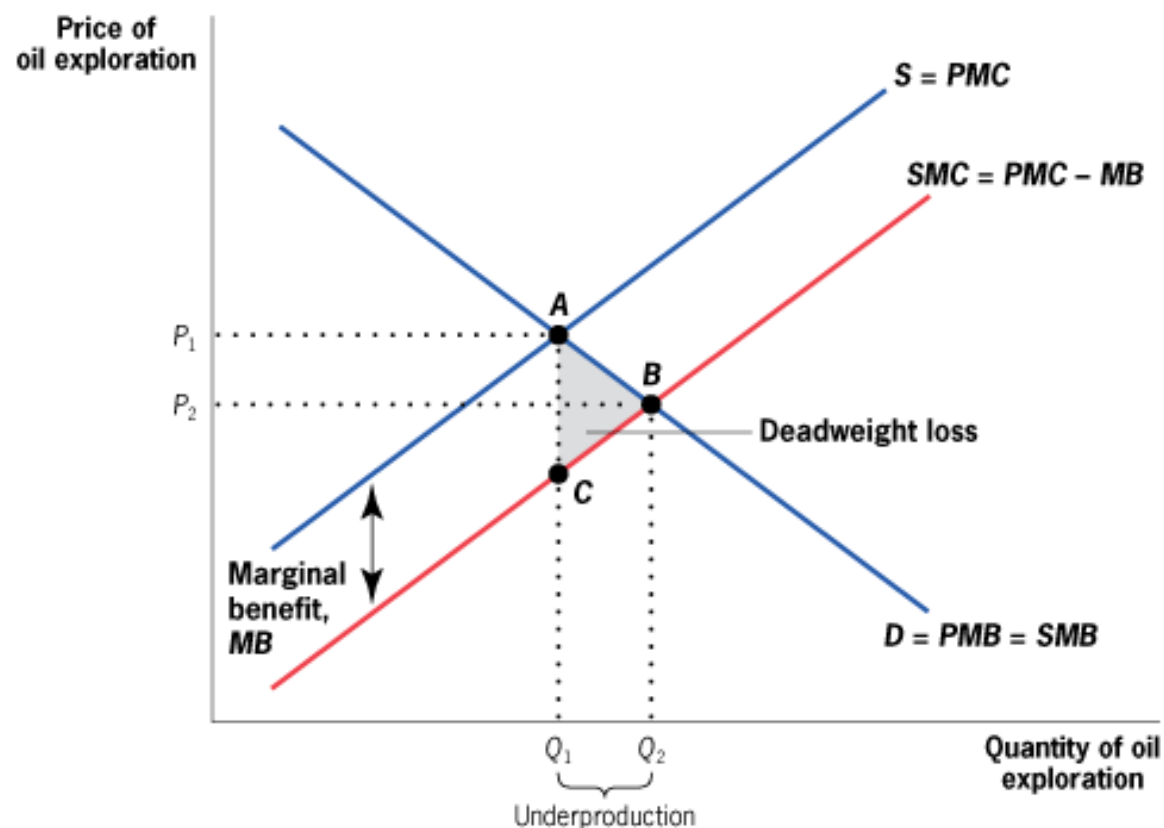
1. Environmental externalities: Compact cars get 25 miles/gallon, but SUVs get only 20.
2. Wear and tear on roads: Larger cars wear down the roads more.
3. Safety externalities: The odds of having a fatal accident quadruple if the accident is with a typical SUV and not with a car of the same size.

5.1

Externality Theory

Positive Externalities

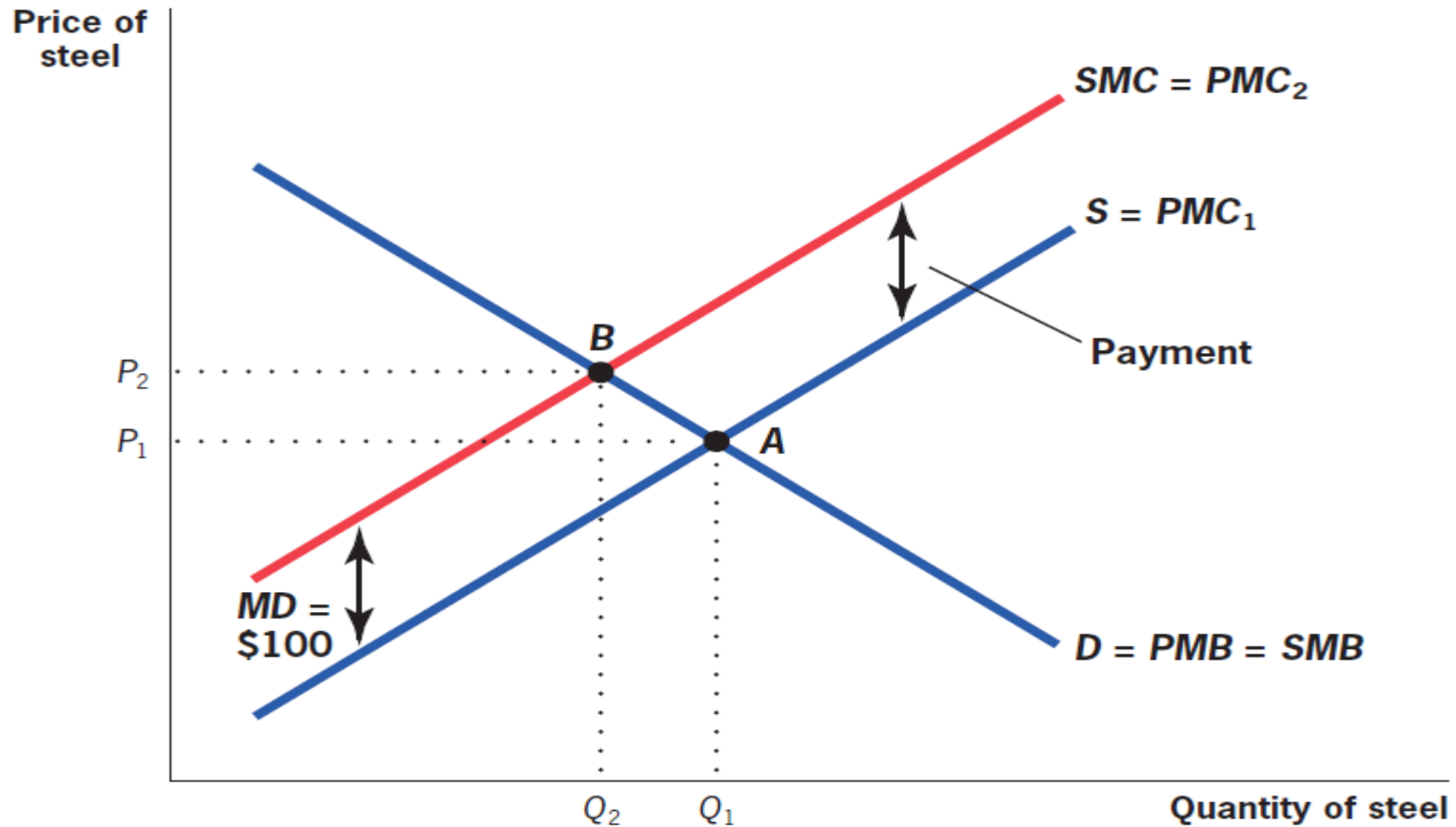
■ FIGURE 5-4



Market Failure Due to Positive Production Externality in the Oil Exploration Market • Expenditures on oil exploration by any company have a positive externality because they offer more profitable opportunities for other companies. This leads to a social marginal cost that is below the private marginal cost, and a social optimum quantity (Q_2) that is greater than the competitive market equilibrium quantity (Q_1). There is underproduction of $Q_2 - Q_1$, with an associated deadweight loss of area ABC.

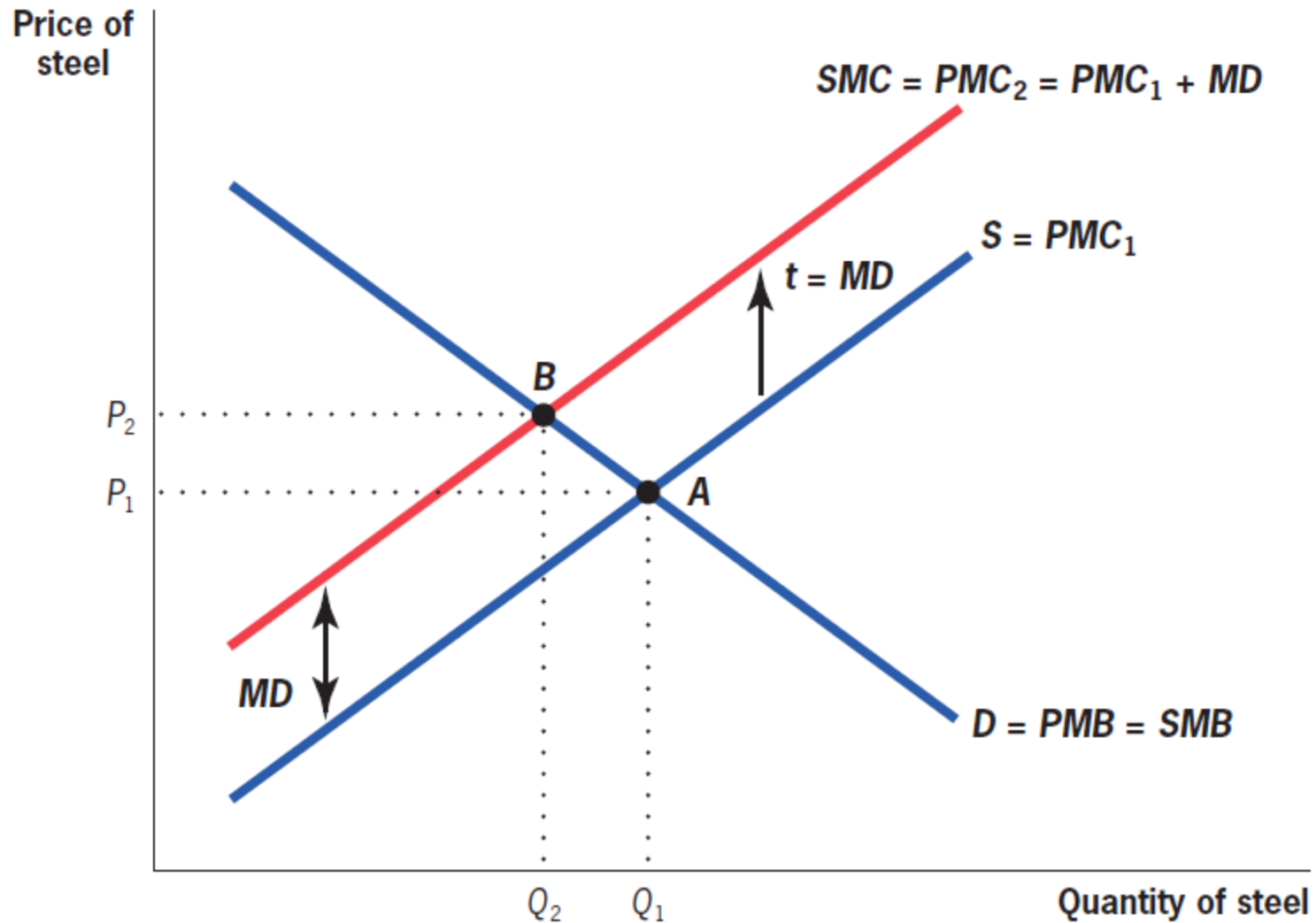
5.2

The Solution: Coasian Payments



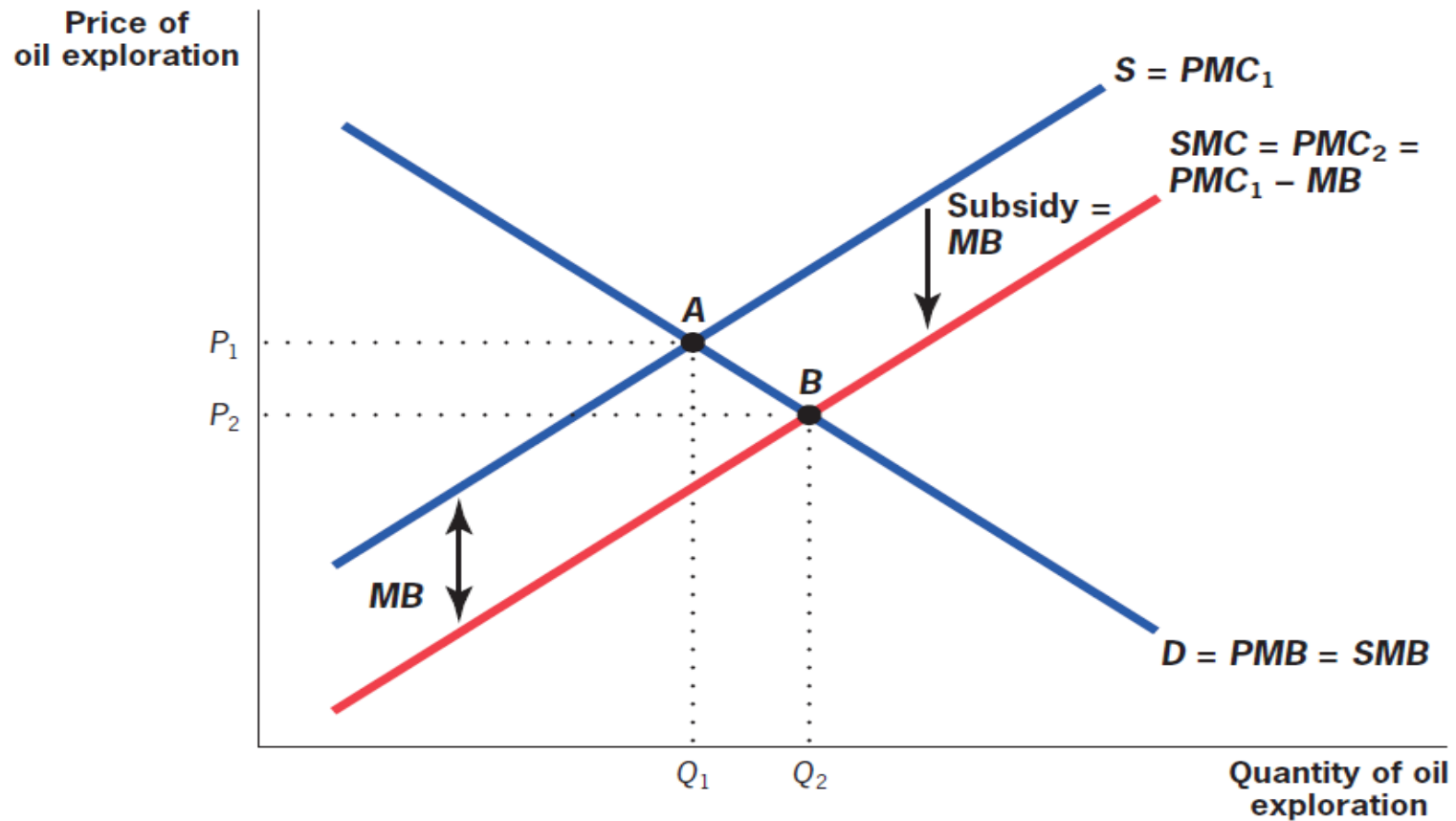
5.3

Corrective Taxation



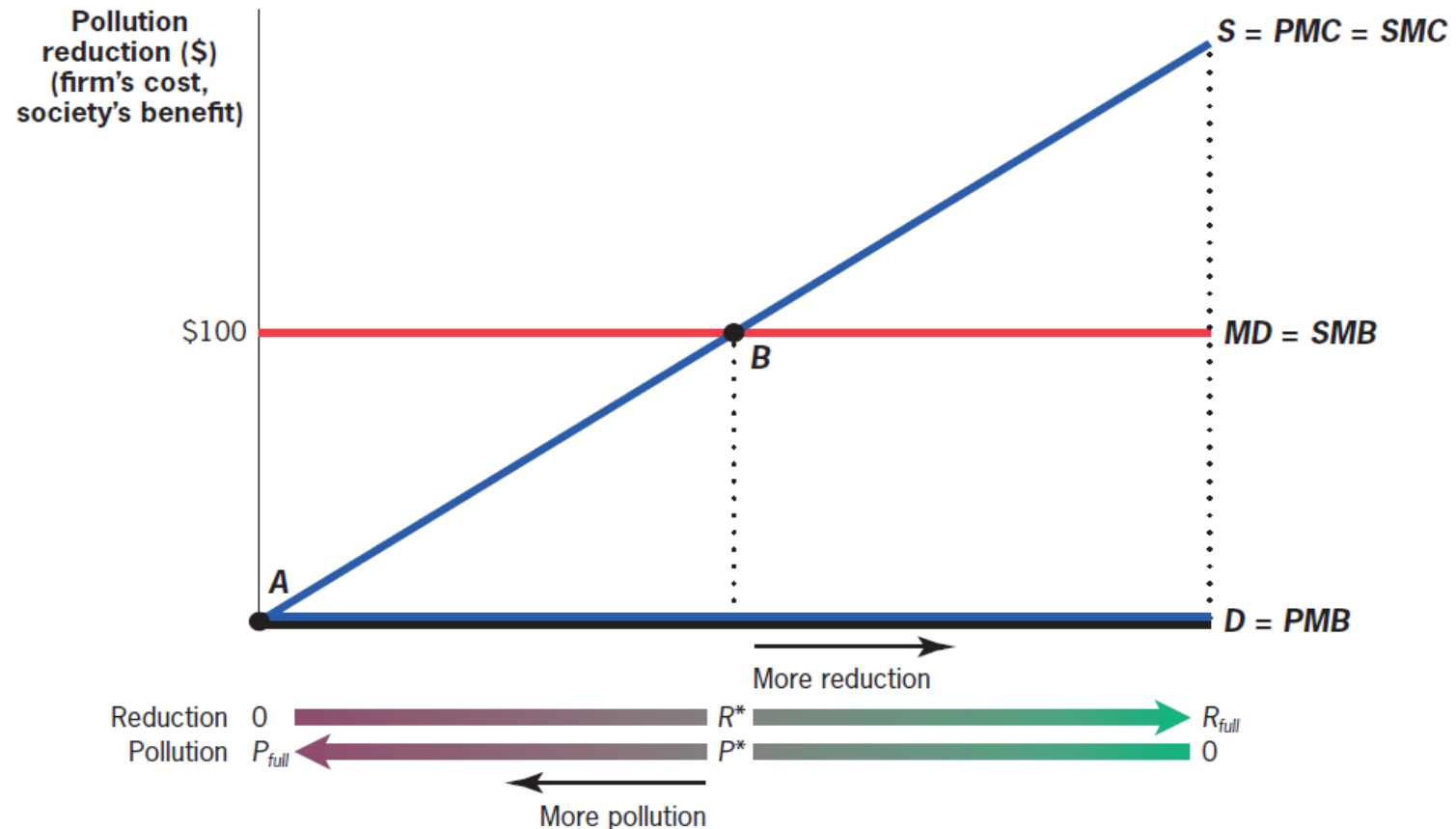
5.3

Corrective Subsidies



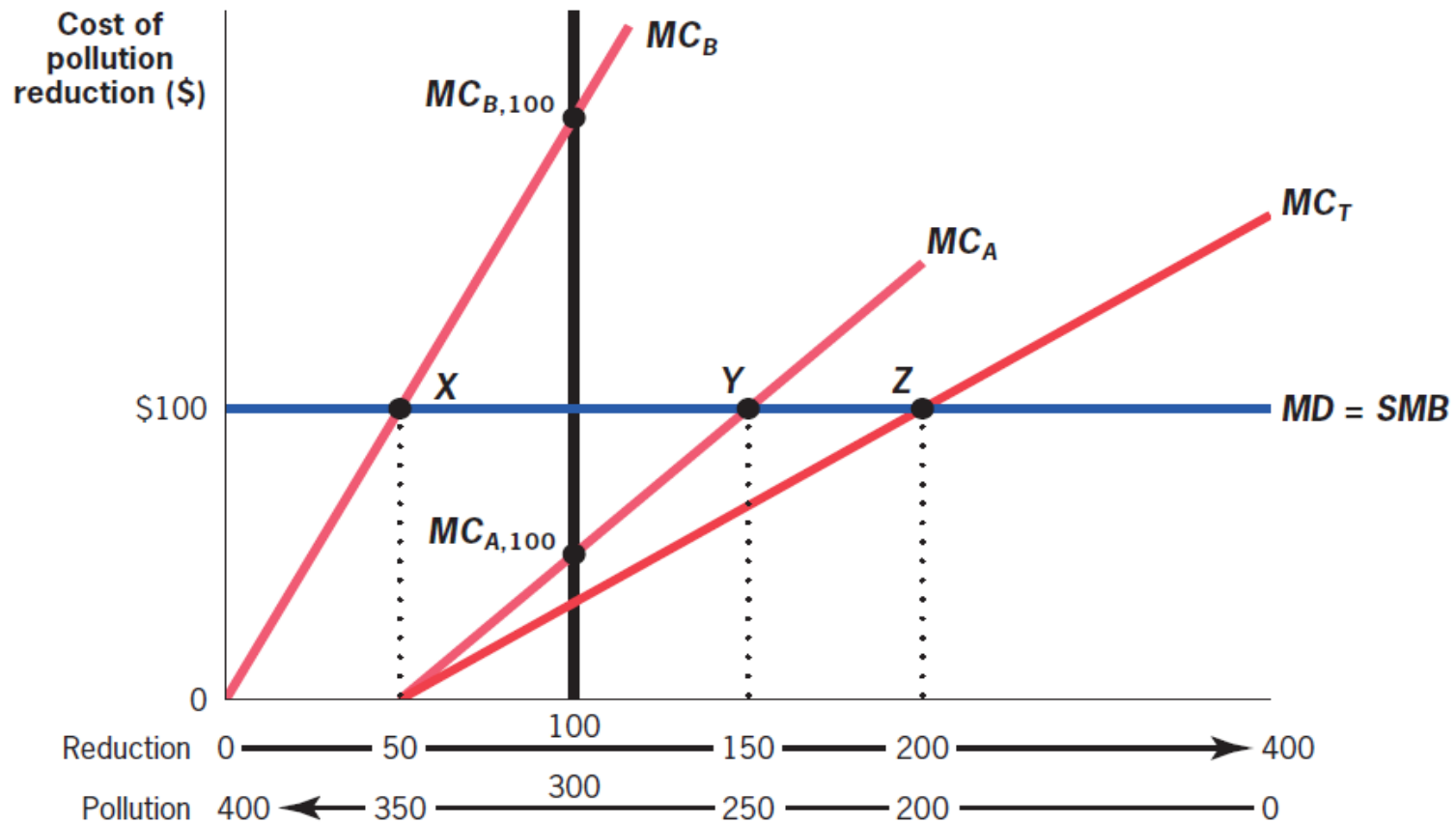
5.4

Distinctions Between Price and Quantity Approaches to Addressing Externalities: Basic Model



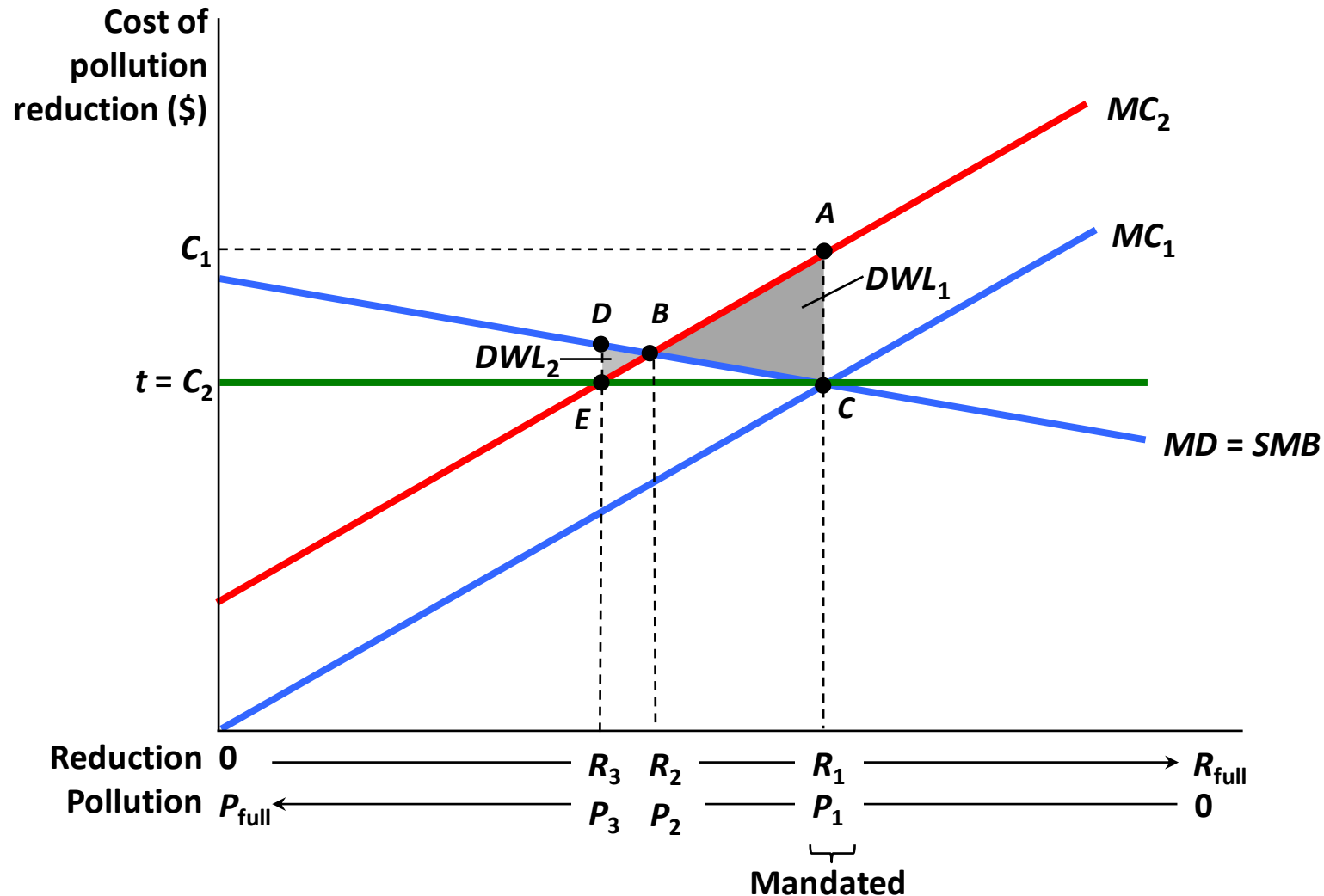
5.4

Multiple Plants with Different Reduction Costs



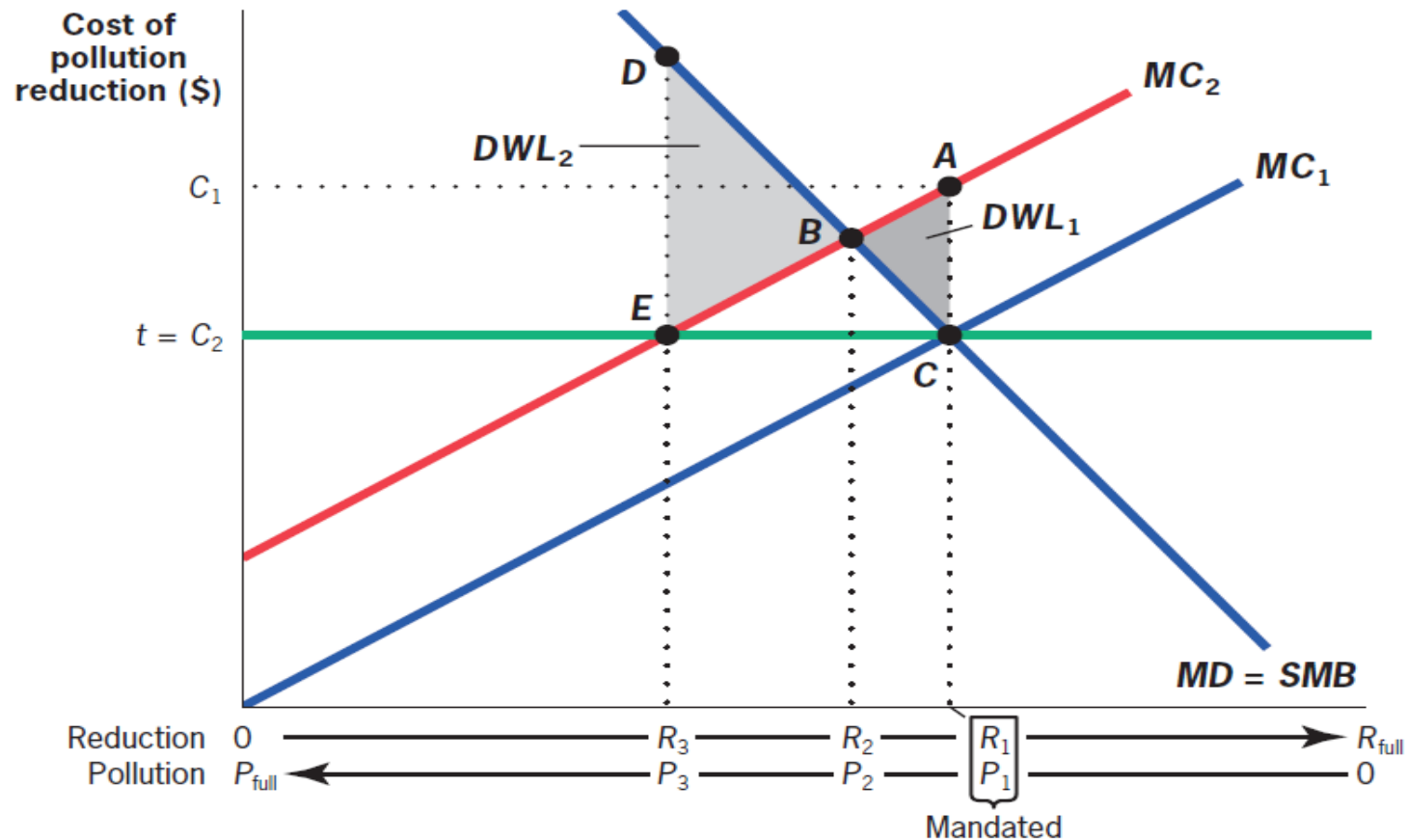
5.4

Uncertainty About Costs of Reduction: Case 1: Flat MD Curve (Global Warming)



5.4

Uncertainty About Costs of Reduction: Case 2: Steep MD Curve (Nuclear leakage)



6.1

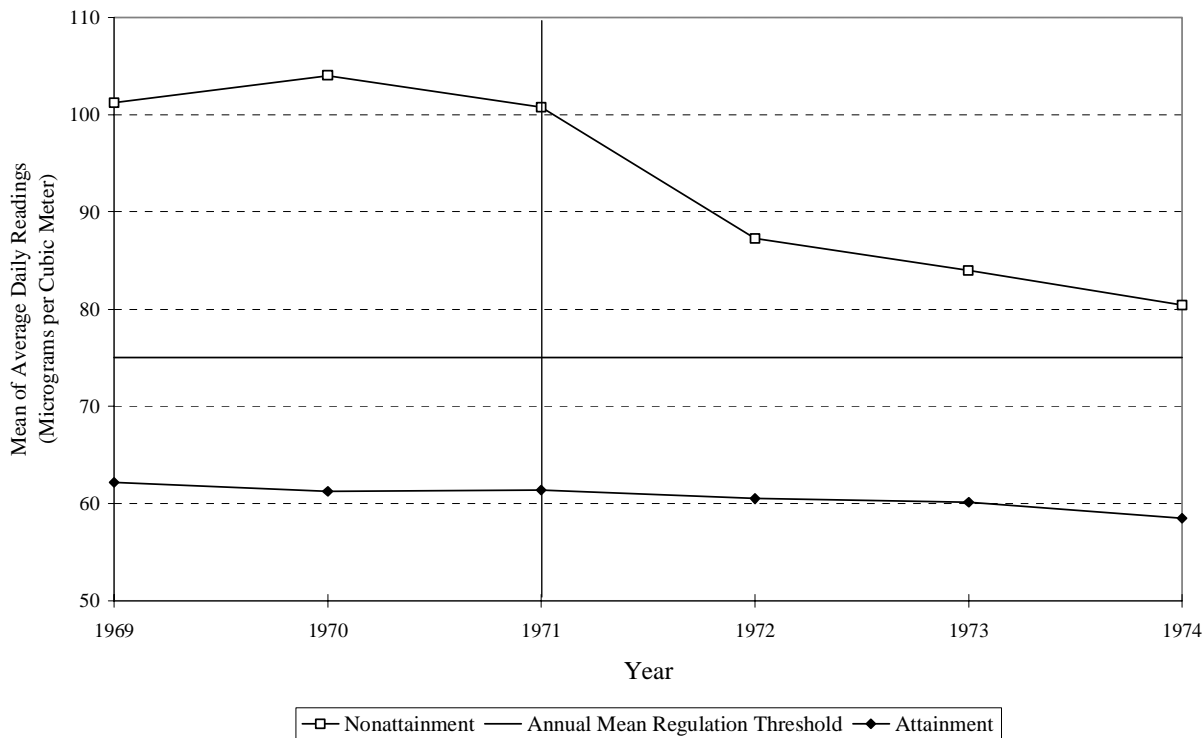
Estimating the Adverse Health Effects of Particulates

How does acid rain (or SO_2) affect health?

- The typical approach taken in this literature is to relate adult mortality in a geographical area to the level of particulates (such as SO_2) in the air.
- The results are suspect: Areas with more particulates may differ from areas with fewer particulates in many other ways, not just in the amount of particulates in the air.

Figure 2: Trends in TSPs Pollution and Infant Mortality, by 1972 Nonattainment Status

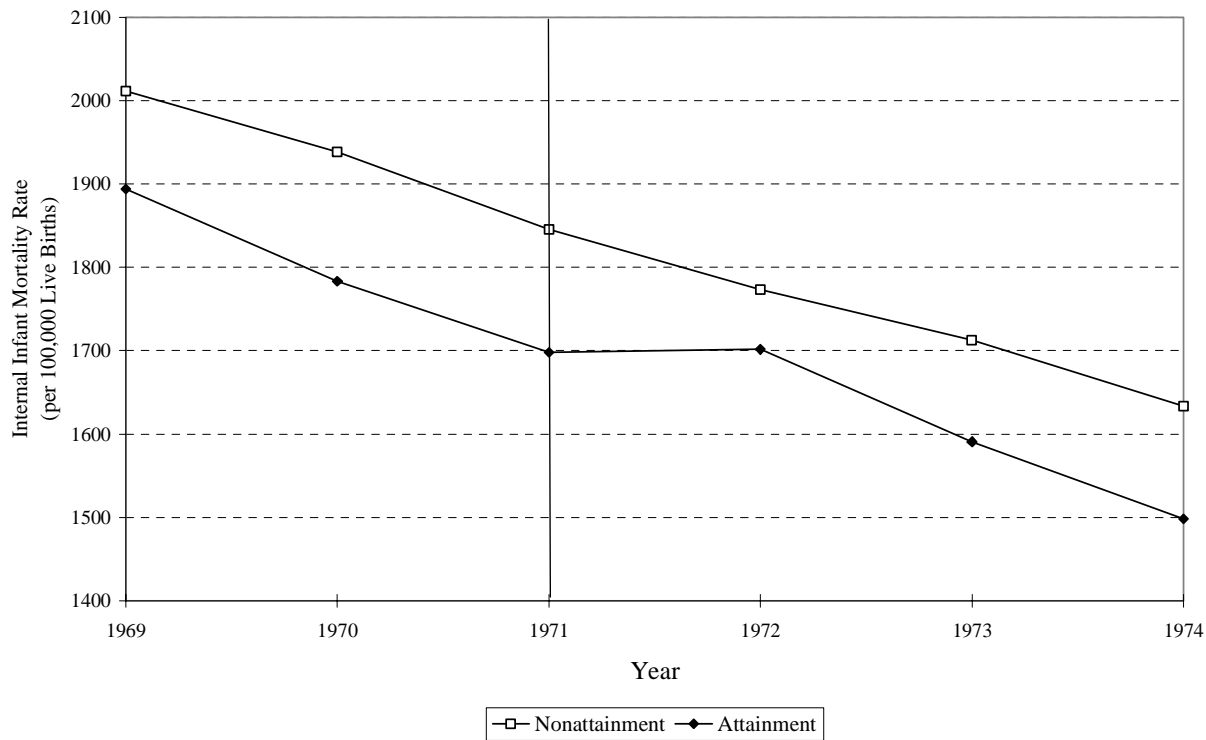
A. Trends in Mean TSPs Concentrations, by 1972 Nonattainment Status



Source: Authors' tabulations from EPA's "Quick Look Reports" data file.

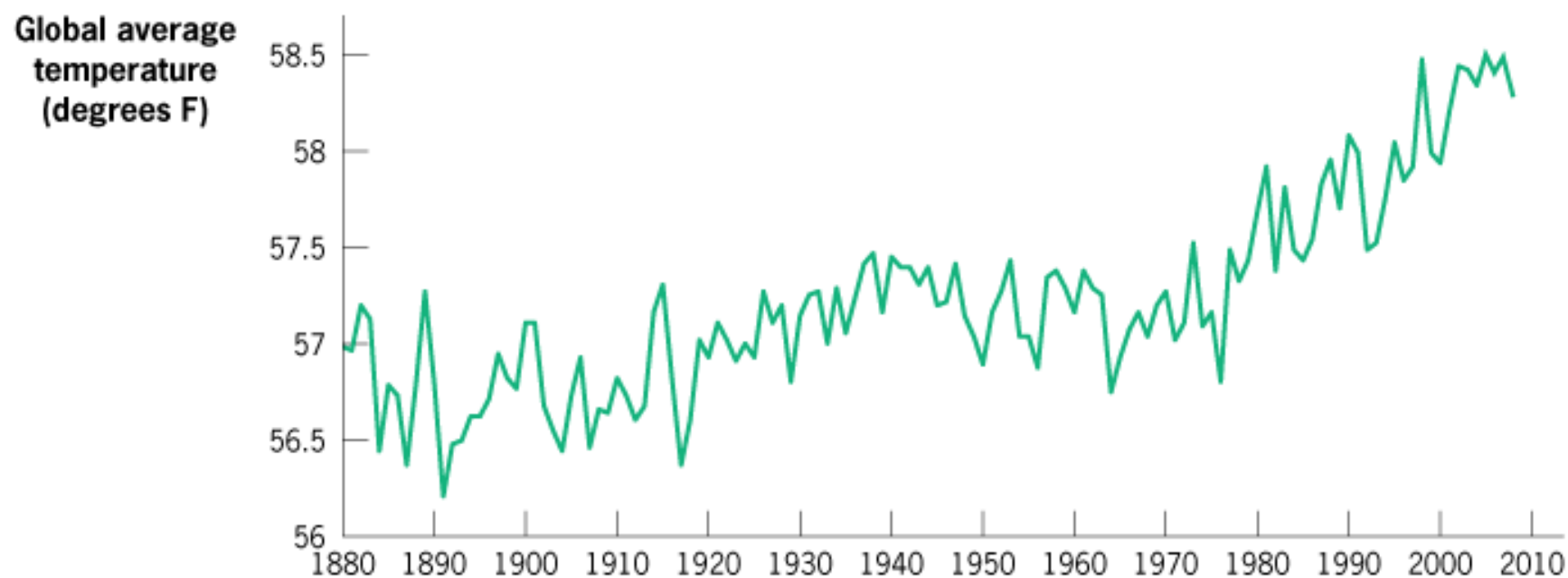
Source: Chay and Greenstone (2003)

B. Trends in Internal Infant Mortality Rate, by 1972 Nonattainment Status



Source: Chay and Greenstone (2003)

■ FIGURE 5-1



Average Global Temperature, 1880 to 2008 • There was a steady upward trend in global temperatures throughout the twentieth century.

6.2

Global Warming

Global warming is a serious environmental externality.

- Gas emissions lead to increased global temperature because of the greenhouse effect.
 - **Greenhouse effect:** The process by which gases in the Earth's atmosphere reflect heat from the sun back to the Earth.
- Global temperatures are increasingly more rapidly than any time in the last 1000 years.
- Temperatures are projected to rise even more rapidly over the next century.

6.2

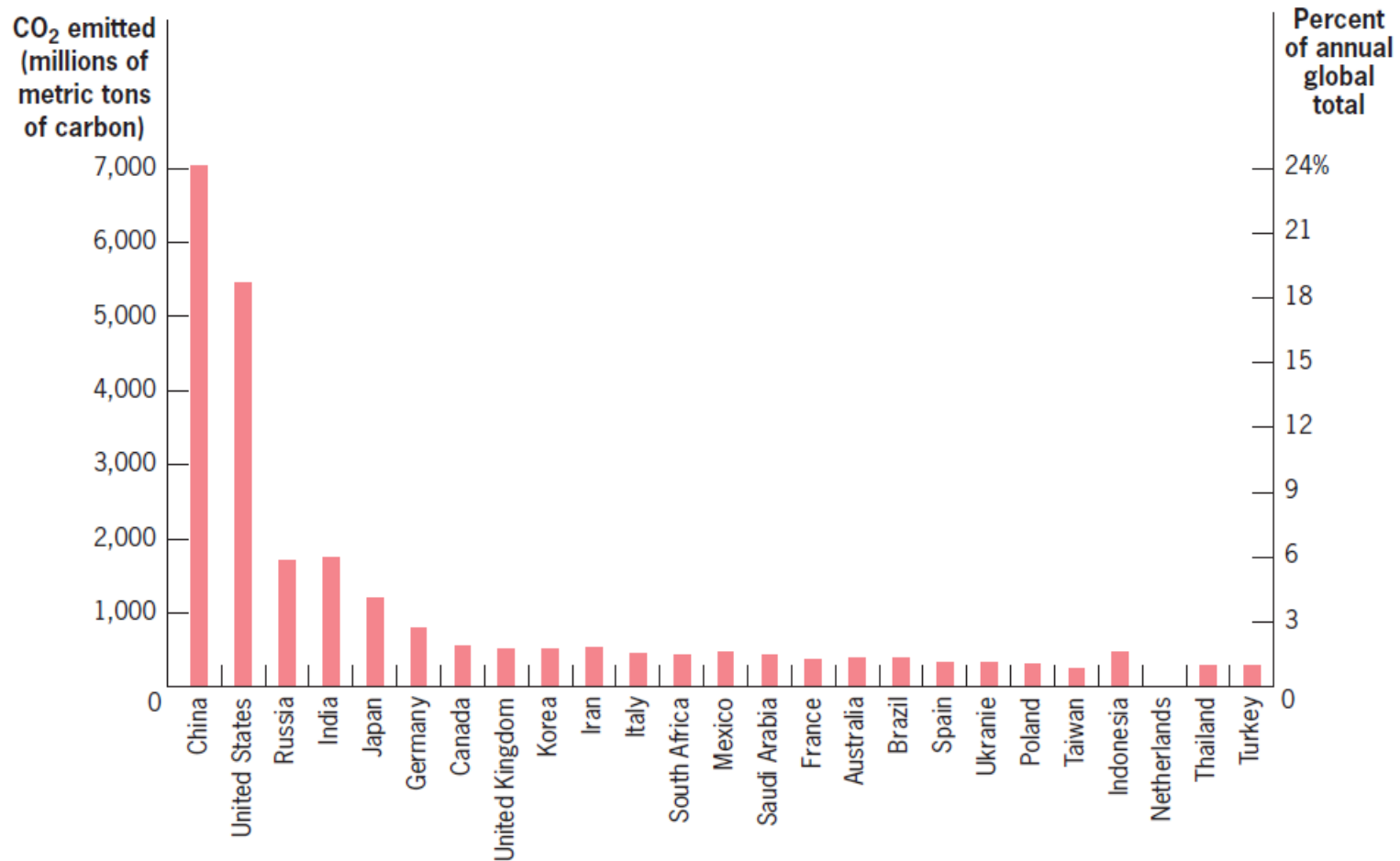
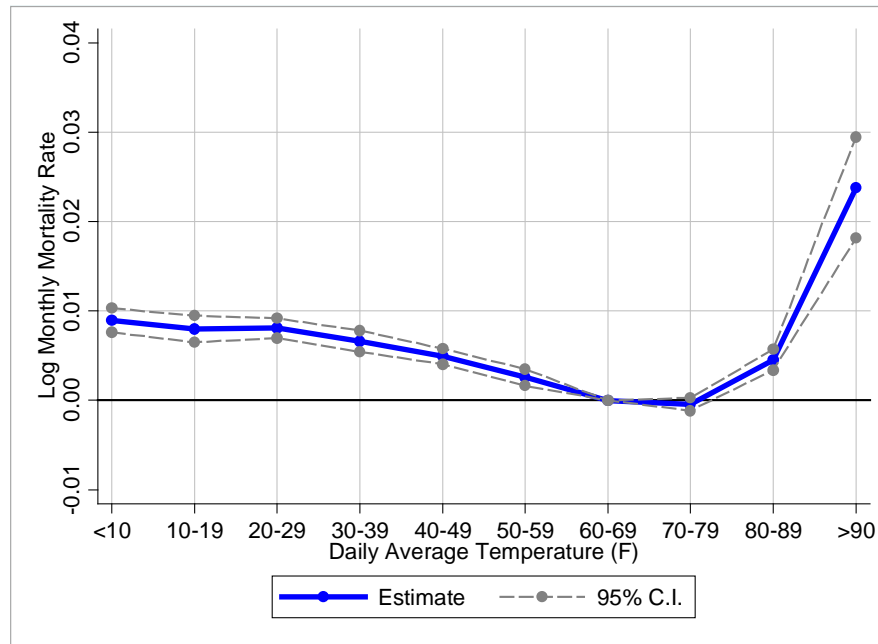
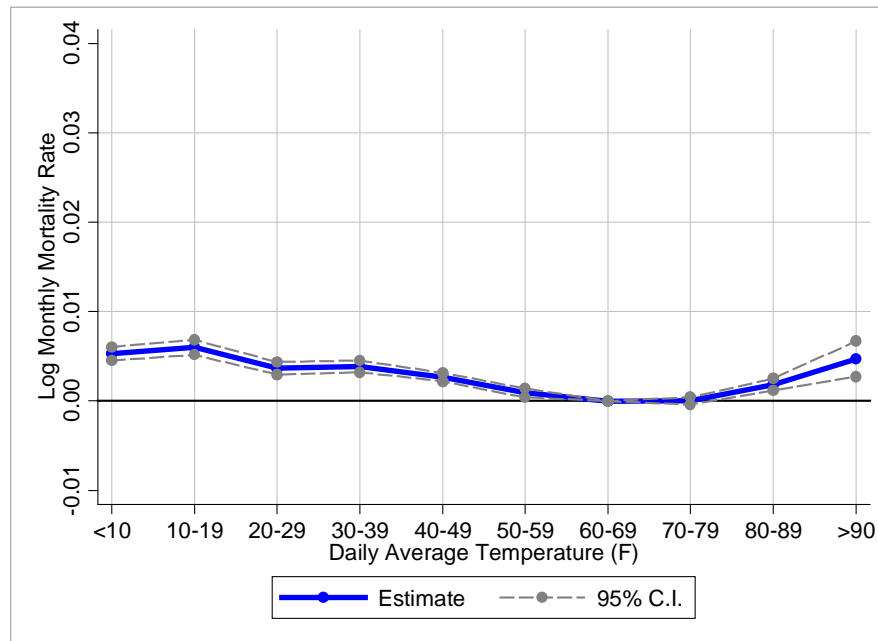
CO₂ Output: 25 Largest Contributors

Figure 2: Estimated Temperature-Mortality Relationship (Continued)

(c) 1929-1959



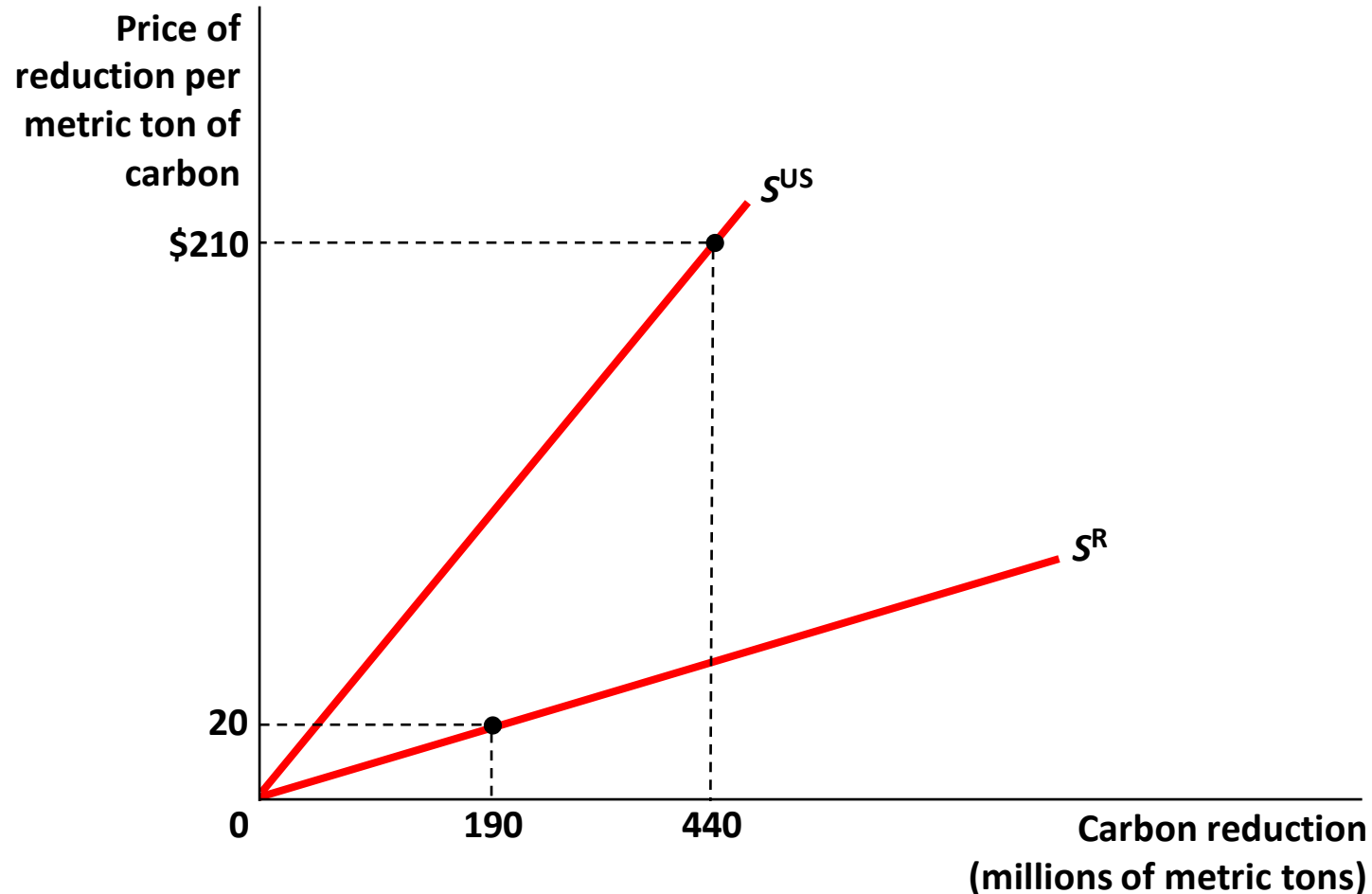
(d) 1960-2004



Notes: Figure 2 plots the response function between log monthly mortality rate and average daily temperatures, obtained by fitting Equation (1). The response function is normalized with the 60°F – 69°F category set equal to zero so each estimate corresponds to the estimated impact of an additional day in bin j on the log monthly

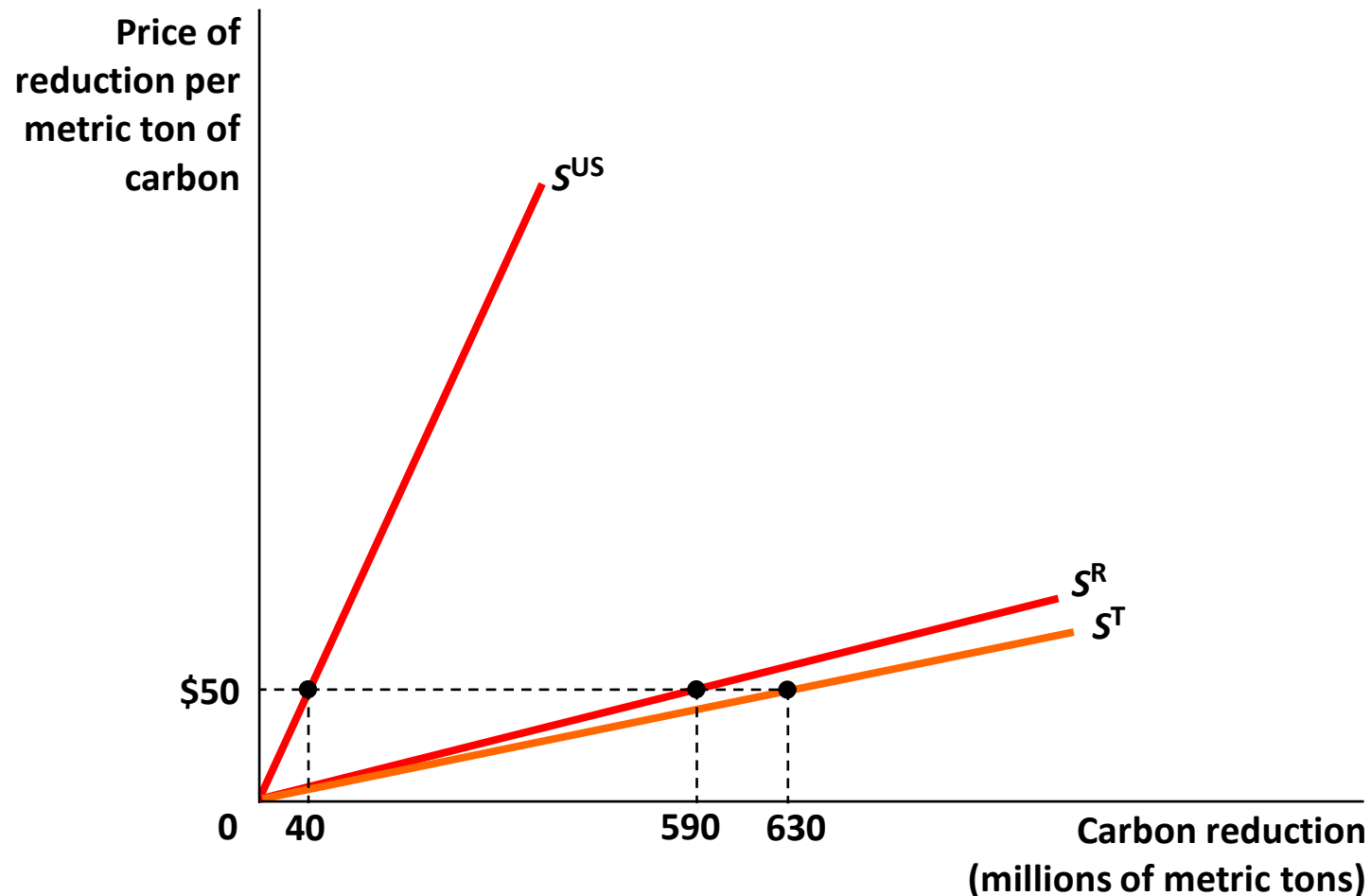
6.2

Can Trading Make Kyoto More Cost-Effective?



6.2

Can Trading Make Kyoto More Cost-Effective?



▶ APPLICATION

The Montreal Protocol and Ozone layer hole

- ▶ An excellent example of international cooperation is the Montreal Protocol of 1987, which banned the use of chlorofluorocarbons (CFCs).
- ▶ As with global warming, this was a potentially enormous long-run problem.
- ▶ Unlike global warming, the CFC problem was showing itself immediately and urgently: by the 1980s, a 25 million square kilometer hole had opened in the ozone layer over Antarctica!
- ▶ This hole spurred the international community to action, and in September 1987, the Montreal Protocol was adopted, aiming for complete phaseout of specified chemicals (mostly CFCs and halons) according to specified schedules.
- ▶ The result is that scientists predict the hole in the ozone layer will begin to recover and return to normal around 2050.

It may take some type of exciting, newsworthy event to spur action on global warming, but global warming will not be solved for centuries after emissions are greatly reduced. If the world waits for a crisis to take action, it may be too late.

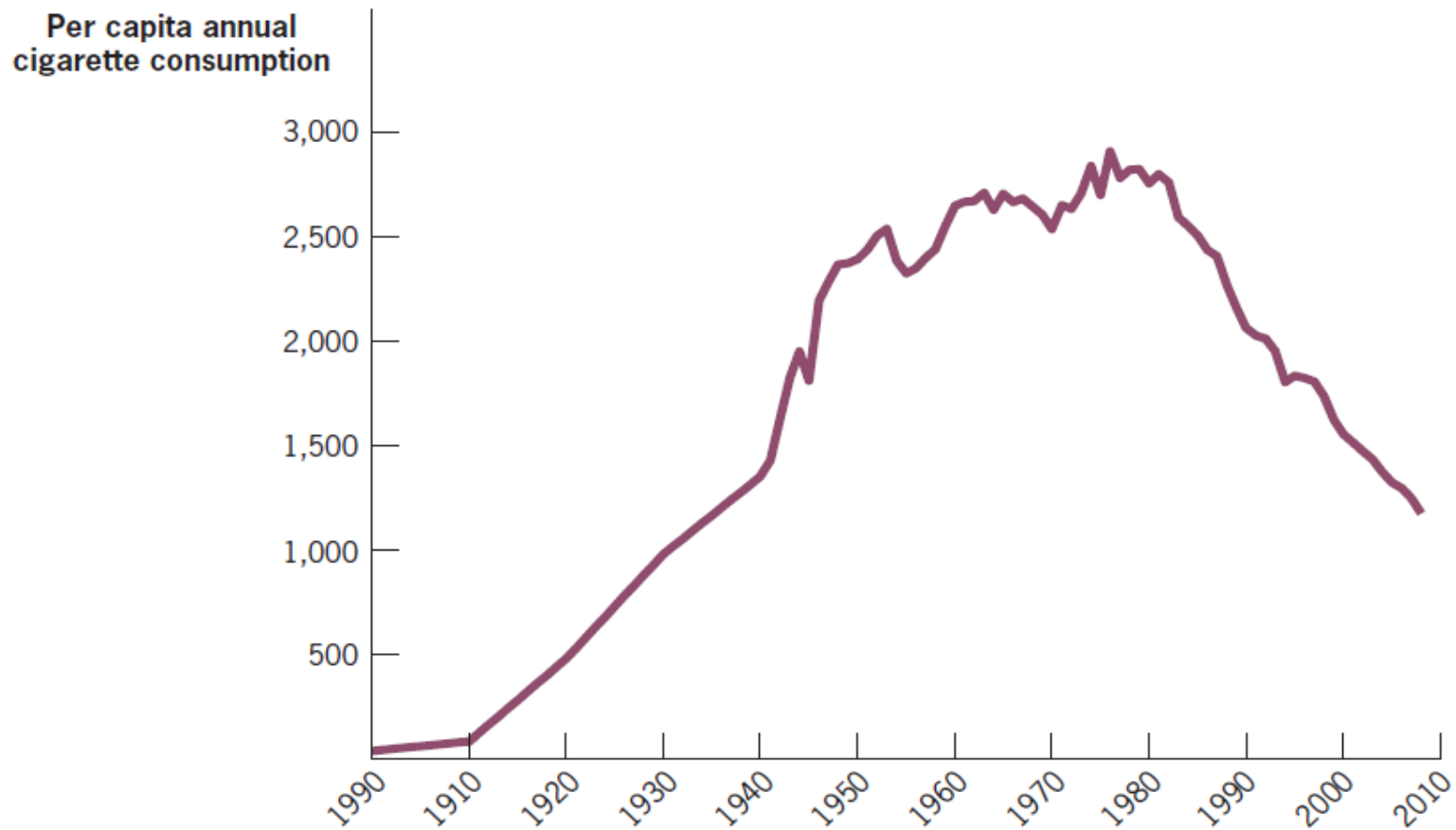
6.3

The Economics of Smoking

- Not all externalities are large-scale environmental problems.
- Some of the most important externalities are local and individualized.
- Many of these arise in the arena of personal health, and one of the most interesting is smoking.

6.3

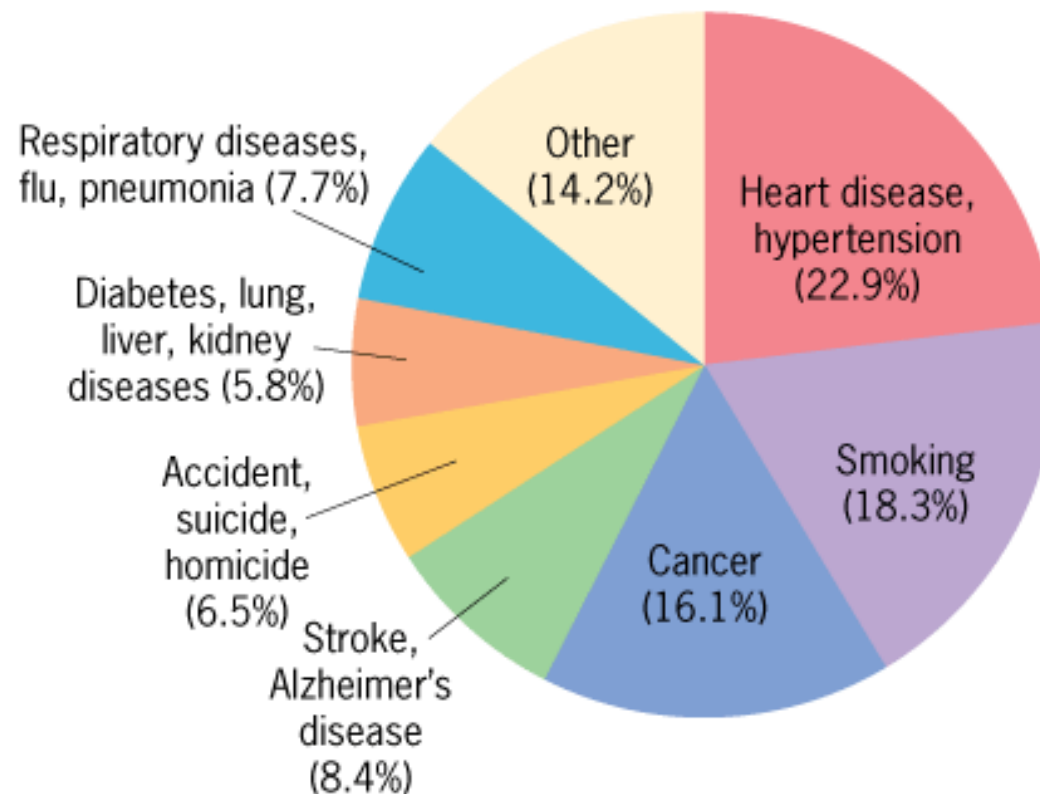
Per Capita Annual Cigarette Consumption, 1990–2010



6.3

The Economics of Smoking

■ FIGURE 6-5



Leading Causes of Death, 2008 • Smoking-related deaths represent 18.3% of all deaths, more than other cancers combined and almost as much as other heart diseases.

6.3

The Economics of Smoking

The Externalities of Smoking

■ TABLE 6-1

The Effects of Smoking: Externalities or Not?

Effect	Not an externality if...	An externality if...
Increased health care costs	Insurance companies actuarially raise premiums for smokers.	Many individuals are insured by entities that spread the health costs of smokers among all of the insured; also, the health costs of the uninsured are passed on to others.
Less-productive workers	Employers adjust individuals' wages according to productivity.	Employers do not adjust wages according to individual productivity, so that they must lower wages for all workers to offset productivity loss.
Increased number of fires	Smokers set fire only to their own property, requiring no help from the fire department, and insurance companies adjust premiums according to smoking status.	The fires damage nonsmokers' property, raise the cost of the local fire department, or raise fire insurance premiums for all.
Earlier deaths	Smokers do not pay Social Security taxes or would not incur medical costs later in life.	Nonsmokers save money because smokers die too early to collect full Social Security benefits and because their deaths reduce the high health costs near the end of life (a positive externality).
Secondhand smoke effects	The effects are minimal or smokers account for their families' utility when deciding to smoke.	The effects are serious and smokers do not account for their families' utility when deciding to smoke.

Cigarette smoking has a number of physical and financial effects, but in many cases they may not be externalities. The first column of this table lists examples of the effects of smoking. The second column discusses the situations under which these are not externalities, and the third column discusses the situations under which they are externalities.