# externalities

definition

types

examples

private vs. social optimum

private-sector solutions: Coase Theorem

public-sector solutions: Pigouvian taxes and subsidies, quantity regulation and creating new markets

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## IPCC: Global warming is getting deeper

The report of the Intergovernmental Panel on Climate Change is mindbogglingly thorough and cautious - the work of 259 top scientists from 30 countries

Deep heat: more than 90 per cent of solar heat ends up in the oceans and it may have penetrated far down where monitoring is poor Photo: Getty Images

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## Introduction to Externalities: Global Warming

- In 1997, representatives from over 170 nations met in Kyoto, Japan, to negotiate an international pact to limit the emissions of carbon dioxide.
- Carbon dioxide emissions contribute to global warming, which could cause enormous damage.
- The cost of reducing the use of fossil fuels, particularly in the major industrialized nations, is immense—perhaps 10% of GDP for the United States.

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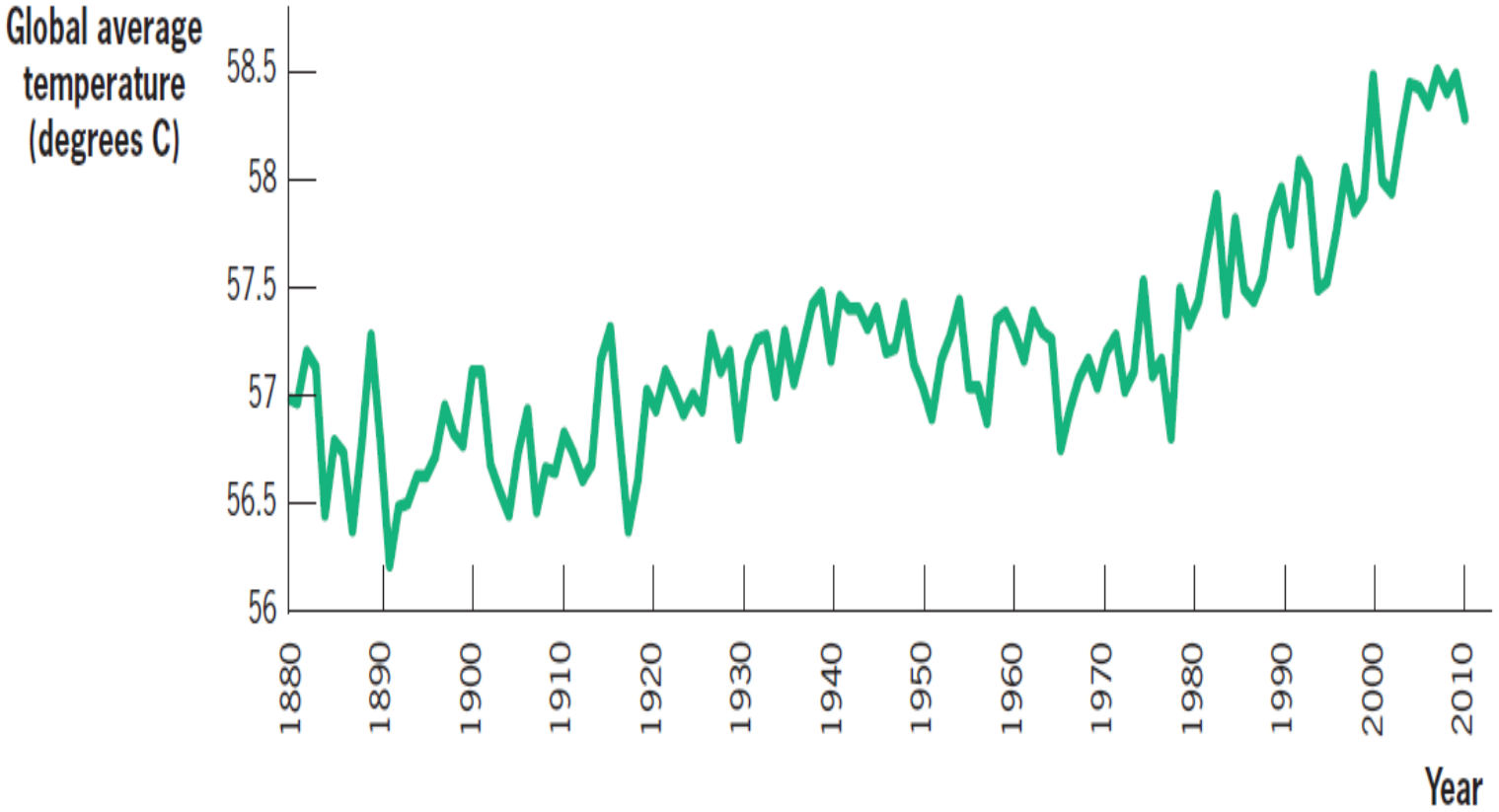
## Average Global Temperature, 1880−2011



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## Externalities: Main Concepts

Global warming is a classic example of an externality, which is a kind of market failure.

- Externality: Externalities arise whenever the actions of one party make another party worse or better off, yet the first party neither bears the costs nor receives the benefits of doing so.
- Market failure: A problem that causes the market economy to deliver an outcome that does not maximize efficiency – Assumptions of 1st Welfare Theorem do not hold.

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## Externalities: Concept and Types

- an externality is present whenever some economic agent's welfare is "directly" affected by the action of another agent in the economy
- "directly"="not through the market";

  externalities associated with missing markets

- positive externality (non-excludability) vs. negative externality (impossibility of rejection)
- consumption vs. production

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## Negative Externalities

- Negative production externality: When a firm's production reduces the well-being of others who are not compensated by the firm.
  - Pollution from steel production, dumped in a river, hurts fishermen.
- Negative consumption externality: When an individual's consumption reduces the well-being of others who are not compensated by the individual.
  - Smoking at a restaurant affects the health and enjoyment of others.

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## Private and Social Marginal Cost

Negative production externalities drive a wedge between private and social marginal cost.

- Private marginal cost (*PMC*): The direct cost to producers of producing an additional unit of a good.
- Social marginal cost (*SMC*): The private marginal cost to producers plus any costs associated with the production of the good that are imposed on others.
- The loss from pollution is a cost of production imposed on others.

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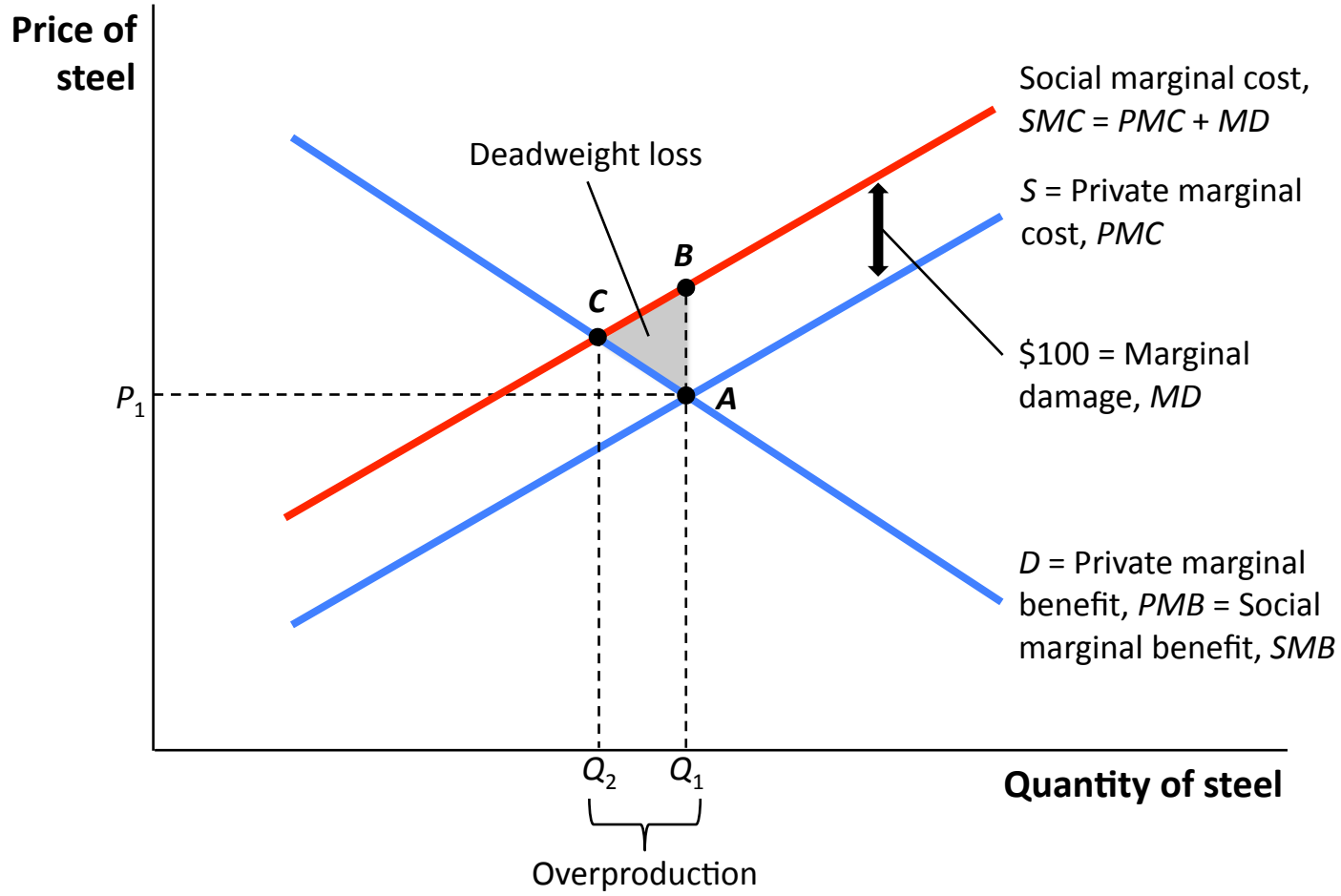
## Economics of Negative Production Externalities: Steel Production



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## Private and Social Marginal Benefit

Negative consumption externalities drive a wedge between private and social marginal benefit.

- Private marginal benefit (*PMB*): The direct benefit to consumers of consuming an additional unit of a good.
- Social marginal benefit (*SMB*): The private marginal benefit to consumers, minus any costs associated with the consumption of the good that are imposed on others.
- The loss of health or dining pleasure is a cost of smoking imposed on others.

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## Externalities and Efficiency

How do externalities affect efficiency?

- Efficiency requires that *SMC* = *SMB*.
- The market sets *PMC* = *PMB*.
- When *PMC* = *SMC* and *PMB* = *SMB*, the market is efficient.
- Production or consumption externalities lead to inefficiency.

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## 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.

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'*I'm really happy for you*.'

## Positive Externalities

Externalities can be positive as well as negative.

- Positive production externality: When a firm's production increases the well-being of others but the firm is not compensated by those others.
- Positive consumption externality: When an individual's consumption increases the well-being of others but the individual is not compensated by those others.

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## Private-Sector Solutions to Negative Externalities: The Solution

- Externalities undermine efficiency because one party does not pay the costs or get all the (net) benefits of its actions.
- The solution to this is therefore to internalize the externality.
- Internalizing the externality: When either private negotiations or government action lead the price to the party to fully reflect the external costs or benefits of that party's actions.
    - The fishermen could pay the steel producer to reduce production.

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## A possible solution: The Coase Theorem

The Coase theorem says that private parties will be able to solve the problem of externalities (under complete information).

- Coase theorem (Part I): When there are well-defined property rights and costless bargaining, then negotiations between the party creating the externality and the party affected by the externality can bring about the socially optimal market quantity.
- Coase theorem (Part II): The efficient solution to an externality does not depend on which party is assigned the property rights, as long as someone is assigned those rights.

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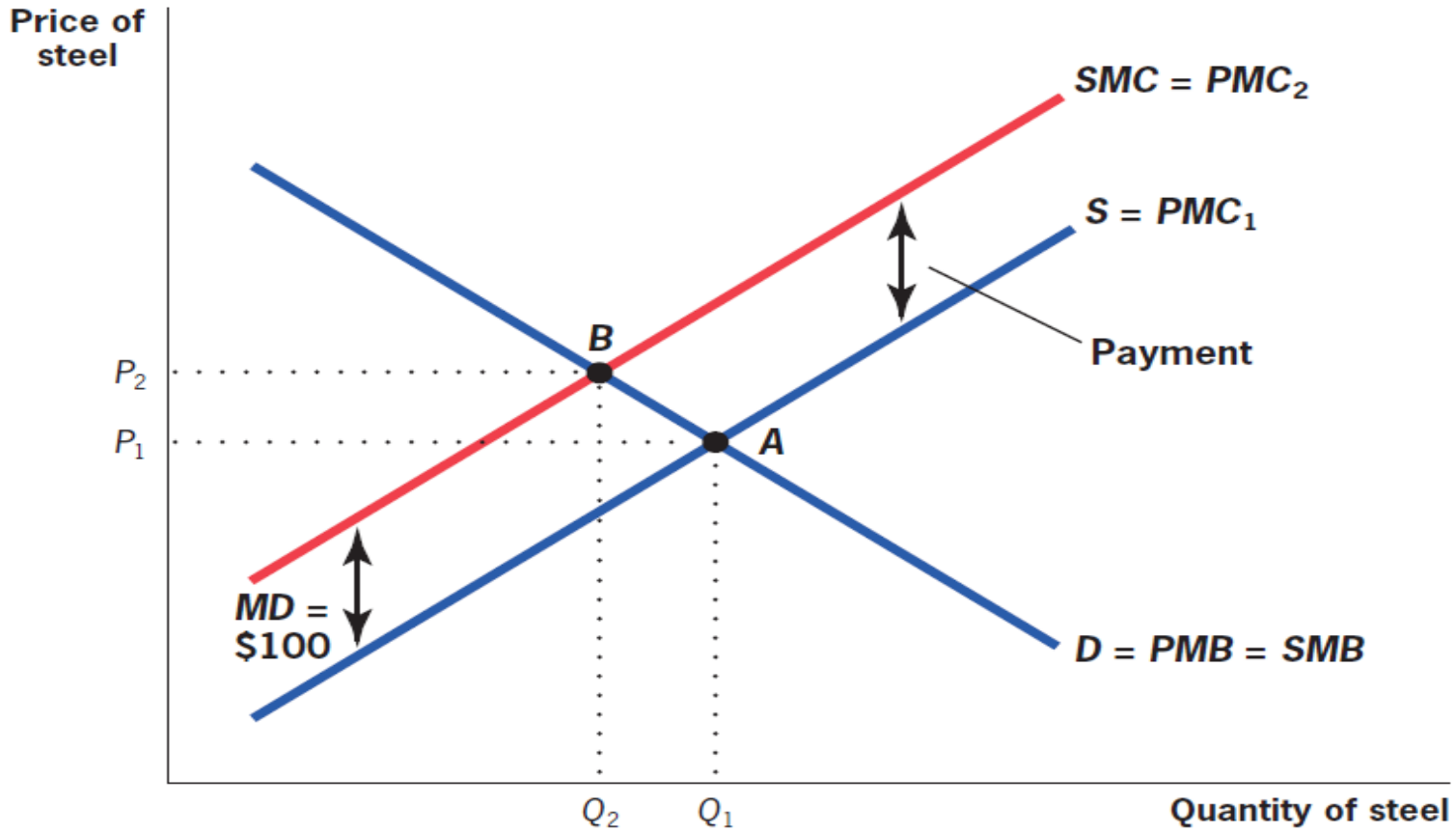
## A Possible Solution: Coasian Payments



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## The Problems with Coasian Solutions

There are several difficulties with Coasian solutions, making them less likely to arise as more people become involved.

- The assignment problem: Does the fisher pay the steel plant for not polluting? Or does the steel plant pay for polluting? Also consequences for investment in the long run.
- The holdout problem: Shared ownership of property rights gives each owner power over all the others. Each person has veto power, and so may demand enormous payments.

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## The Problems with Coasian Solutions

- The free rider problem: When an investment has a personal cost but a common benefit, individuals will underinvest. Individuals may not want to pay enough to reduce pollution.
- Transaction costs and negotiating problems: It is hard to negotiate when there are large numbers of individuals on one or both sides of the negotiation.
    - This problem is amplified for an externality such as global warming, where the potentially divergent interests of billions of parties on one side must be somehow aggregated for a negotiation.

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## Achieving the Social Optimum

- Internalization (e.g. merger)
- Coase Theorem: negotiation and property rights

Public policy makers employ three types of remedies to resolve the problems associated with negative externalities:

1. Corrective taxation to discourage use
2. Subsidies to encourage use
3. Regulation to directly change use – quantity regulation or market creation

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## Corrective Taxation and Subsidies

- Taxes and subsidies change the private marginal cost or marginal benefit without affecting the social marginal cost or benefit.
- They can therefore be used to internalize the externality.
- Taxes that correct externalities are called “Pigouvian taxation,” after A.C. Pigou.

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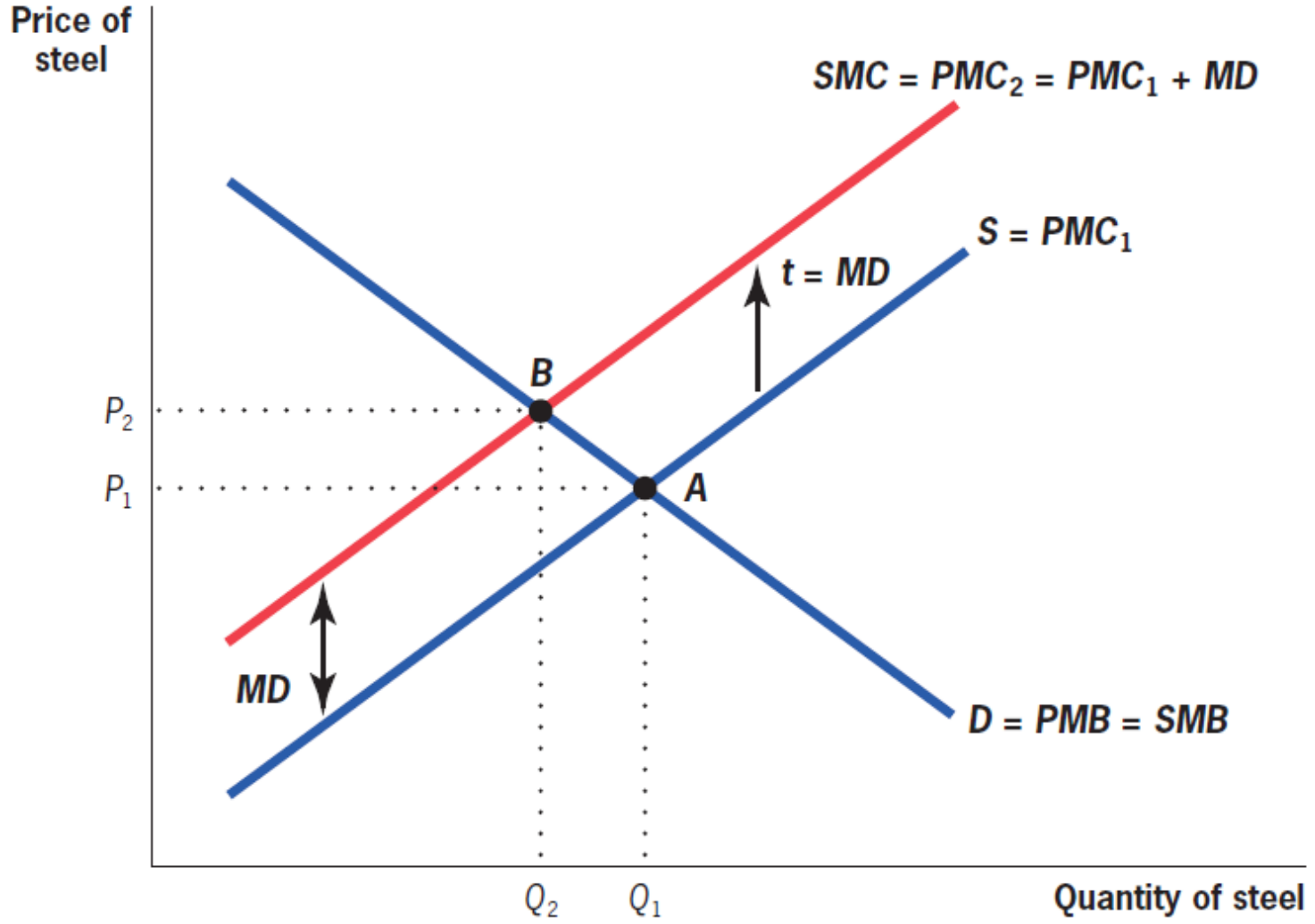
## Corrective Taxation



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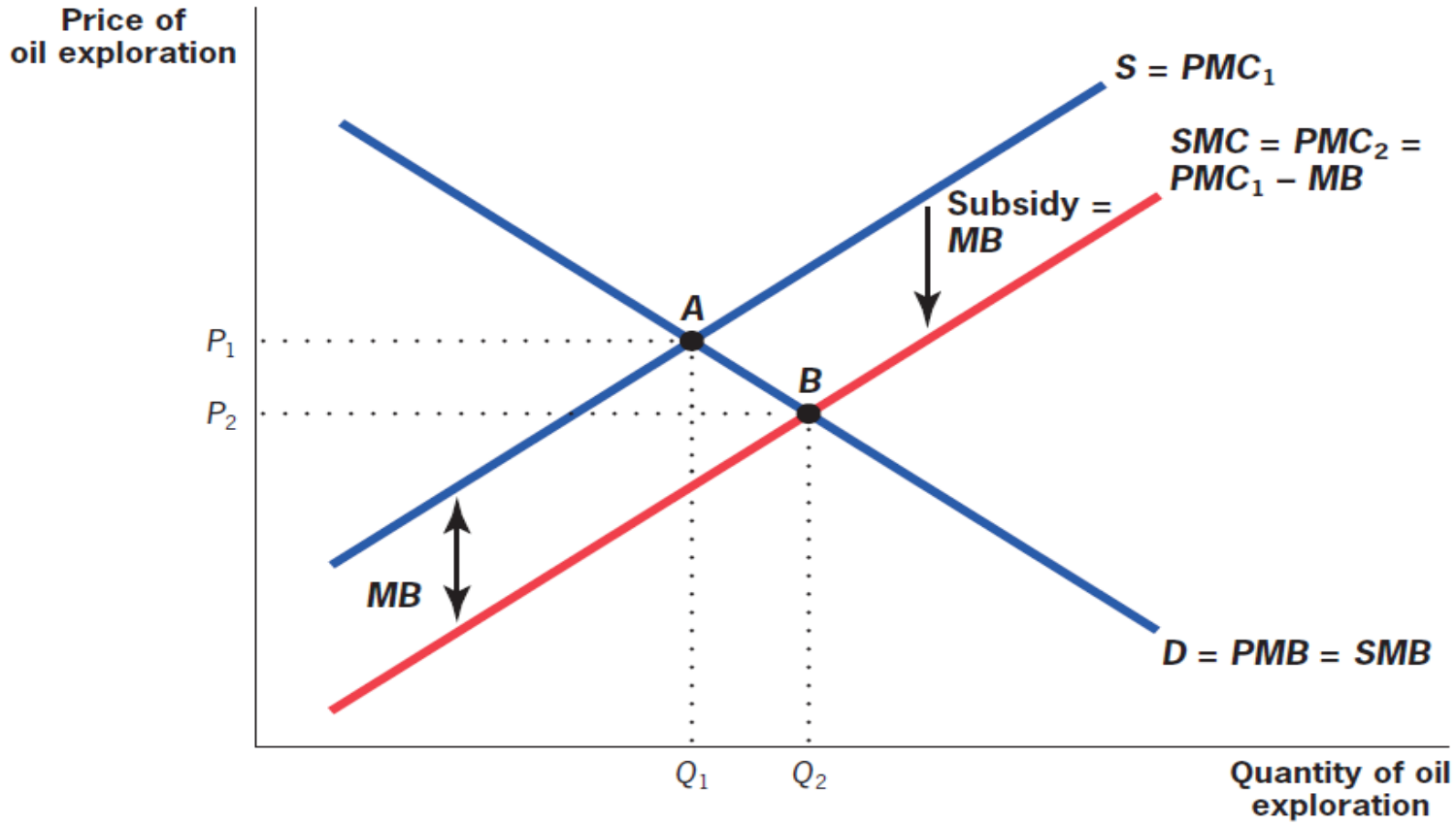
## Corrective Subsidies



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## Regulation

- In an ideal world, Pigouvian taxation and regulation would be identical.
- Regulation has been the traditional choice for addressing environmental externalities in the United States and around the world.
- In practice, there are complications that may make taxes a more effective means of addressing externalities.
- To see this, switch focus to “market for pollution reduction.”

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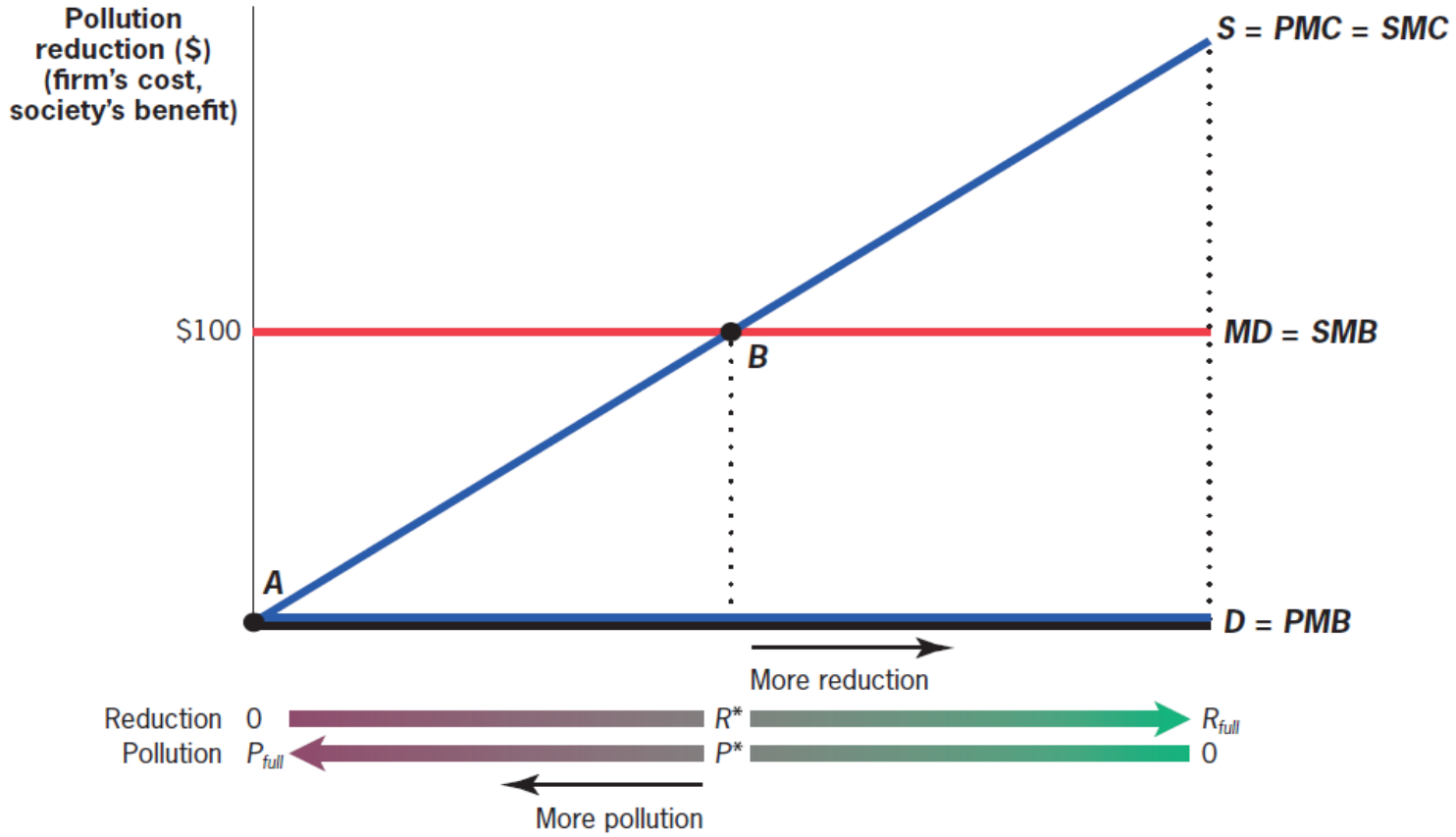
## Distinctions Between Price and Quantity Approaches to Addressing Externalities: Basic Model



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## Price Regulation (Taxes) versus Quantity Regulation in This Model

How do price regulation (taxes) and quantity regulation differ?

- The efficient solution is for *SMB* = *SMC*, and *SMC* = *PMC*.
    - Finding efficient quantity requires knowing the whole *SMC* curve.
- If price (tax) = *MD*, then firms will pollute until *SMC* = *PMC*—setting price requires only knowing *MD*.
    - But if marginal damage were unknown or not constant, setting tax would also be hard.

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## Multiple Plants with Different Reduction Costs

- The main benefit of taxation over regulation arises when plants differ in their cost of reducing pollution.
- How to determine how much each plant should produce?
- Regulation often requires each plant to reduce usage by the same amount, but it would be more efficient to have the low-cost plants reduce use by more.
- Taxes achieve this.

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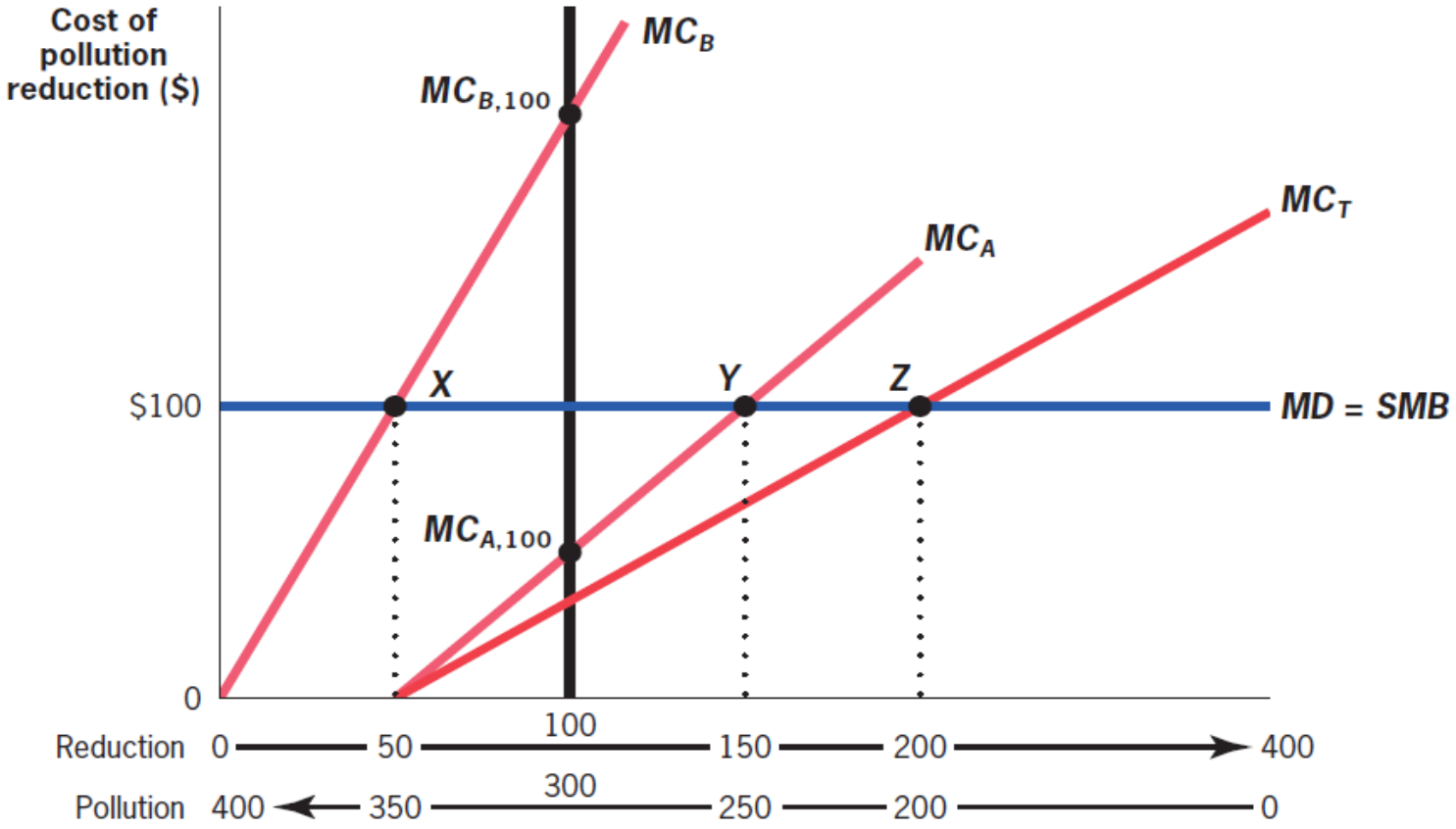
## Multiple Plants with Different Reduction Costs



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## Multiple Plants with Different Reduction Costs

Three possible policies here are:

1. Quantity regulation: For each plant, the marginal cost of reducing pollution is set equal to the social marginal benefit of that reduction.
2. Corrective tax: Pigouvian taxes cause efficient production by raise the cost of the input by the size of its external damage.
3. Quantity regulation with tradable permits: Trading allows the market to incorporate differences in the cost of pollution reduction across firms.

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## Uncertainty About Costs of Reduction

How does uncertainty about costs of reduction affect corrective strategies?

- If costs are high, than regulation could be expensive since we will force plants to comply.
- Using a price mechanism avoids this problem since firms will adjust until cost of adjustment = tax.
- But if costs are uncertain, then so is the amount of pollution reduction that a tax achieves.

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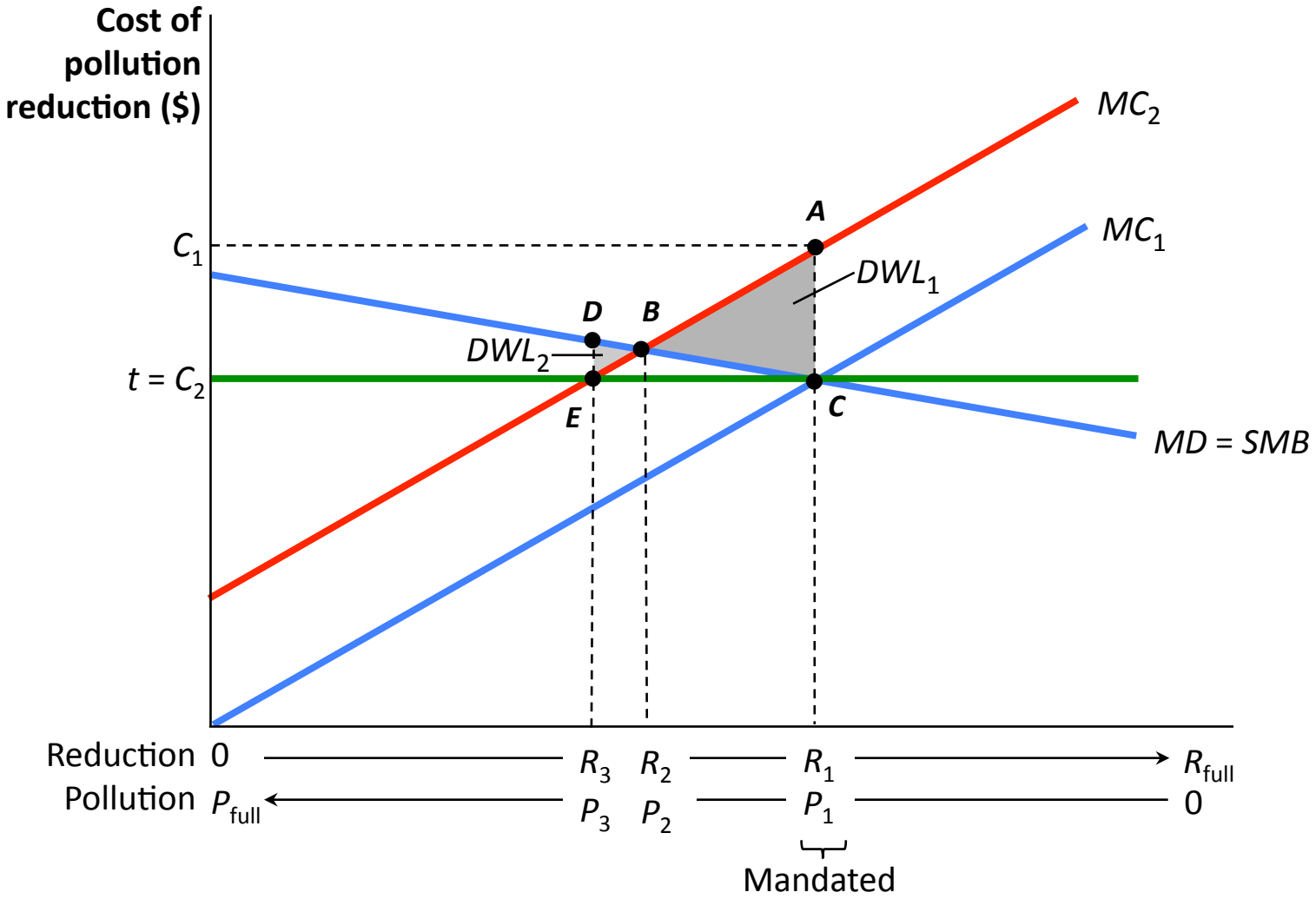
## Uncertainty About Costs of Reduction:
## Case 1: Flat *MD* Curve (Global Warming)



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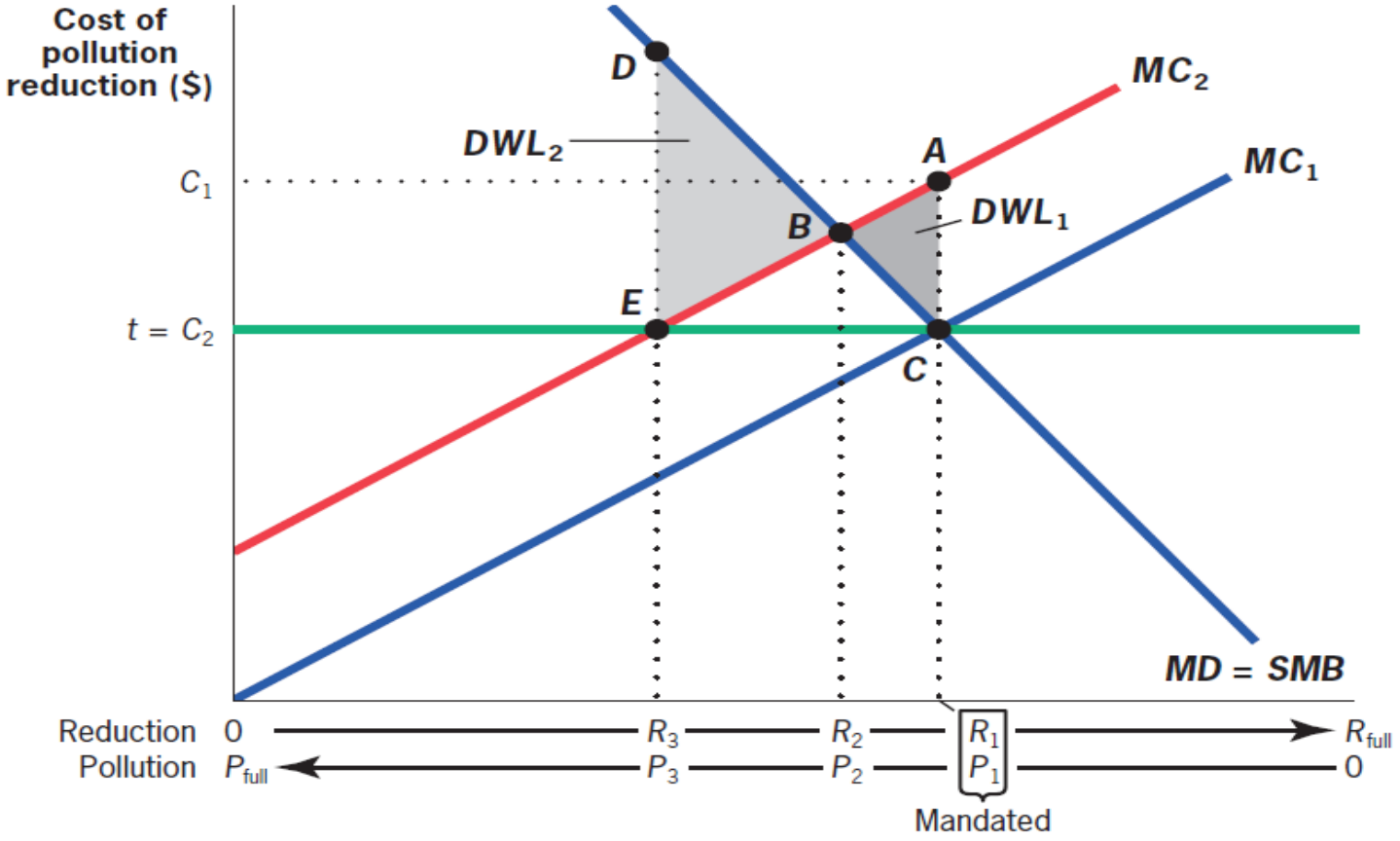
## Uncertainty About Costs of Reduction:
## Case 2: Steep *MD* Curve (Nuclear leakage)



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## Uncertainty About Costs of Reduction: Implications for Instrument Choice

- Using taxes leads to lower costs…
- … but less control over the amount of pollution reduction.
- The instrument choice depends on whether the government wants to get the amount of pollution reduction right or whether it wants to minimize costs.

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## Conclusion

- Externalities arise when one party's actions affect another party, and the first party doesn't fully compensate the other for this effect.
- Externalities are the classic answer to the "when" question of public finance: If externalities are present, then the market has failed and intervention is potentially justified.

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## Conclusion

- This naturally leads to the “how” question of public finance. Two solutions:
  1. Price-based measures (taxes and subsidies)
  2. Quantity-based measures (regulation)
- Which of these methods will lead to the most efficient regulatory outcome depends on factors such as the heterogeneity of the firms being regulated, the flexibility embedded in quantity regulation, and the uncertainty over the costs of externality reduction.