

Environmental and Health Economics ECON/ENVR/SOSC 2310

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Market Failures

The “invisible hand” of the marketplace leads self-interested buyers and sellers in a market maximize the total benefits that society can derive from a market.



Market Failures

- Voluntary exchange benefits both buyers and sellers is a fundamental building block of the economic way of thinking.
- But what happens when a voluntary exchange affects a third party who is neither the buyer nor the seller?

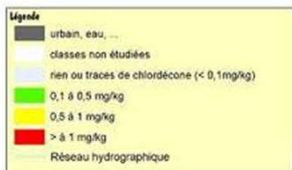
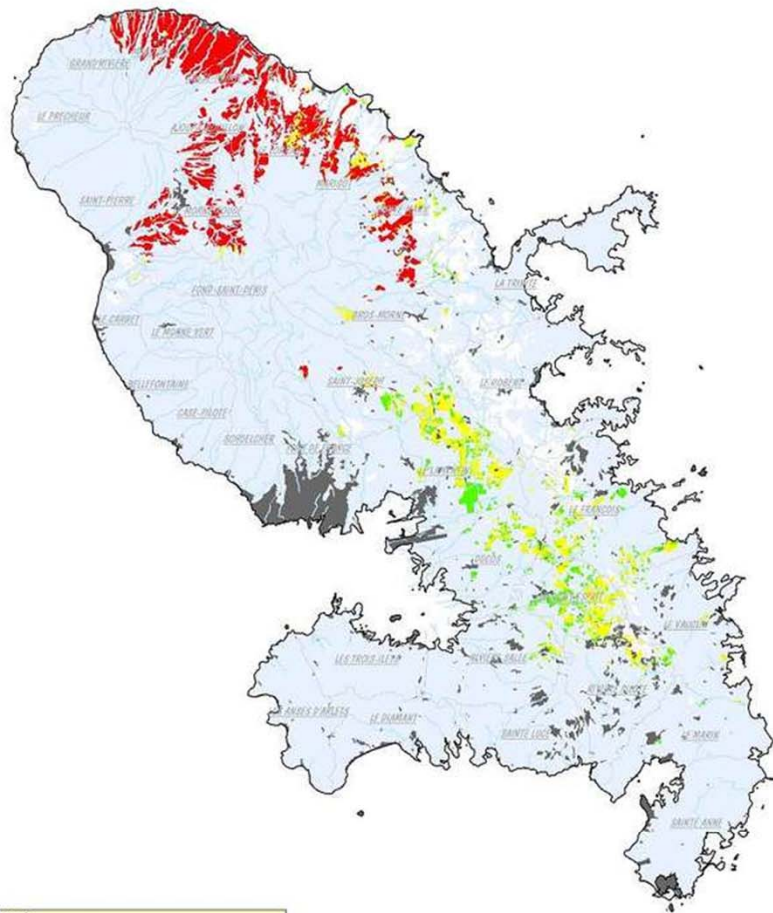


Pesticides

- The pesticide chlordecone was used in the Caribbean islands of Guadeloupe and Martinique (both part of France) to kill the banana weevil.

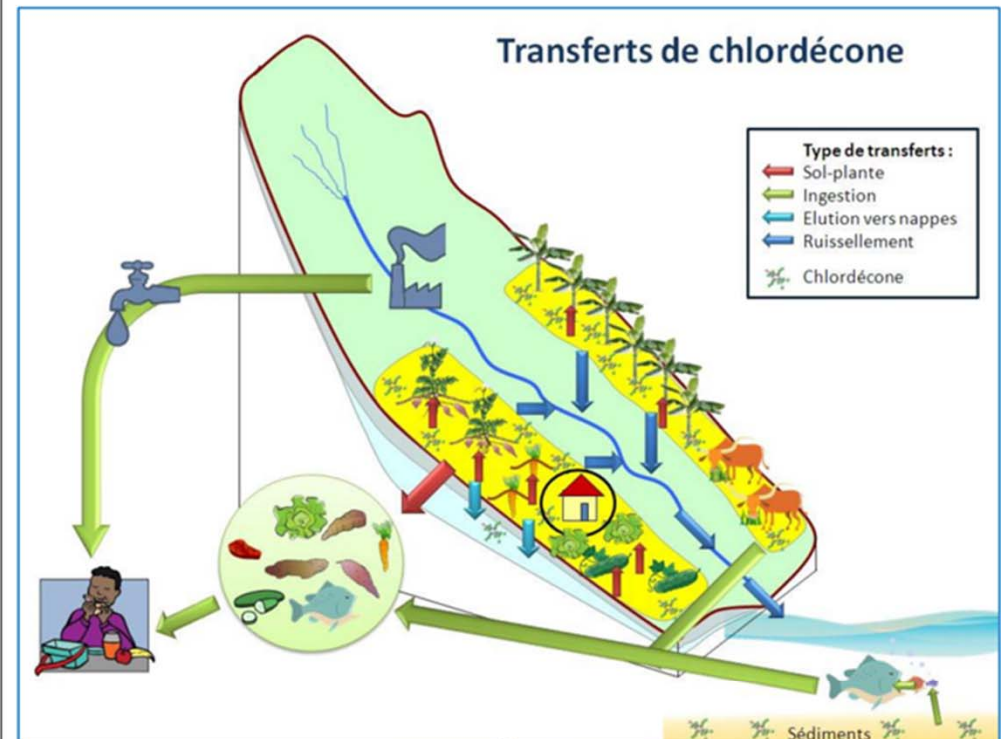


Cartographie statistique de la contamination potentielle des sols en Chlordécone (Version 1 11/2004)



Cartographie : SIO DIREN Martinique - Novembre 2004
Source des données : SIO DIREN Martinique - SIO 972 - BOTOPO® 2000 ©IGN Paris - BDIM

The chemical was washed off the land into rivers that flowed to the coast.

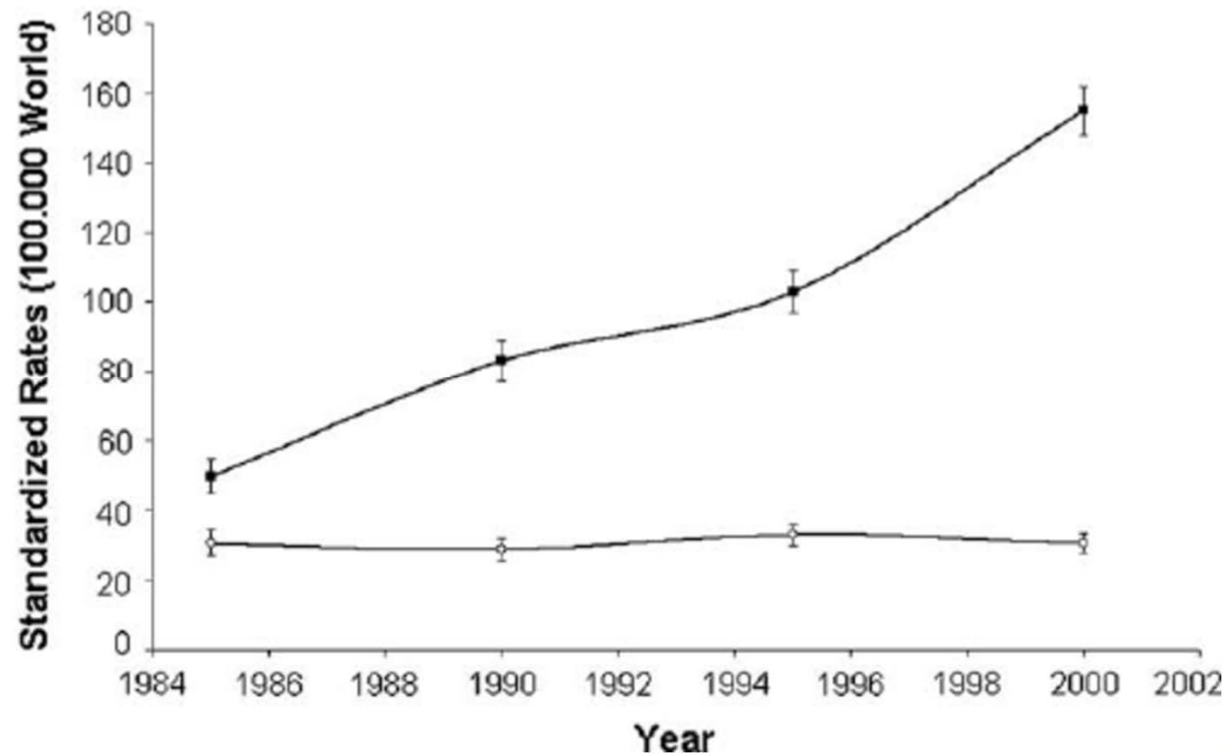


Pesticides

- The French government received reports on contamination in Guadeloupe, but waited until 1990 to ban the substance, and were pressured by banana plantation owners to give them a special exemption until 1993.
- ‘I’ve been eating pesticide for 30 years. But what will happen to my grandchildren?’ , Franck Néri, a Gaudeloupean fisherman



Prostate Cancer in Martinique



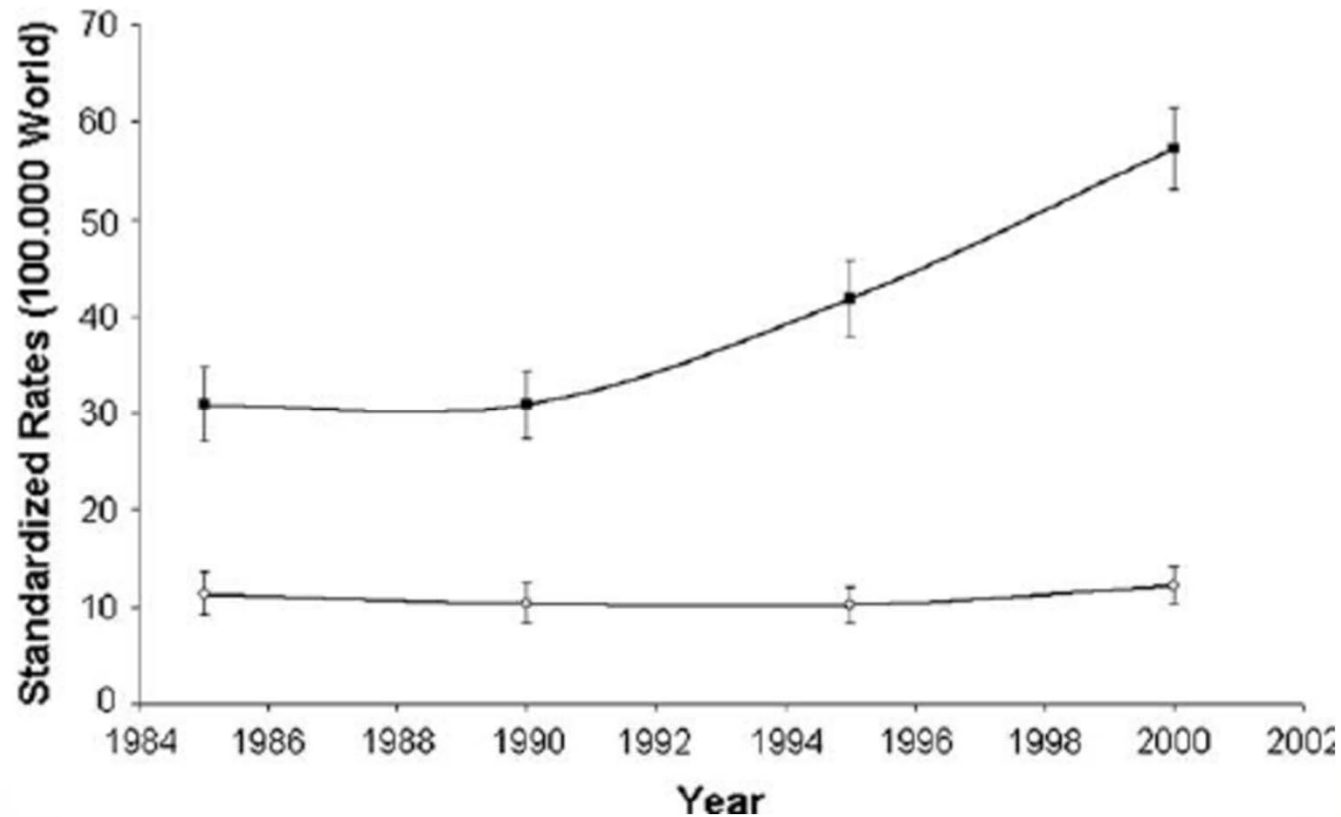
Incidence and mortality for prostate cancer in Martinique and Metro France



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Breast Cancer in Martinique



Breast Cancer in Martinique in comparison with metropole France



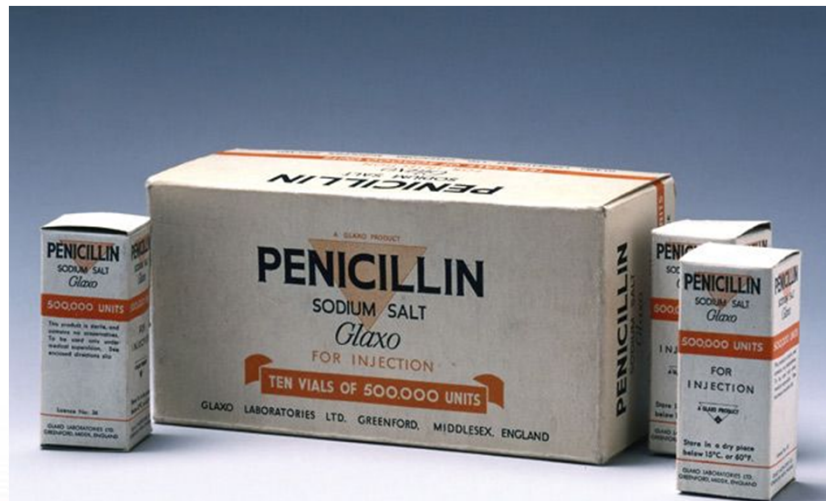
Consequences

- In 2012, the fraction of Martiniquean men suffering from prostate cancer was the highest in the world and almost twice that of the second-highest country, and the mortality rate was well over four times the world average.
- Neurological damage in children, including cognitive performance, has also been documented.



Antibiotics

- Since the discovery of penicillin in 1928, the development of antibiotics has brought huge benefits to mankind.



Antibiotics

- WHO recently warned: ‘Unless we take significant actions to ... change how we produce, prescribe and use antibiotics, the world will lose more and more of these global public health goods and the implications will be devastating.’
- Why?



Antibiotics

- Bacteria become resistant to antibiotics when we use them too often, in the wrong dosage, or for conditions that are not caused by bacteria.
 - Unlicensed private medical practitioners use antibiotics when other treatments would be better.
 - To save money, the patients often stop taking the antibiotics when they feel a little better.
- As a result, leaving the allocation of antibiotics to the market can have damaging consequences.



Externalities

- When a market outcome affects **parties other than the buyers and sellers in the market**, side-effects created are called **externalities**.
(sometimes called **spillovers**)
- When the impact on the bystander is adverse, the externality is called a **negative externality**.
- When the impact on the bystander is beneficial, the externality is called a **positive externality**.



Examples of Negative Externalities

- Examples of Negative Externalities
 - Automobile exhaust
 - Cigarette smoking
 - Barking dogs
 - Loud stereos in an apartment building



Examples of Positive Externalities

- Examples of Positive Externalities
 - Immunizations
 - Research into new technologies
 - Education

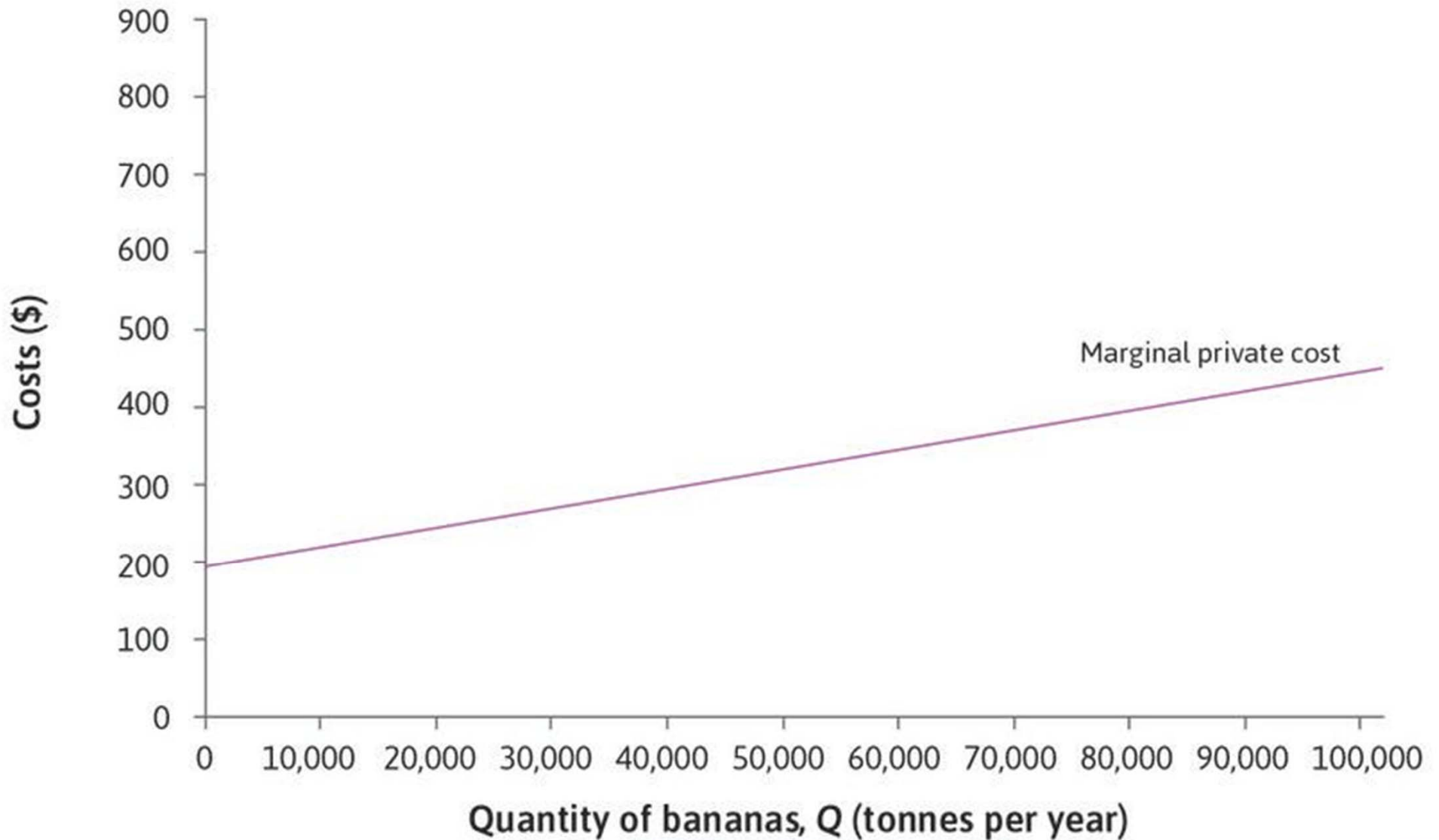


Negative Externality

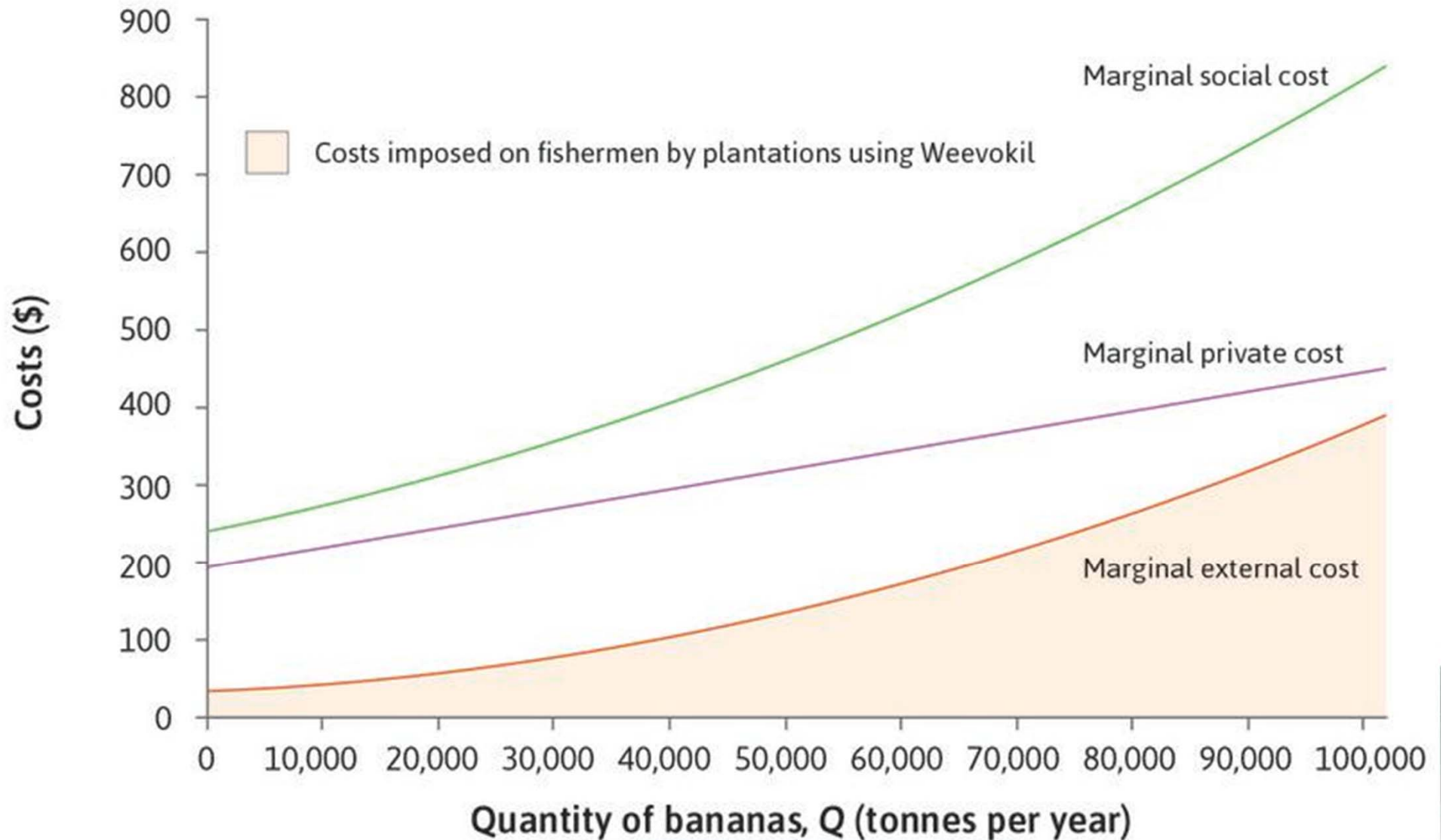
- How we model negative externality?
 - when the externality of pollution exists, **the supply curve no longer represents all social costs**
 - For each unit of output produced, the social cost includes the **private costs** of the producers **plus the cost to those bystanders (external costs)** adversely affected by the pollution.



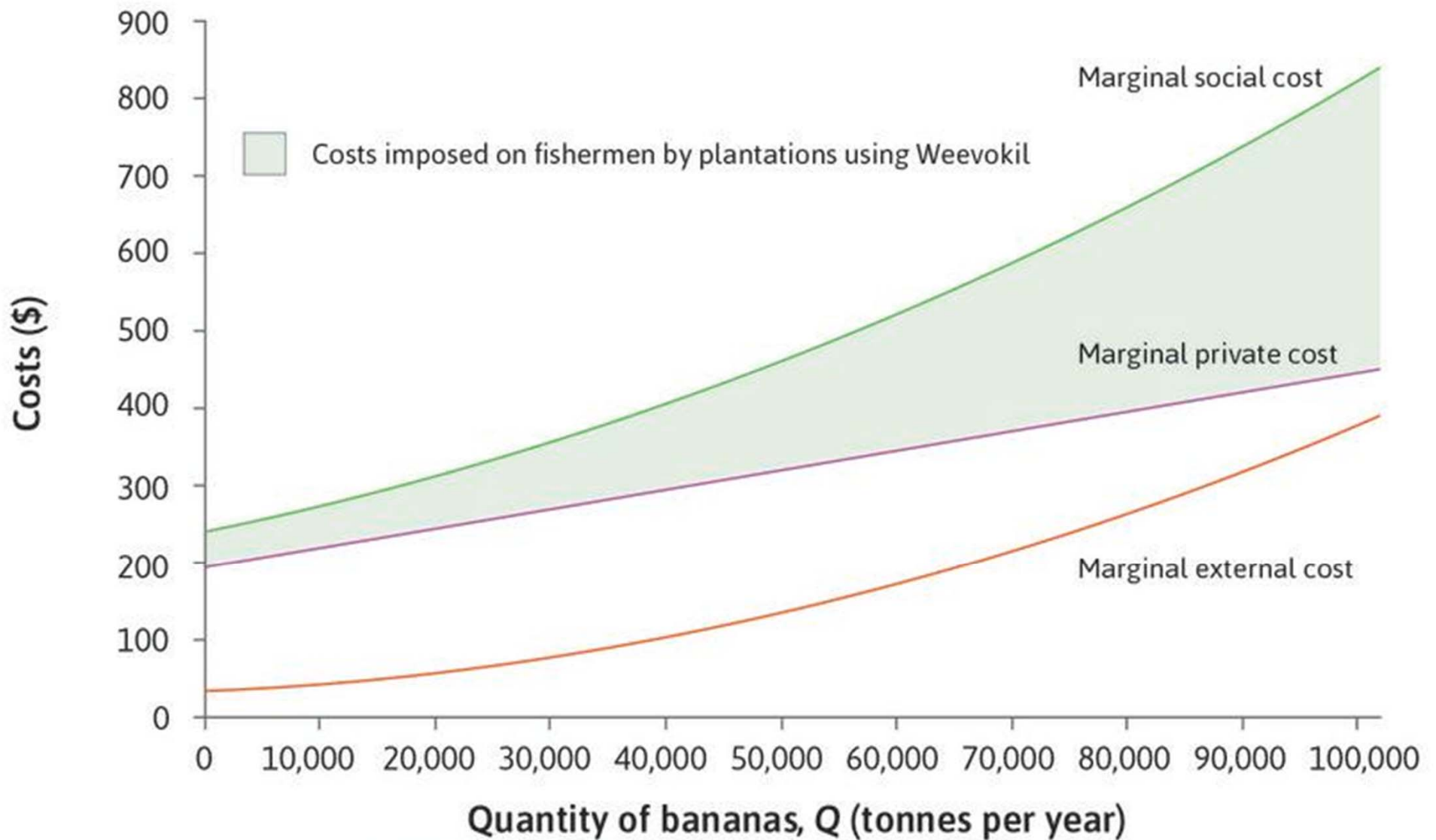
Negative Externality



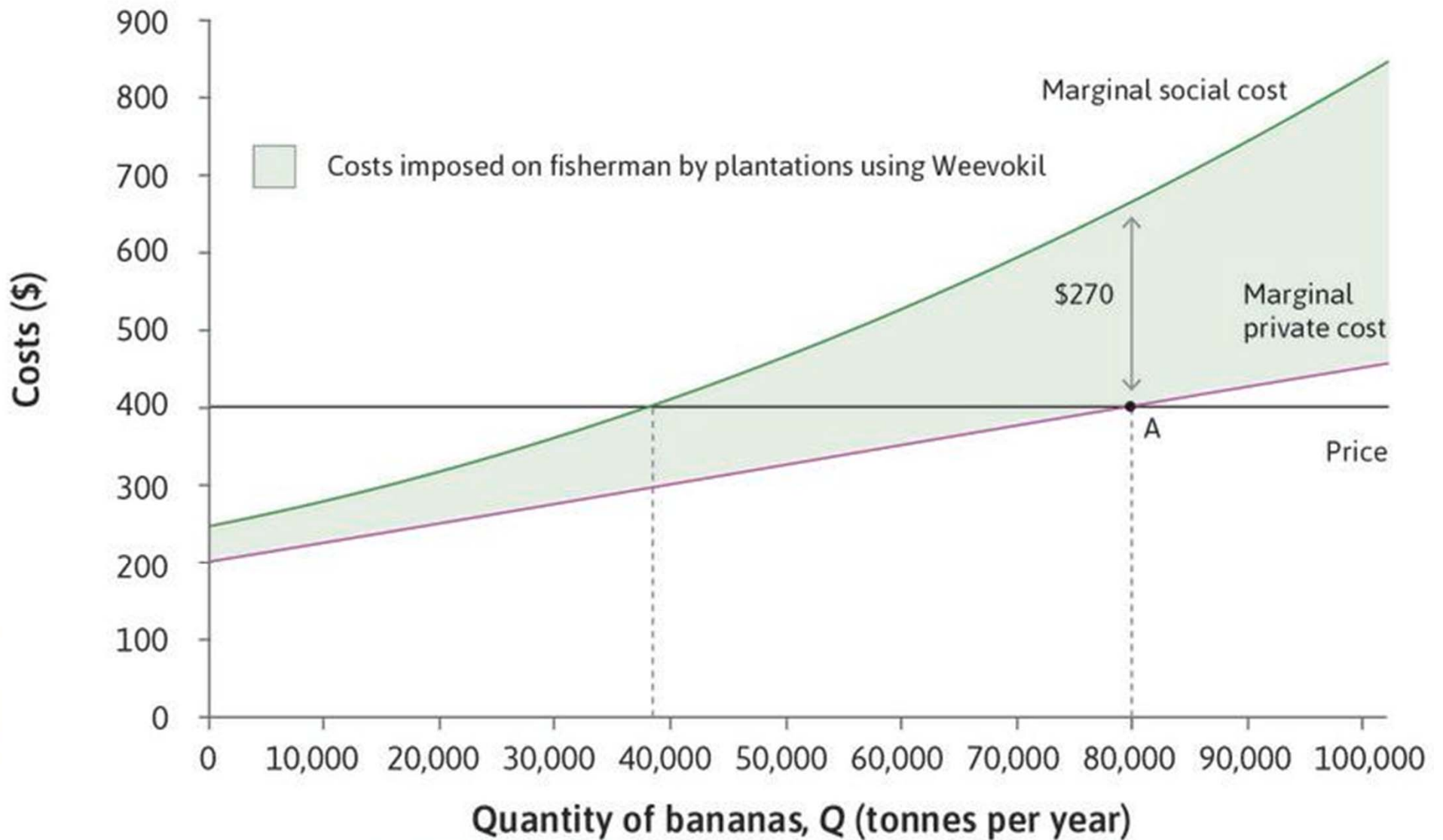
Negative Externality



Negative Externality



The plantations' choice of banana output.

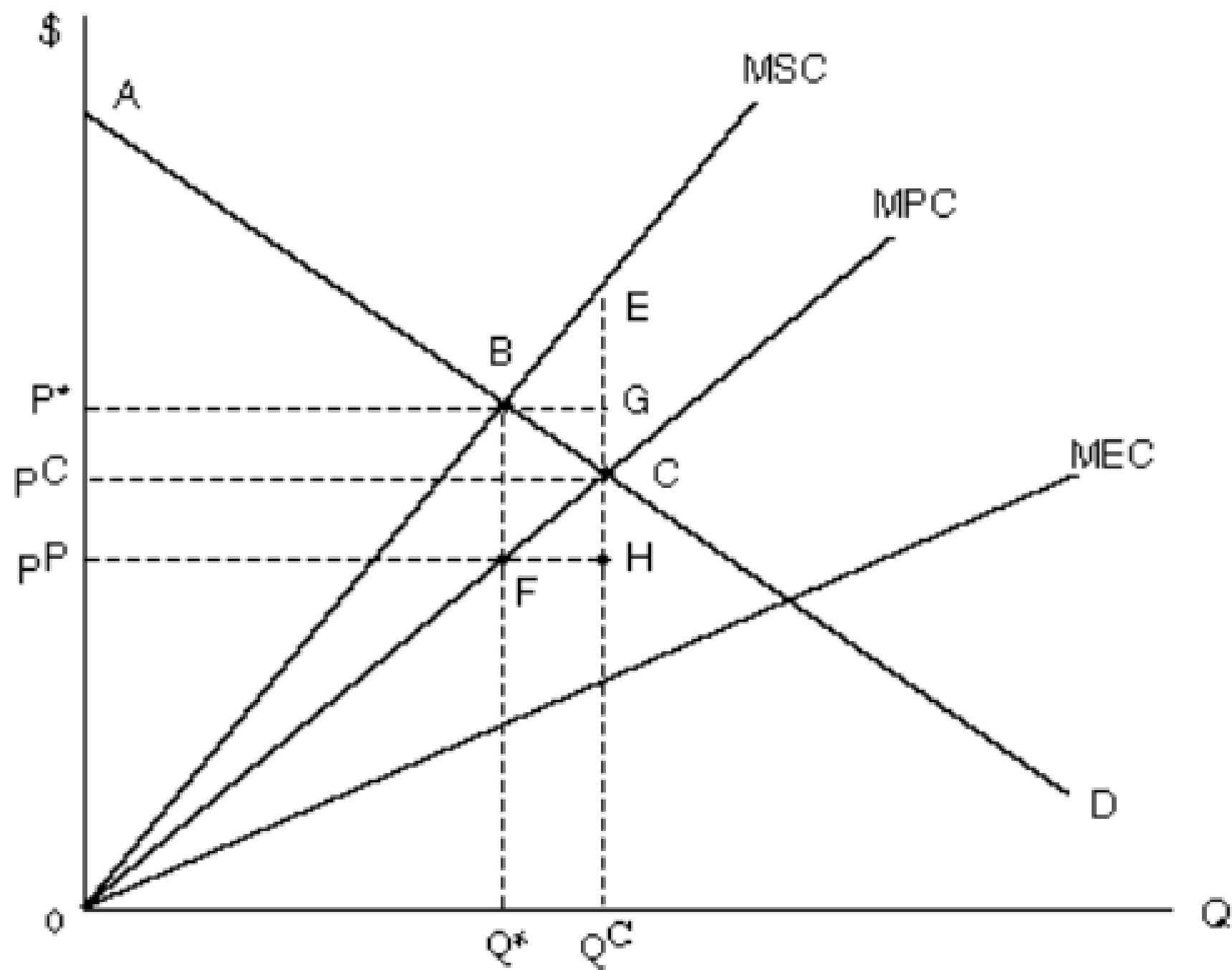


Externality and Welfare

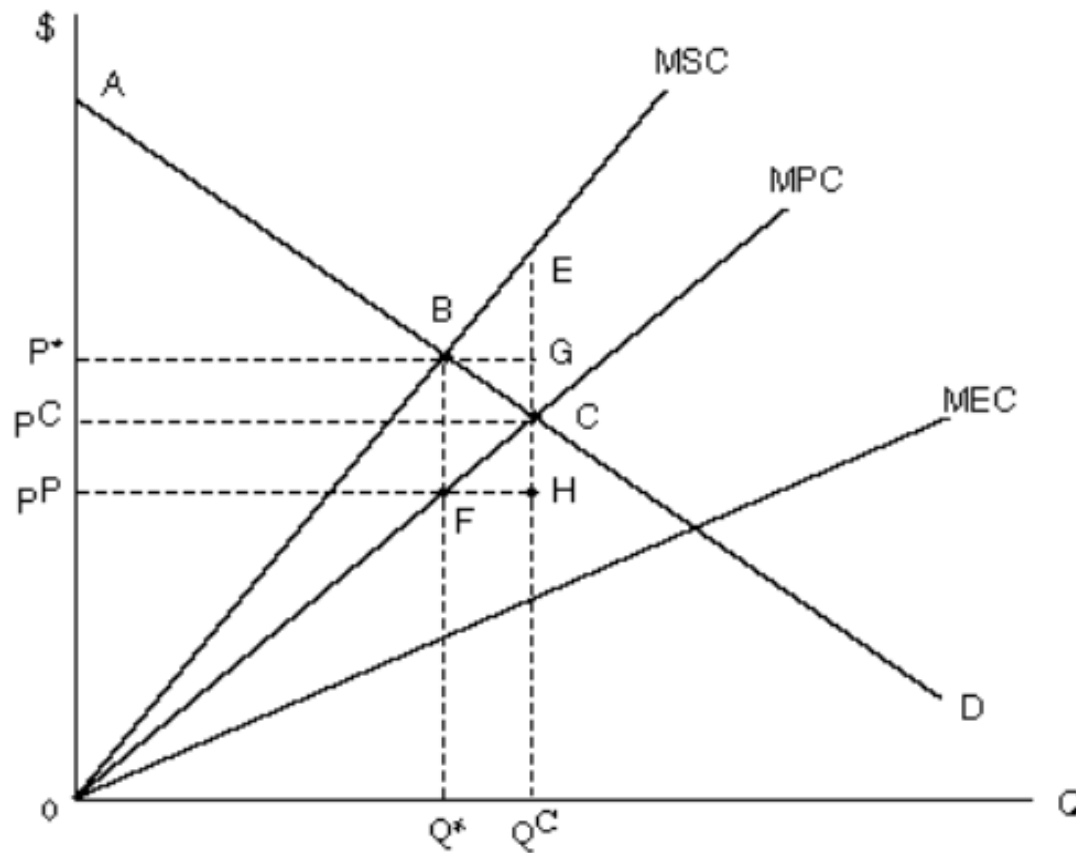
In a typical supply and demand model, find out the social welfare when there is a negative externality in a competitive market.

Find out the social welfare associated with the optimal point.





Production Externalities and the Failure of Competitive Markets



MSC = marginal social cost (vertical sum of MPC and MEC)

MPC = marginal private cost (inverse of the private supply curve)

MEC = marginal externality cost (suffered due to pollution)

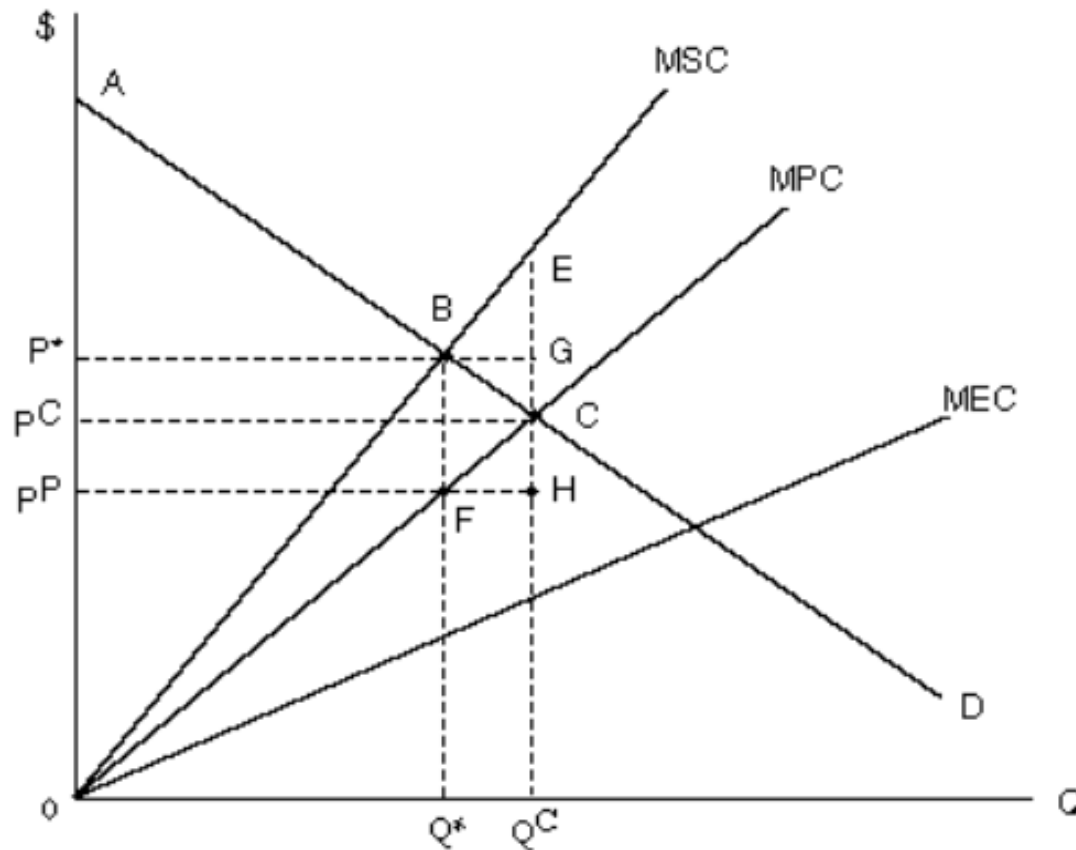
In this case, the marginal external cost is increasing as we produce more.



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Production Externalities and the Failure of Competitive Markets



Social optimum at B (where $MSB=MSC$)

$CS = ABP^*$

$PS = P^*BFO$

External Cost = OBF

Social Welfare = $ABFO - OBF = ABO$

Free market outcome at C

$CS = ACP^c$

$PS = OCP^c$

External Cost = OCE

Social Welfare = $ABO - BEC$

Deadweight Loss = BEC



Negative Externalities in Production

- The intersection of the demand curve and the **social-cost curve** determines the **optimal output level**.
- The socially optimal output level is less than the market equilibrium quantity.
- The producers produces too much under perfect competition



Externalities

- Externalities cause markets to be inefficient, and thus fail to maximize total surplus.
- The “invisible hand” of Adam Smith will not be “pushing folks in the right direction”.
- What policies can be used to correct the problem?



Internalizing Externalities

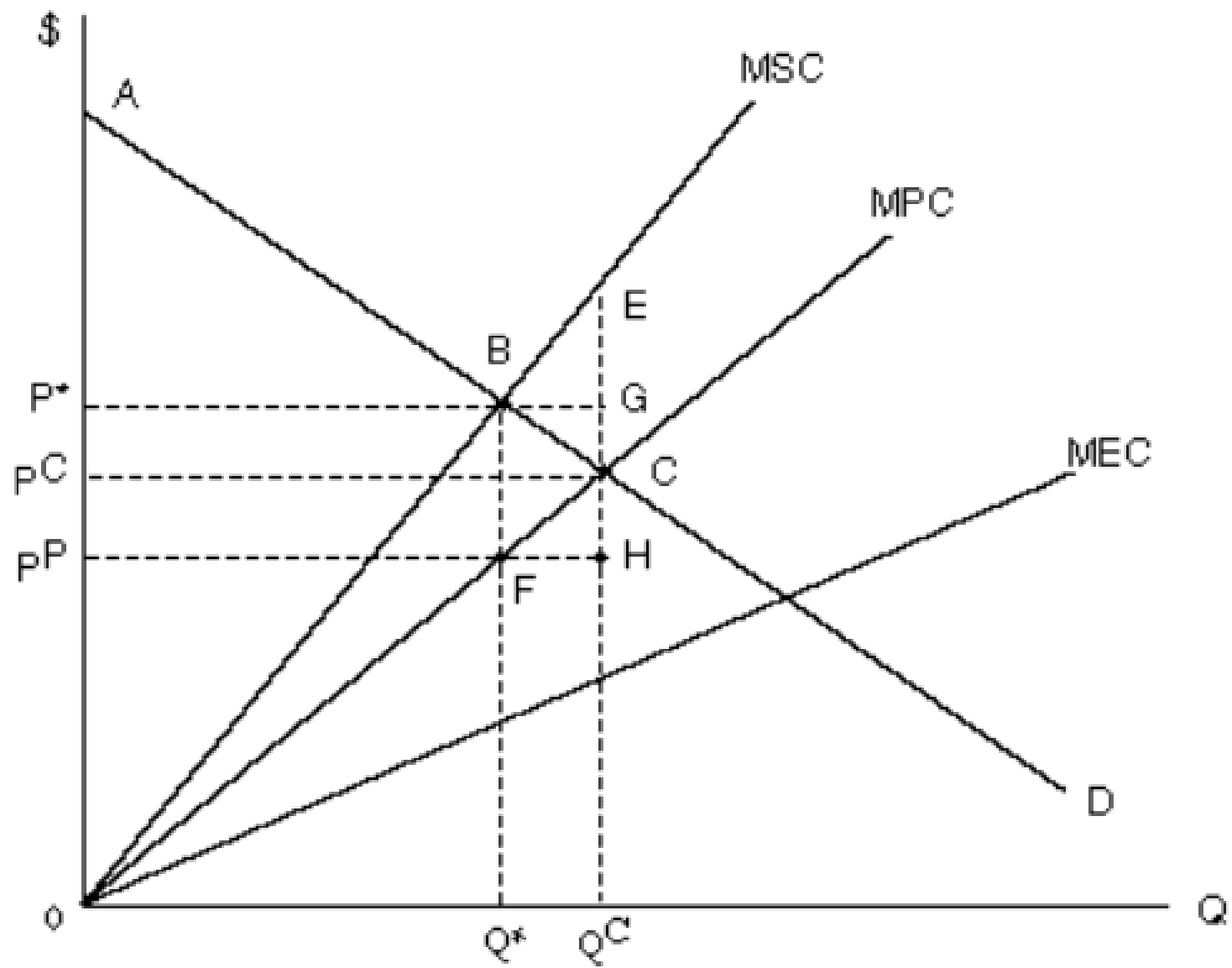
- **Internalizing an externality** involves altering incentives so that people take into account the external effects of their actions.
- This social optimum may be achieved by several policies:
 - Command and Controls (CACs)
 - Market-Based Instruments (MBIs)



CACs: Standards on Pollution or Output

- The government restricts output to Q^* .
 - Output restrictions can be implemented rather simply through **production quotas**.





CACs: Standards on Pollution or Output

- The welfare implications of an Output Restriction:
 - Consumer surplus = ABP^*
 - Producer surplus = $OFBP^*$
 - Government revenue = ?

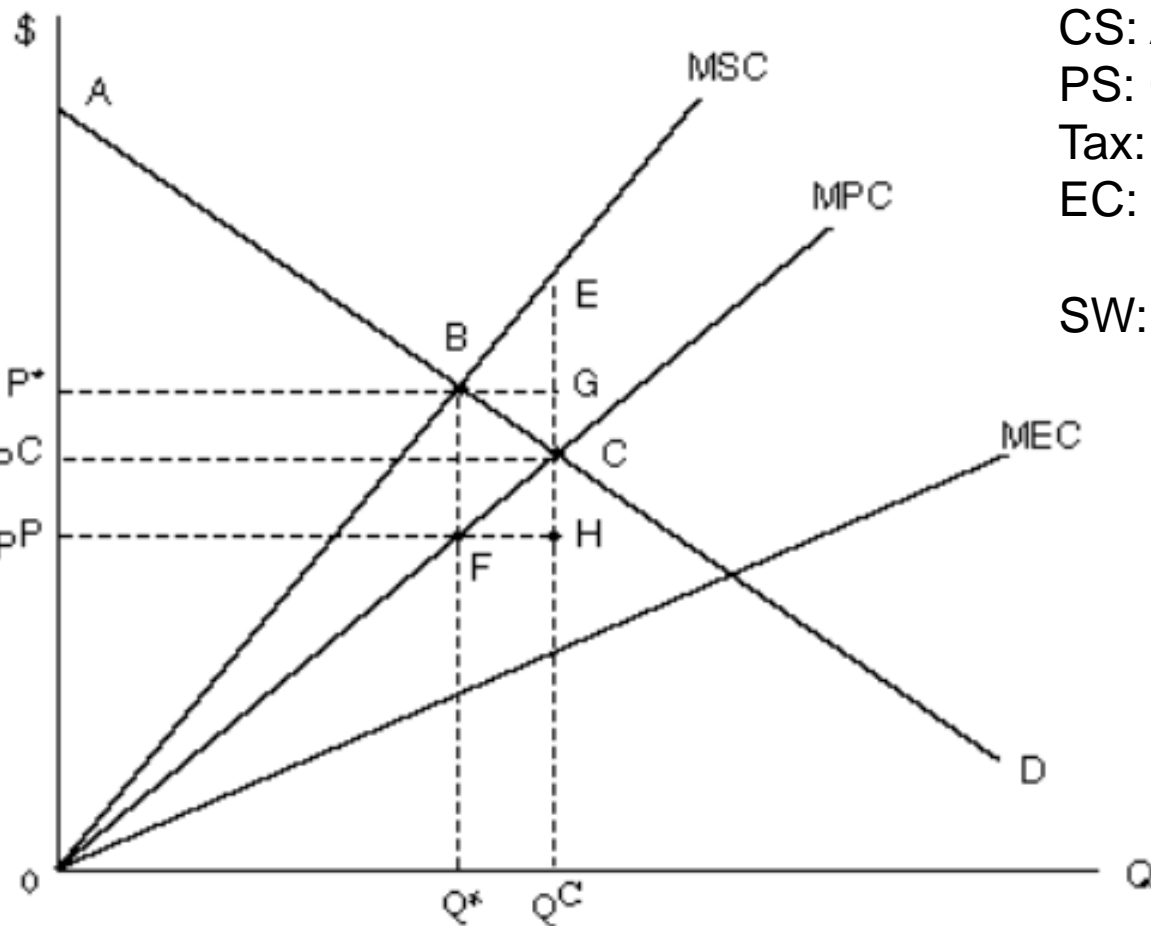


MBIs: Production Tax

- The government can impose a tax on production
 - An Externality Tax of $t^* = P^* - P^P$.
- From the graph, we know that t^* will achieve Q^* units of production.
 - The firm treats the tax rate as an additional component of its marginal private cost
 - A unit tax of t^* shifts the MPC curve upwards in a parallel fashion by the distance t^*



Tax Rate



After tax equilibrium:

CS: ABP^*

PS: OFP^P

Tax: P^*P^PFB

EC: OBF

SW: ABO



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MBIs: Production Tax

- The optimal tax (i.e. the one that achieves Q^*) is clearly $t^* = MEC(Q^*)$.
- Welfare:
 - Consumer surplus= ABP^*
 - Producer surplus= OFP^P
 - Government revenue= P^*BFP^P



Discussion

- Would firms favor pollution tax policies or command-and-control as a way to reduce pollution?
- How about the government?



Production Tax

- Government revenue not only corrects the externality, it also gives the government the opportunity to reduce other, distortionary taxes (such as income taxes or sales taxes) in the economy, thereby eliminating other deadweight losses in the economy.
- However, in practice, the relationship between pollution and production output is often very difficult to estimate with any degree of precision.



Command and Controls (CACs)

- Producers prefer output restrictions to externality taxes, because producers gain a larger share of the total social surplus under output restrictions.
- However, if the legal rights to the production quota can be bought and sold (i.e., if the production quota is **transferable**), then producers will bid against each other for the quota rights until the quota price equals $P^* - P^P$.



MBIs: Tradable Pollution Permits

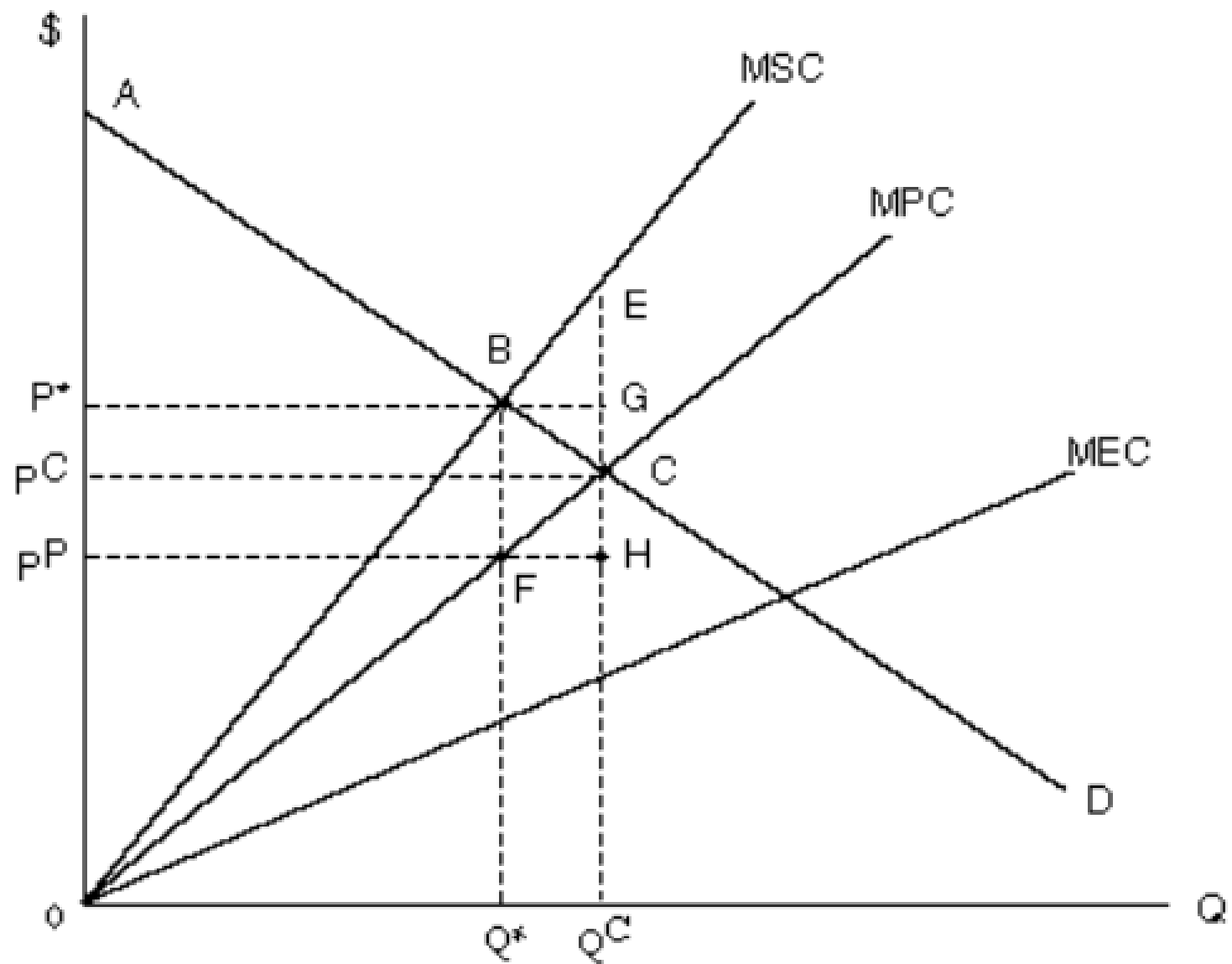
- **Tradable pollution permits** allow the voluntary transfer of the right to pollute from one firm to another.
 - A market of these permits will eventually develop
 - A firm that can reduce pollution at a low cost may prefer to sell its permit to a firm that can reduce pollution only at a high cost.



Tradable Pollution Permits

- Whoever initially had the legal rights to the transferable quota will earn **quota rents** equal to P^*BFP^P by selling the quota rights to producers.
- After paying for the quota rights, producers will be left with surplus = P^PFO .
 - The producer surplus is now the same as it was under an externality tax
 - The quota rents here are equal in size to Government Revenue under the externality tax.





Quota Rents

- The government can shift the quota rents from producers to other economic agents (such as consumers, poor graduate students, or even back to the government itself) by choosing who initially gets the legal rights to the transferable quota.



Air Market in the US

- National trading program in SOX from power plants in the US
 - Cap and trade
 - Auction of some rights
 - <https://www.epa.gov/airmarkets/allowance-markets>
 - <https://www.epa.gov/airmarkets/so2-allowance-auctions>

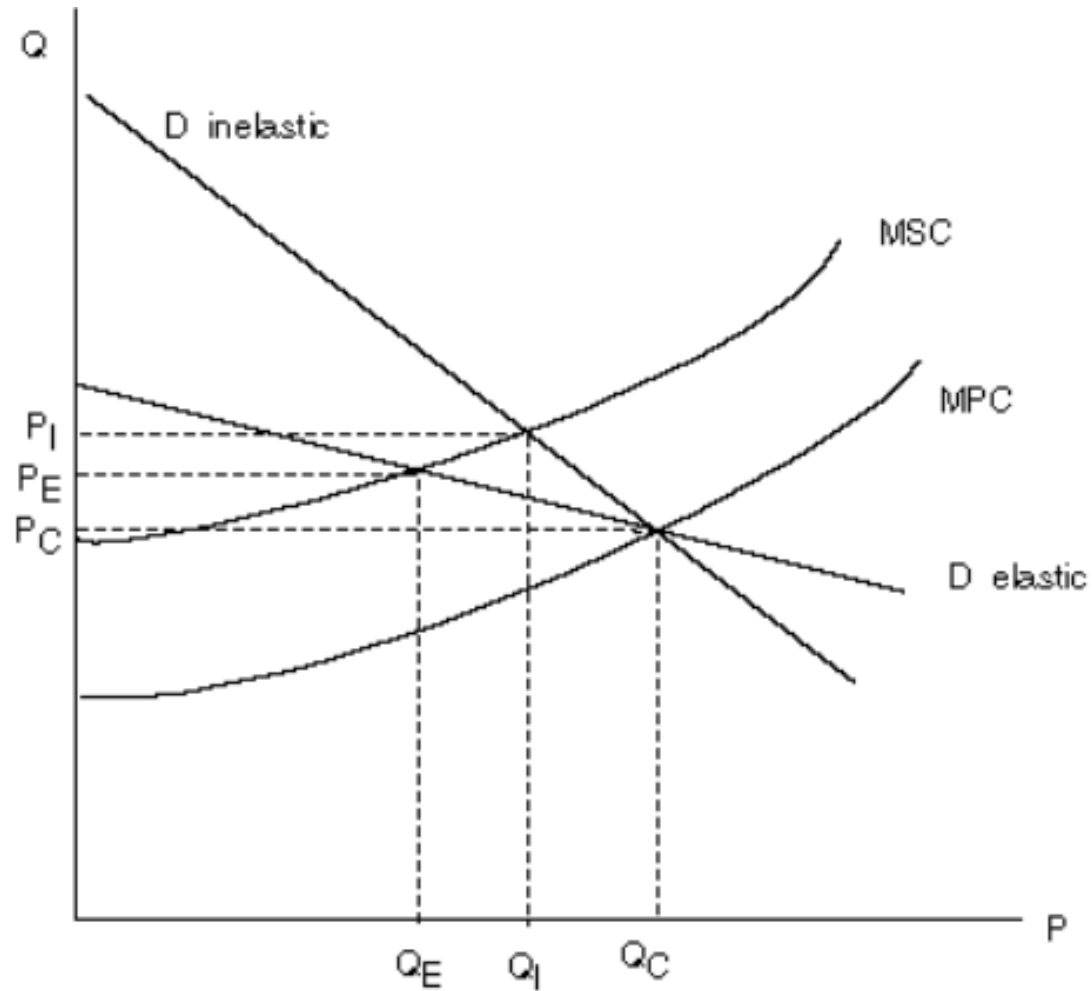


Elasticity and Externality

- Draw a regular Supply and Demand System with negative externality.
- Find out the perfect competitive equilibrium.
- Draw a steeper Demand curve that also crosses the equilibrium
- Discussion:
 - Compare the social optimum for both cases, and what can you tell about the difference between social optimal and competitive equilibrium?
 - Is it possible that the producer actually like regulation?



Elasticity and Externalities



P_c, Q_c = competitive price and quantity in the market

P_i, Q_i = socially optimal price and quantity when demand is inelastic

P_e, Q_e = socially optimal price and quantity when demand is elastic

Elasticity and Externalities

- When demand is inelastic, the socially optimal level of production, Q_i , is not too far from the competitive level of production, Q_c .
- Under conditions of highly inelastic demand, the inefficiency associated with a production externality may be small, so that it may not be worth regulating the externality.
- Depending on the value of the demand elasticity, producer profit may actually increase under pollution regulation.



Elasticity and Externalities

- If demand for the final product is inelastic, then a regulation that decreases production, such as a quota/standard designed to reduce pollution, will increase the market price a lot.
- In such case, producers may actually desire regulation!

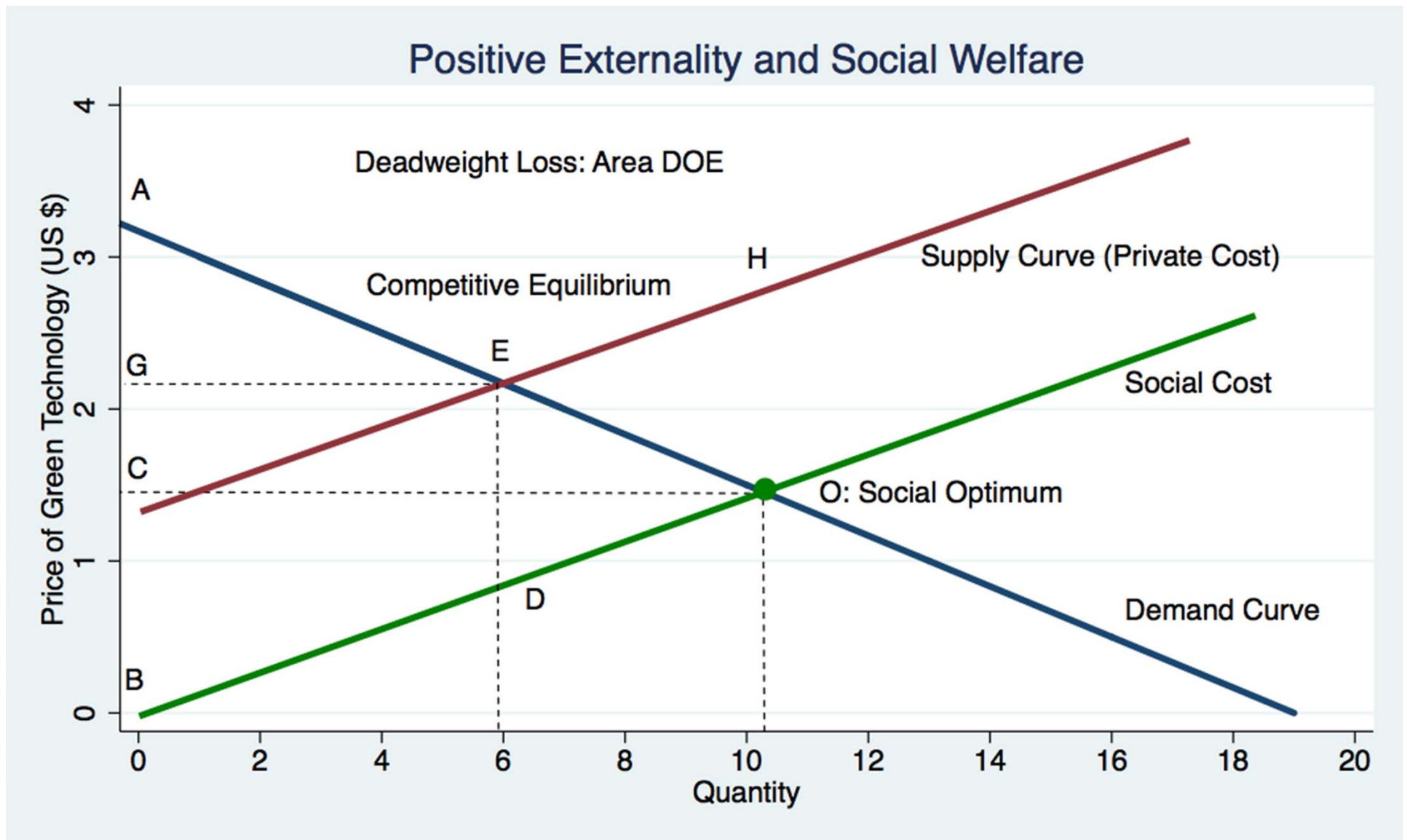


Positive Externality: Technology Spillover

- When an externality *benefits* the bystanders, a positive externality exists.
- The social costs of production are less than the private cost to producers and consumers.
 - A **technology spillover** is a type of positive externality that exists when a firm's innovation or design not only benefits the firm, but enters society's pool of technological knowledge and benefits society as a whole.



Technology Spillover



Positive Externalities in Production

- The intersection of the demand curve and the social-cost curve determines the optimal output level.
- The optimal output level is more than the equilibrium quantity.
- The market produces a smaller quantity than is socially desirable.



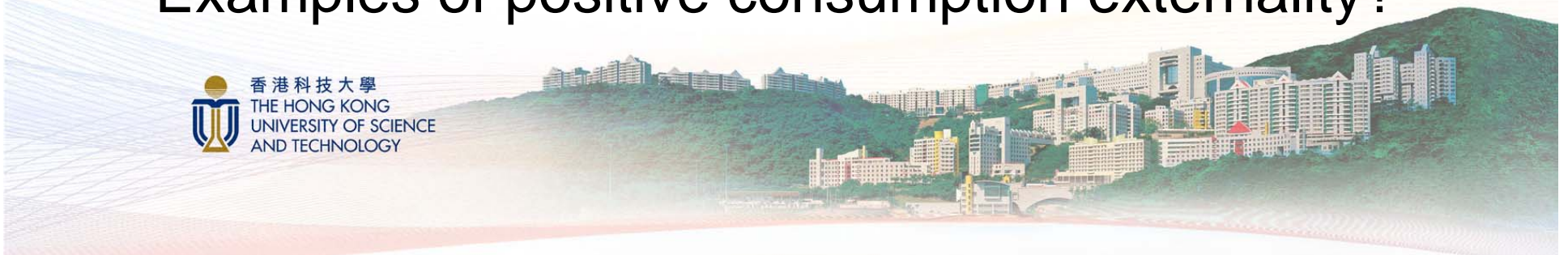
Internalizing Externalities: Subsidies

- Government often uses **subsidies** as the primary method for attempting to internalize positive externalities.
- Government intervention in the economy that aims to promote technology-enhancing industries is called technology policy.
 - *Patent laws* are a form of technology policy that give the individual (or firm) with patent protection a property right over its invention.



Consumption Externality

- Consumption may also create externalities.
- When consumption externalities exist, the social value to a product differs from private value (the demand curve)
- Examples of negative consumption externality?
- Examples of positive consumption externality?



Externalities and Market Inefficiency

- Negative externalities in production or consumption lead markets to produce a larger quantity than is socially desirable.
- Positive externalities in production or consumption lead markets to produce a smaller quantity than is socially desirable.

