Environmental and Natural Resource Economics

Externalities & Economic Policy

Kostas Dellis
kdellis@aueb.gr

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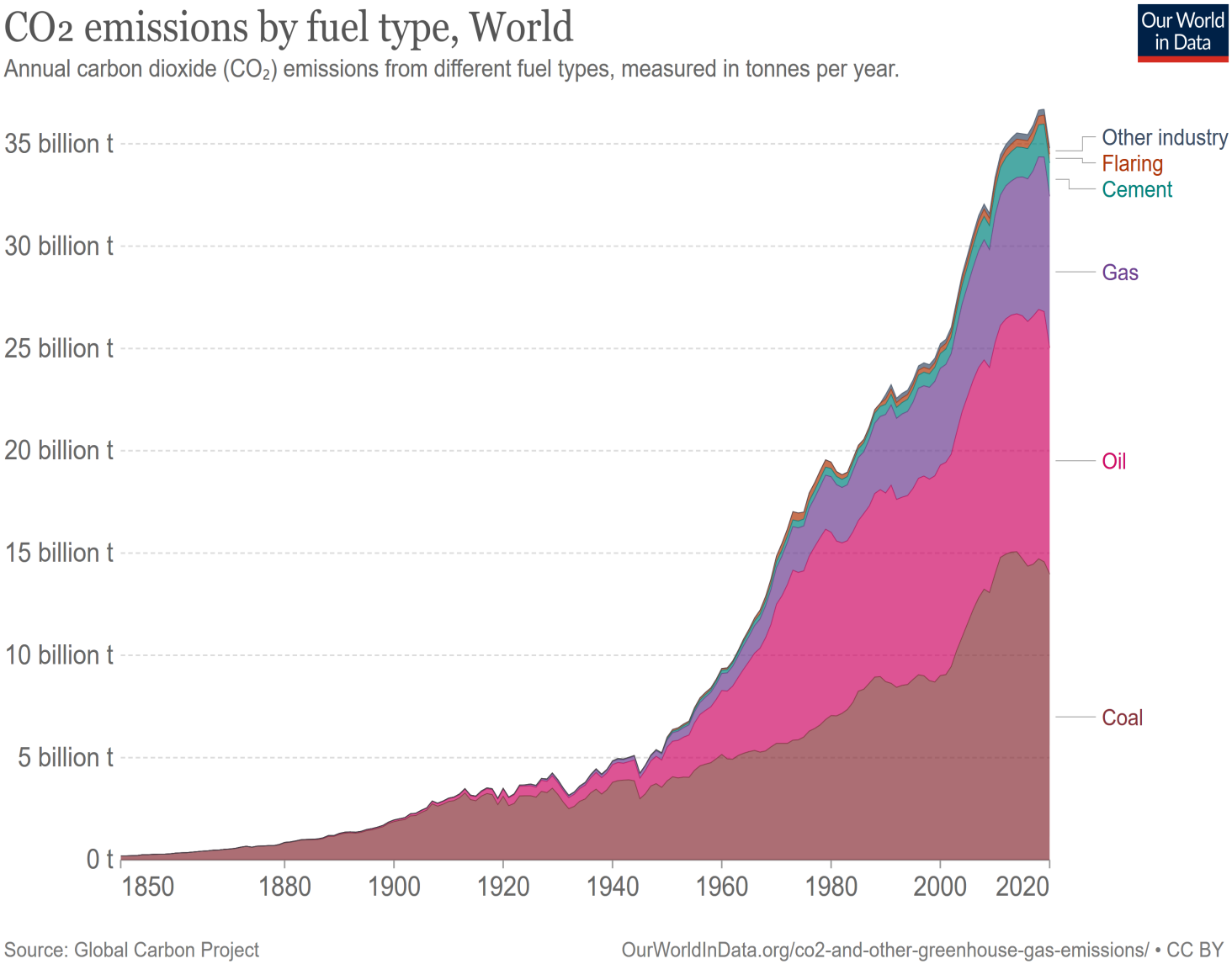
- Importance of *Trade-offs & (dis)Incentives*

CO2 Emissions



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- Inefficient Outcome $\rightarrow$ (*the right*) Government Intervention

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  - Distortion of Economic Freedom

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- Each Economic Policy (& System) is evaluated in terms of
  - **Efficiency**
  - **Justice**
  - **Freedom**

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Definition

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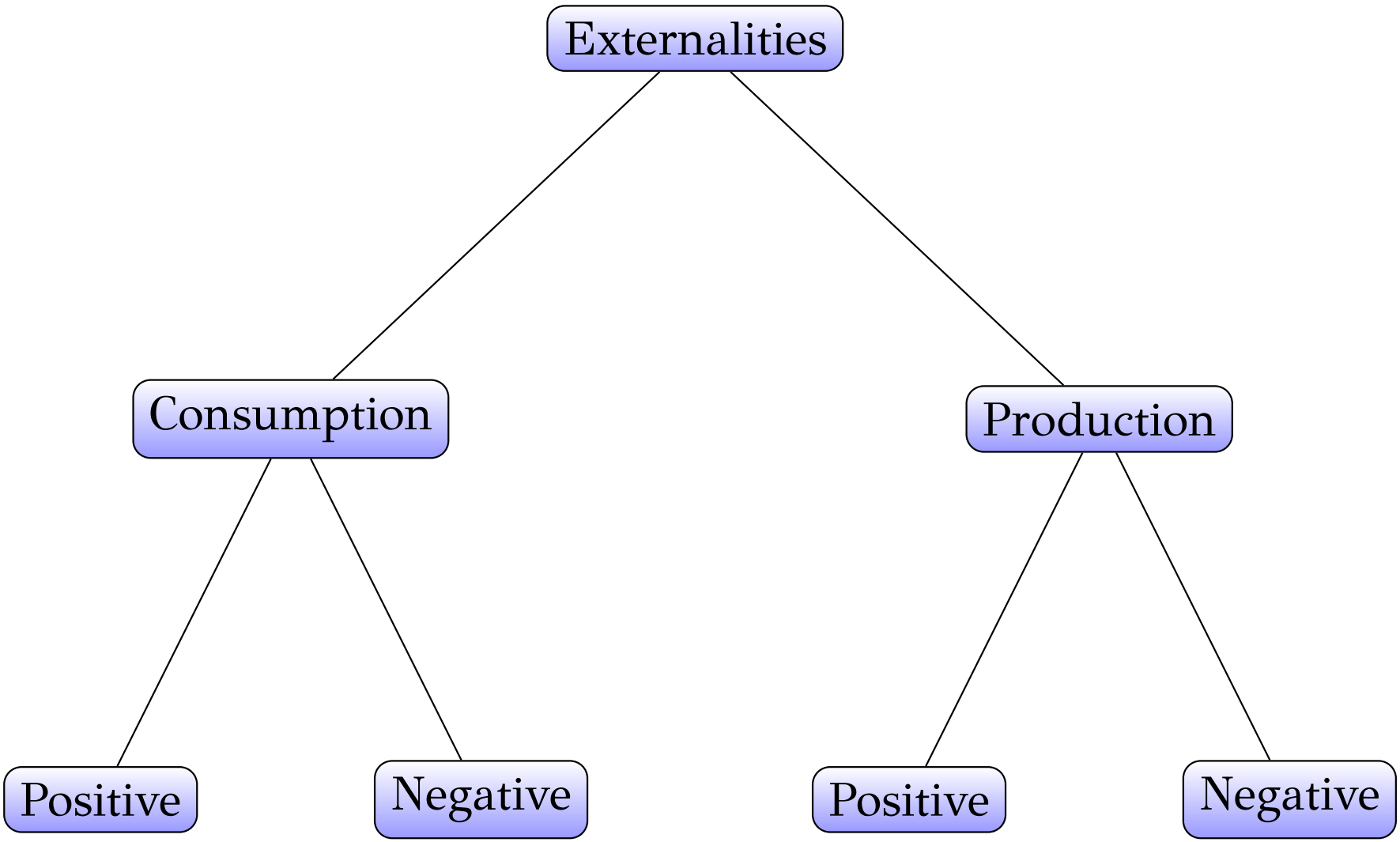
- Externalities are one important case of *market failure*

Externalities Classification



Externalities Fundamentals

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- **Production Externalities:** Private vs Social Cost
  - Positive Externalities: $MSC < MPC$
  - Negative Externalities $MSC > MPC$
- **Consumption Externalities:** Private vs Social Benefit
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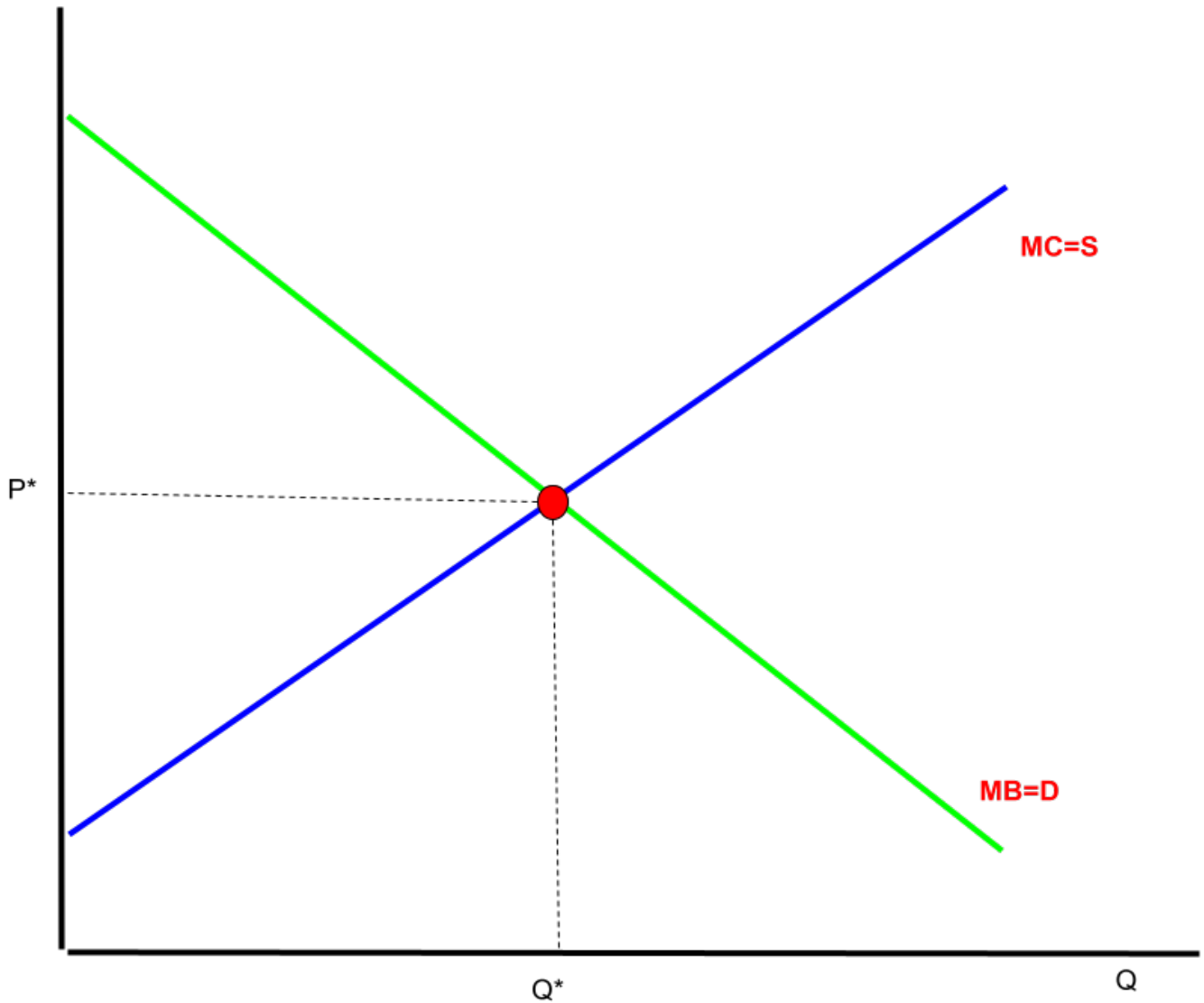
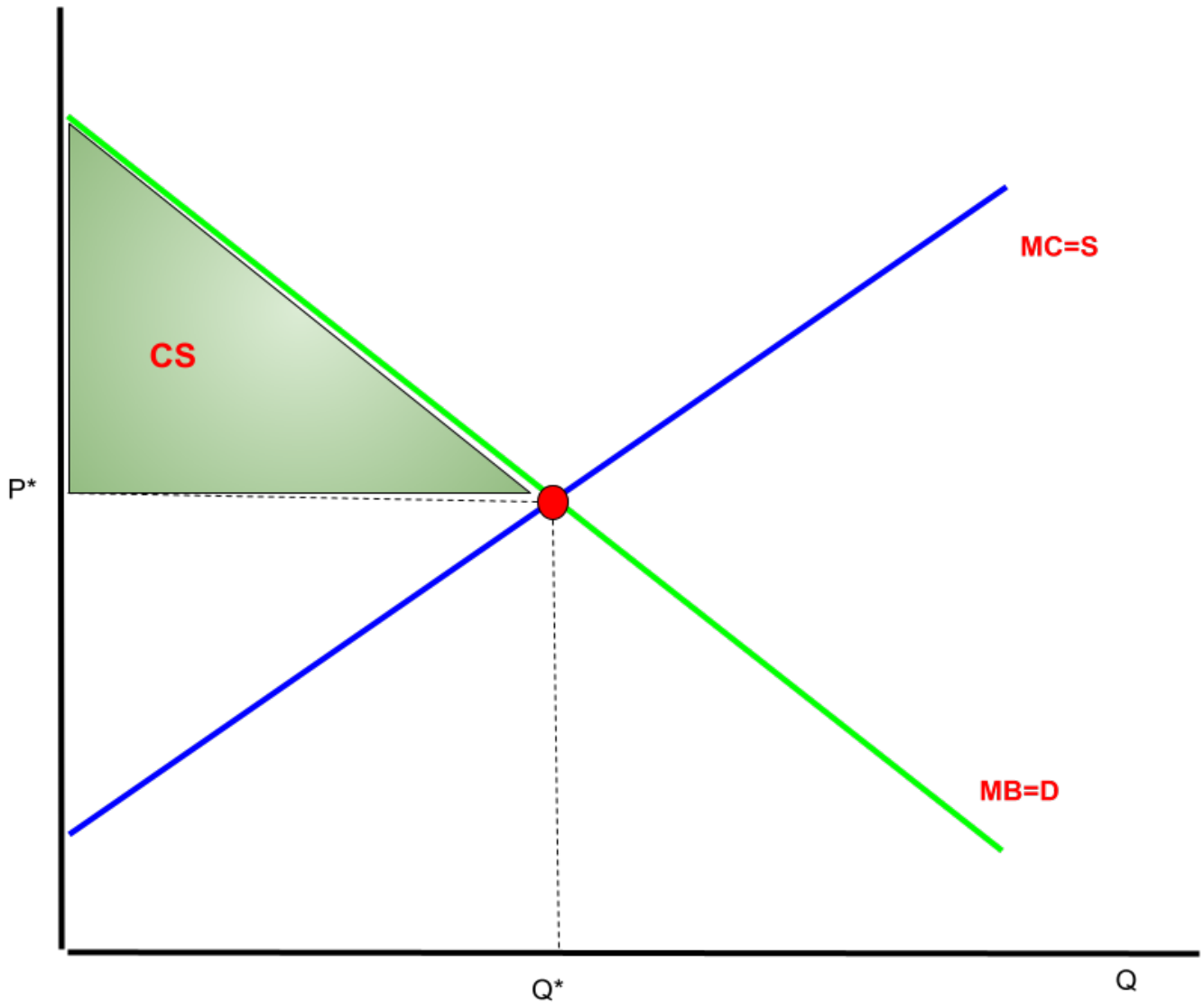
$$MSC = MPC + MD$$

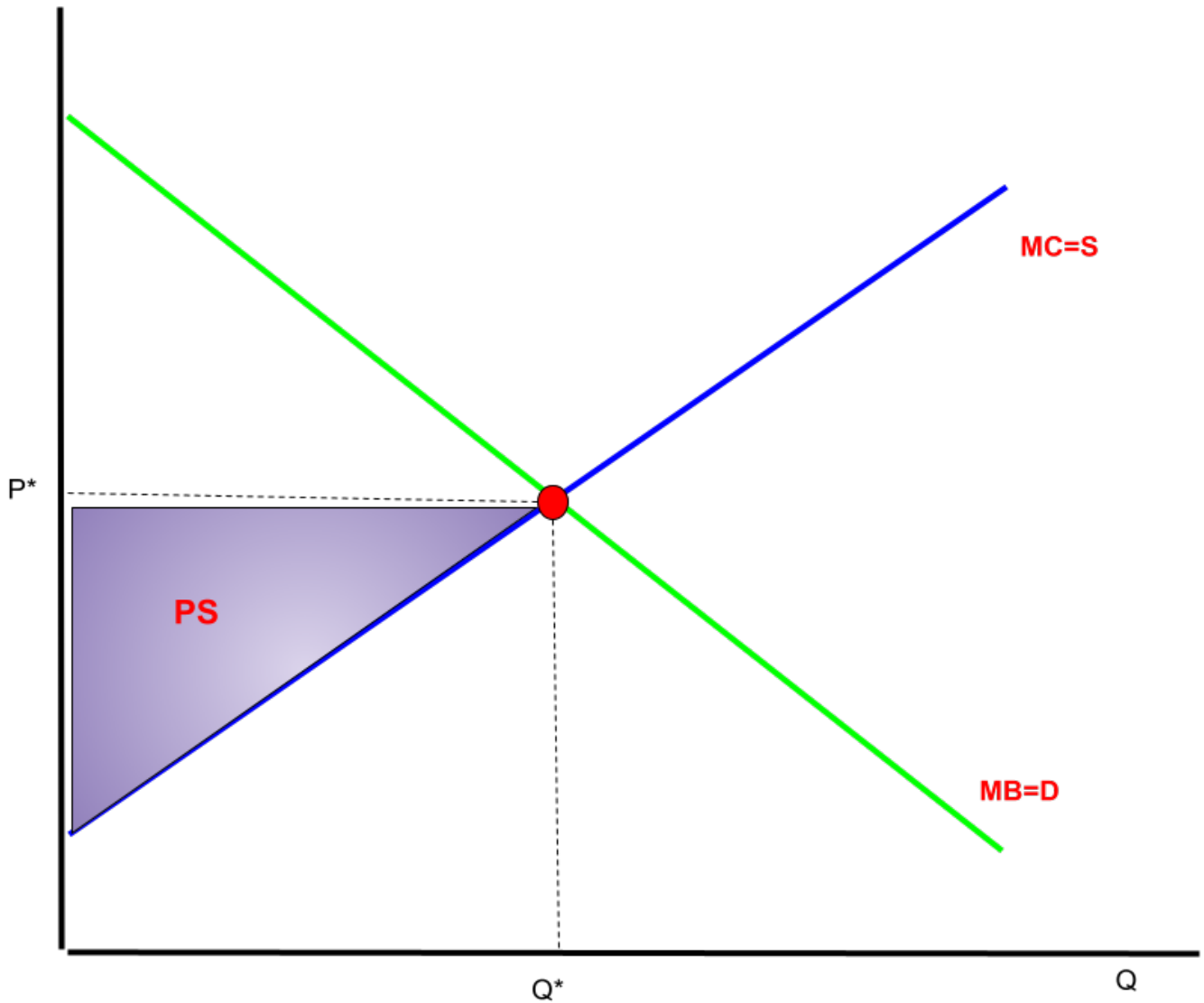
Market Equilibrium



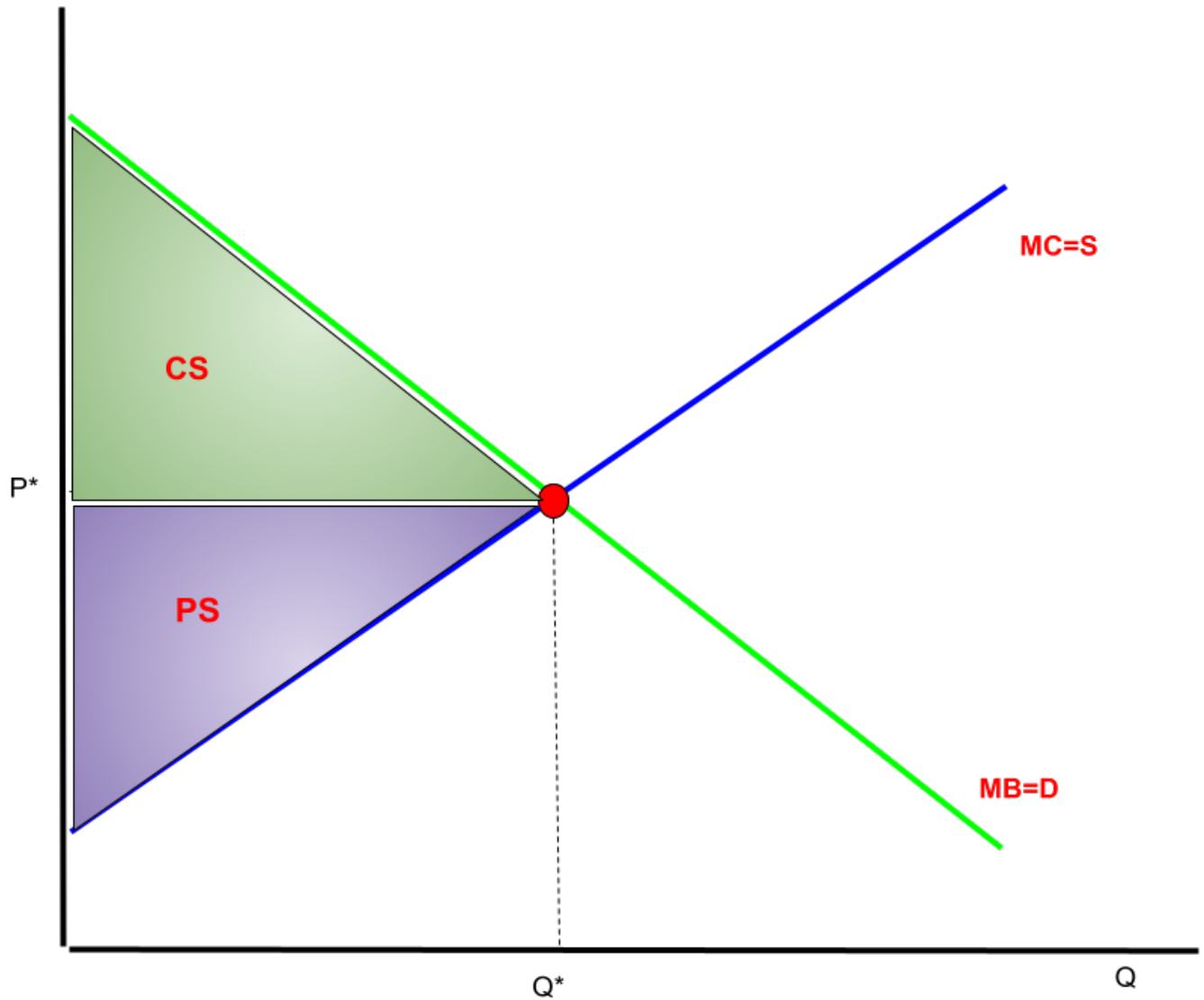
Consumer Surplus



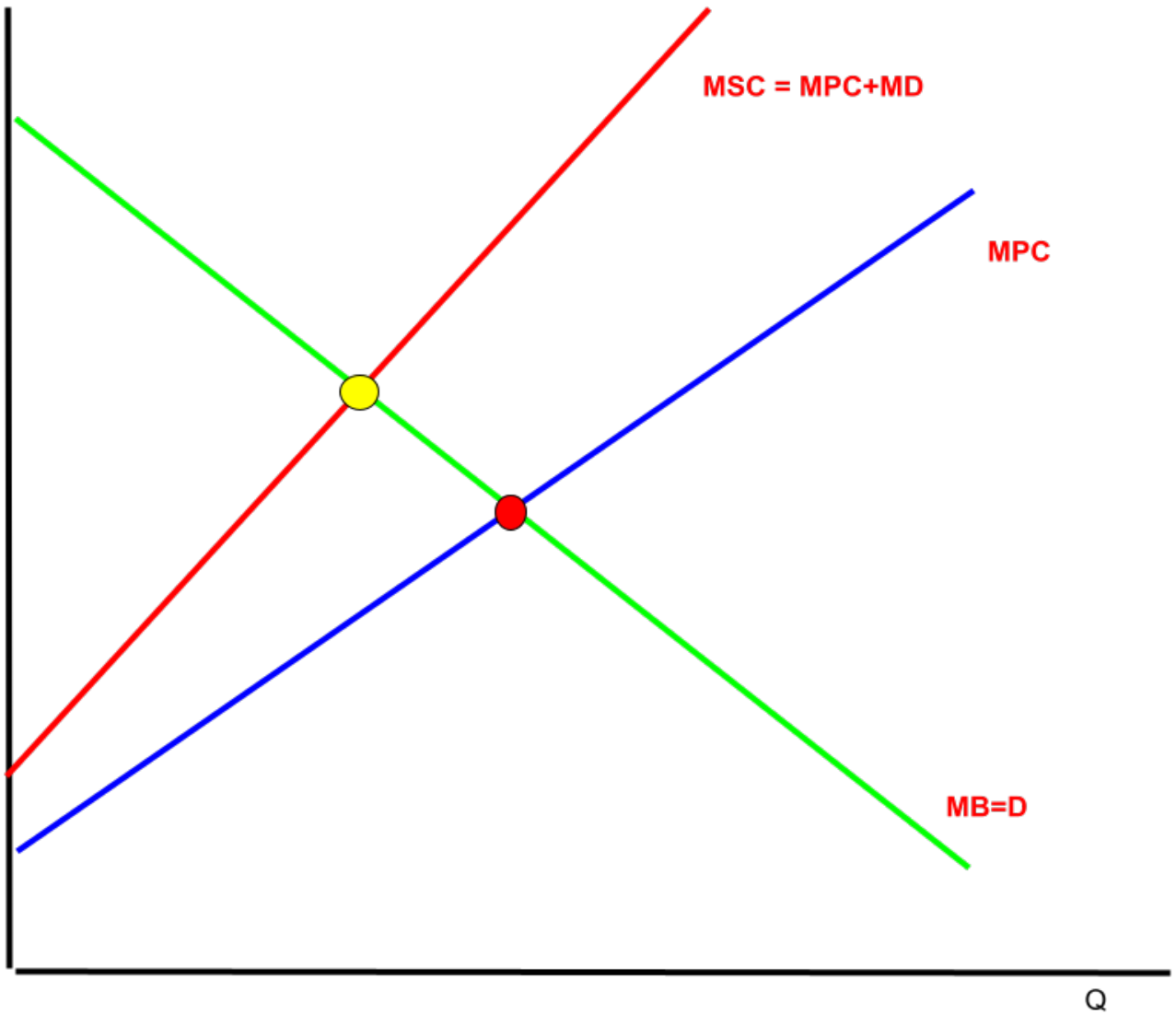
Producer Surplus



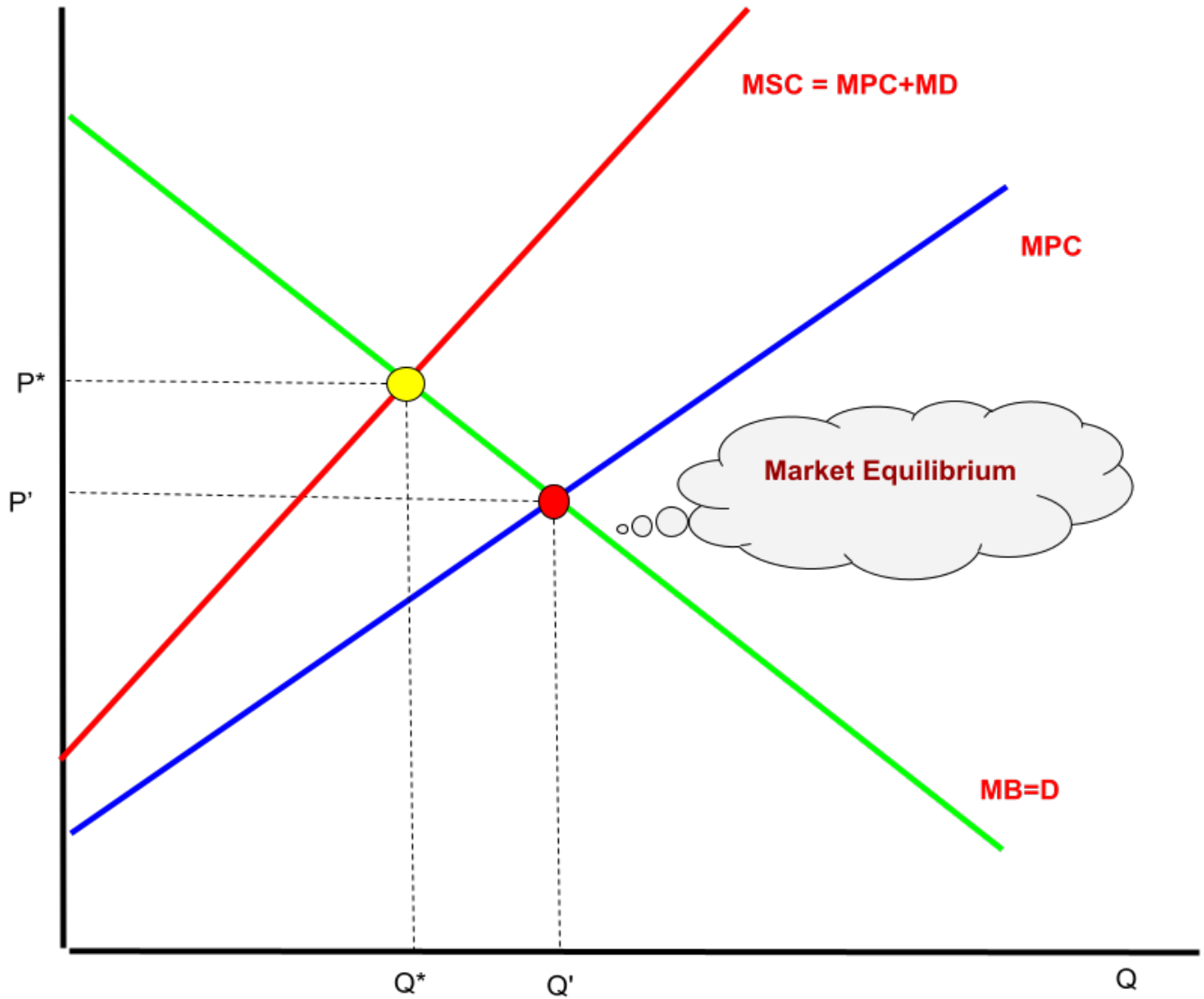
Total Welfare



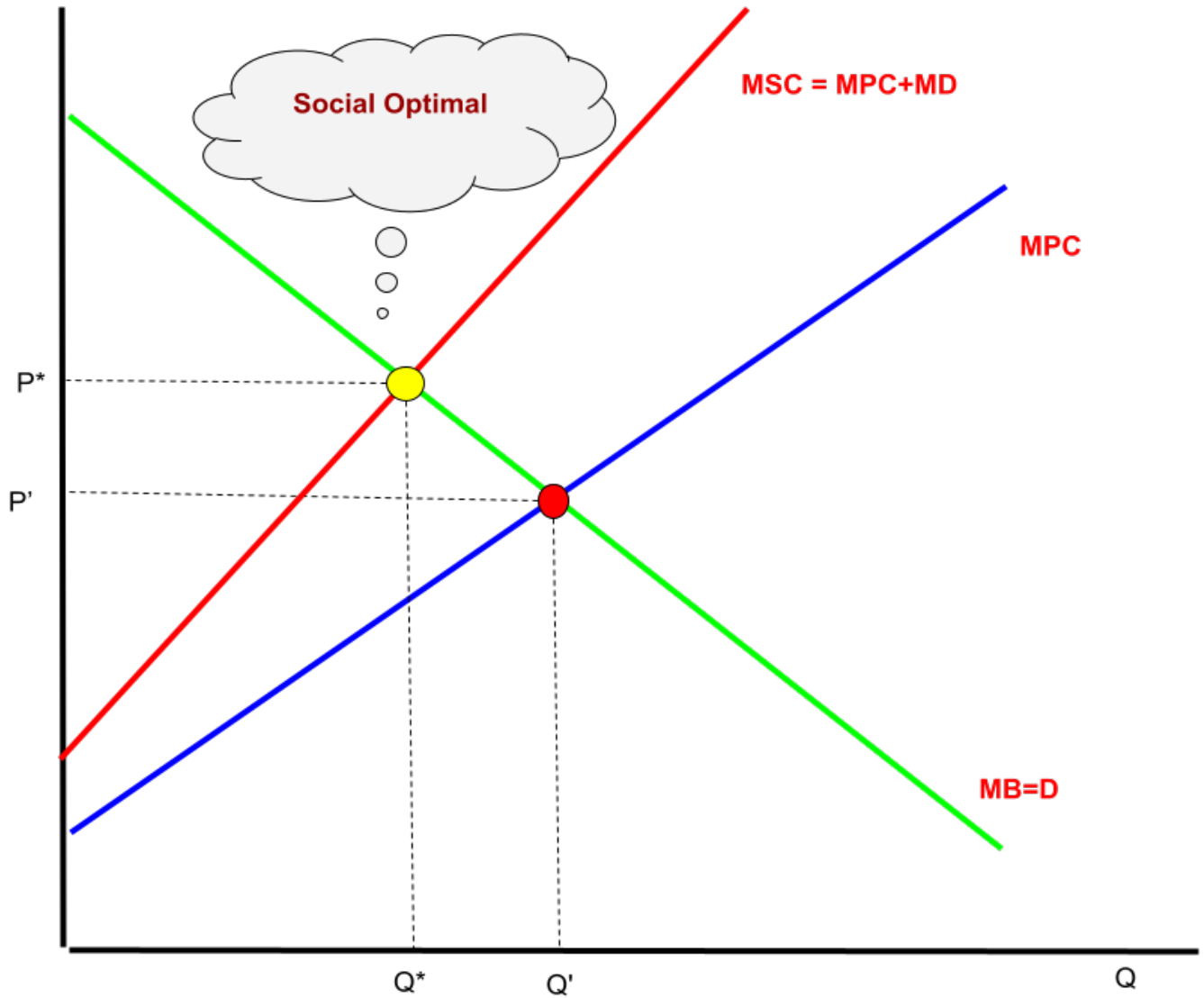
Negative Production Externality



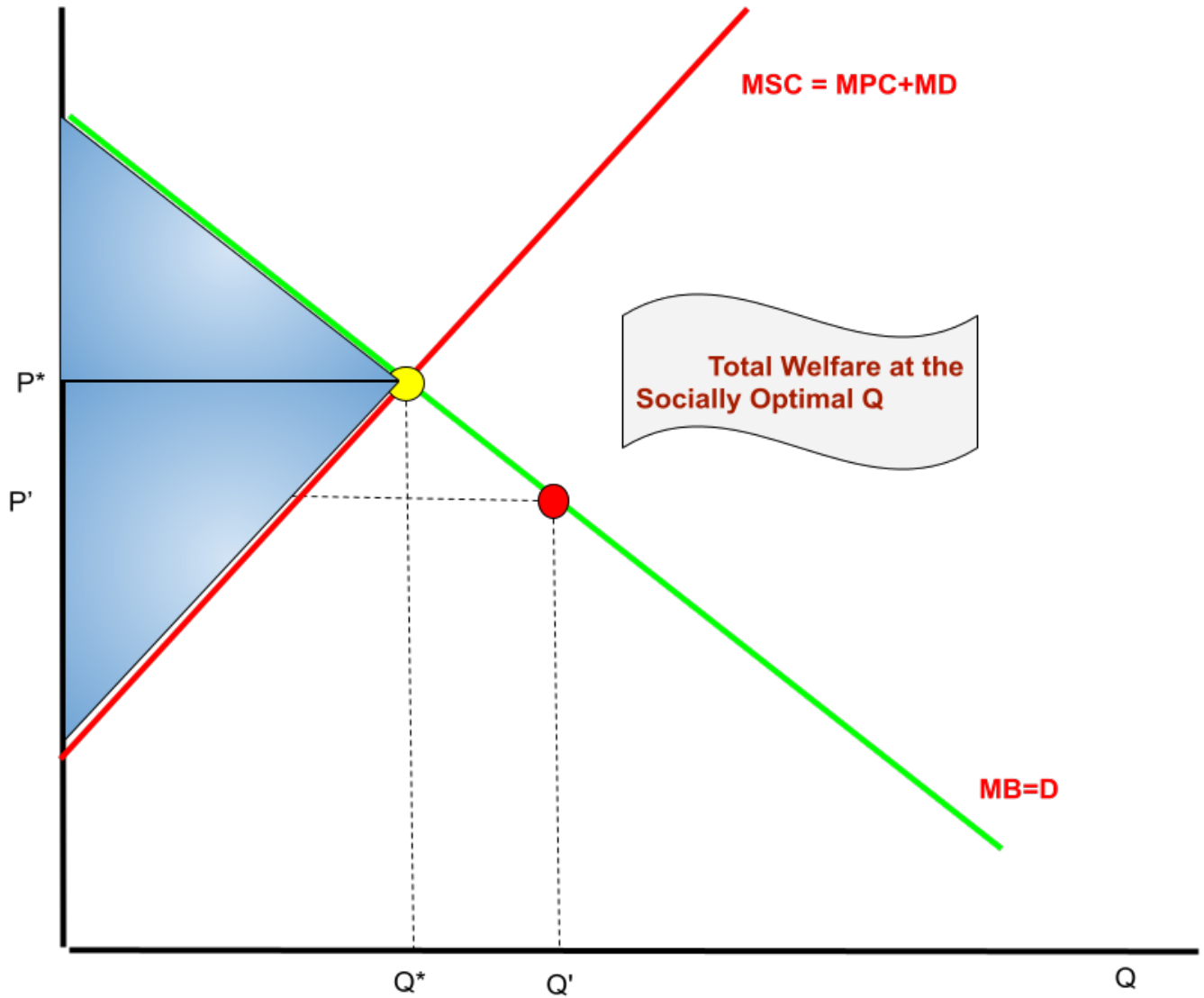
Market (Private) Equilibrium



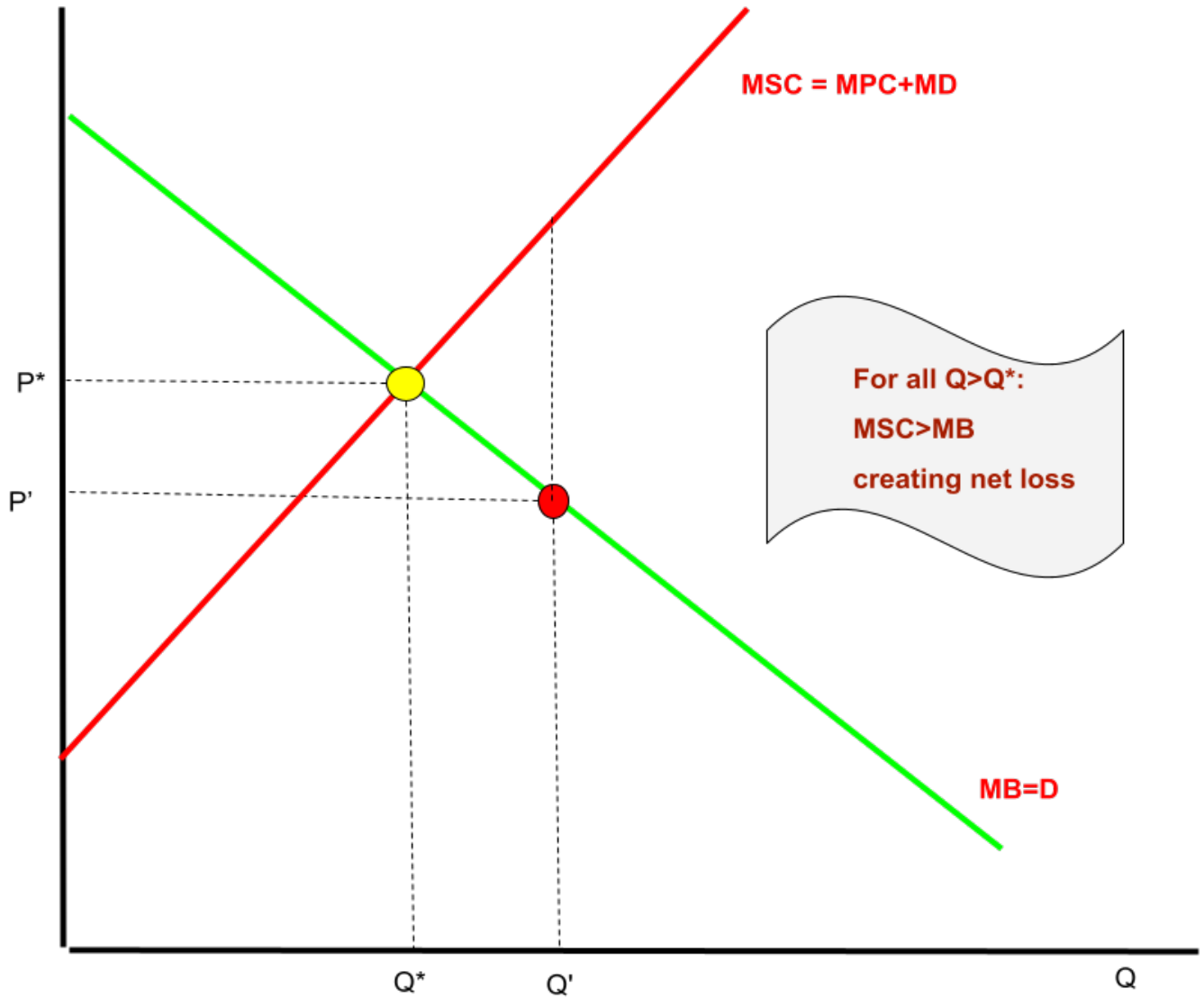
Socially Optimal Equilibrium



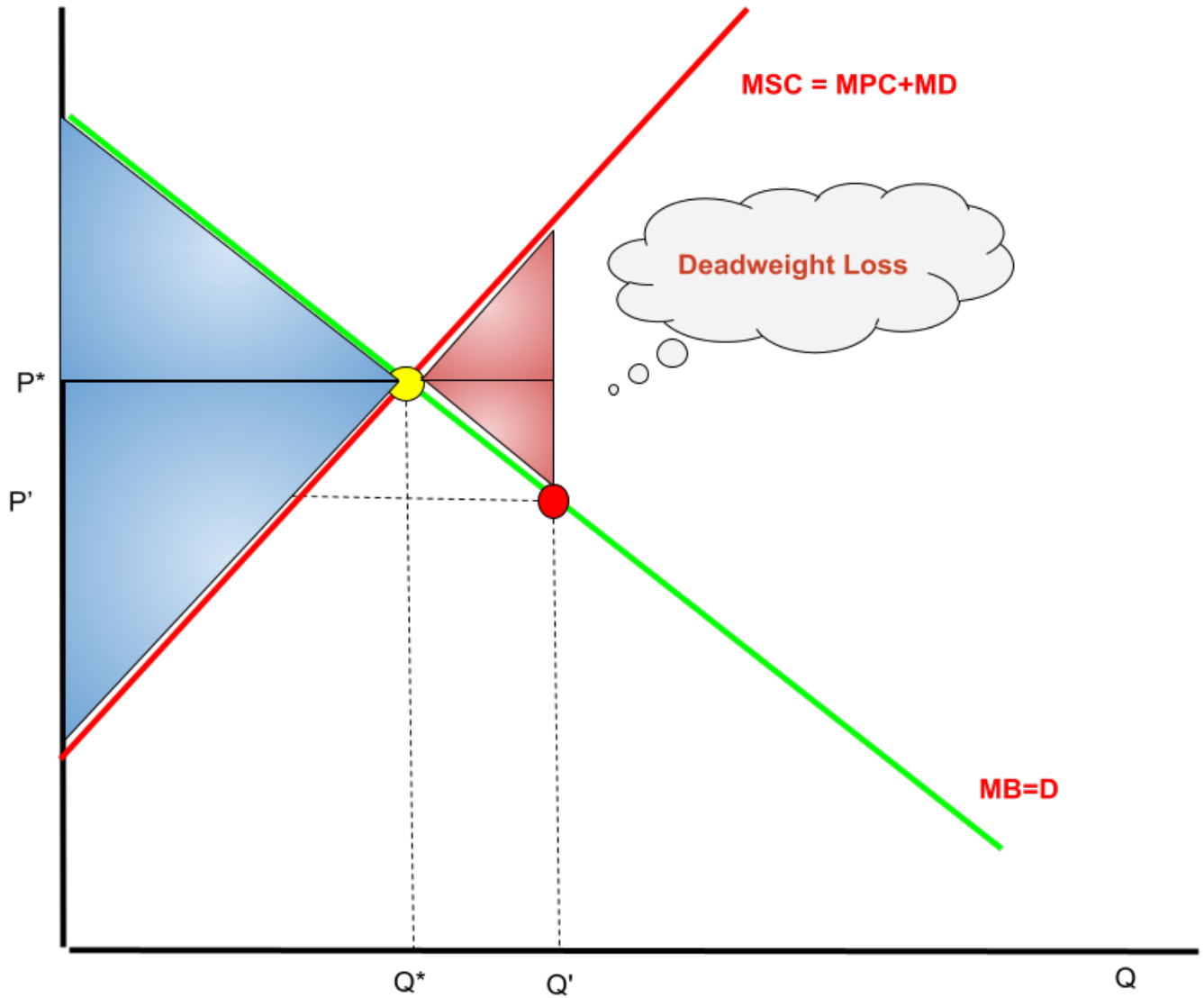
Maximum Welfare



Society's View



Welfare Loss



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  - **Taxes**
  - **Subsidies**
  - **Production Permits (e.g. Carbon Permits)**
  - **Definition of Property Rights**
  - **Market Regulations and Regulatory Bodies**

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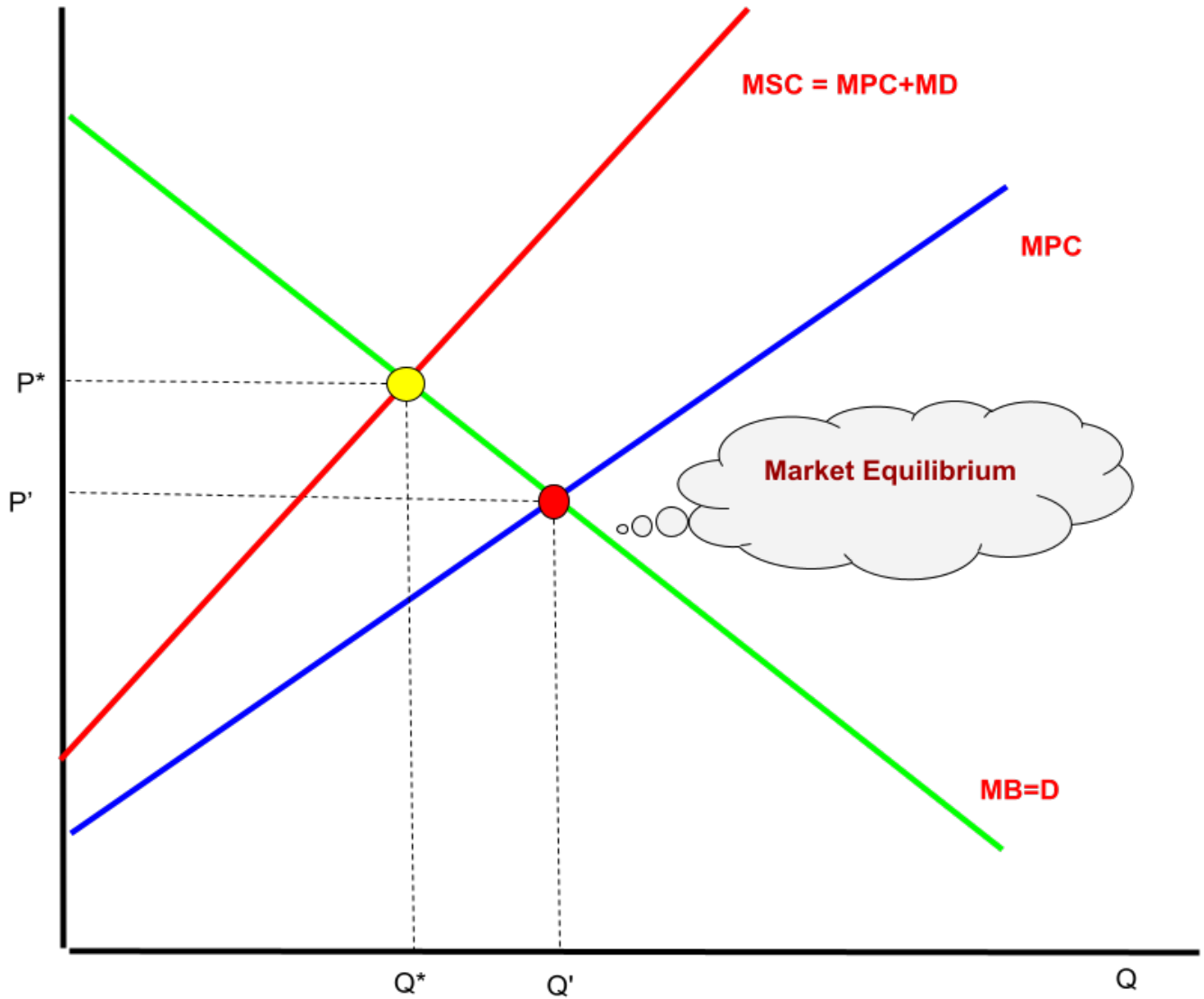
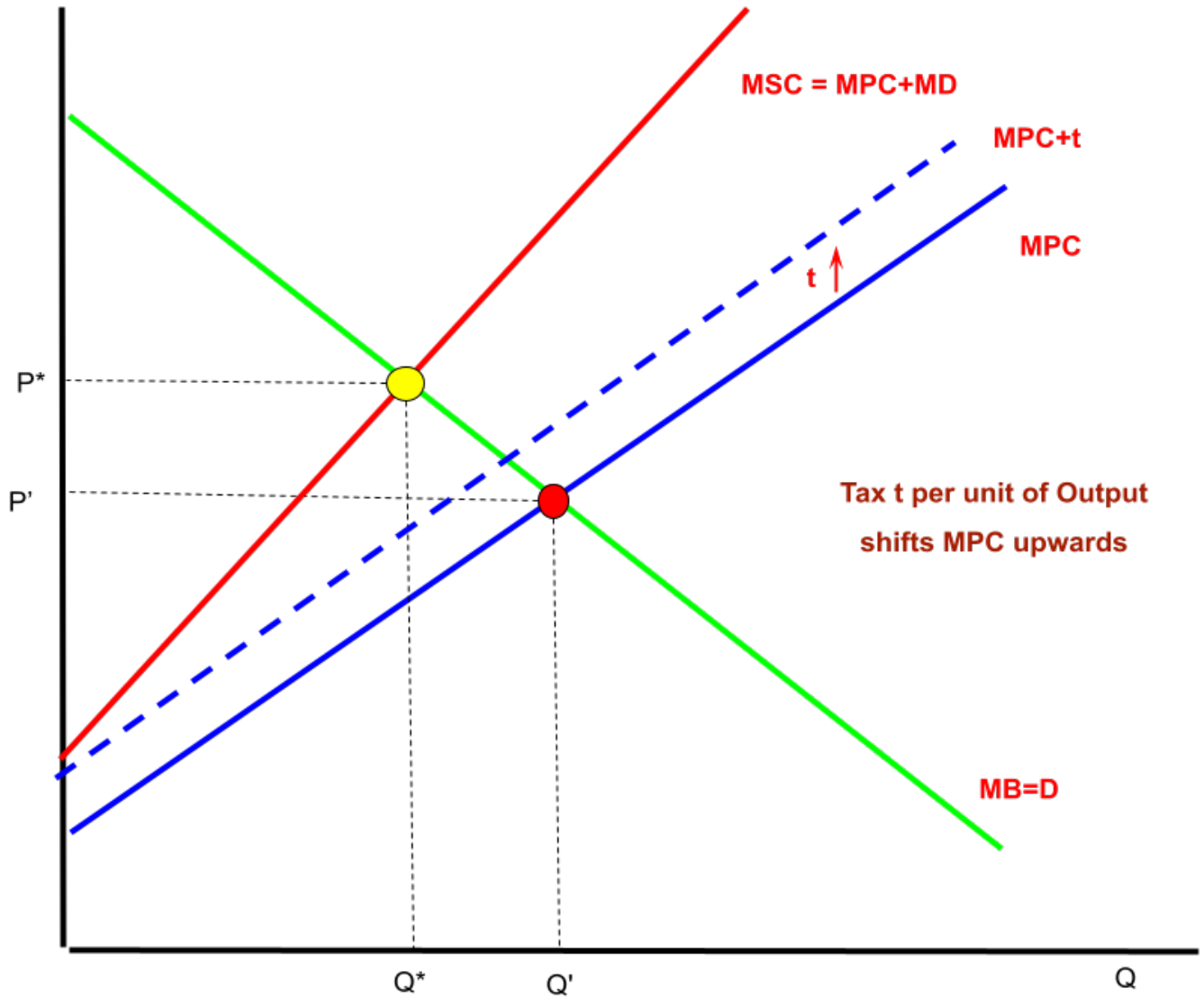
- The *correct* tax rate is equal to the **Marginal Damage (MSC-MPC) at the socially optimal output** ensures Profit Maximization at the Pareto Optimal Equilibrium

$$t = MD(Q*)$$

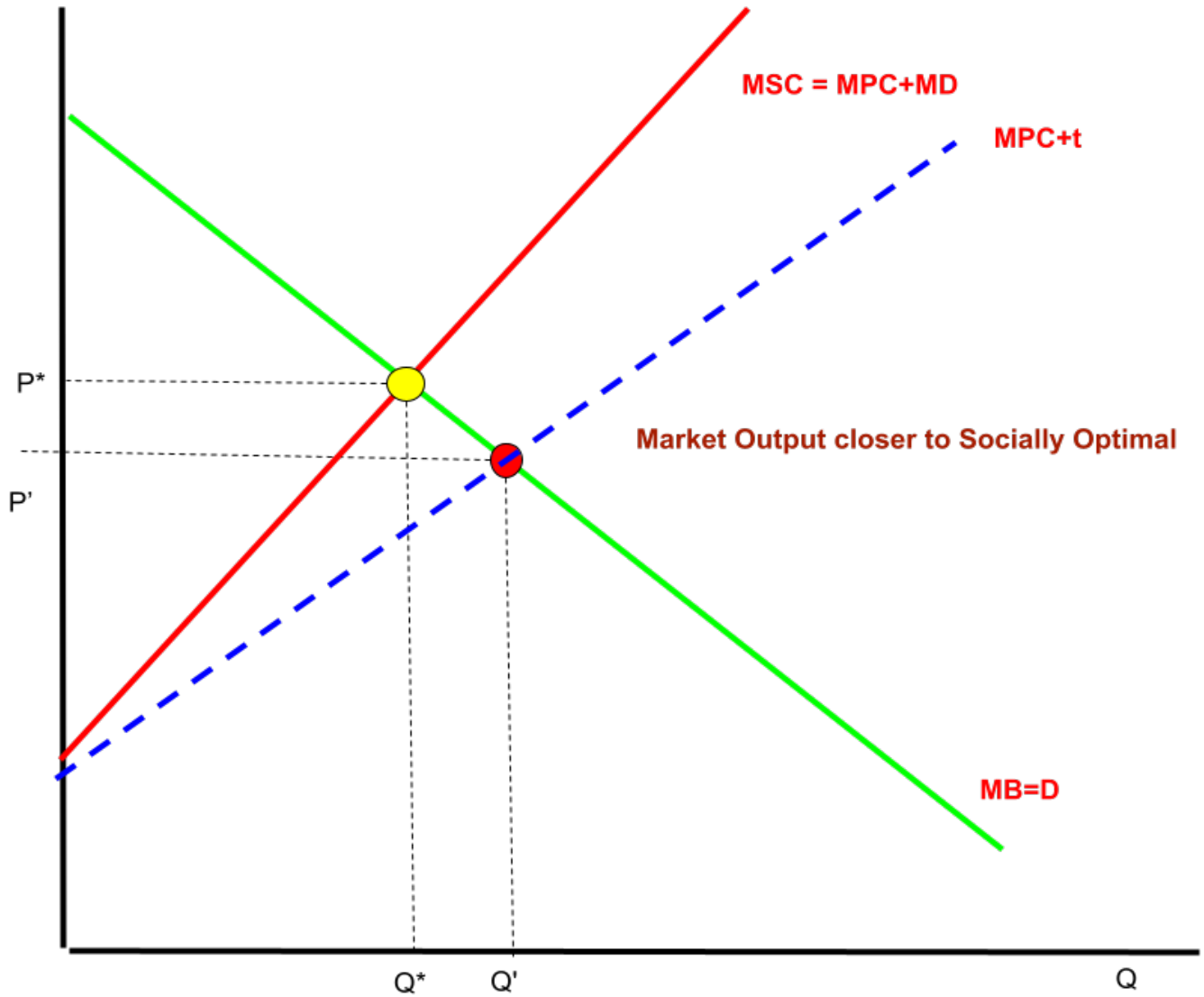
Pigovean Tax 1



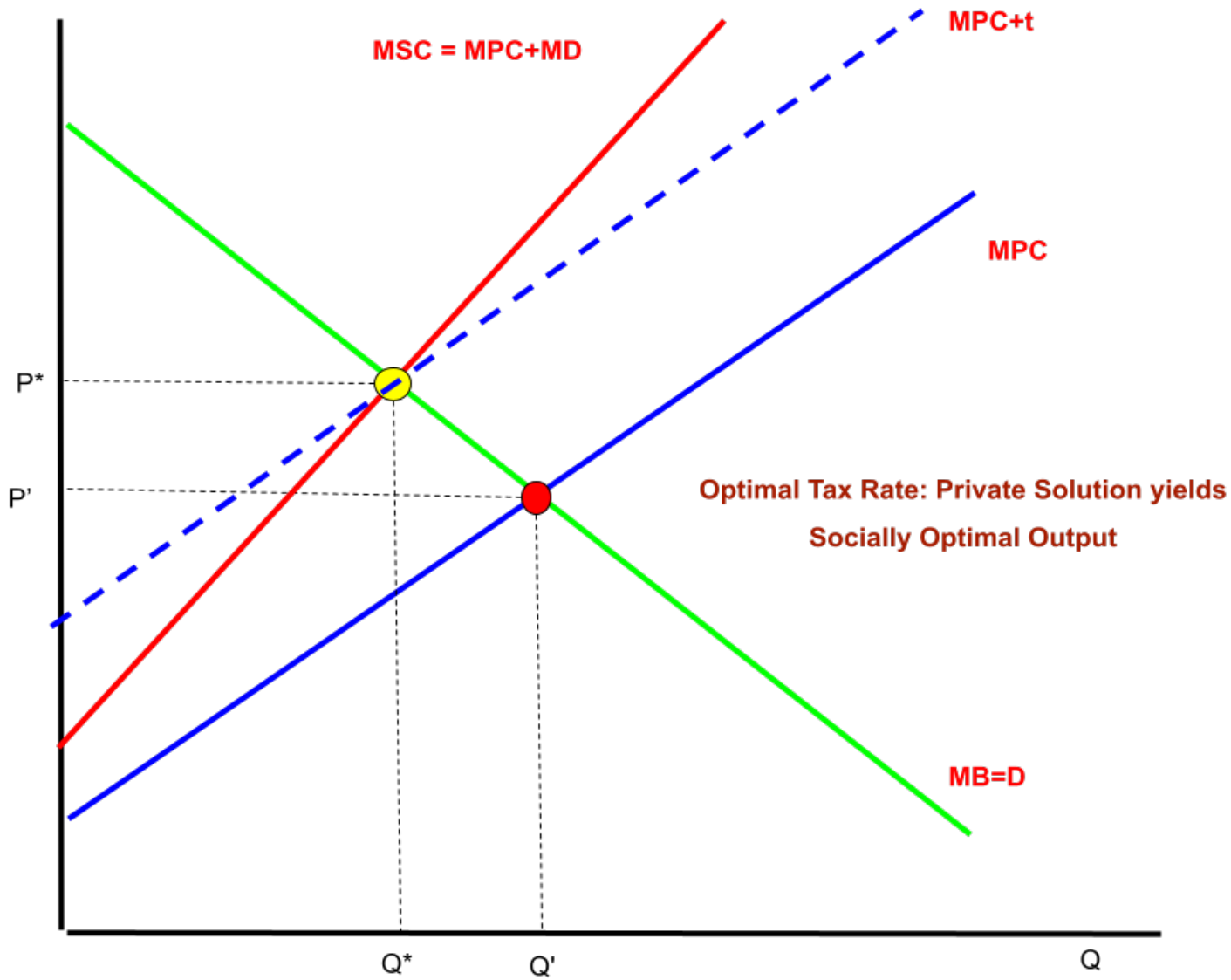
Pigovean Tax 2



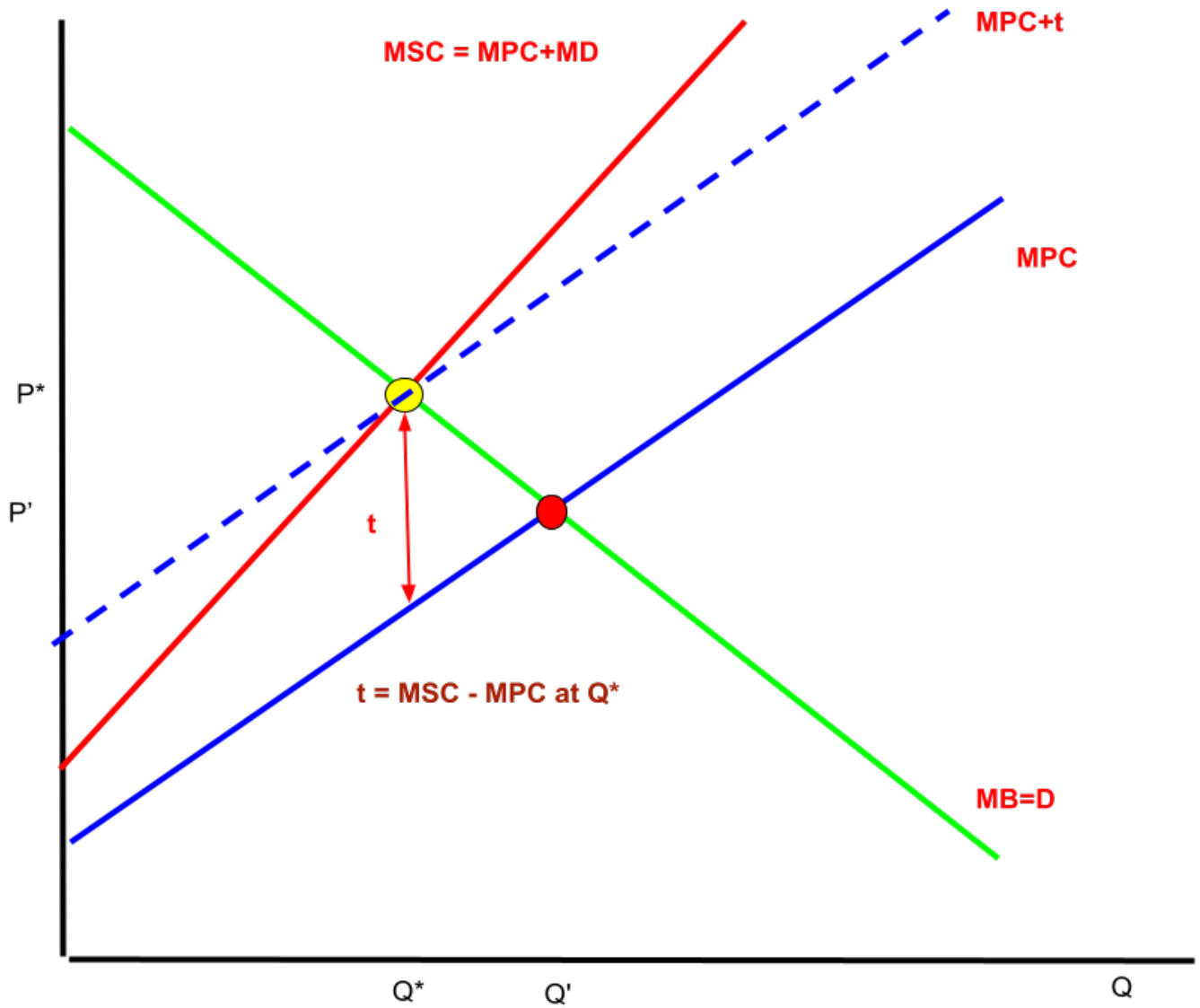
Pigovean Tax 3



Pigovean Tax 4



Pigovean Tax 5



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- Conditional on **Zero Transaction Costs** (*plausible?*)

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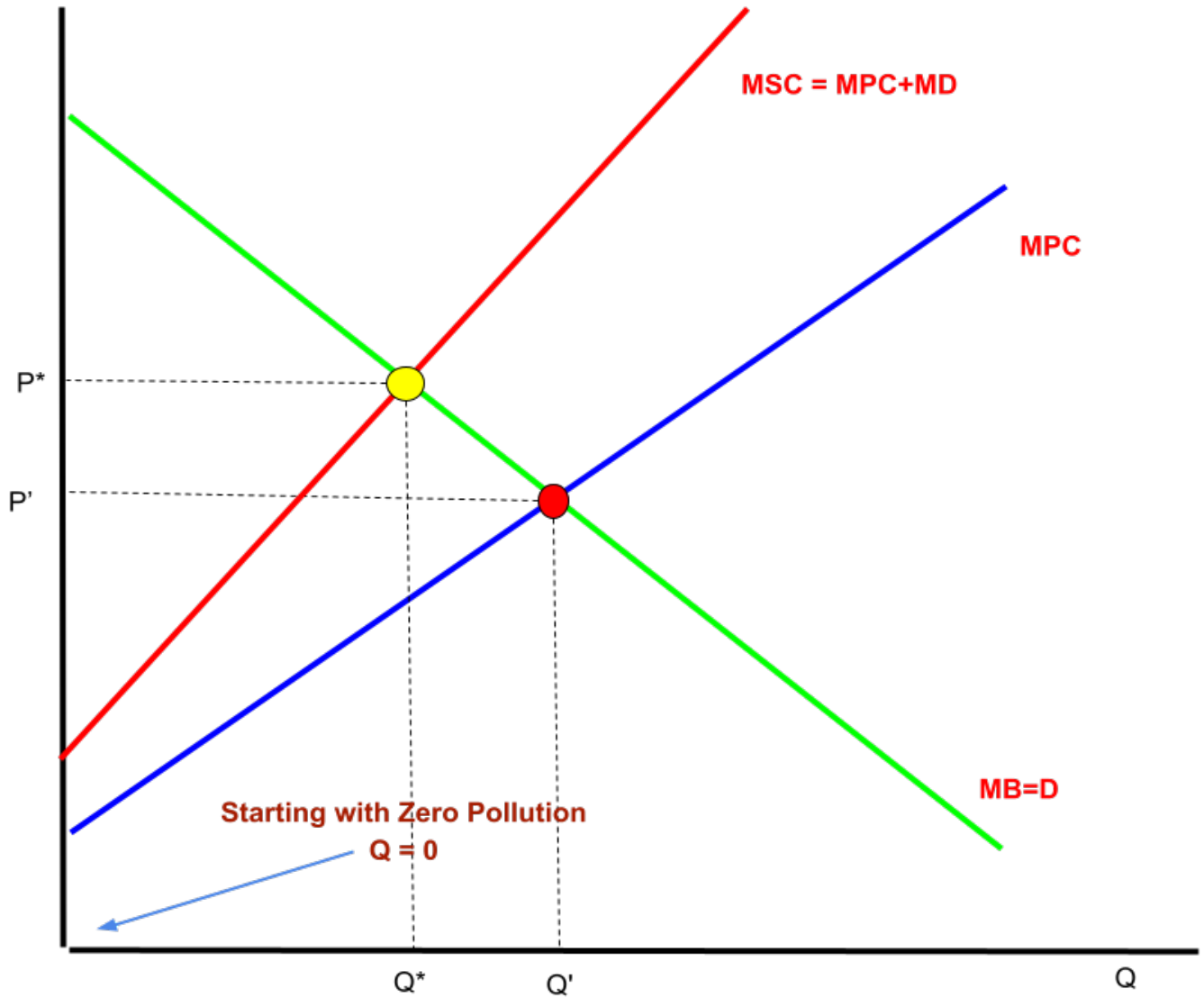
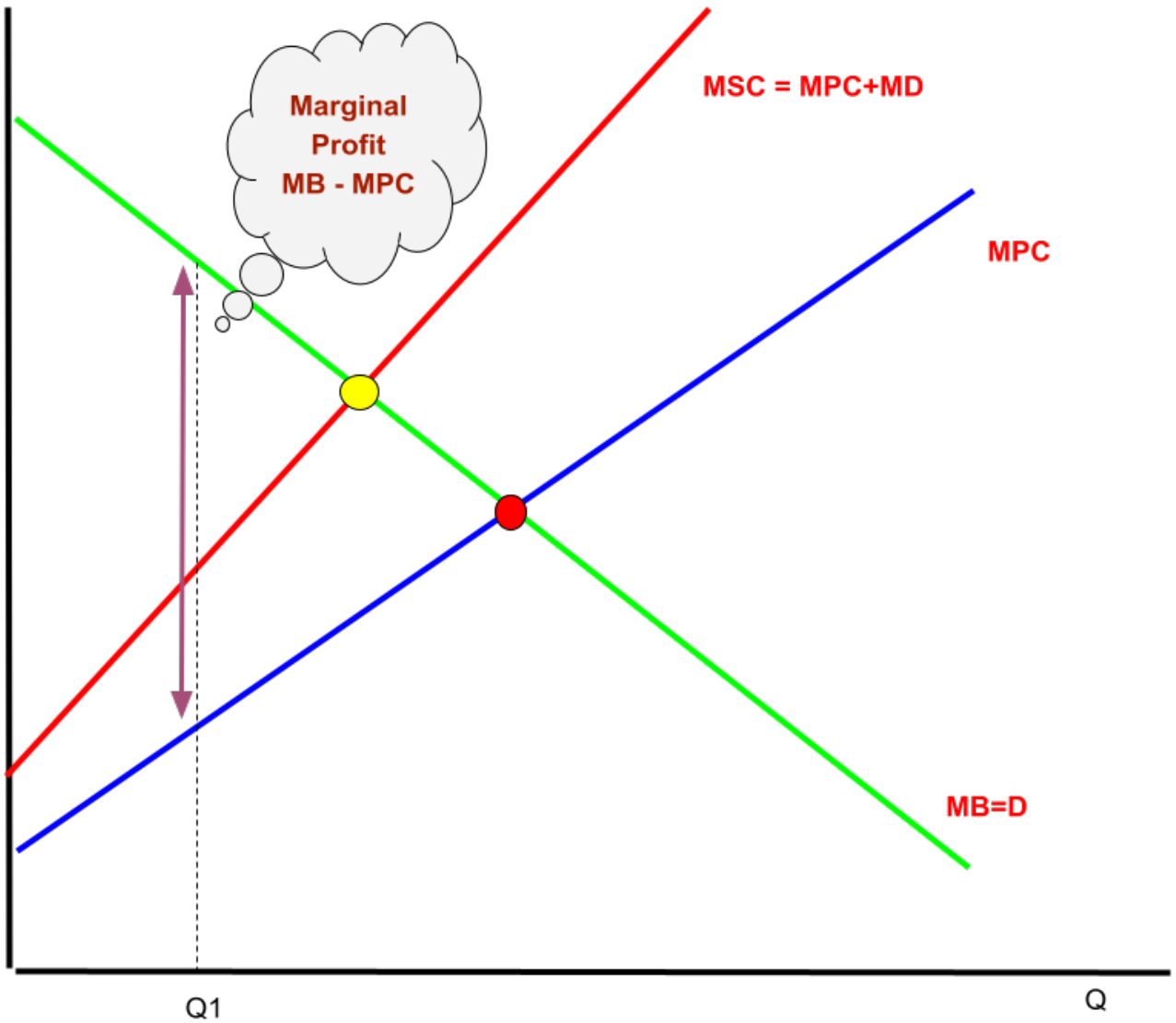
Property Rights awarded to the "Victim"



Firm View



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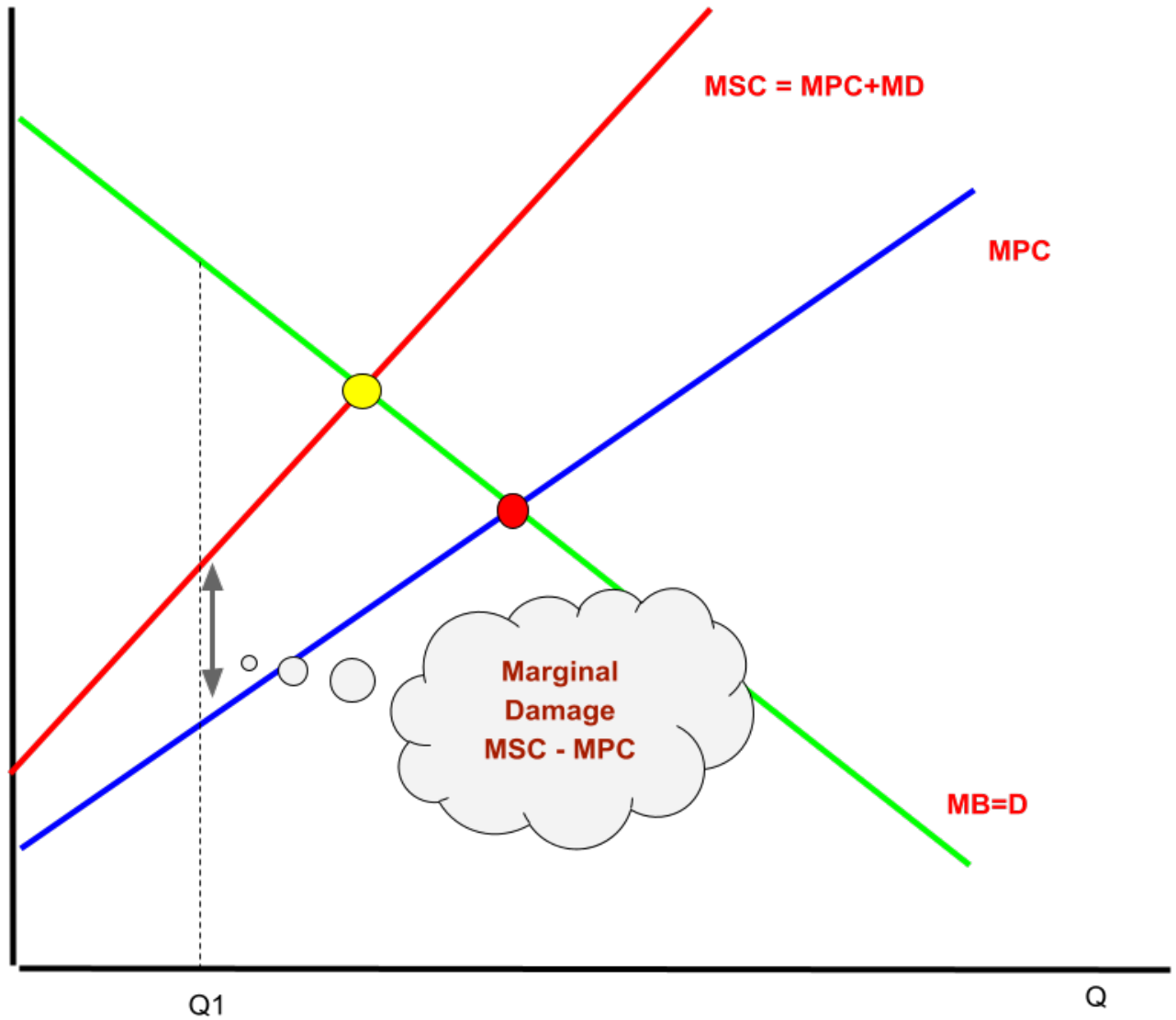
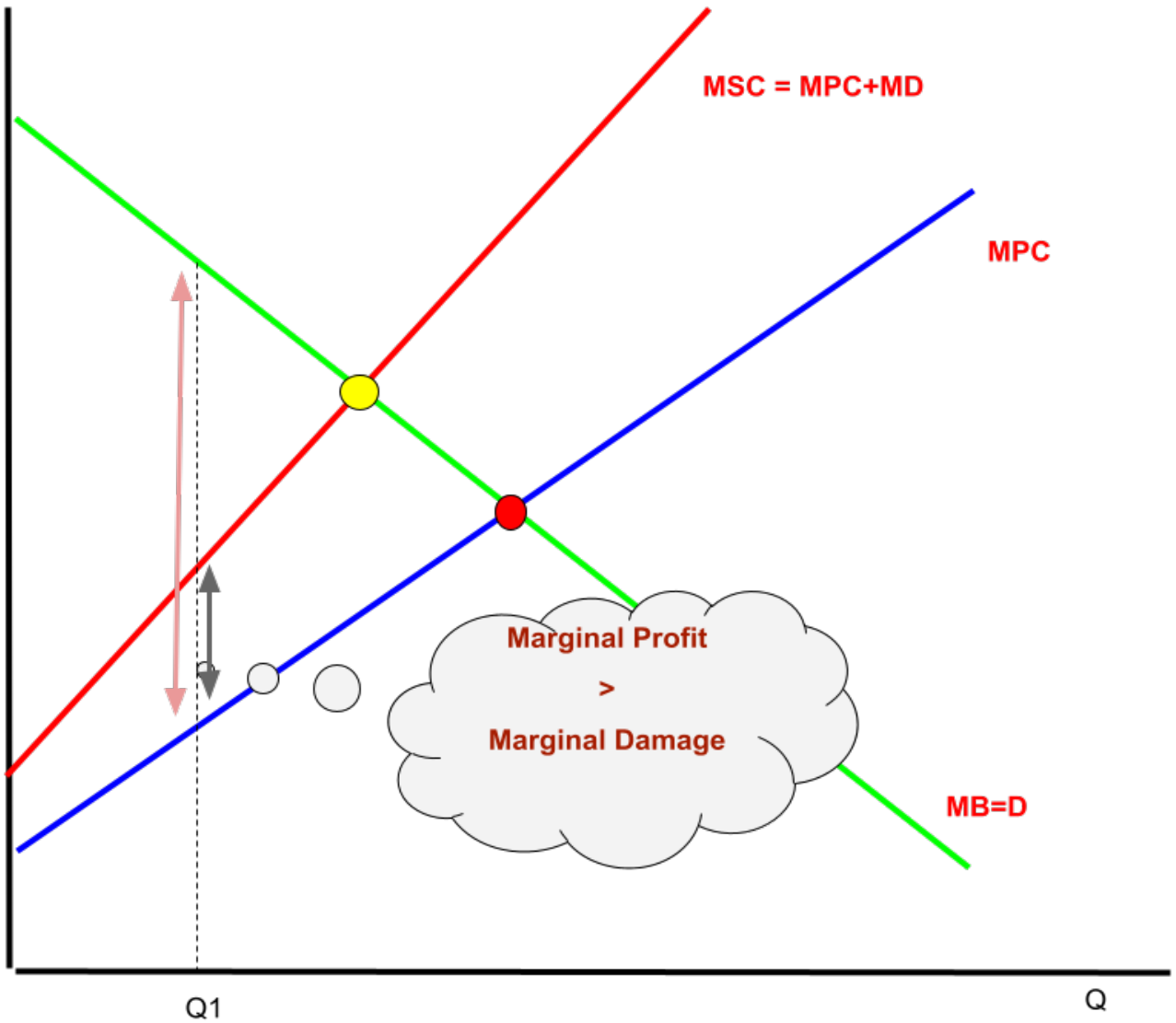
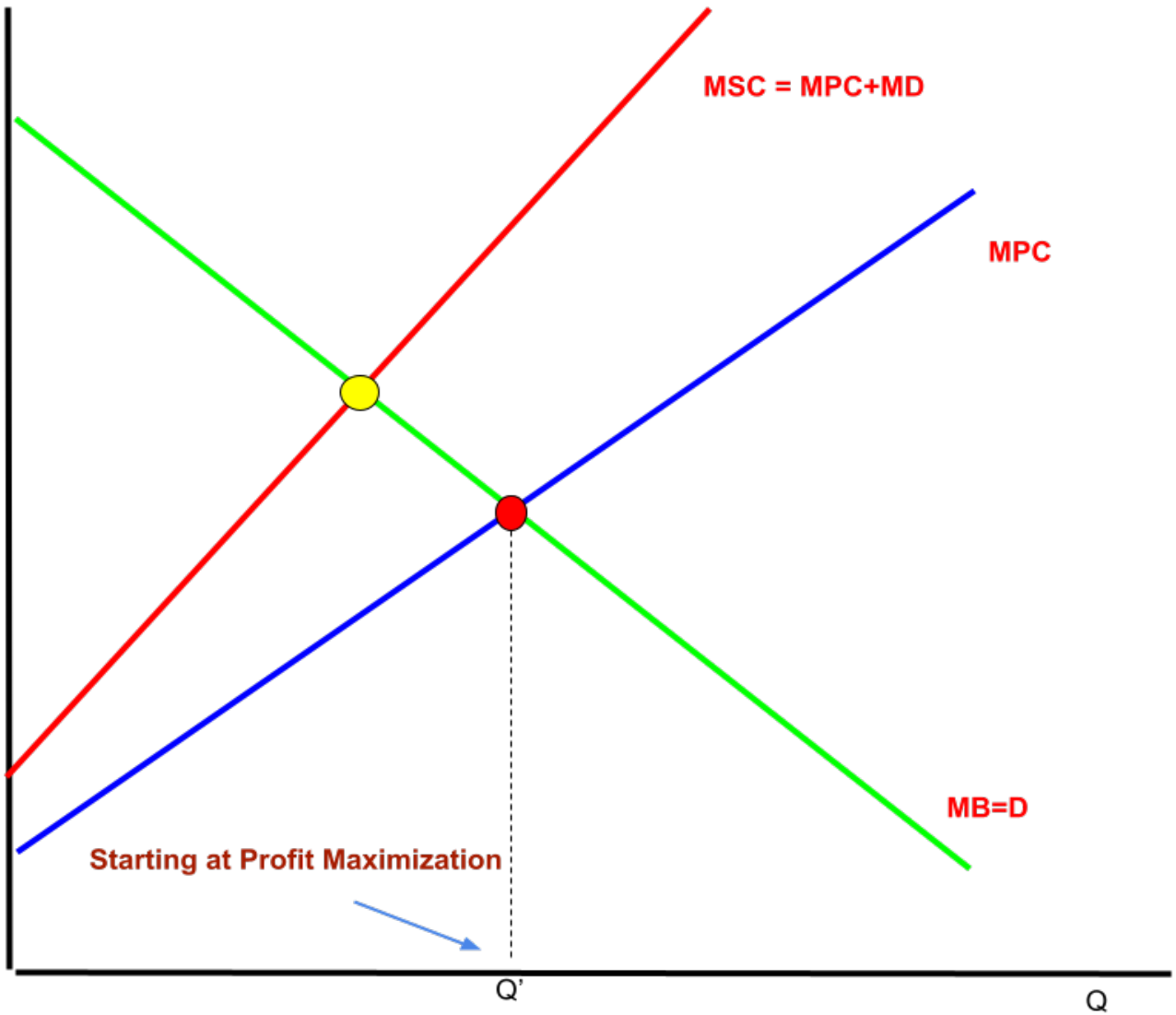


Q1 is Produced



Property Rights awarded to the Polluter



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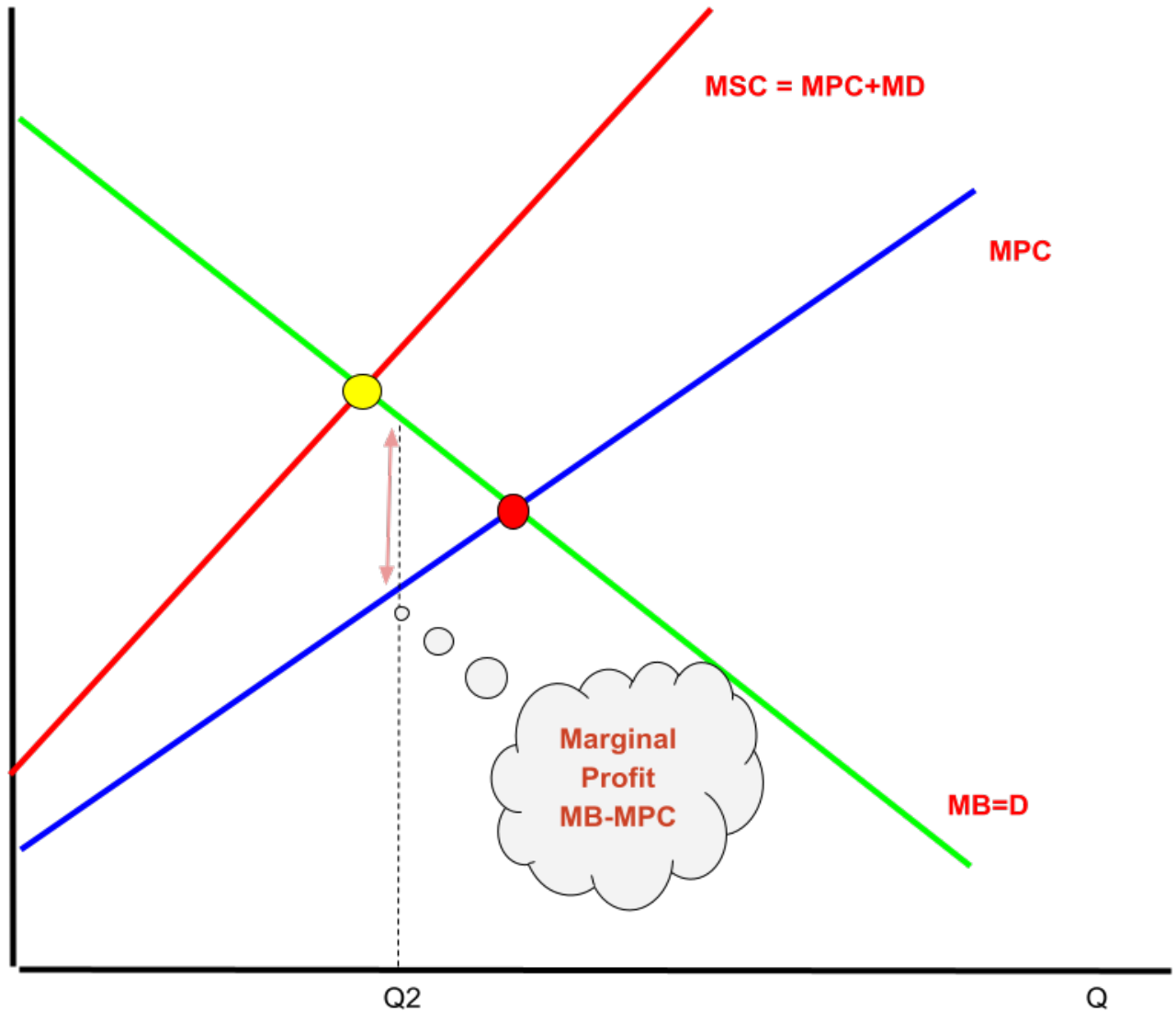

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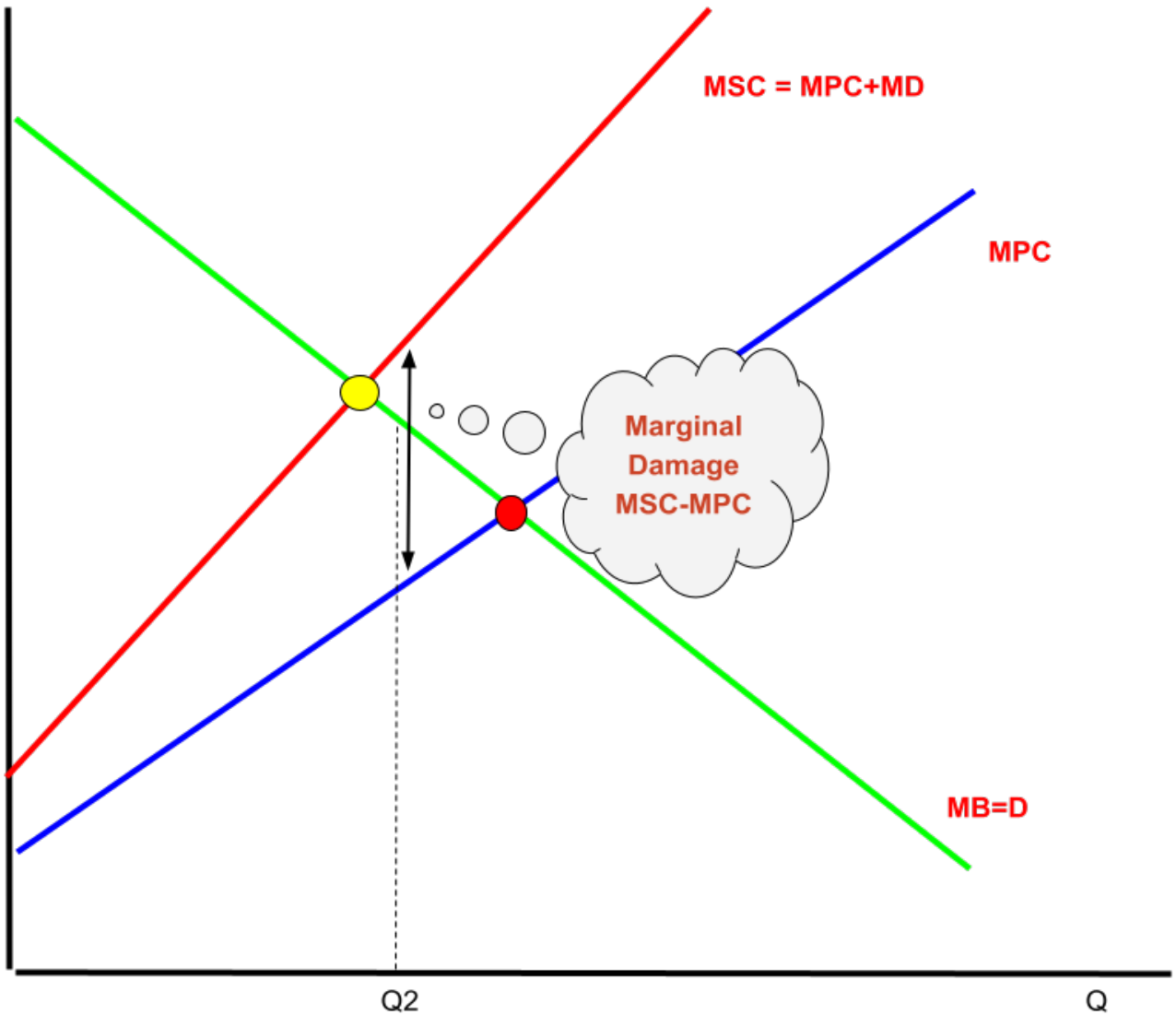
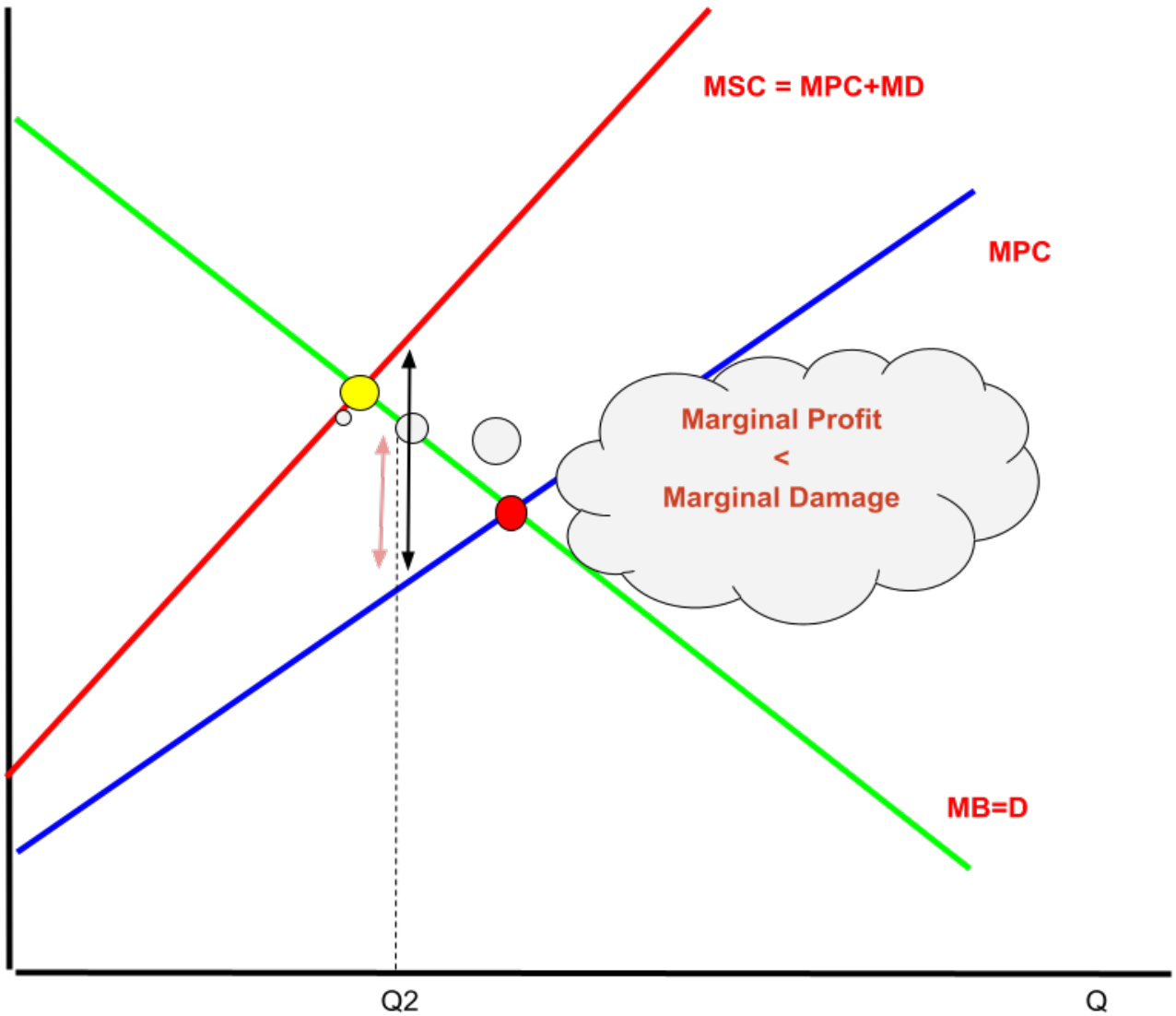


Q2 is Averted



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- Insightful analysis lacking applicability to **large scale** Environmental Issues

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- Drawbacks in addressing **Diffusion non-Point Source Pollution** Overflow of fluids in a city (*run-off)*

Environmental Standards

1. **Ambient quality standards**
2. **Emission or discharge standards**
3. **Process standards**
4. **Product standards**
5. **Technical standards**

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- The **Ambient Air Quality Directives** set EU air quality standards for 12 air pollutants: sulphur dioxide, nitrogen dioxide / nitrogen oxides, particulate matter (PM10, PM2.5), ozone, benzene, lead, carbon monoxide, arsenic, cadmium, nickel, and benzo(a)pyrene (Link)

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- Standards designed based on
  - What can be achieved through available **emissions control infrastructure**
  - The environmental effects of pollution

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     - **Best Practicable Technology (BPT)**
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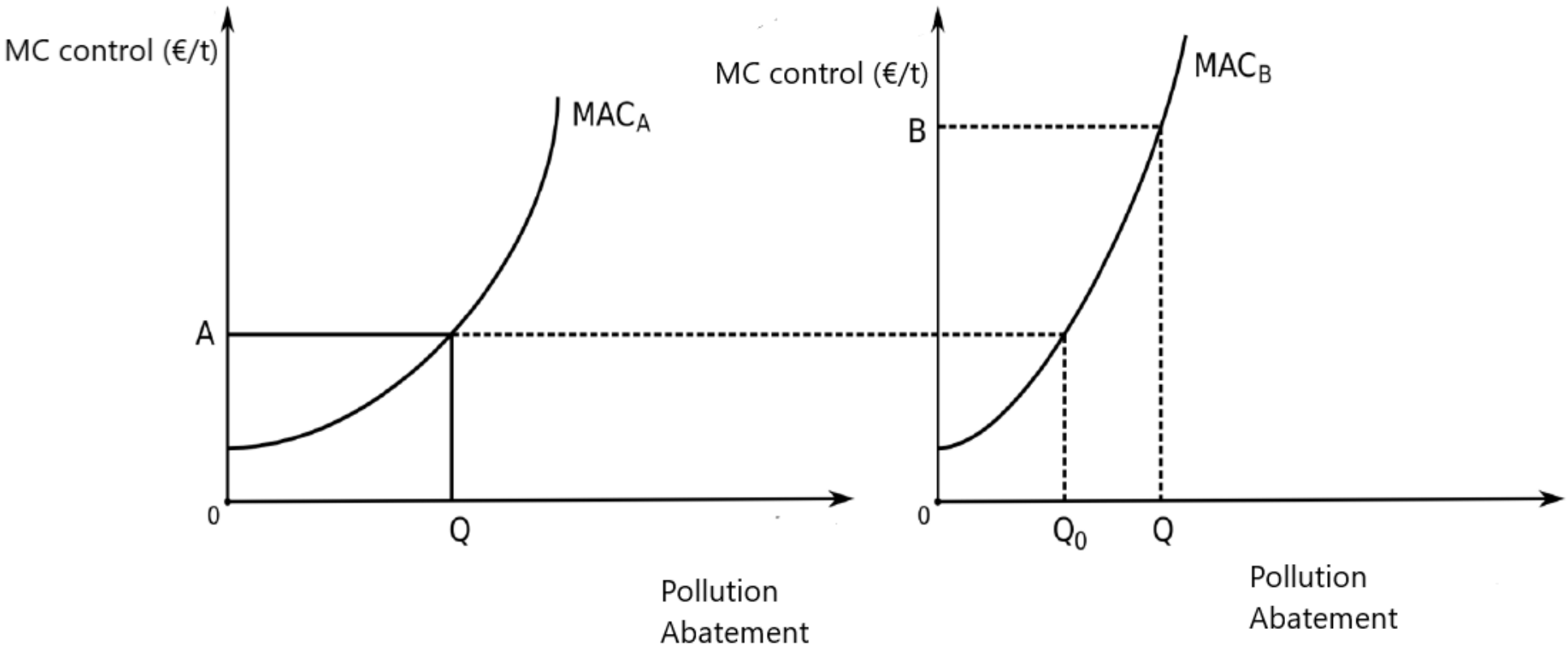
Standards Efficiency



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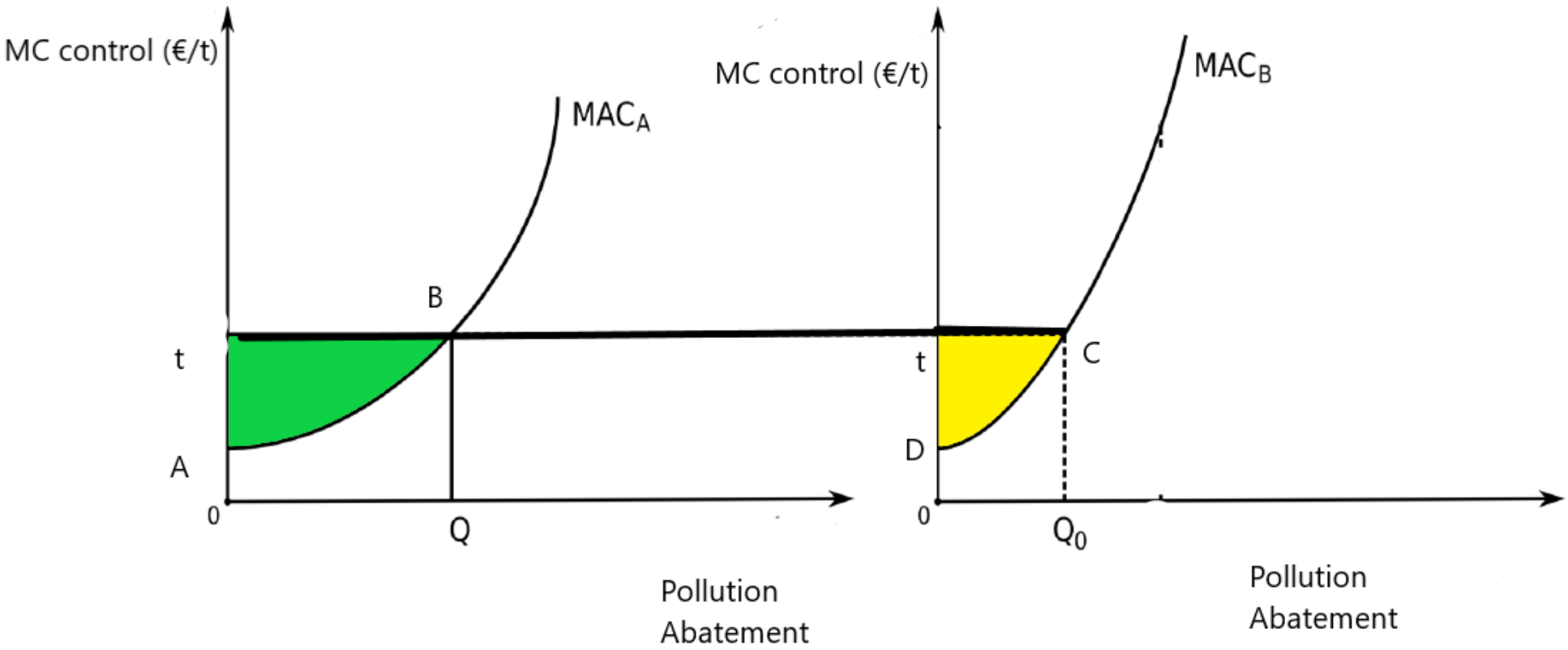
Environmental Tax



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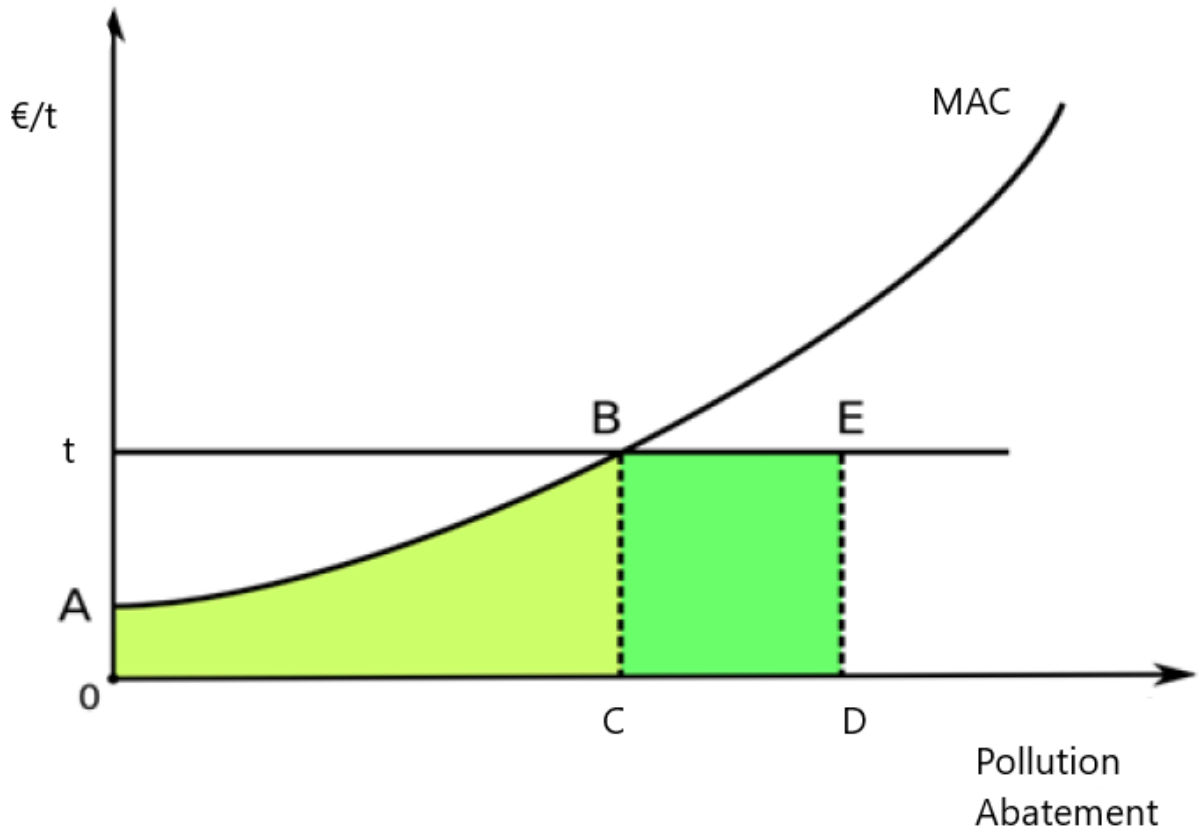
- **Second-Best Solution**: A substantially high Tax rate

Optimal Tax



Evaluation of Environmental Taxation

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- **Drawbacks**
  1. Requires perfect information of Regulating Authority (demand & supply elasticities, technology level etc.)
  2. Distortion $\rightarrow$ *Deadweight Loss*
  3. **Regressive Taxation**
     Energy/Fuel tax disproportionately affecting low-income households with high income elasticity

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3. **Deposit Refund Systems (DRS)**
   - *Refundable Tariff* on Price of Product associated with pollution
   - Encourages *Recycling and Re-using*

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- Different Marginal Costs of Control $\rightarrow$ Incentive for Trade

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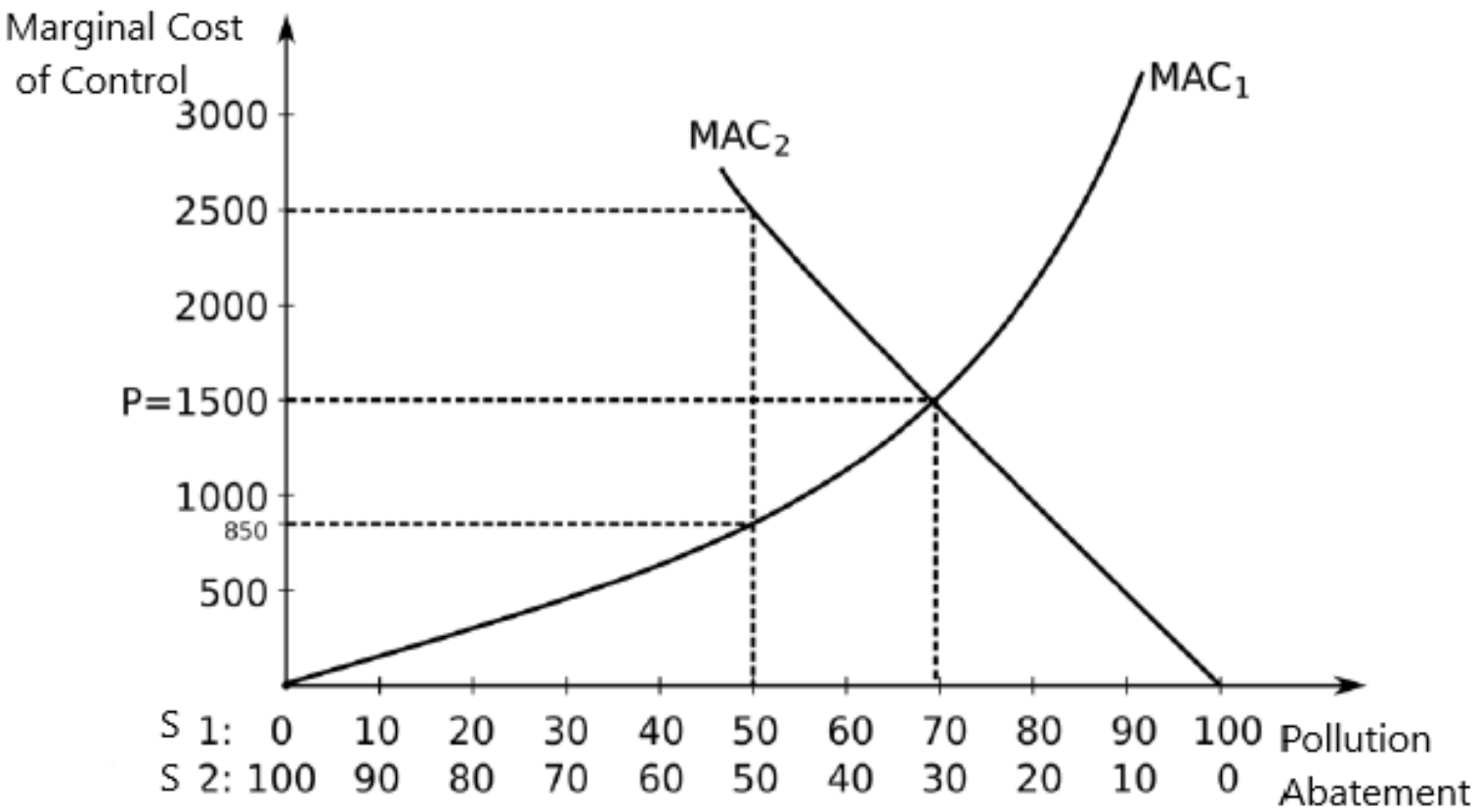
Cap and Trade Example



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- At P=1500 €Source 1 has 30 Permits (controls 70 units) and Source 2 has 70 Permits (controls 30 units)

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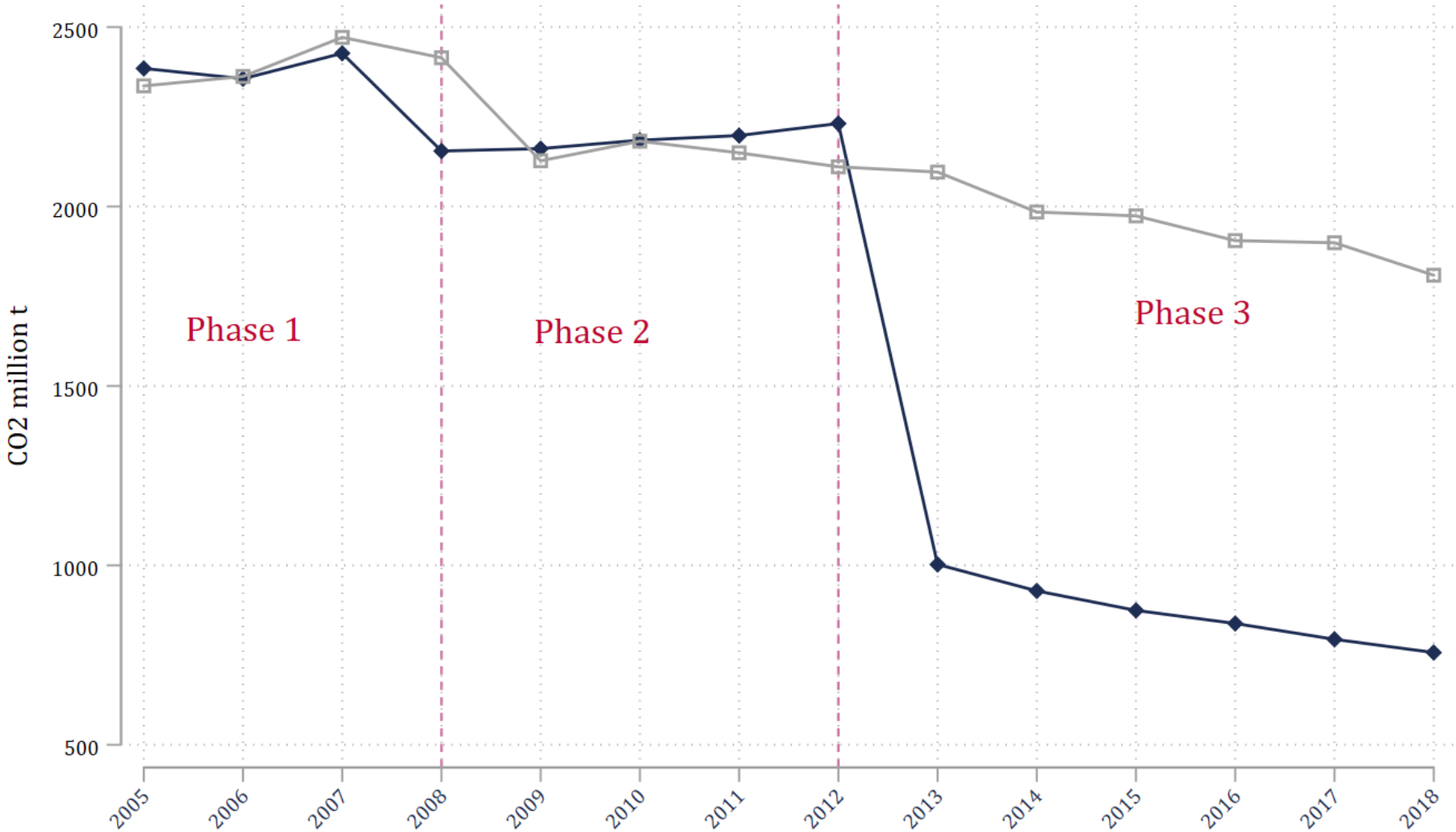
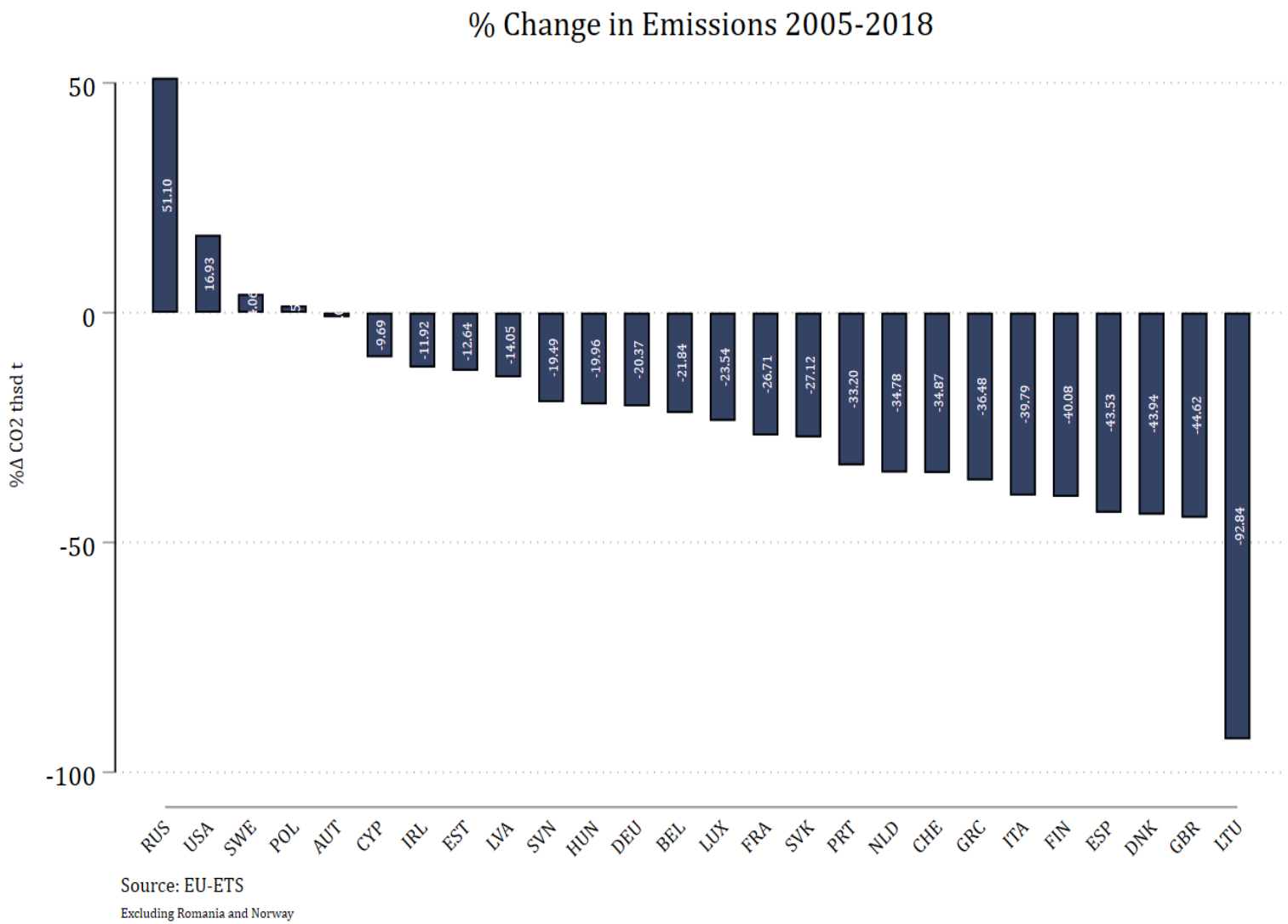
Carbon Price - ETS

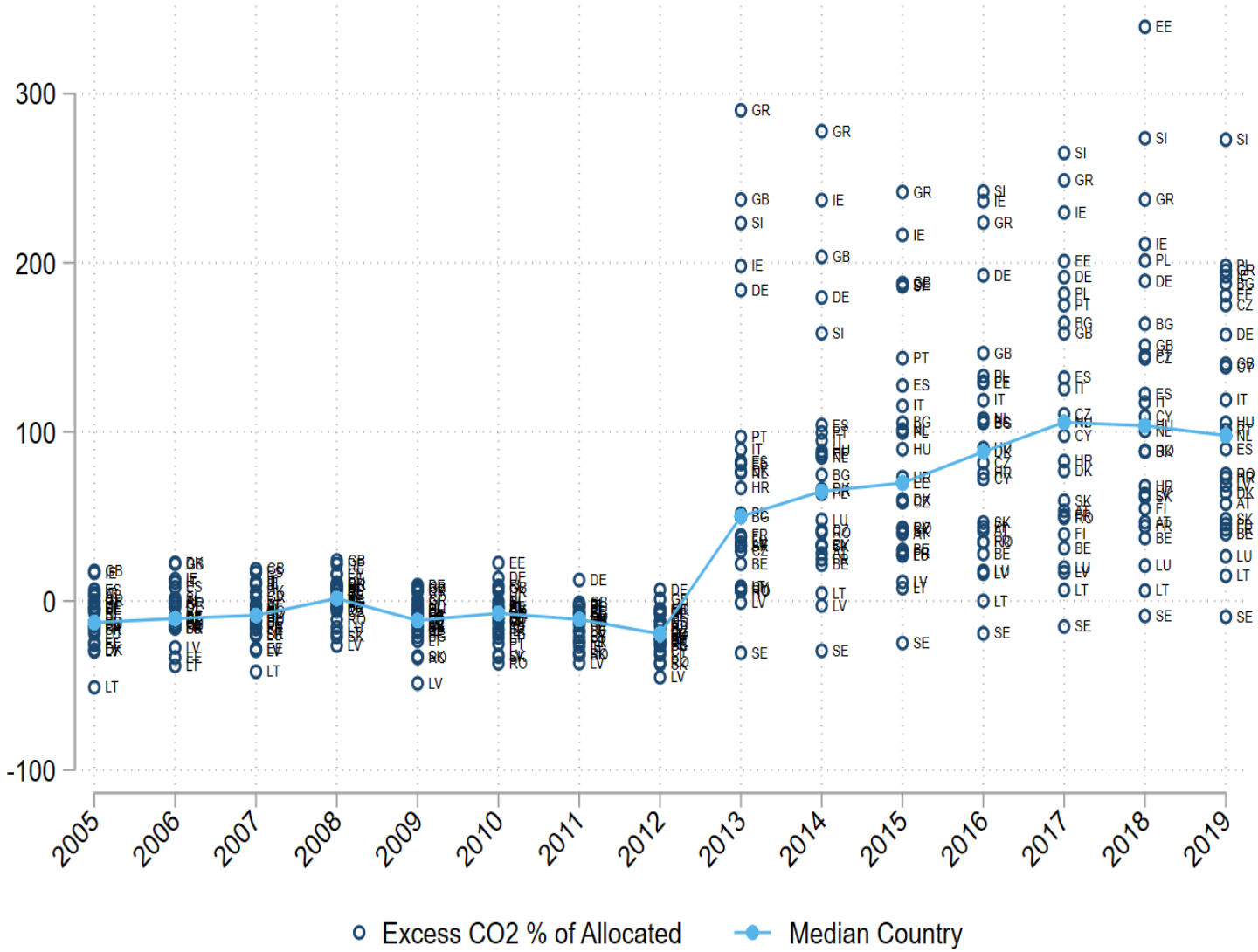
Verified & Allocated Emissions - ETS



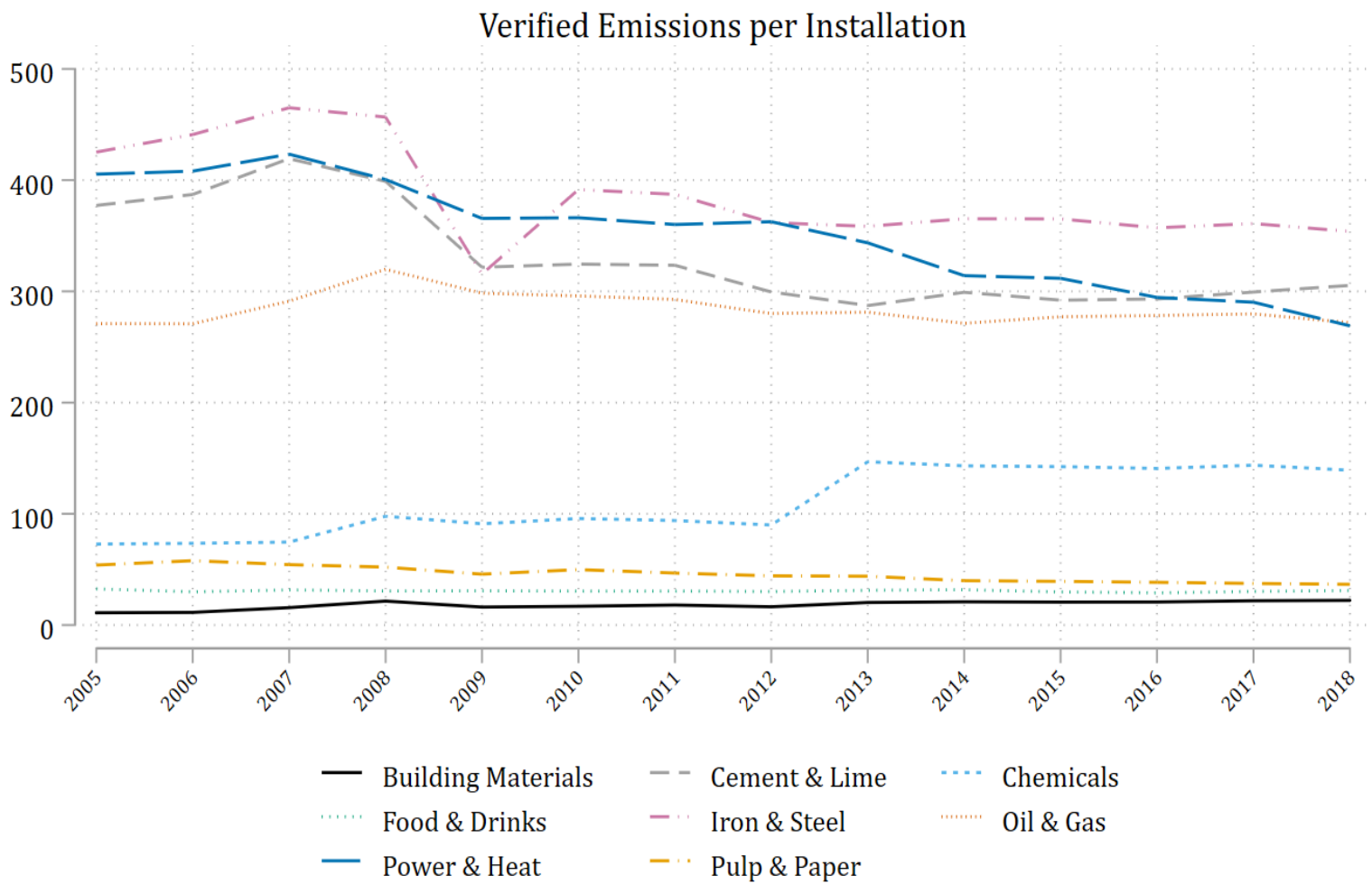
GHG Emissions Change - ETS



Excess Emissions % of Allocated by Year



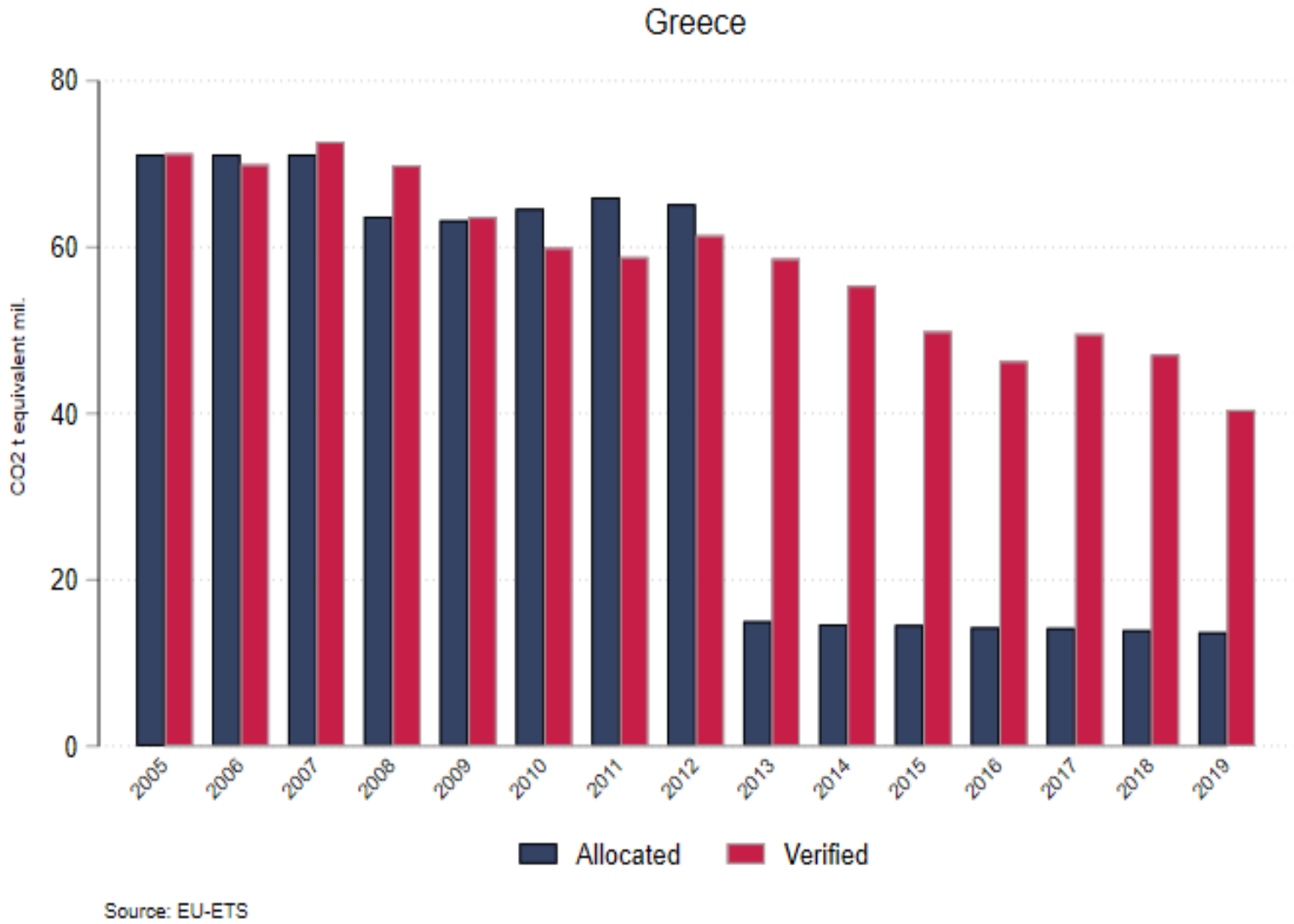
GHG Emissions by Industry - ETS



Source: EU ETS

Industries with >400 Installations

GHG Emissions Greece - ETS



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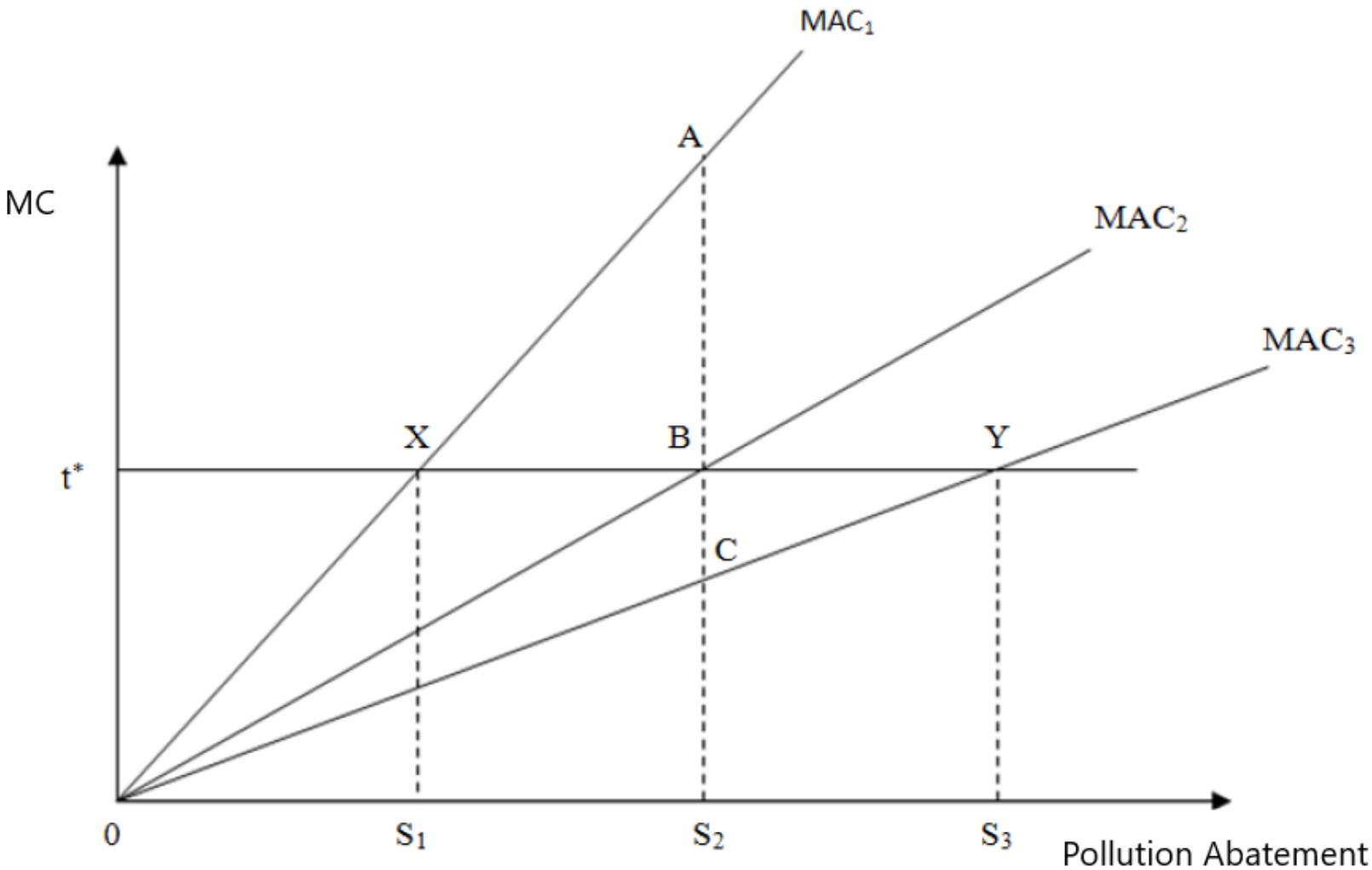

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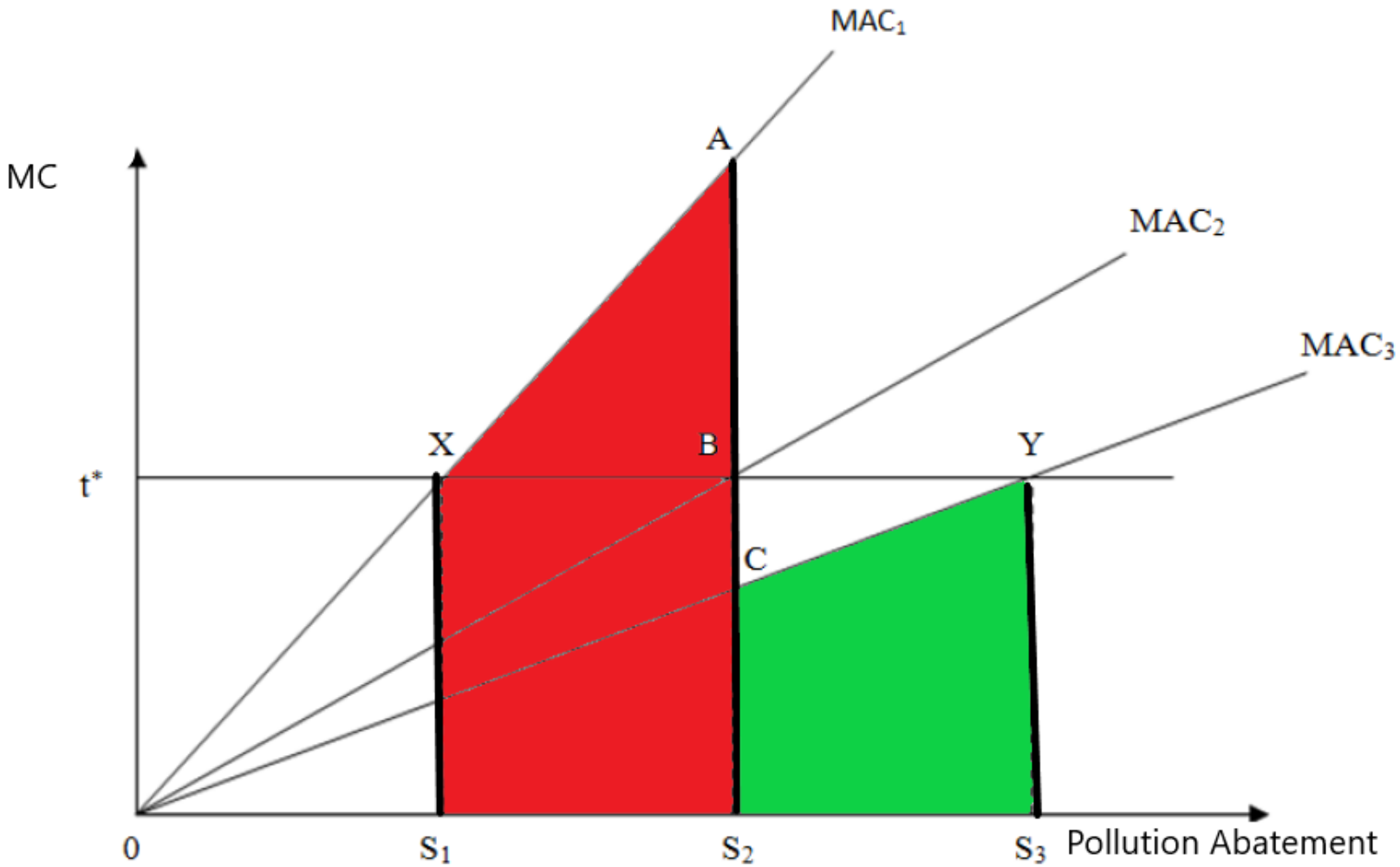

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- Total Abatement Cost (Standard) = $OAS_1 + OBS_2 + OCS_3$

$$TAC_{standard} - TAC_{tax} = S_1XAS_2 - S_2CYS_3 > 0$$

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- **Popularity**
  - **Taxes** opposed by Business Sector
  - Potentially *Passed-through* to consumers