**Salzburg**
**REFORM conference**
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# A Balance of 18 years EU ETS Wharf

**Aviel Verbruggen**
**University of Antwerp**

**www.avielverbruggen.be**

# Opening the Wharf
[Reading time: 40”]

At COP3 (Kyoto, Dec. 1997), the EU reluctantly accepted emissions trading as a climate policy instrument.
Soon, DG Environment minds were reprogrammed: *emissions trading markets would innovate mitigation solutions to save the climate*.

Spurred by energy corporates & neoclassical economists, the EC freshmen opened the EU ETS wharf.
From economics textbooks + superficial scan of the US $SO_2$ program, a too ambitious, simplistic ‘cap-and-trade’ market design emerged.

However, free permits, fraud, rent skimming, absent innovation, … spoiled the dream and spread confusion.

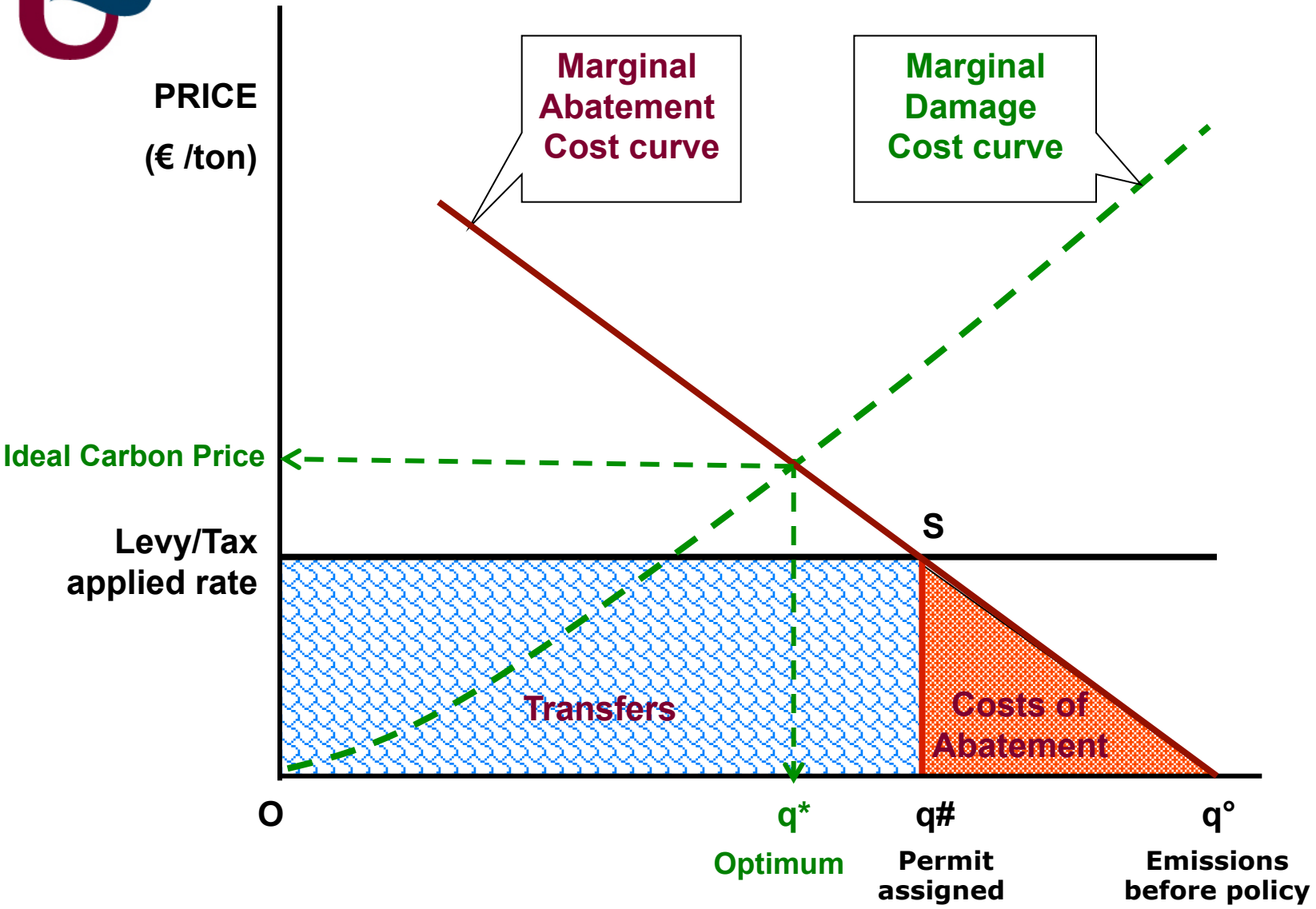
# ETS debate: issues & choices

- **Economics & cost-benefit frame dominate**
  - 'Money makes the world go round'
  - Price everything – only what is priced, is relevant
  - Based on aggregates/averages – hides unequality, diversity
  - Assumes unlimited substitutability – hides irreversibility
- **Urgency of action & results**
  - Atmosphere & Climate disruption is irreversible
  - No time for lenient experimentations
- **ETS debate is unwieldy**
  - Non-economic views neglected
  - Facts obscured – next phase will be better (remind atoms)
  - This lecture addresses the economics core of ETS, i.e.:
    * pricing GHG (carbon) emissions
    * price induced innovation (IPCC WG3 IAM)

# Lecture overview (+30 slides)

1. **Introductory economics** (sorry, but necessary) +2
2. **Anatomy of EU ETS** (economic instrument) +12
3. **Learning** (US $SO_2$ policy; EU's Tradable Green Certificates) +3
4. **Reality check on carbon prices** +10
5. **Evaluation & Future** +3

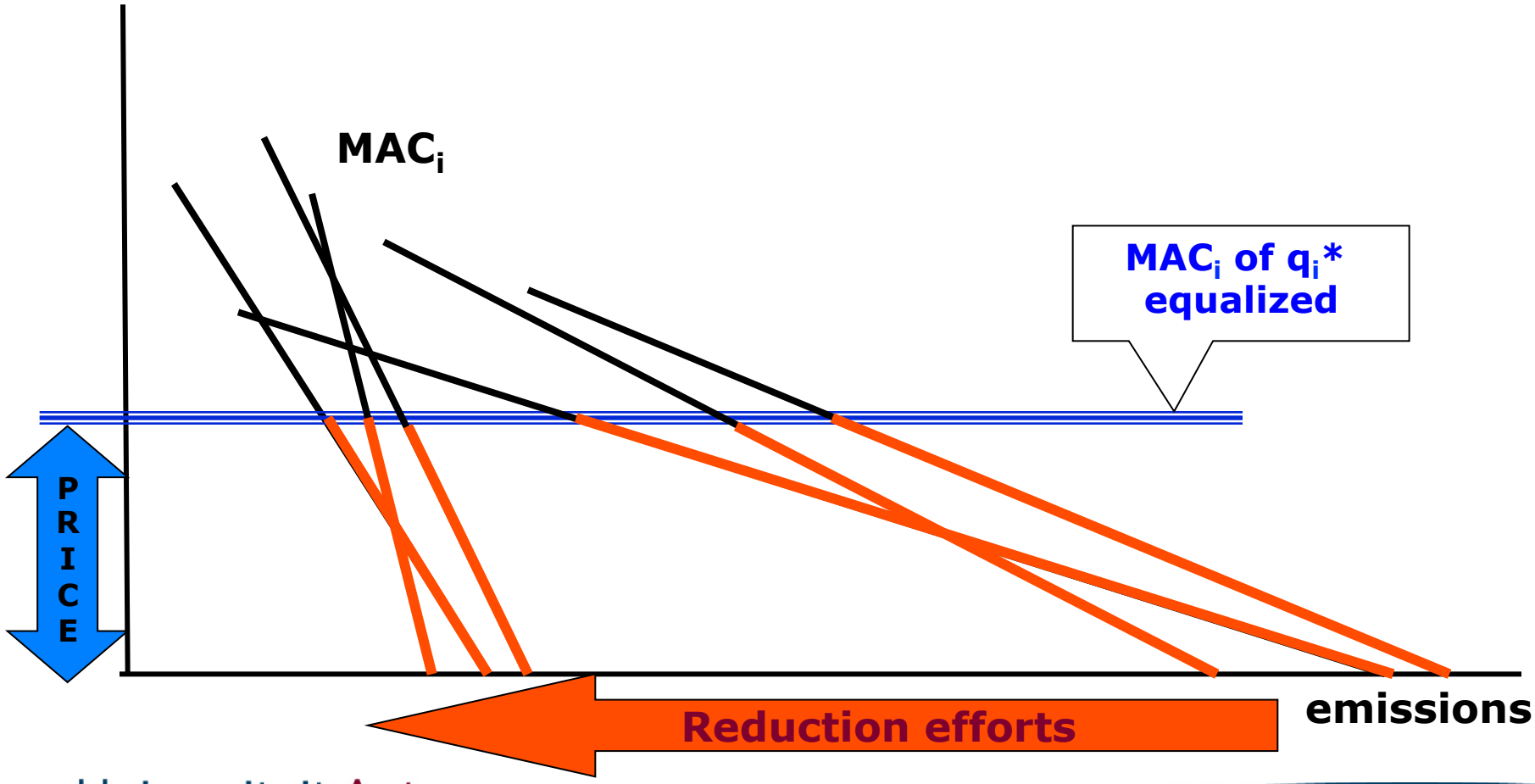
# Cost-benefit: least-cost emission level q* + polluters search minimum expenses



## Minimize total expenses for all polluters, under one CAP = find 11,500 $q_i$* emission quantities; $\Sigma_i q_i$* = CAP

€/unit

**Mathematical rule (Lagrange): minimum expenses *iff* the 11,500 MACi(qi*) are equal**



# 2. Anatomy of ETS

**Merriam Webster's Collegiate Dictionary:**

**Anatomy: 'the art of separating the parts of an organism in order to ascertain their position, relations, structure and function' (mostly, pictures support the descriptions).**

**An ETS holds 4 constituent parts:**

- [i] Policy goals
- [ii] Costs of GHG abatement (mitigation, compliance)
- [iii] Carbon emissions prices
- [iv] Allocations of tradable emissions permits

- **every part = range of options (within constraints)**
- **assemblage of particular options = ETS exemplar**

# Component [i]
# Two major policy goals for EU ETS

## A-goal - Atmosphere

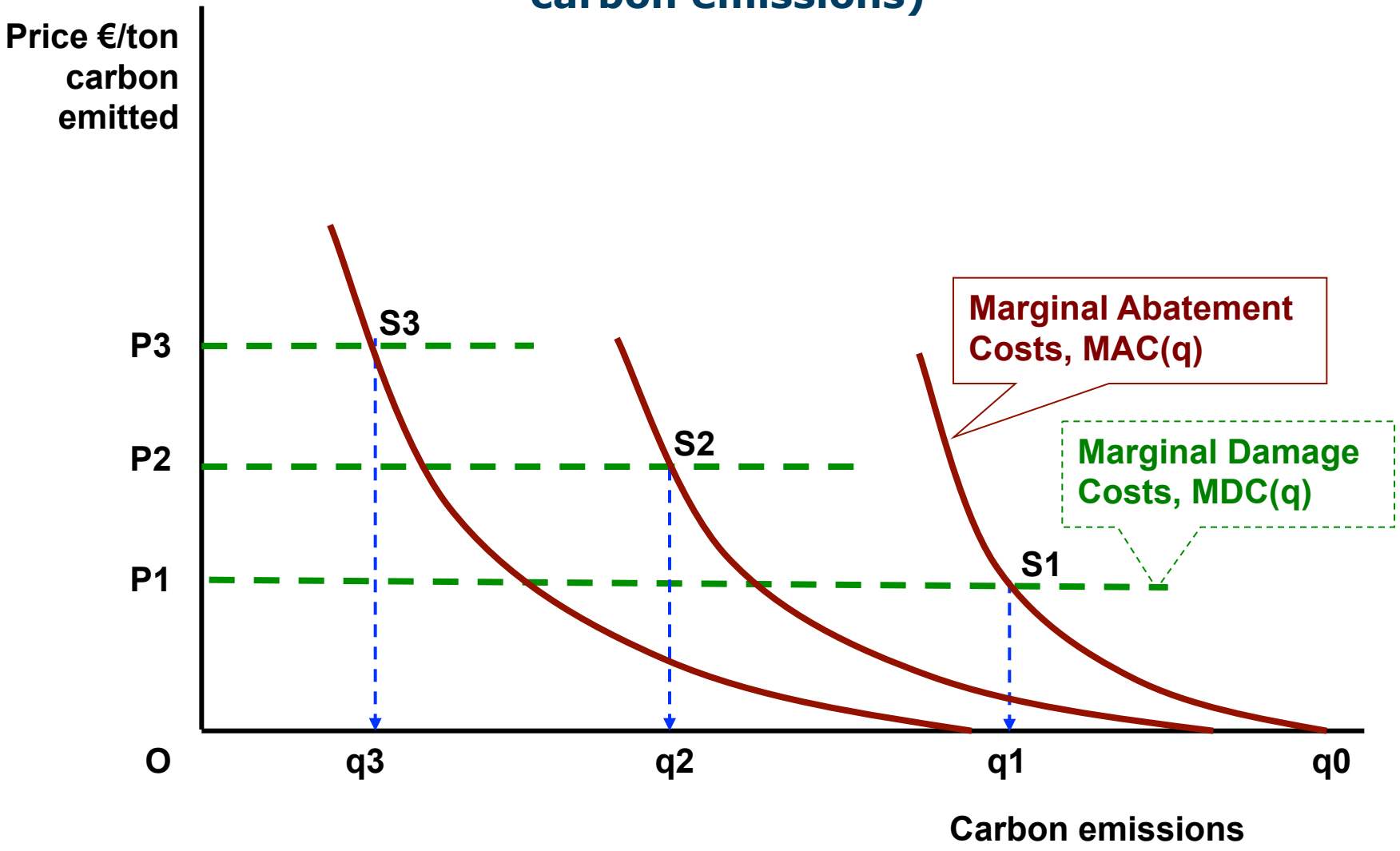
= pursue Atmospheric stability and cleanness
> emitting (industrial) activities
> carbon emissions down 80-95%
> by the nearest date (before 2050)
+ induce disruptive de-carbonizing innovations
++ higher carbon emissions prices as inducing force

## Π-goal – Profit / Protection of industries

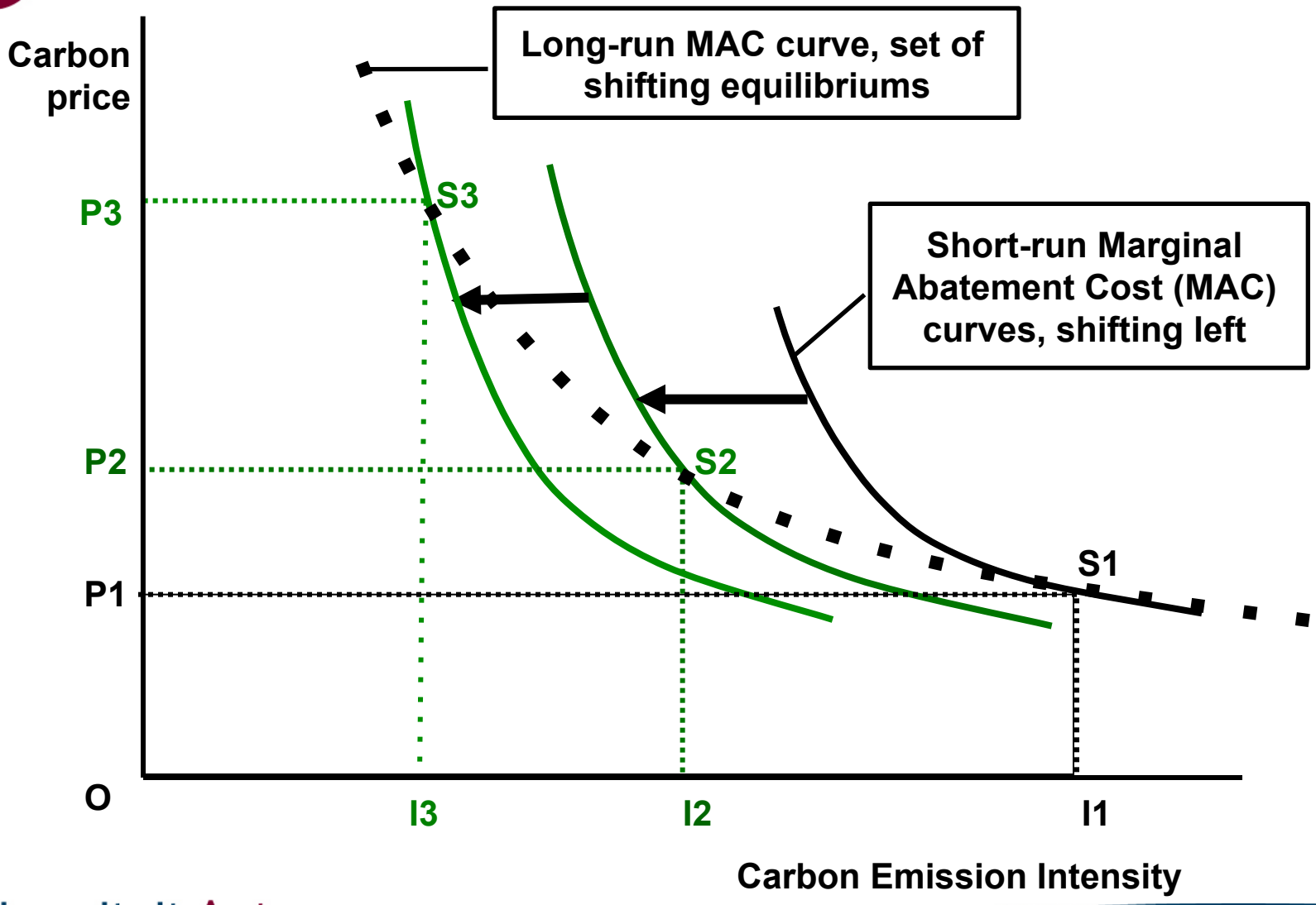
= maintain/expand EU's industrial activities
> businesses, employment
>> profits
+ avoid 'carbon leakage'
++ no € burdens on Energy-Intensive Trade-Exposed (EITE) industries

**Are the two goals reconcilable?**

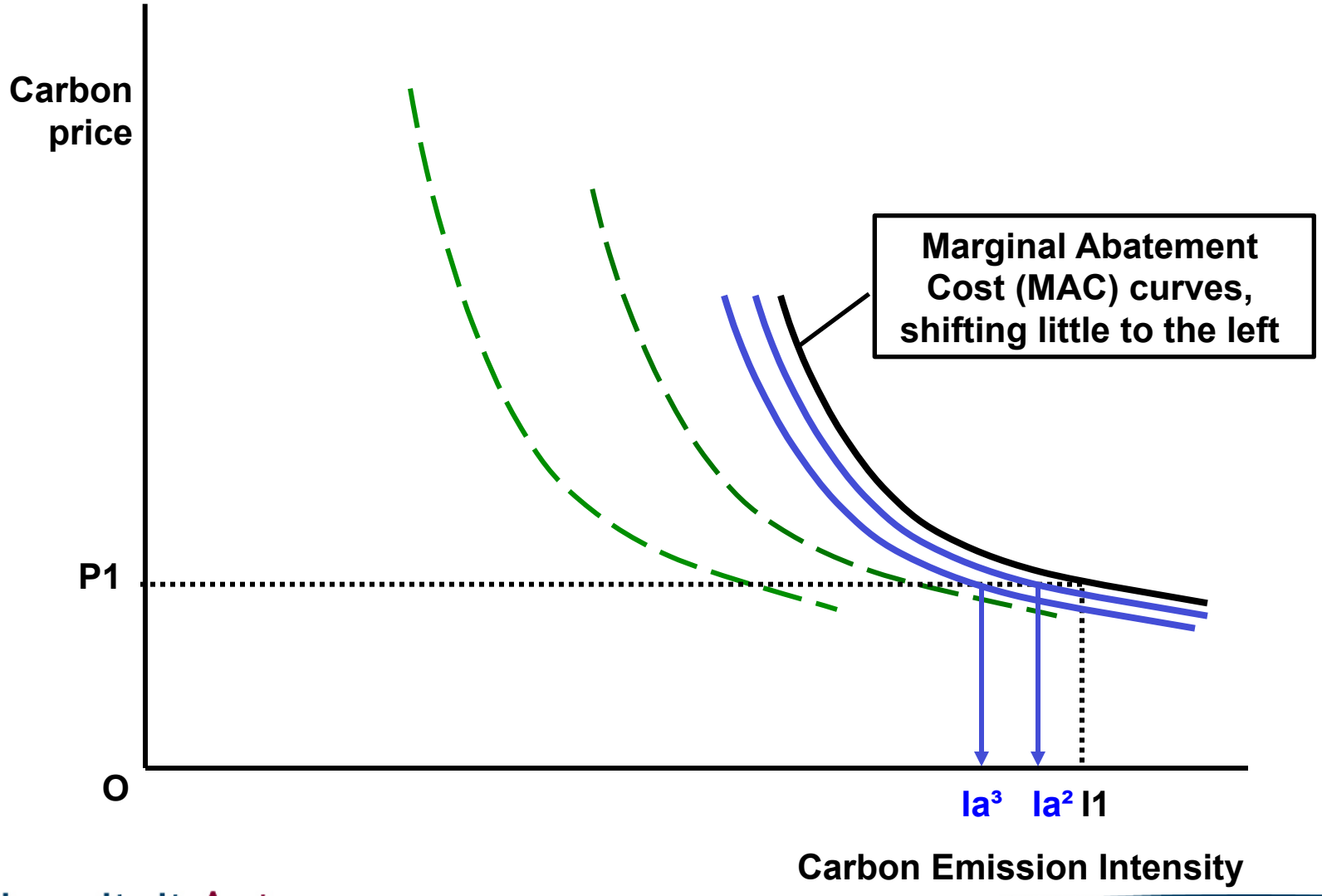
# Component [ii]
# Costs of compliance (abatement, mitigation of carbon emissions)



# Innovations in compliance, induced by high Carbon prices, shift cost curves and reduce optimal Intensities



# Without inducing carbon prices: autonomous innovations (ceteris paribus, other innovation drivers excluded)



# Component [iii] Carbon emissions pricing

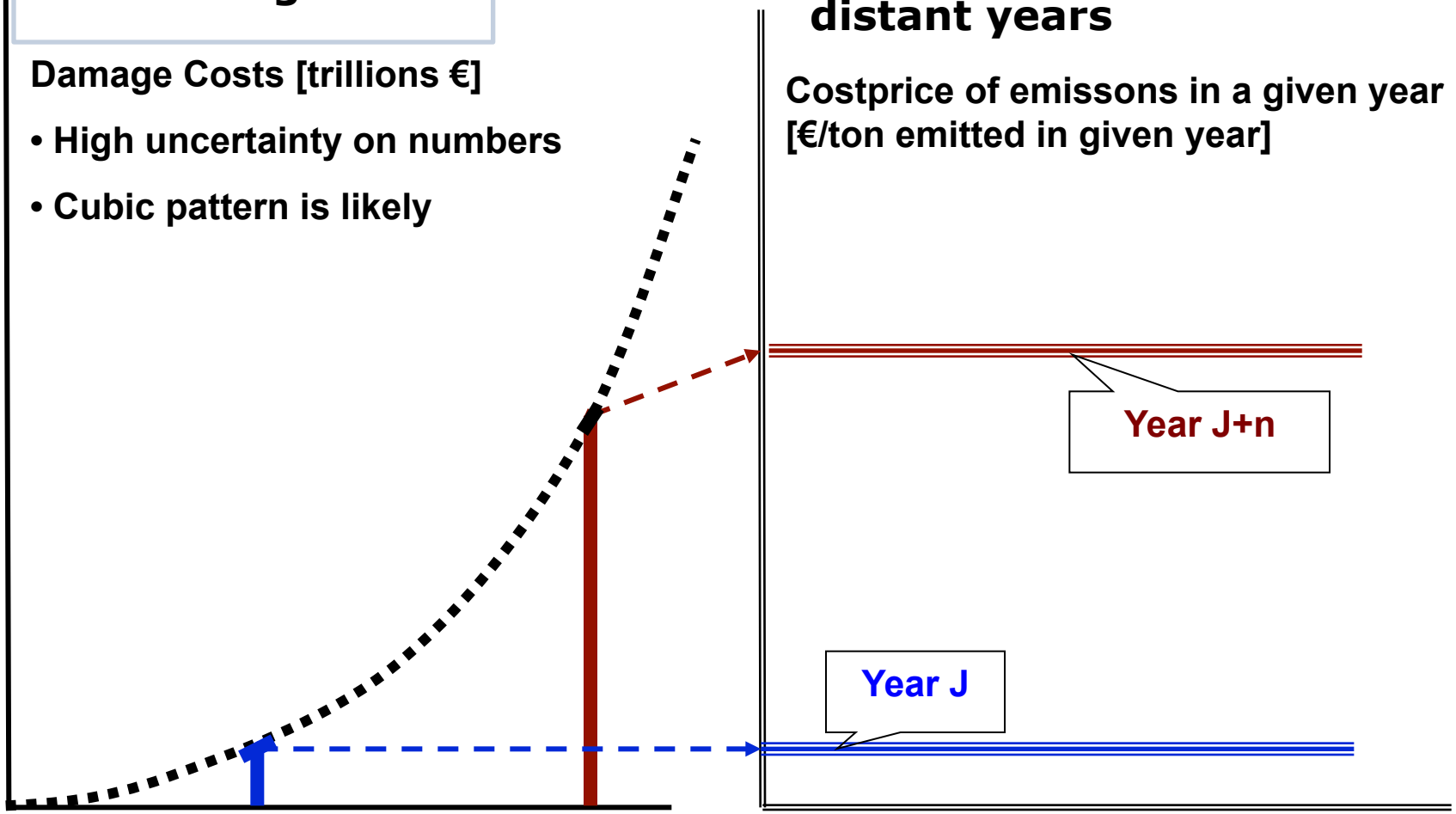
## Total damage costs

Damage Costs [trillions €]

- High uncertainty on numbers
- Cubic pattern is likely

## Damage cost prices for two distant years

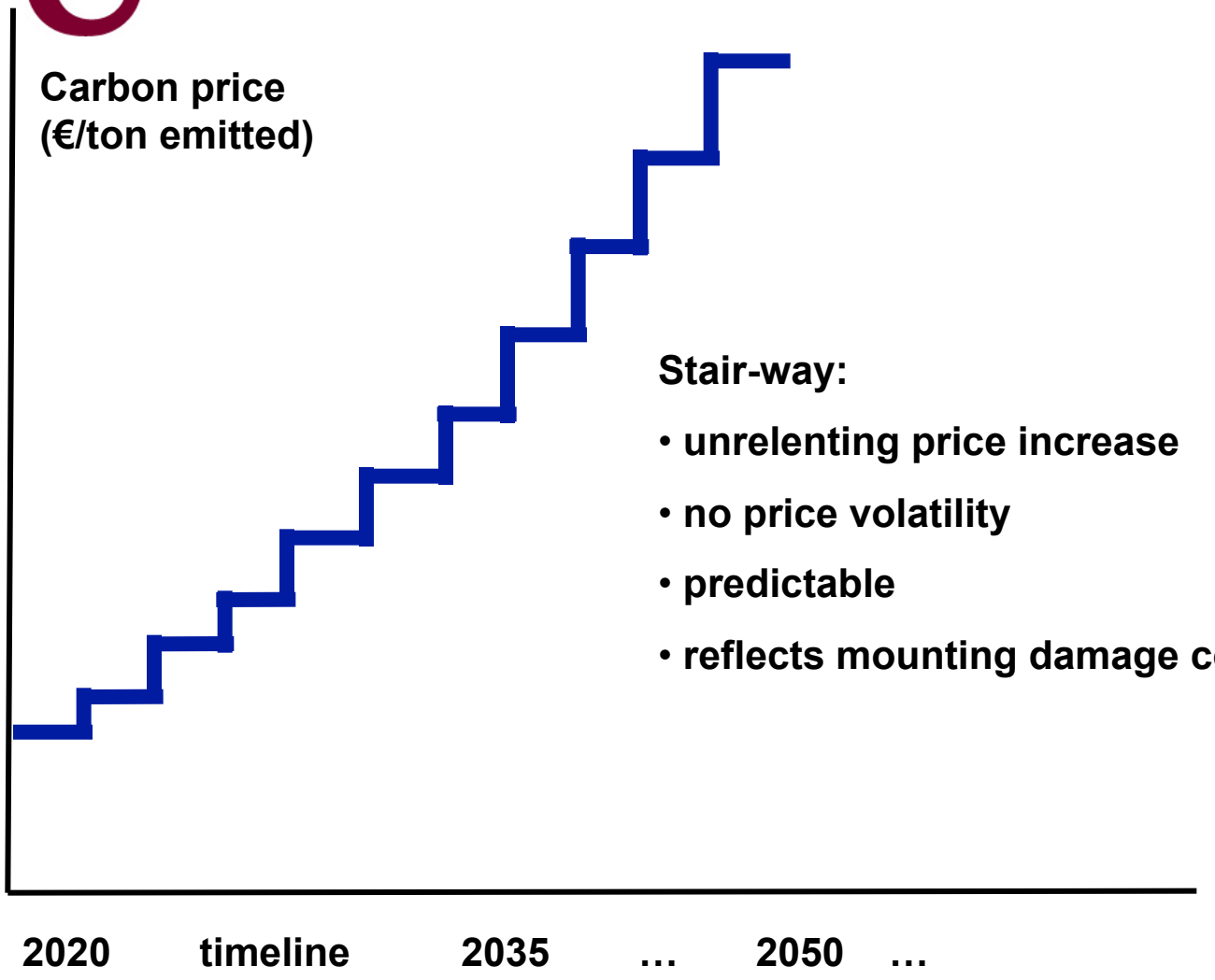
Costprice of emissons in a given year [€/ton emitted in given year]




GHG Concentration in the atmosphere, every year adding a few ppm, due to the yearly GHG emissions

GHG Emissions (ton)

# Carbon price 'optimal' path = stair-way




**Stair-way:**

- unrelenting price increase
- no price volatility
- predictable
- reflects mounting damage costs

# Carbon price stairs evolving over time
## (specific outcomes depend on start year, height & gradient)

# Component [iv] Allocation of tradable emissions permits

## ETS is a levies-permits hybrid ⌥ permits allocation

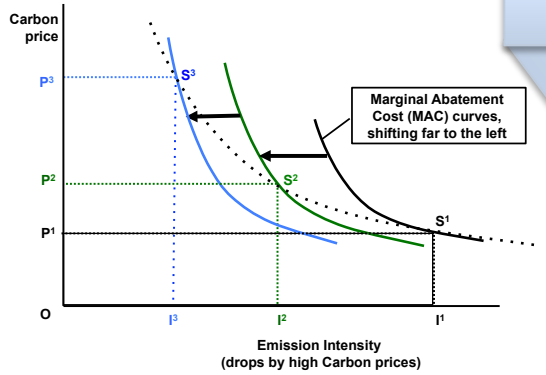
### LEVIES

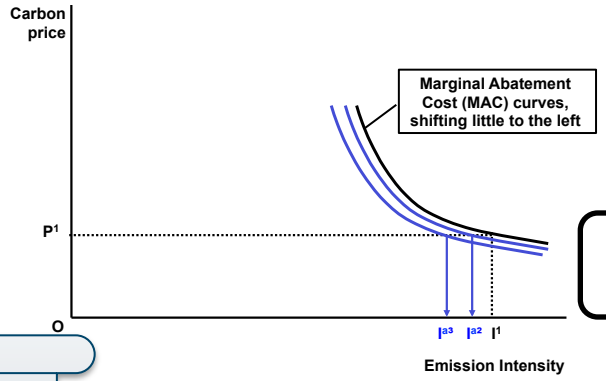
- Yearly auctioning of shrinking year quota
- Auctioning of quota for a trade period of a few years
- Auctions spread over years, following the demand for permits
- Partial auctioning, partial free gifts
- Assign permits to the principle MACi = λ
- Assigning expected BAT emissions
- Grandfathering

### PERMITS

| [i] Goals of EU policy | [ii] Costs of Compliance | [iii] Carbon emissions Prices | [iv] Allocations of tradable emissions permits |
|---|---|---|---|
| Atmosphere A-goal: all industrial activities without carbon emissions (by 2050?) | Innovation of products, services, technologies | Carbon emissions price stair | Levies-permits hybrid ⌥ permit allocation |

Induced Innovation




Autonomous Innovation

## LEVIES

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## PERMITS

Profit π-goal: maintain, expand EU's industrial activities, business, employment

→ Antw

→ No leakage by carbon price

→ carbon price stair is not climbed

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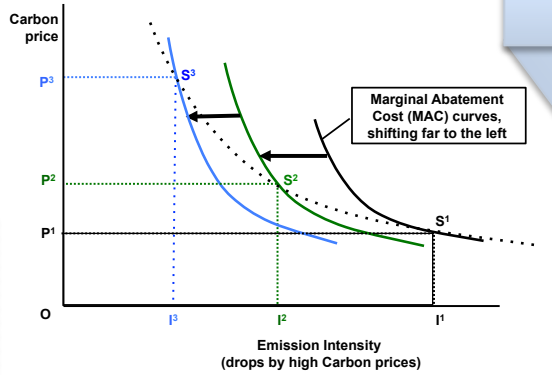


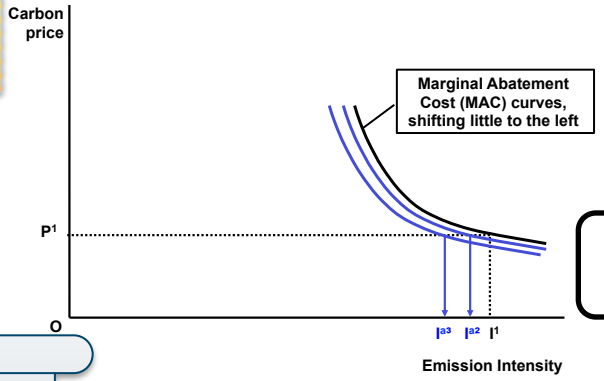


Autonomous Innovation

Conflicting goals.
Not attainable both with one instrument

Profit π-goal: maintain, expand EU's industrial activities, business, employment

Antw

No leakage by carbon price

carbon price stair is not climbed

## LEVIES

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## PERMITS

# Findings from Anatomy study

. ETS exemplars depend on assembled selection of component options

. Conflicting goals require different exemplars

. EU ETS successful in protecting (serving) EU's large industries interests

. High-price [*with high-cost for industry*] EU ETS exemplar is unlikely [*the more sticky MACs are*]

# Characteristics of US $SO_2$ program

- **Single segment of acid pollution**
  - $SO_2$ from USA coal fired power stations, production tech fully known
  - NOx regulated in separate segments
  - Leakage not an issue
- **Low abatement expenses**
  - Mainly low-sulfur coal substituted for high-sulfur coal
  - Mature add-on technologies (scrubbers)
  - Lousy cap did not need advanced scrubbers
- **Rich regulatory bequest at the start in 1990**
  - Sector regulated by state PUCs, coordinated by NARUC
  - EPA since 1970: capable, diligent, informed, …
- **Thin market <<< stringent EPA policy making**
  - Free permits; 2.8% of cap auctioned + return of revenues
  - Banking as extra flexibility
  - Few trade across non-affiliated companies

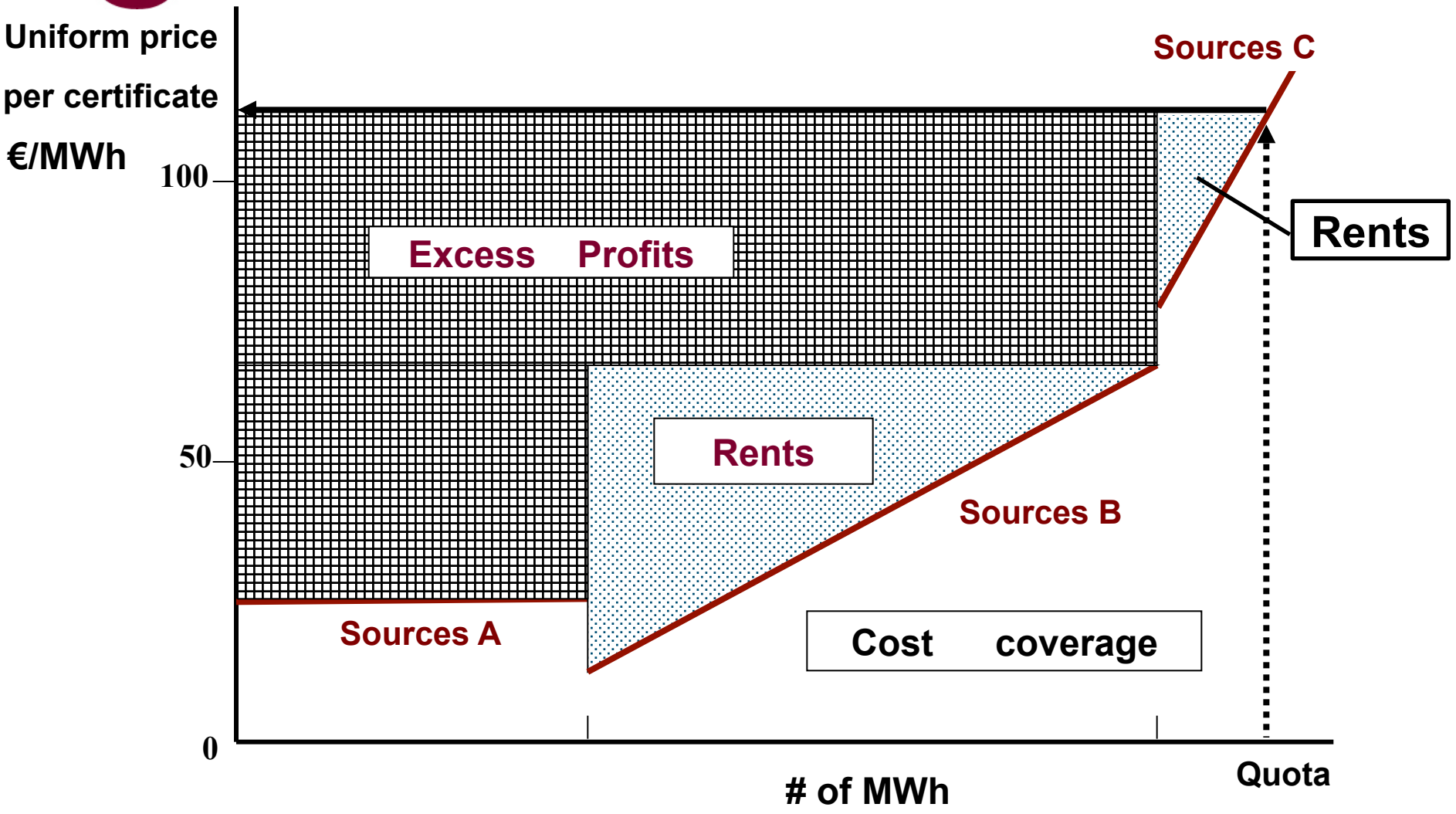
# EU's Tradable Green Certificates

- 1999:EC promotes TGC for pan-European RE support
  - Germany resisted and saved FIT support
  - A few TGC were set-up: Frehsman Flanders exemplary
- Salient attributes & results of TGC
  - Amalgamate all RE supplies {source x technology}
  - Single price per certificate (= per MWh generated)
  - Huge excessive profits (euphemism: 'windfalls')
  - No technological innovation
  - 'Market' metamorphosed in ruling *à la tête du client*

⇔ Technology specific FIT support for solar PV + wind

- Affordable, fast, deep, tech. development success
- Economists: 'FIT expensive', 'perverse effects on ETS'

# Cost coverage, Rents and Excess Profits in Tradable Green Certificate systems



# 4. Reality check

**Mission of Climate Policy**
**Purpose of policy instruments (ETS):**
**Deep De-Carbonization**

**Innovation is the magic key to**
*** low-costing abatement, mitigation**
*** new products, practices, institutions, …**

**ETS '*price induced innovation*' credo =>**
- **Hammering on high carbon prices**
- **Shifts in Marginal Abatement Cost curves**

**We investigate**
**Carbon prices & MAC shifts**

# Carbon price or prices

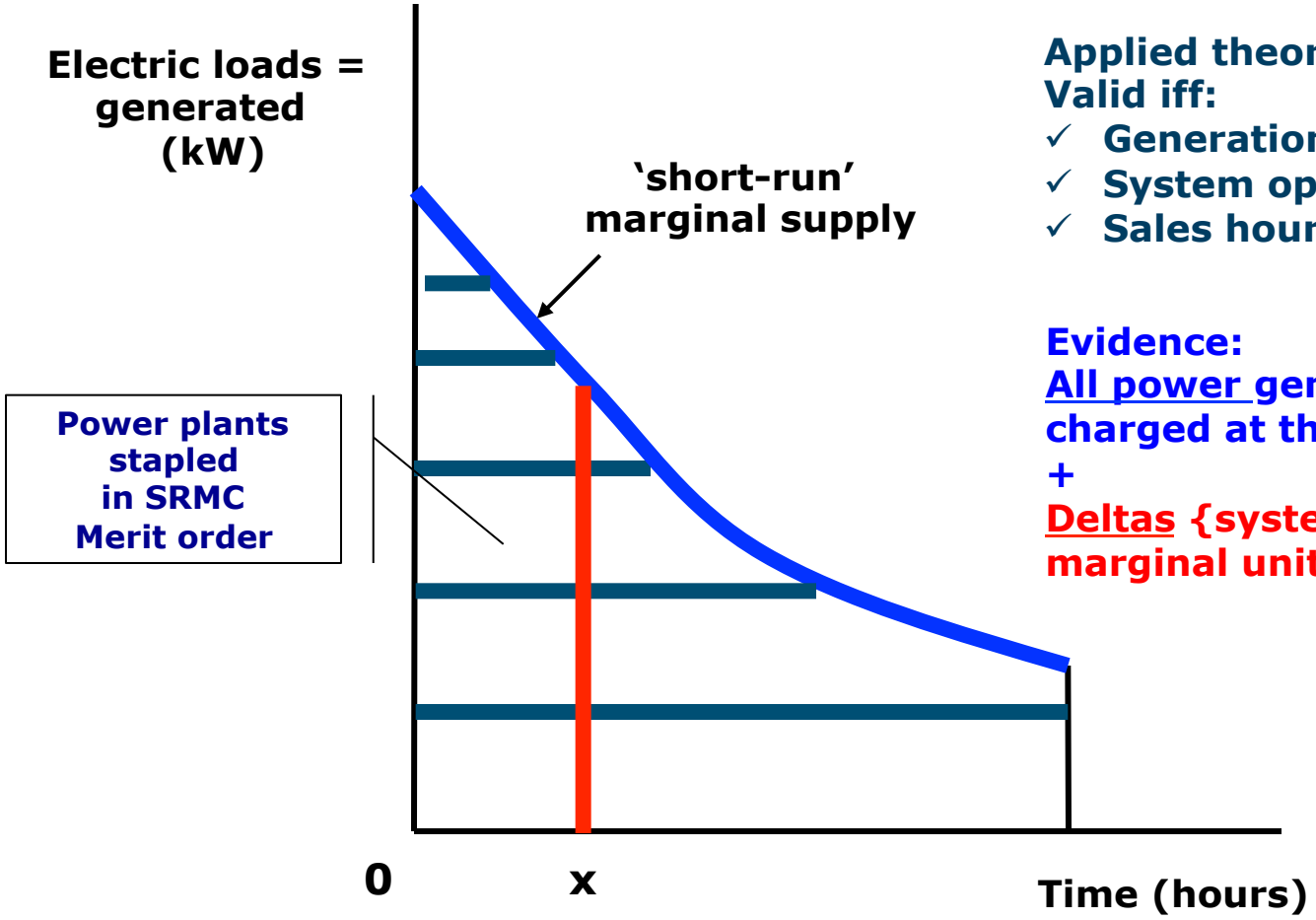
- Holy grail of neo-classical (neoliberal) economists
  - Either 'harmonized global $CO_2$-eq levy/taks rate' (fixed)
  - Or: 'uniform ETS permit prices' (volatile)

- 'Money makes the world go round' affects all people
  - Maximize Benefits (revenues) + Minimize Costs (expenses)
  - Self-interest keeps economic order (≈ gravity in physics)
  - Movement = overcoming gravity & short-near self-interest

- Confusion price (€/unit) ⌘ bill (quantity of €)
  - If one unit (house, car): price = bill
  - If many units (kWh, ton $CO_2$): price << bill
  - Real economic decisions are based on bills, not on prices (see: 'capital budgeting' for business investments )

# Economics Theory: welfare maximum by Short-Run Marginal Cost (SRMC) pricing

[Ramsey – Boiteux – Steiner]




**Applied theory: power generation**
**Valid iff:**

- ✓ Generation units on command
- ✓ System optimally composed
- ✓ Sales hourly measured & billed

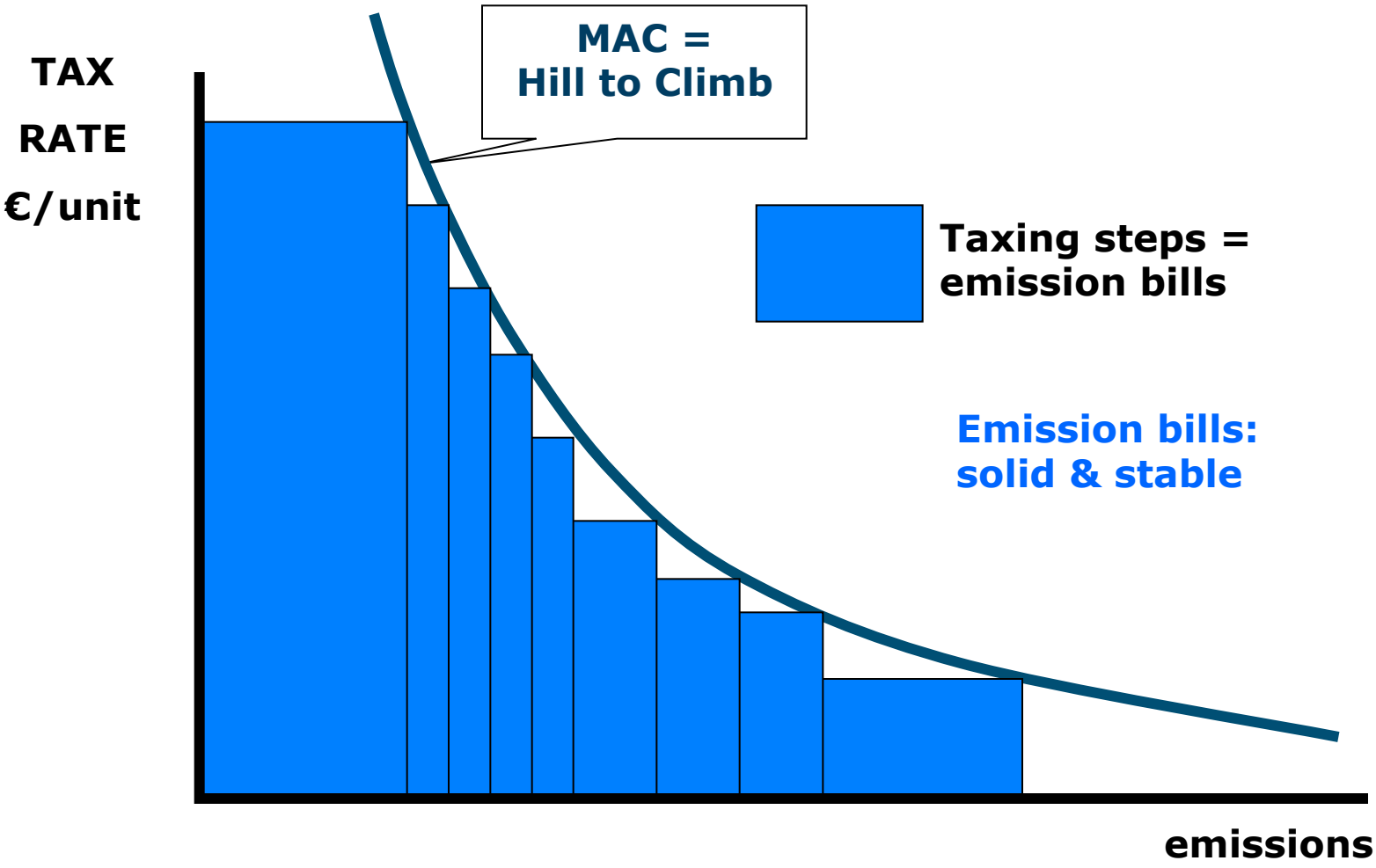
**Evidence:**
**All power generated during hour x is charged at the system SRMC(x)**
**+**
**Deltas {system SRMC(x) – SRMC infra-marginal units}, cover fixed costs**

# EU ETS in practice

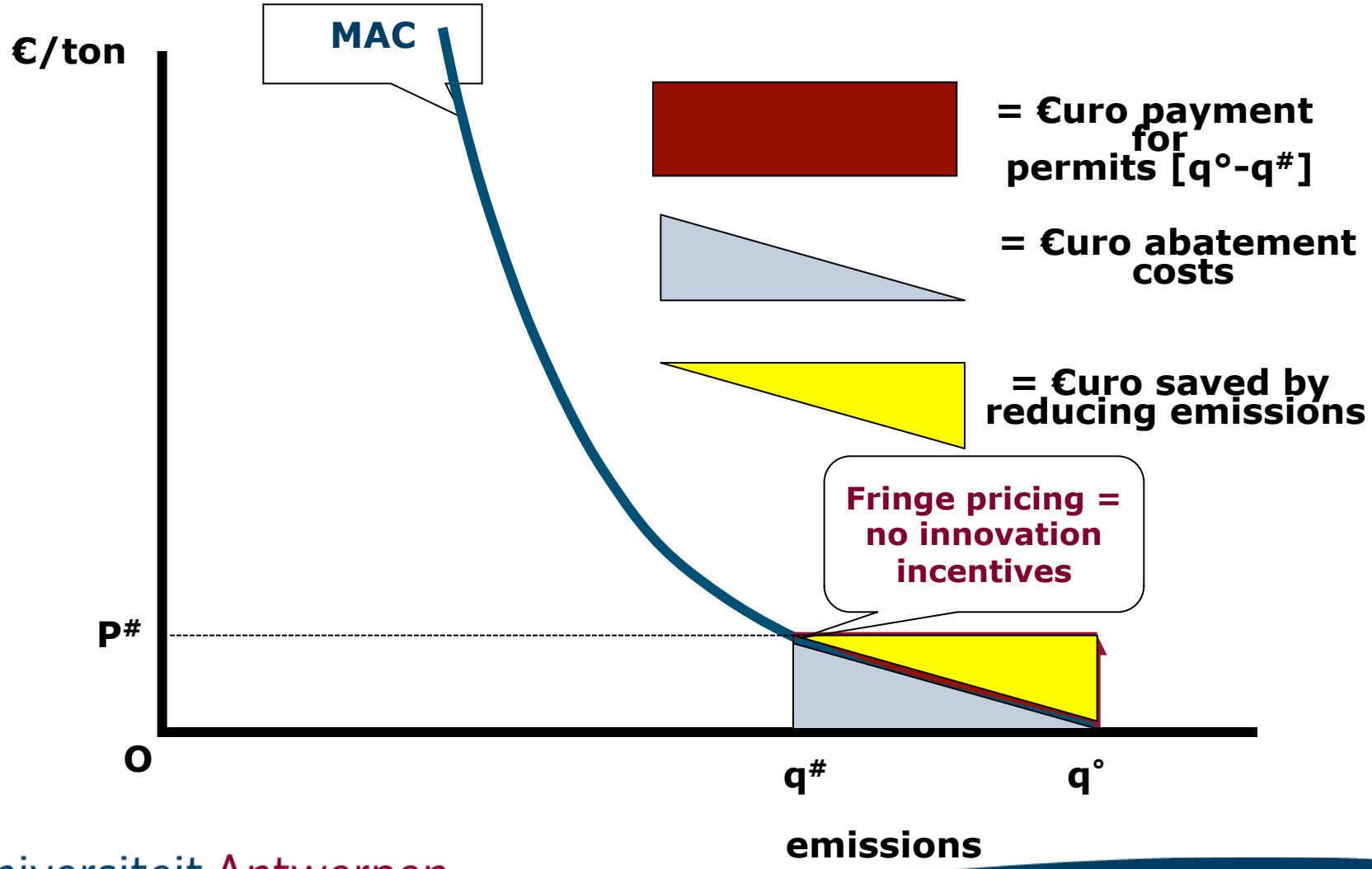
- **Free Permits up to 'benchmarked' emission levels**
  - **Permit price = penalty on emissions beyond**
  - **No trade in permits, but trade in penalties**

- **ETS advocates' discourse: 'Tail wags Dog'**
  - **⇔Marginal is derivative of total (not the reverse)**
  - **⇔ MC-pricing optimal IFF all submarginal units also pay the system marginal cost**

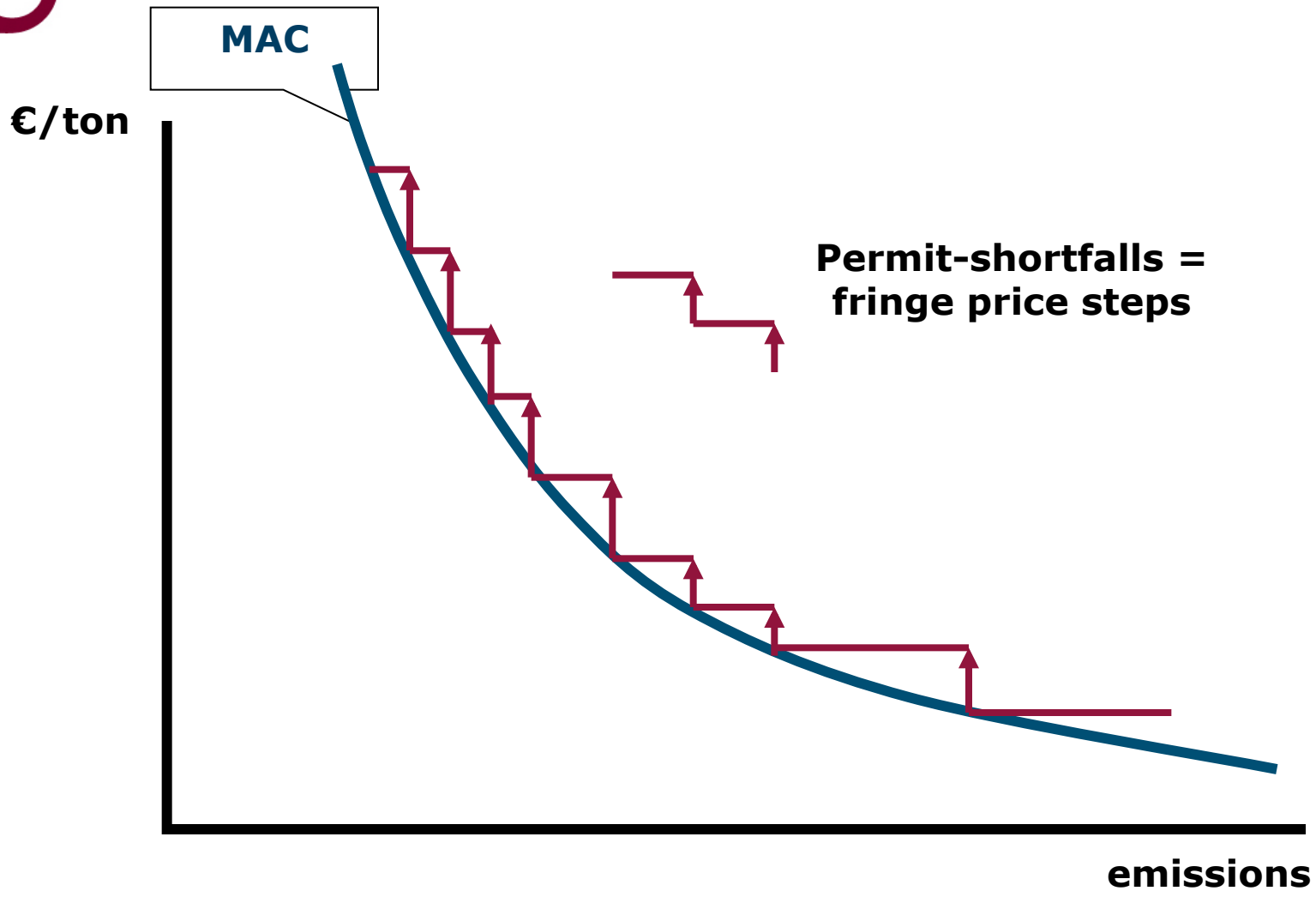
# Climbing the Emissions Reduction Slope via Interior Stair



# Free quota + fringe pricing of permit-shortfalls. The economics logic of a rational polluter

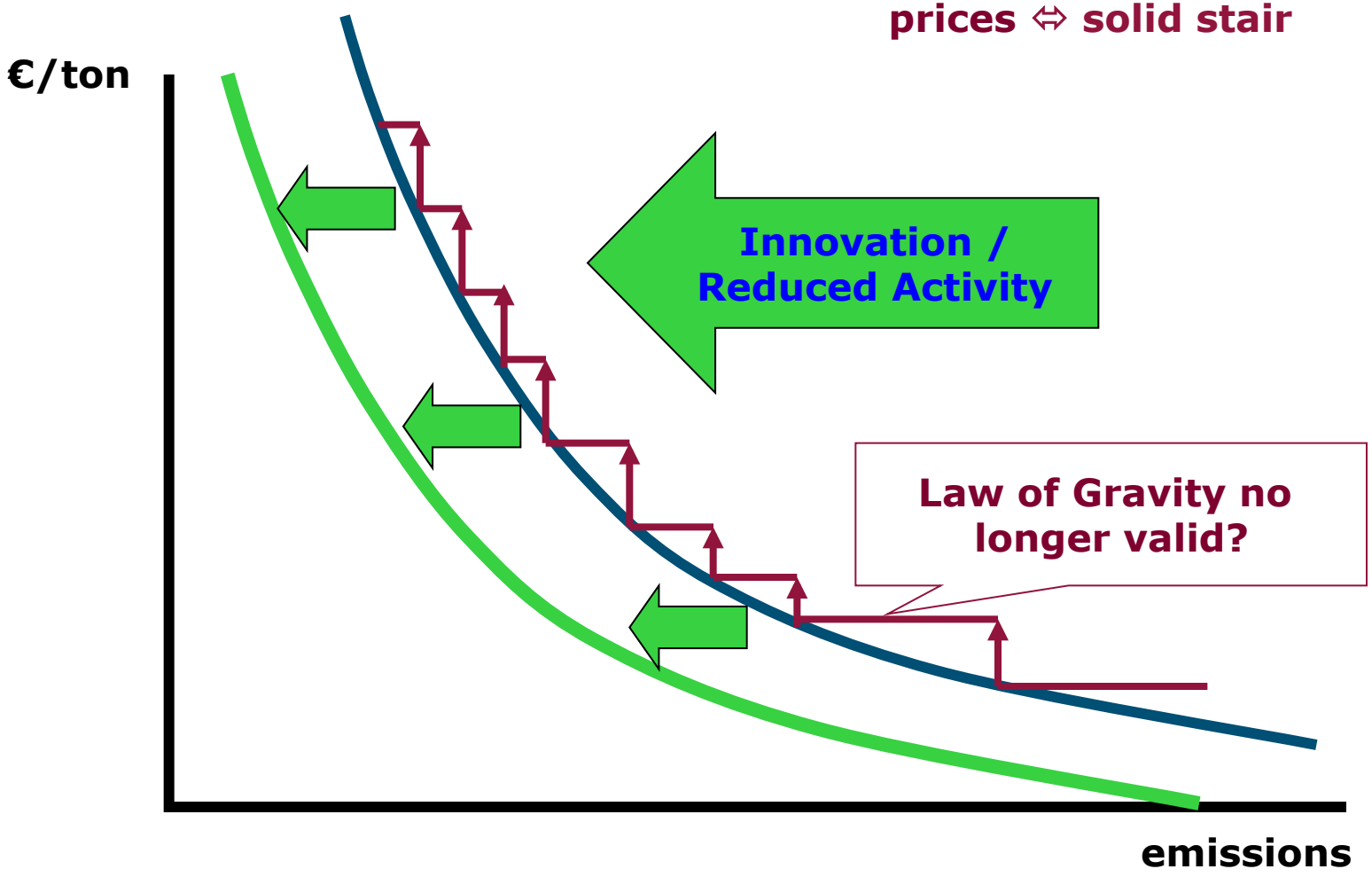


# Free quota + fringe pricing of permit-shortfalls = Exterior stair



# Exterior stair = unstable construction

**Trade in penalties: volatile prices ⇔ solid stair**



# Dubious ETS Carbon Prices

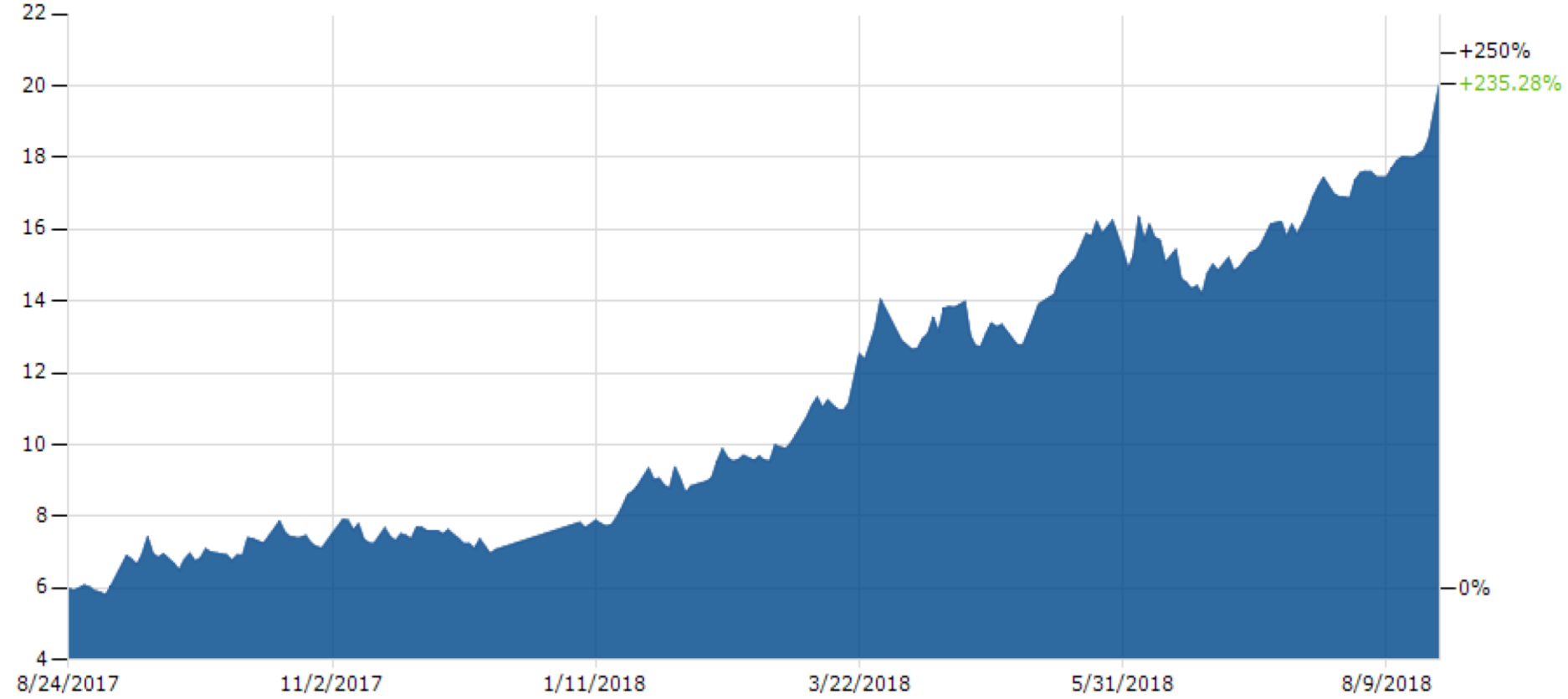
- **ETS permit prices**
  - Fringe price ≠ marginal price
  - ETS unique selling point 'uniform carbon price sets $MAC_i$ equal = minimum total AC' is hollow
  - Phase 1 & 2 [2005-2012]: 98% of permits free + banking into Phase 3: 2.3 billion permits hoarded + windfalls, fraud
  - Phase 3: auction for power generators (prices €5 to €8) + EITE activities get free permits (bill = 0)

- **Who pays the ETS bills?**
  - Electricity consumers are charged the ETS bills
  - However, governments (UK, Germany, Belgium, …) reimburse EITE 75-85% the ETS driven costs on their electricity bills
  - Finally: non-ETS electricity consumers pay the ETS
  - A considerable price increase = huge profits on the hoarded permit stock in 2018, before the MSR starts in 2019

# ETS posted prices 24 August 2017-2018

**(Source: Market Insider, 24 August 2018)**

Significant increase since last year, from €6 to €20/permit



# ETS helpful for climate policy?

- **Untill today?**
  - **After 2005: RWE, EON, GDF-SUEZ started construction of large scale coal plants in the Netherlands, Germany, …**
  - **ETS has not pulled decarbonization innovations**
  - **Almost 20 precious years have been irrevocably lost, causing more irreversible losses to the globe's climate**

- **Phase 4 [2020-2030]**
  - **In 2019: metamorphosis from cap-and-trade to a collar (bottom & ceiling) price control (MSR)**
  - **Otherwise, no major changes**
  - **One more decade lost?**

# Can ETS survive high permit prices?

- **Yes**
  - When roll-of mechanisms persist: the non-ETS electricity consumers pay the bill
  - However, pivotal role of electric power corporates may be undermined by fast growth in solar & wind supplies

- **No, when prices are charged on industrial emissions**
  - Industries cannot, will not, pay twice: a yearly permits bill + investments in de-carbonizing innovations, i.e.
  - price induced innovation is mostly fiction; the more fictituous, the more sticky the MAC curves are
  - Carbon leakage is then likely to occur
  - More likely is that industry will quit (blow-up) the ETS

# Has GHG emissions trading a future?

**Prerequisites:**

- ❖ **'Diversity & Segmented' substitutes for 'Amalgamation & Uniform' in handling emission sources & applying economic instruments.**
- ❖ **Submit Policies & Instruments to Sustainability Assessment**
- ❖ **Accord with stimuli for decarbonization innovations, which are more important than market mechanisms**
- ❖ **Revise belief in uniform price induced innovation**

❑ **Yes, GHG emissions trading may play a role**

- ❑ **When organized per industrial sector / subsector**
- ❑ **On a global scale, e.g, all cement plants (> some size) to preclude leakage**
- ❑ **Foster flexibility above permit trade**

The EU ETS being a scam, generates two feelings:

- **Relief**: better climate policy is feasible after breaking the deception
- **Responsibility**: find new effective, efficient and fair policies