CEPR/EAERE 11/15/23

Cost Containment and Market Stability in Global Carbon Markets

Christian Traeger

Department of Economics, University of Oslo, Norway
ifo Institute for Economic Research, Germany
CEPR Climate Change RPN

Background

Importance

- ~50 countries + subnational entities use either carbon tax or cap and trade system
- Following the Paris Agreement over 80 additional countries consider implementation
- At 2022 prices, EUETS market value ~150 billion USD – double its 2021 value
- Alternatives usually bad (command and control, Inflation reduction act, …)

Issues with current cap & trade systems

- Prices very volatile as a result of macroeconomic recessions, technological progress, asymmetric information
- Slow regulatory response
- Very complicated market stability reserve (after backloading!)
- Cheap abatement left on the table, hefty price increases at short note
- Long-standing concern that taxes are more efficient than wide-spread cap & trade

Focus for next 15-20min

1. "Flexible mechanism":
   Steer price-quantity relation continuously and efficiently
   rather than fixing price or quantity
   - Roberts & Spence (1976), Requate & Unold (2001), Montero (2008), Kollenberg & Taschini (2016,19), Karp & Traeger (2021), Burtrow et al (2021)
   - Motivate, discuss implementations, focus: Smart Cap

2. What's the efficient price-quantity relation/responsiveness for CO2?
   - Common efficiency argument suggests tax close to efficient
   - Contrasts starkly with quantity-based commitments
   - Re-examine the argument in GHG context (especially CO2)

   ➔ Maybe emissions should not be quite as responsive after all

Motivation

Why a "flexible mechanism"?

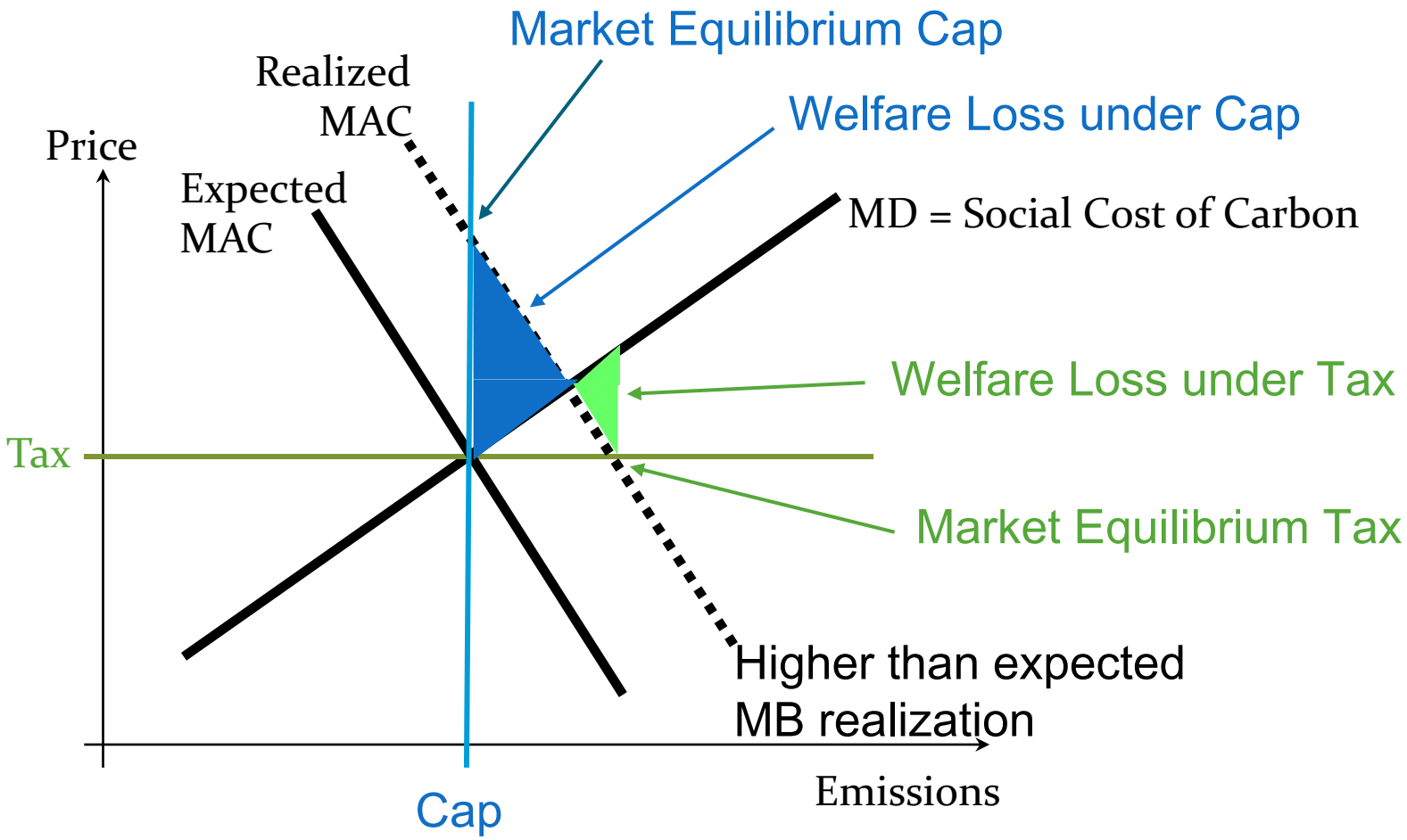
1. Uncertainty:
   - Social planner perspective:
     Ex-ante optimal cap or tax rarely ex-post optimal

   Who carries the costs?
   - Classic cap: firms (price risk & return risk on mitigation investments)
   - Tax: environment, future generations, Paris Accord promises
   - "Flexible mechanism" efficiently balances costs to firms & the environment

2. Negotiation:
   - Firms afraid of potentially high prices
   - Environment concern: too little abatement (especially when prices are low)
   - Compromise: Do more if costs/price are low, less if price/costs are high

3. Moral incentive failure of classic cap: ("Waterbed effect")
   - What I abate more will be emitted by someone else
   - offsetting abroad

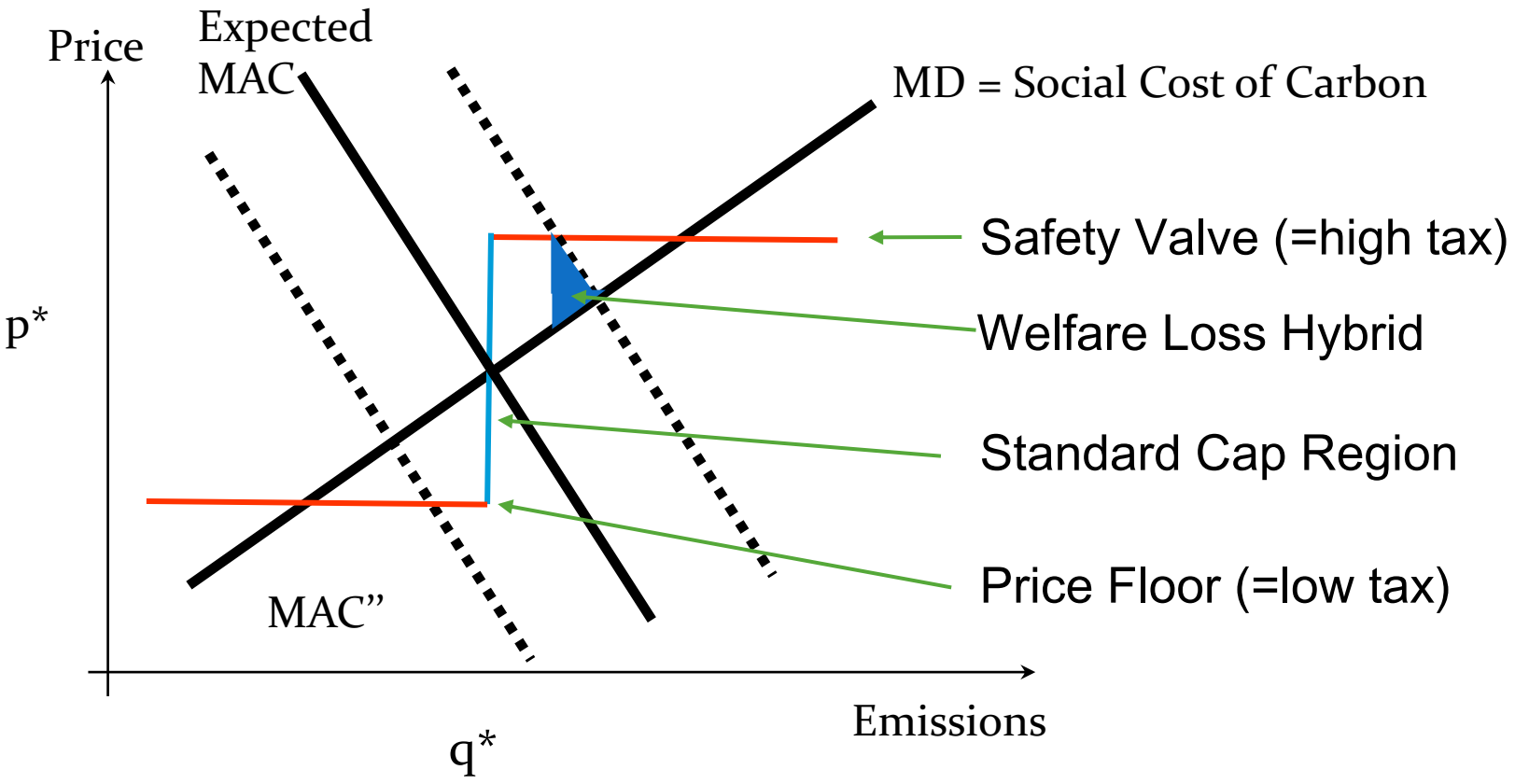
Price vs Quantity: simple static Weitzman (1974) reasoning



*Observe: Flatter MD curve -> **Lower Welfare Loss under Tax***

Hybrid System

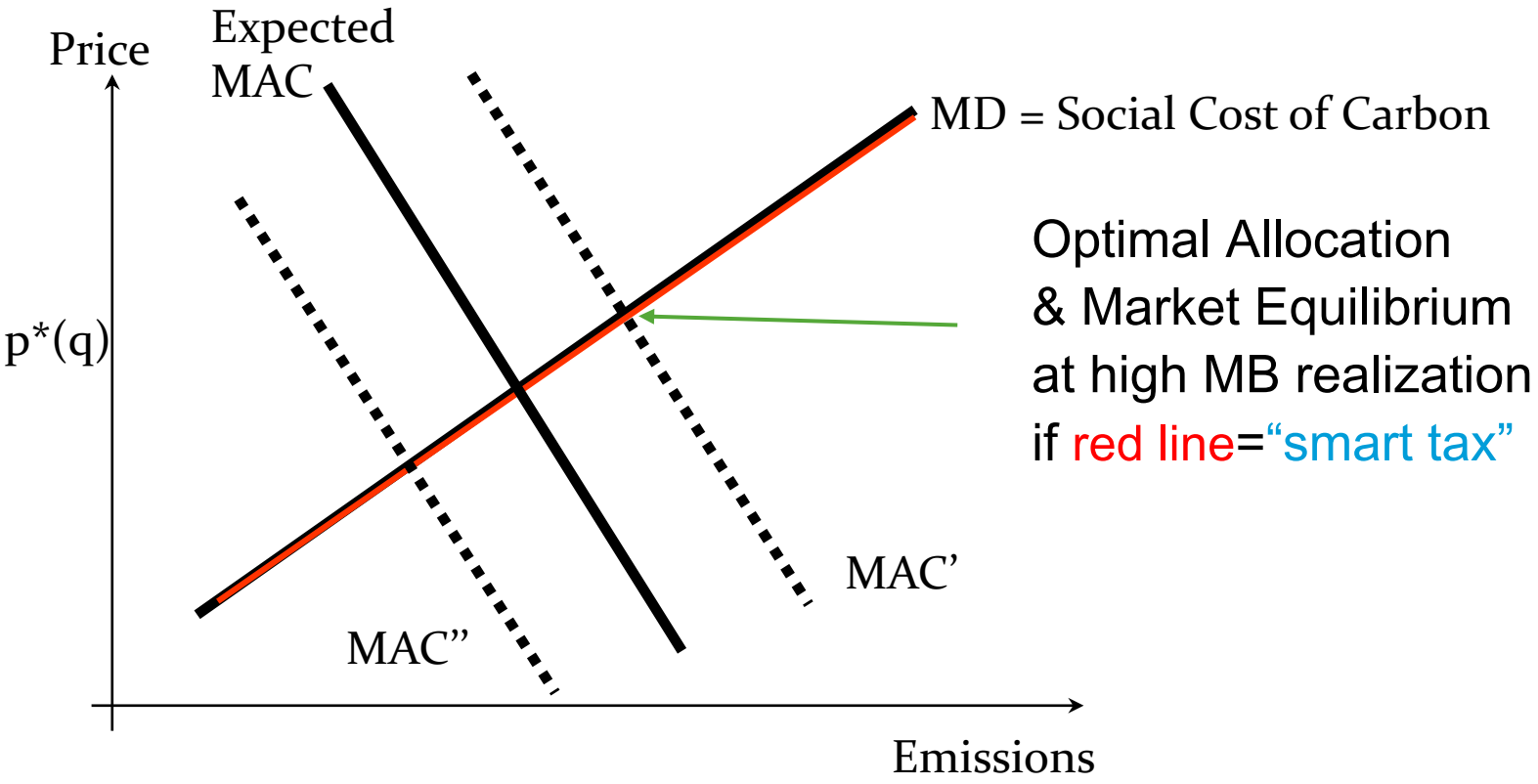
Motivated by Dallas:



"Fully Flexible System"

Let the price follow the social cost:

If we can move along the red line there is no welfare loss



Optimal Allocation
& Market Equilibrium
at high MB realization
if red line="smart tax"

Letting price follow social cost:

How to steer along the social cost (red line)?

- Requate & Unold (2001): Approximate red line offering call options
  - Great idea. Static setting. More difficult if prices are volatile.
- "SMART TAX": non-linear tax equal to red line
  Announced tax is a function of aggregate emissions
  - Informational issue: Individual firm has little real time information about **expected aggregate emissions** at end of year/commitment period and, thus, expected prices
  - Politically cap & trade seems preferred
- Cap & trade auctions: Continuous auction supply curve
  - Promising. Limited grandfathering.
  - Balance frequency (for information) & market density (strategy prfns)

Alternate suggestion:

- "SMART CAP" (Karp & Traeger 2021)

Smart Cap: "Trade rights, not units of emissions"

The Smart Cap: A cap'n trade implementation of the smart tax

- Distribute Q allowances – allowances are not in tons of CO2
- Announce a "conversion function" *q(price):*

  Each allowance gives claim to emitting $q(price)$ emissions, where $price$ is the *equilibrium market price of certificates*
- use standard cap & trade market to trade certificates

Karp & Traeger (2021) discuss equilibrium and its stability. Advantages:

- Use standard market setting
- Price signals aggregate information for firms in continuous time
- Market power could be accounted for (otherwise results in lower emissions), but not sure a concern in major markets

2. What's the efficient slope to steer along for CO2?

How price-responsive should a flexible mechanism be?

Static answer & SCC-based extension

- For climate:
  - Per-period damages as a function of CO2 are very flat.
  - SCC (time aggregated damages) still pretty flat

  Why?
  - Because warming is logarithmic in CO2

➔ impact of emission shocks smooth out over time

- Alleviating price risk to firms gets priority

➔ Emissions supply should be very price-elastic. Tax close to first-best. ("Weitman's slope criterion").

If MAC shocks are due to uncertain technological progress

➔ Tax no longer close to first-best; emissions should be less price-responsive. (Karp & Traeger (2018): "slope + shift criterion")

2. What's the efficient slope to steer along for CO2?

Background:

- We can and should condition any cap (smart or dumb) explicitly on major macroeconomic fluctuations affecting demand for allowances

Therefore:
Focus the endogenous response on the role of uncertain abatement costs generated by uncertain green technological progress

- Better-than-expected green technological progress
- Lowers abatement costs and, thus, MAC curve, thereby
- Reducing future equilibrium emissions, thereby
- Reducing future marginal damages of a ton of CO2 emitted today
- Shifts down the Social Cost of Carbon (SCC)

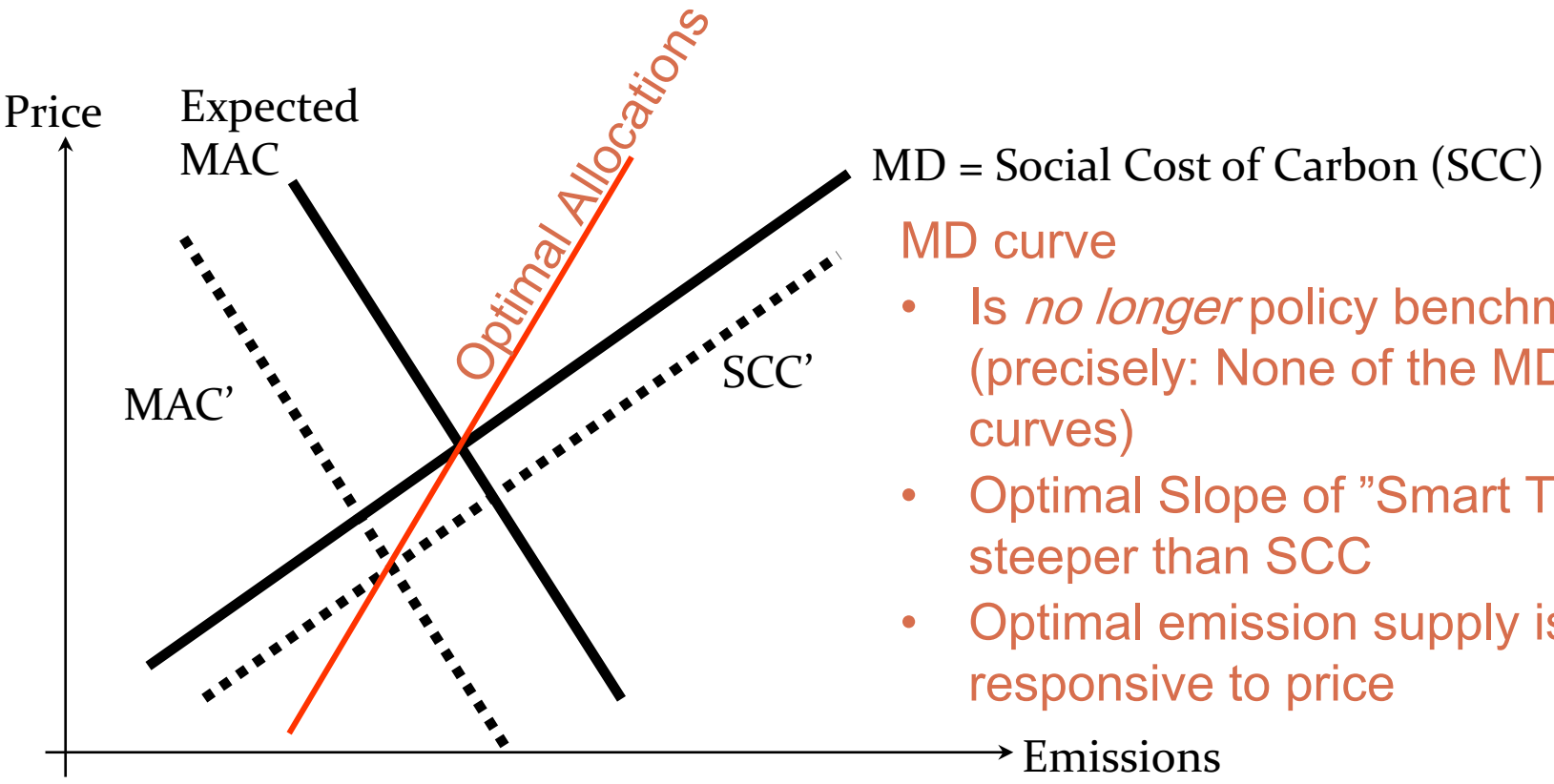
Note: Acting as if global policy, but basic reasoning relies on

- Technological progress being global (also if no global policy)

Dynamic World with Technological Progress

Intuition: Better-than-expected green technological progress

- Lowers abatement costs -> lower MD of CO2 emitted today
- MD = SCC shifts. Perfectly correlated to MAC curve shift.



MD curve

- Is *no longer* policy benchmark (precisely: None of the MD curves)
- Optimal Slope of "Smart Tax" is steeper than SCC
- Optimal emission supply is less responsive to price

Some Practical Comments

If smooth control (smart cap or smooth auction supply) sounds "too academic" …

- ***use smart tax or cap to inform quantities supplied based on last period's price (last auction/last commitment period)***
- now standard cap and trade system
- Still responsive even if with a delay
- Still allows firms to anticipate future prices based on current signals

With banking and borrowing partly incorporated already today, but

- Smooth response can avoid need for banking and borrowing

Why would you want to avoid banking and borrowing?

- Makes pricing a complex boundary value problem with often unclear boundary conditions (adds unnecessary uncertainty on firm side)
- If not using period-conversions of certificates, emissions price will not grow with SCC but instead based on outside investment options

Summary

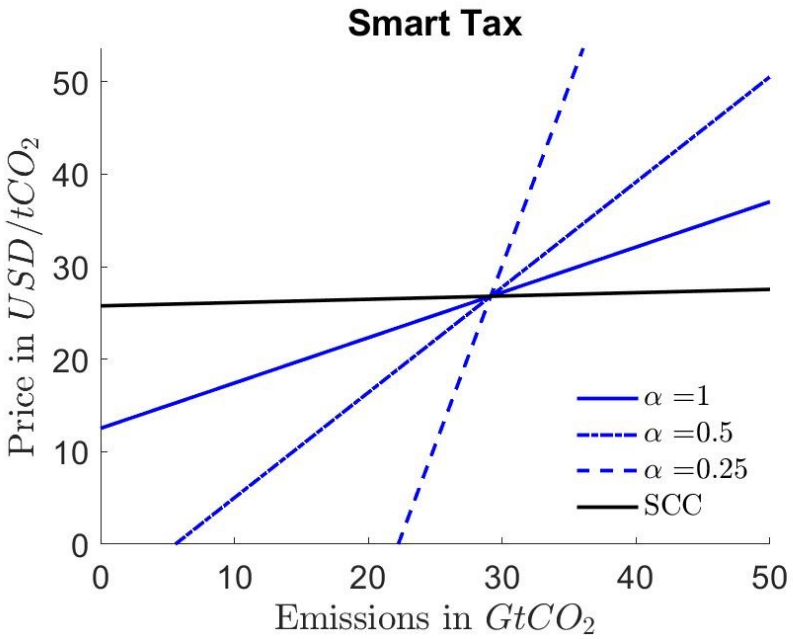
Using smart cap or smooth supply functions in auctions:

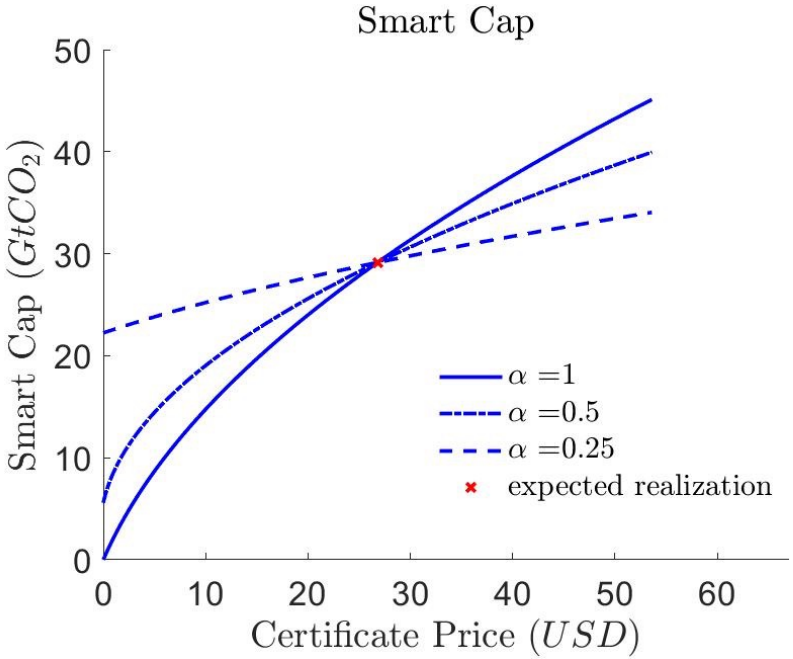
- can implement large efficiency gains with *minimal information requirement*
- Is an "optimal compromise" between cap & tax, both *economically & politically*
- Employs & only slightly modifies existing institutions
- *Has a better incentive structure than standard cap & hybrid system*
- Avoids slow policy response
- *Avoids overly relying on banking for shock smoothing*
- *Avoids financial commitment* to buy up certificates at price floor

Avoids some of the weird implications and complexity of e.g. EU ETS' market stability reserve

Quantitative Illustration. Slow technology adoption reduces optimal emission responsiveness

If new innovations are not fully adopted within a commitment period ($\alpha < 1$), the relative shifts of MAC and SCC curve change, increasing slope of smart tax





with partial adoption during commitment period:

- Smart tax becomes steeper: Price more responsive to quantity change
- Smart cap becomes less responsive: Quantity becomes less responsive