

The Economics of Climate Change

Lecture 11:

Multiple policy goals and multiple instruments

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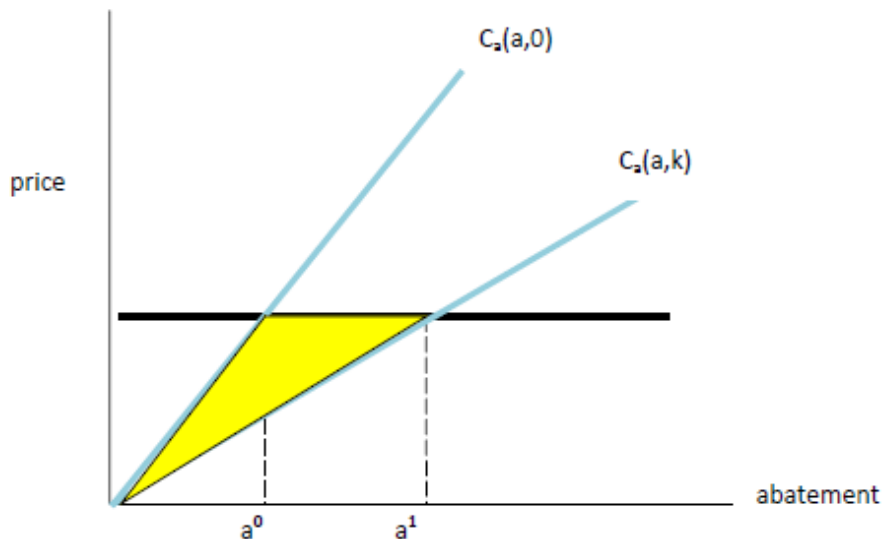
The effects of Emissions Trading and taxes on innovation

- Fischer et al. (2003) JEEM
- n competitive firms
- one of those firms is an innovator
- Stage 1: innovator decides on level of R&D
- Stage 2: other ($n - 1$) firms decide whether to adopt technology in
- return for fee or to (imperfectly) imitate technology
- Stage 3: All firms choose emissions level given tax or permit system

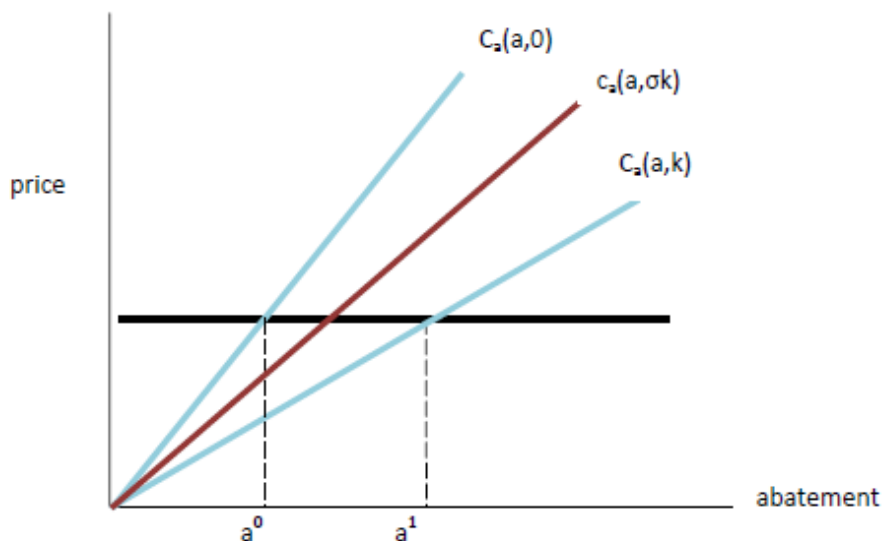
Adoption Choice

- Firms differ with respect to technology $t \in \{0, \sigma k, k\}$
- Hence MAC of abatement a is $C_a(a, t)$
- Innovators usually can monetize spillover benefits from by selling the new less emission intensive technology k
- Followers (non-innovating firms) can benefit by
 - buying the new technology from the innovator
 - developing an alternative σk which is less efficient but assumed costless

Innovation and MACs under a tax

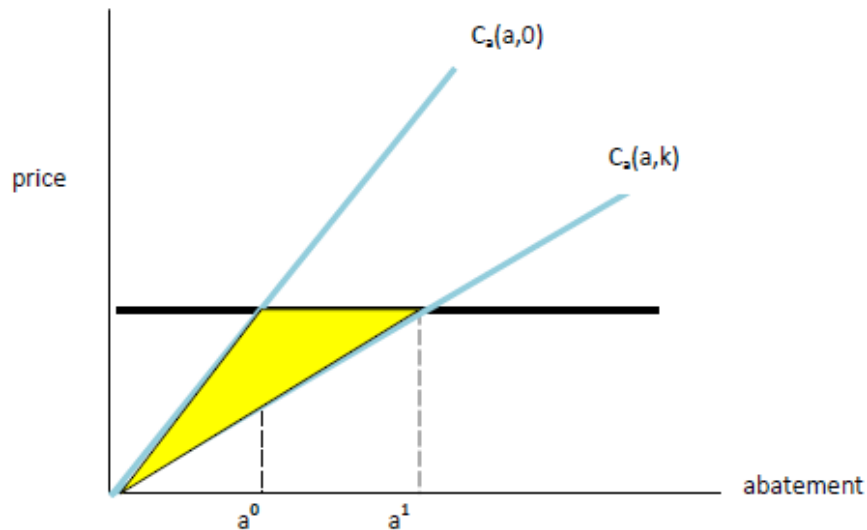


- Cost reduction by innovation k

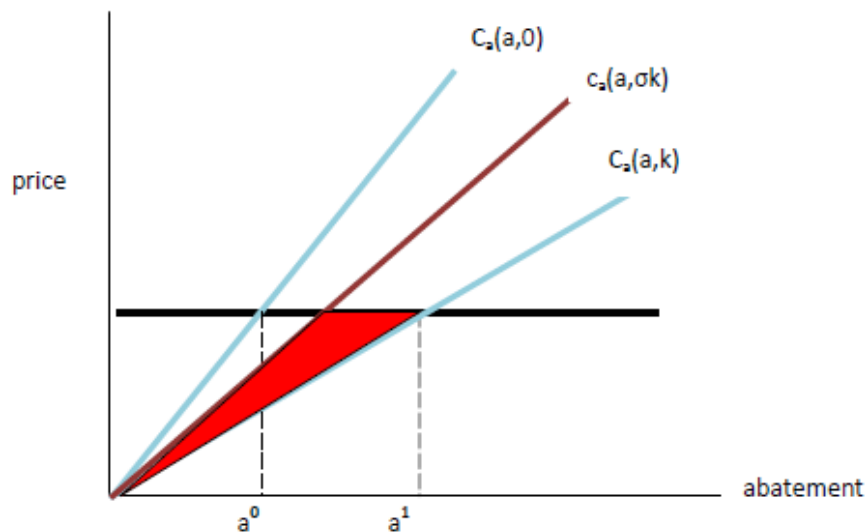


- MAC with costless copying of technology (σk)

Innovator's extraction of rent

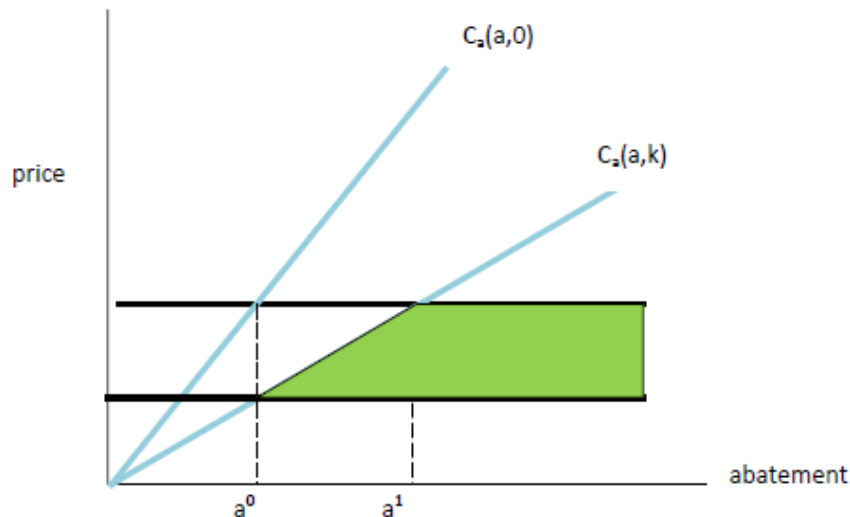
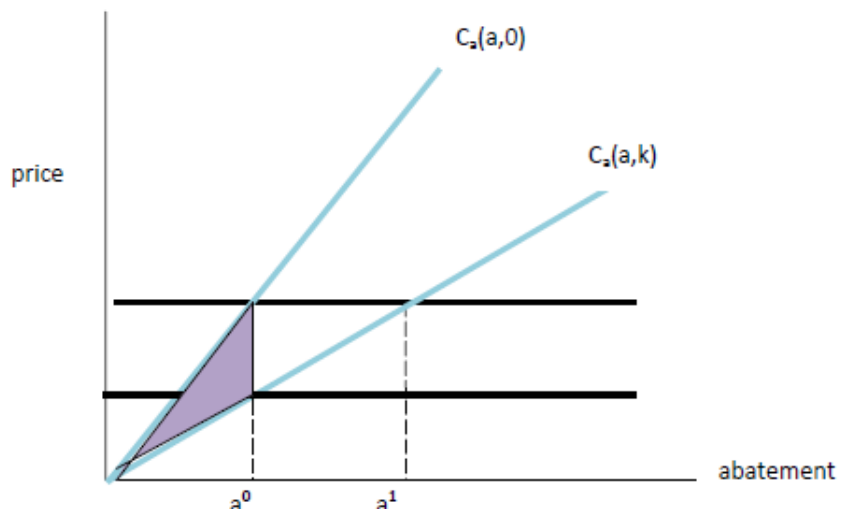


- Innovator's gains from selling the technology if imitation is absent



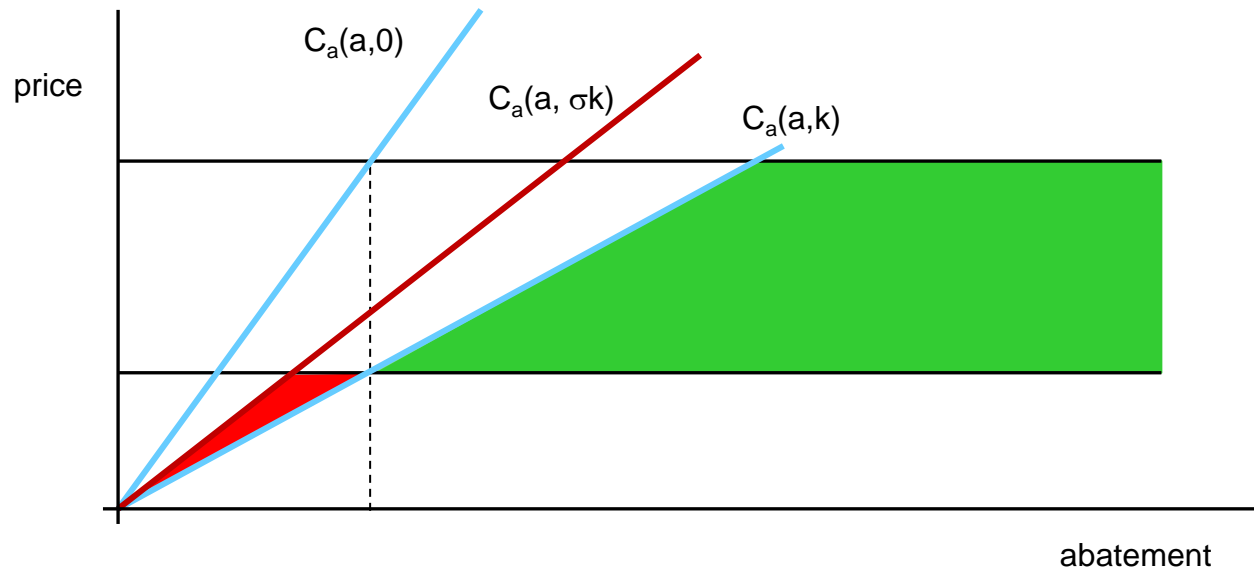
- Innovator's gains from selling the technology if costless imitation is possible

Emissions trading without imitation



- If innovation is adopted by the market, the market price for a given emissions target will fall.
- Innovator achieves two rents
 - a) From cost reduction
 - b) From lower market prices

Emissions trading with imitation

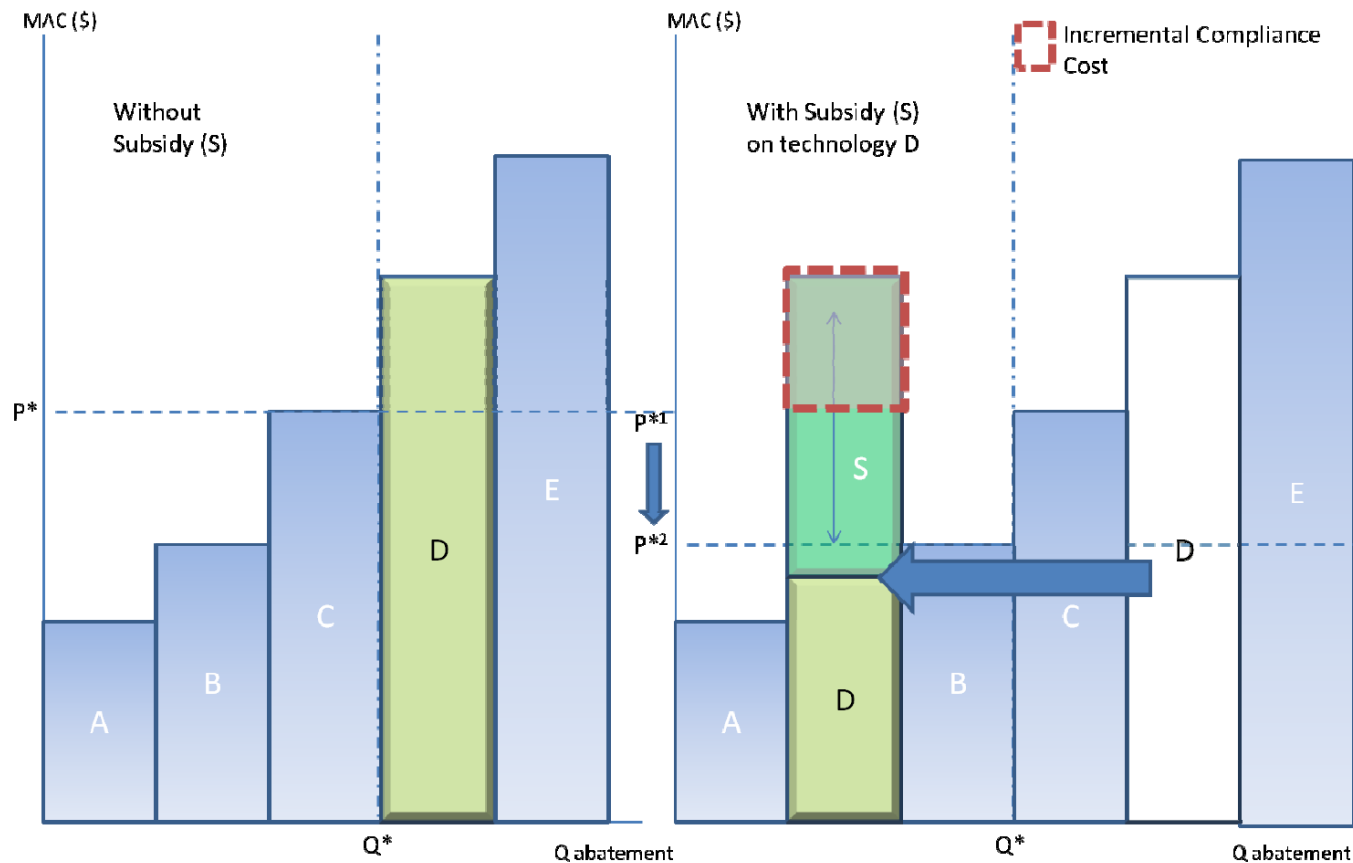


- If imitation is possible gains from adopting the innovation reduces only by the achievable cost reduction. The gains from reduced market prices persist.

Conclusion

- In general, ambiguous results on whether permits or taxes can result in higher innovation incentives:
- σ (the imitation parameter) will influence whether taxes or permits have a larger innovation incentive
- $\sigma = 1$ favors emissions trading and $\sigma = 0$ favours a tax instrument
- Yet, it is unclear whether innovation and adoption is at the desired level. Generally, it is assumed that innovation triggered by real-world carbon pricing alone is too low.

Discussion: Will subsidies inefficiently distort an Emissions trading system?



Multiple policy goals/multiple instruments

- In addition to controlling greenhouse gases climate policy instruments are often intended to suit other goals
 - Fostering energy efficiency
 - Energy security
 - Innovation
 - Technology adoption
- Example: The 20-20-20 target within the EU:
 - A 20% reduction in EU greenhouse gas emissions from 1990 levels;
 - Raising the share of EU energy consumption produced from renewable resources to 20%;
 - A 20% improvement in the EU's energy efficiency.

Multiple policy goals/multiple instruments

- Achieving all of the above-stated goals is inefficient
- Tinbergen rule:
 - “For each policy objective, at least one policy instrument is needed.”
- Hence, additional instruments are required:
 - introducing subsidies for fostering R&D and early technology adoption, (e.g. feed-in tariffs)
 - additional taxes for other externalities (VOCs, Nox,SO2, etc.)
 - How about additional taxes within an emissions trading scheme?