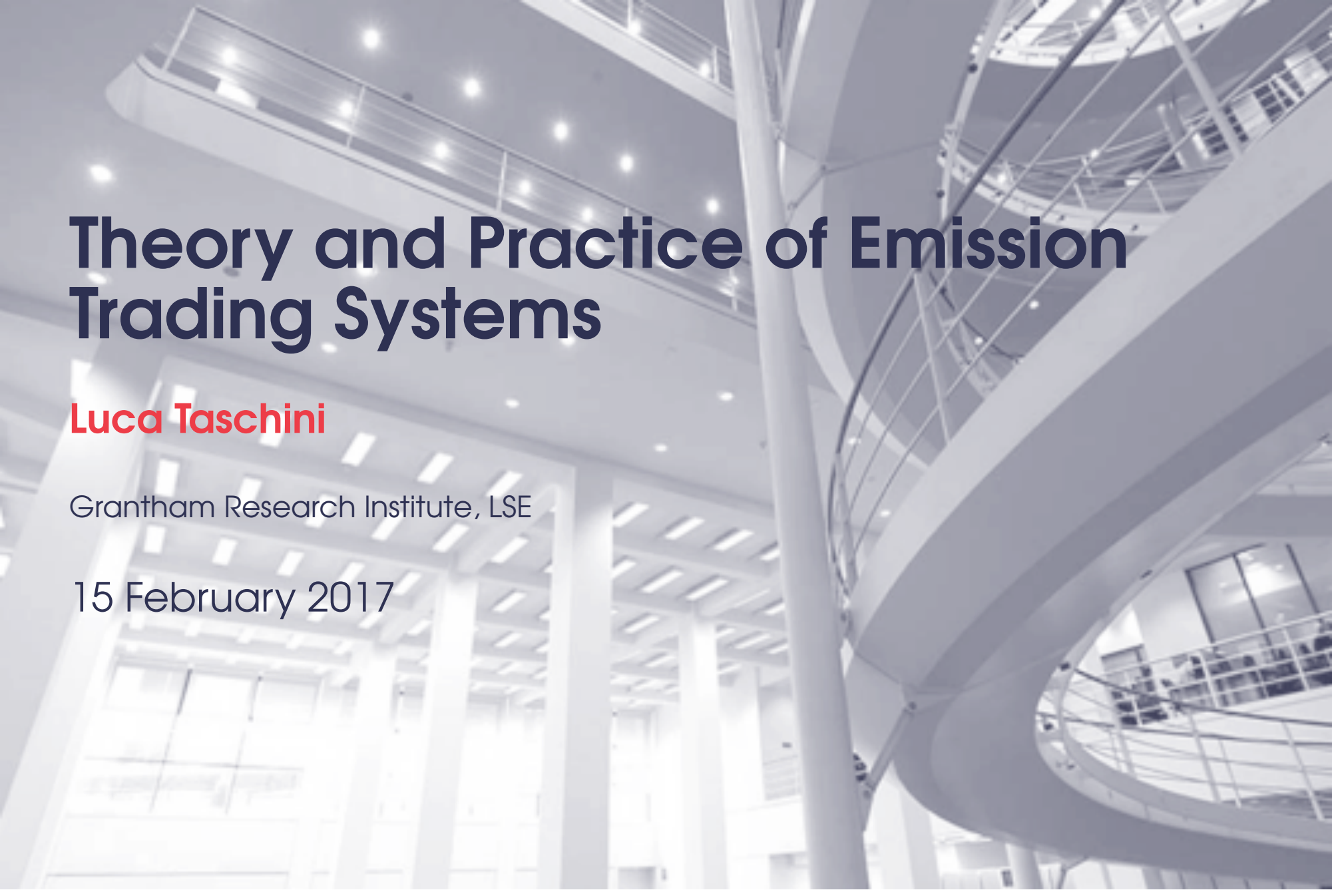

Theory and Practice of Emission Trading Systems

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E·S·R·C Economic & Social Research Council

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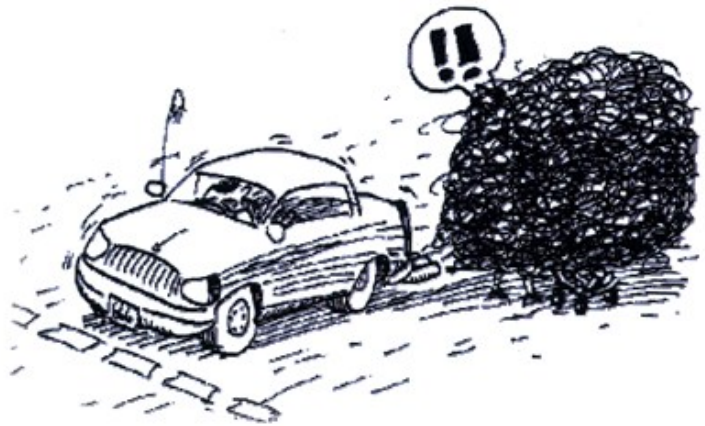
Agenda

- Government intervention and instrument choice.
- The theory of Emission Trading Systems:
  - ETS key design elements.
- The practice of Emission Trading Systems:
  - System revision and market intervention:
    - Price- and quantity-based price management;
    - The EU ETS Market Stability Reserve.
  - Linking international carbon markets:
    - Why linking? Economic and political motivations;
    - Carbon dating: key factors that determine when linking is beneficial;
    - Carbon dating in the real world.

Market failures and Gov. intervention

- In the presence of externalities, private markets tends to over produce (if negative externalities) or under produce (if positive externalities).
- Private markets do not function properly because they do not allocate resources in the most efficient way.
- Governments can correct (internalise) externalities through policy action.

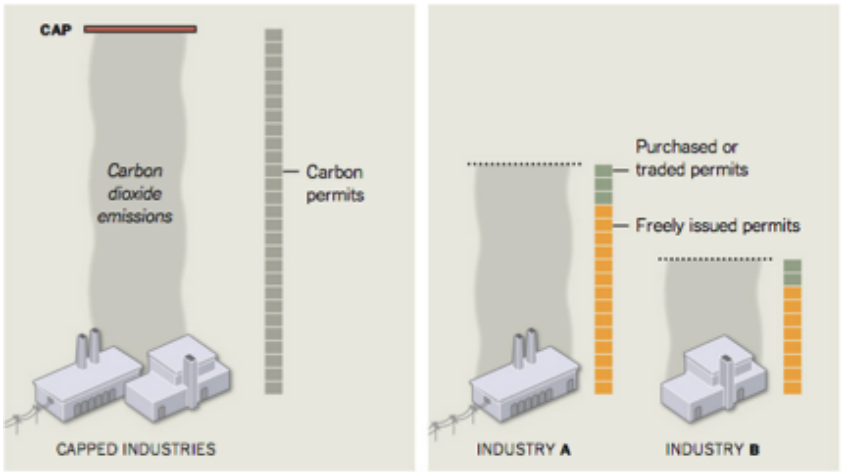


Regulation and instrument choice

- Command-and-control policy refers to environmental policy that relies on direct regulation (permission, prohibition, standard setting and enforcement).
  - To achieve a least-cost solution the information requirements is daunting.
  - No central planner or bureaucrat in Madrid, Brussels or Washington could possibly have the required info about every regulated firm.
- The genius of market mechanisms lies in delegating decisions about abatement at each firm to the firms themselves.
- Market mechanisms
  - price-based instruments (e.g. taxes and subsidies); and
  - quantity-based instruments (e.g. emission trading schemes and renewable obligation certificates) where the price signal emerges from the quantity restriction coupled with a trading scheme.

How does an Emission Trading System work?

- An Emission Trading System (ETS) sets a maximum level of pollution, a cap, and distributes emissions allowances among polluting firms.
- Firms must have an allowance to cover each unit of pollution they produce.
- Firms can obtain these allowances either through an initial allocation or auction, or through trading with other firms.



- Since some firms inevitably find it easier or cheaper to reduce pollution than others, trading takes place.

ETS key design elements

- There are many opportunities to tailor an ETS to reflect the country's specific domestic circumstances and needs.
- Design features:
  - Decide the scope (gases and sectoral coverage);
  - Set the cap (timing for cap setting);
  - Distribute allowance (allocation methods);
  - Use of offsets (offset use and quality & quantity limits);
  - Decide on temporal flexibility (banking and borrowing provisions);
  - Price management and market intervention;
  - Ensure compliance and oversight (MRV and oversee the ETS);
  - ETS linking.

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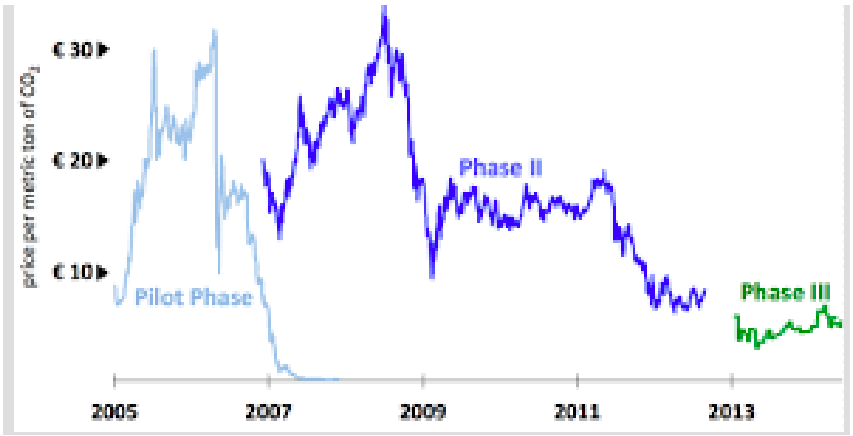
Current experience with price management

- Prior to ETS implementation, the concerns of policy makers have typically focused on the possibility of 'too high' prices.
- Low prices have actually become a greater source of concern.



- Growing recognition that appropriate market management approaches can help ensure mitigation is consistent with long-term goals.
  - Allowance reserves (quantity mechanism)
  - Allowance price corridors (price mechanism)

Current experience with linking

- In successful links to date, partners have generally had strong existing relationships, which facilitated the initial negotiation and governance of links.

- In general, key design features need to be harmonized to ensure environmental integrity.
- Even when systems were designed from the outset to link and harmonization is not required, is linking the preferred option?

ETS key design elements: market management

- There are many opportunities to tailor an ETS to reflect the country's specific circumstances and needs.
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Price management

- Governance models for market management can be characterised in terms of
  - the extent to which they increase price certainty (as opposed to the quantity certainty that ETSs normally provide) and
  - the extent to which interventions are governed by predetermined rules or are at the discretion of regulatory bodies
- For any intervention, there is always a risk that it may increase regulatory uncertainty rather than reduce it.

Market Intervention: Rationale

- Some of the features embedded in the overall market design provide regulated entities with a way to smoothen short-run price fluctuations:
  - temporal flexibility (banking and borrowing),
  - regular auctions,
  - including offsets use and linkage.
- A number of factors can lead to what policy makers may consider the need for intervention:
  - persistent shift in price levels,
  - growing imbalance between supply and demand of allowances.

Market Intervention: the EU ETS

- 1-year surplus consequence of two effects: (1) economic recession and renewables-promoting policies; and (2) incapacity to *respond* to changes in economic circumstances.

Figure: Source DECC (2014).

Responding to high and low prices

- To tackle undesirably high prices, policy makers can seek to maintain or lower prices when they reach a 'high' price threshold by
  - adjusting limits on the use of offsets;
  - selling a limited number of allowances at preset prices from an allowance reserve;
  - setting a hard price cap.
- Policy makers can choose between a variety of interventions to address 'low' prices.
  - setting a reserve price at auction;
  - committing to purchase an unlimited or limited number of allowances from the market to support prices.

Responding to supply-demand imbalance

- Quantity mechanisms aim to manage the number of allowances that are in circulation.
- Given a fixed cap, a quantity-triggered reserve can respond to external shocks by adding or subtracting allowances from a reserve.
- Intervention is based on predefined triggers (rule-based)
  - The Market Stability Reserve (MSR) under the EU ETS is a rule-based mechanism.
  - The MSR is designed to adjust the annual number of allowances auctioned in the market in certain years, based on predefined rules regarding the level of the unused allowance (bank of allowances).
- Intervention is discretionary (reserve in South-Korea).

The EU ETS Market Stability Reserve

- The MSR aims to "address the current surplus of allowances," and "improve the system's resilience to major shocks by adjusting the supply of allowances to be auctioned."

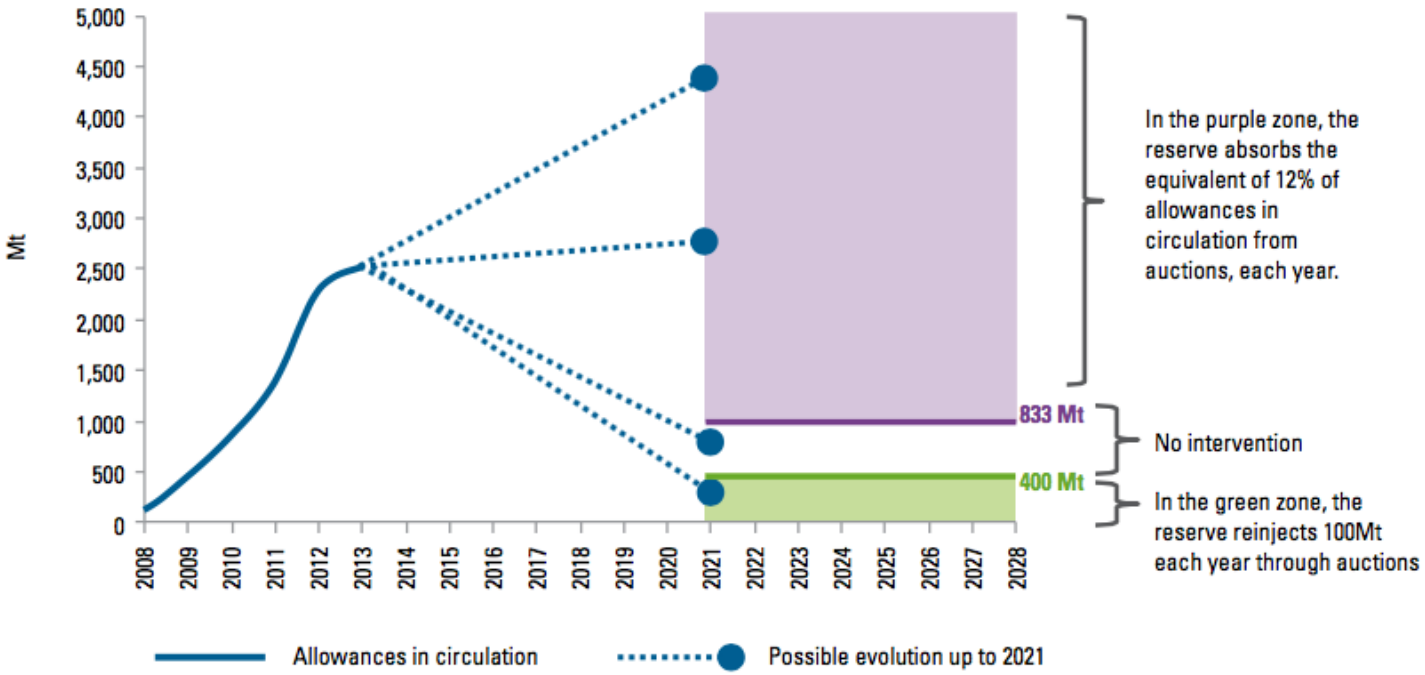


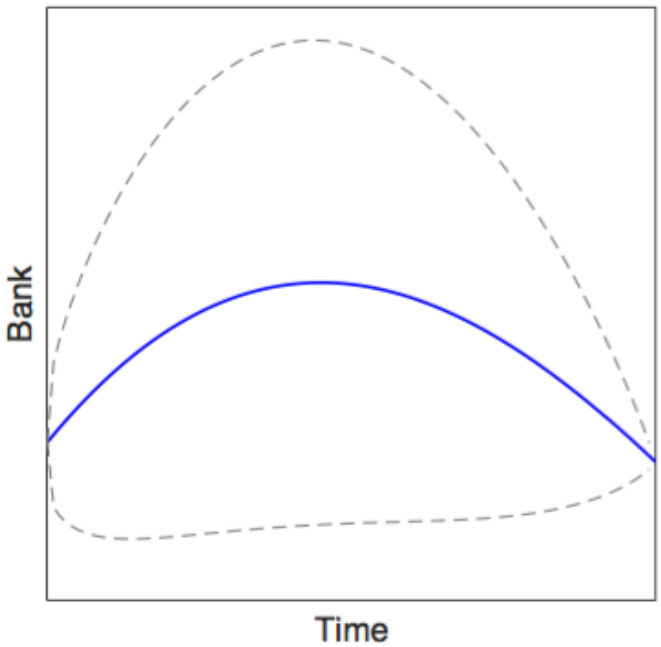
Figure: Source Trotignon et al. (2014).

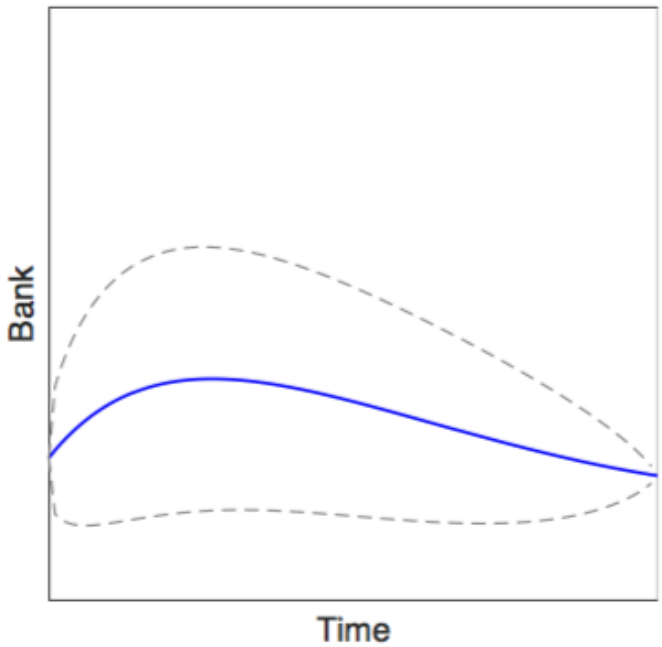
Market management via cap adjustments

- ETSs with fixed caps lack provisions to address systematic imbalances in the supply and demand of allowances.
- In a recent paper we propose a mechanism which adjusts the cap in response to changes in the aggregate bank of permits:
  - *Emissions Trading Systems with Cap Adjustments.* Kollenberg and Taschini JEEM 2016
- Our study shows that the *responsiveness* (optimal policy stringency) can be achieved via an *adjustment rate*, which is indexed to the aggregate bank of allowances.

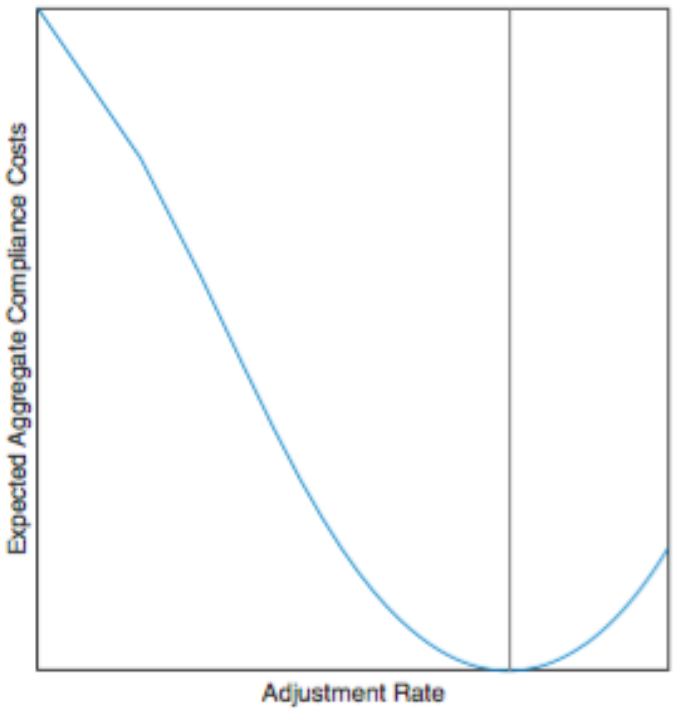
Cap adjustment and the bank of allowances

- Aggregate bank quantiles for a 95% confidence level when the responsive mechanism is inactive (left diagram) and when it is active (right diagram).





Optimal adjustment rate



- By increasing the adjustment rate the cap dynamically change via allocation adjustments.
- Trade-off between:
  - Firms' cost savings caused by the shock-mitigating effect of a responsive policy
  - Firms' loss of benefits from exploiting differences in marginal abatement costs across time

Conclusions on cap adjustments

- Fixed-cap ETSs lack provisions to address allowance demand-supply imbalances resulting from economic shocks.
- Price and market management can improve *responsiveness*.
- We study a quantity-based mechanism which adjusts the cap in response to changes in the bank of allowances.
- The study provides an analytical basis for the EC's choice of a cap *adjustment rate* (the percentage of removal and injection of allowances).

ETS key design elements: system linkage

- There are many opportunities to tailor an ETS to reflect the country's specific circumstances and needs.
- Design features:
  - Decide the scope (gases and sectoral coverage);
  - Set the cap (timing for cap setting);
  - Distribute allowance (allocation methods);
  - Use of offsets (offset use and quality & quantity limits);
  - Decide on temporal flexibility (banking and borrowing provisions);
  - Price predictability and market intervention;
  - Ensure compliance and oversight (MRV and oversee the ETS);
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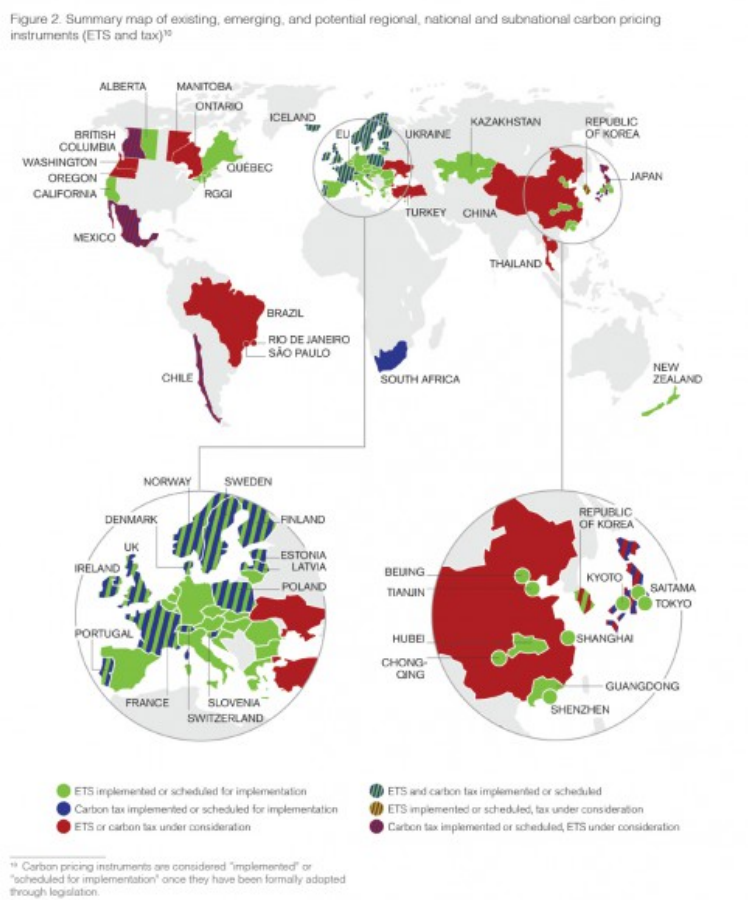
International carbon markets



- As of 2016, ETSs were operating across four continents in 35 countries, 13 states or provinces, and seven cities, covering 40 percent of global GDP, and additional systems were under development.
- A bottom-up policy architecture where ETSs interact can be a significant element of the global climate change policy framework in the future.

Why linking?

- Economic motivations
  - Abatement costs being minimised across a larger pool of regulated firms;
  - Improved liquidity resulting in decreased transaction costs, and
  - Lower overall price variability and thus reduced price uncertainty (depending on who is the linking partner, more on this later).
- Political motivations
  - Linking locks-in ETS as (one of) the local regulatory choice(s) to control emissions
    - Thus the risk of regulatory capture (against ETS) is reduced;
  - Contributes to a level playing field that can facilitate international cooperation
    - Alleviates competitiveness concerns among economies;

Practical considerations

- Need for regulatory changes to ensure regimes are compatible:
  - Monitoring, reporting and verification (MRV) of emissions.
  - Enforcement and penalty mechanisms.
  - Registry system.
  - Cost containment mechanisms.
- You need to choose the right partner!
- May be easier to link systems which are designed from the start to be linkable (see CA and Quebec under the WCI platform).

Enter 'carbon dating'

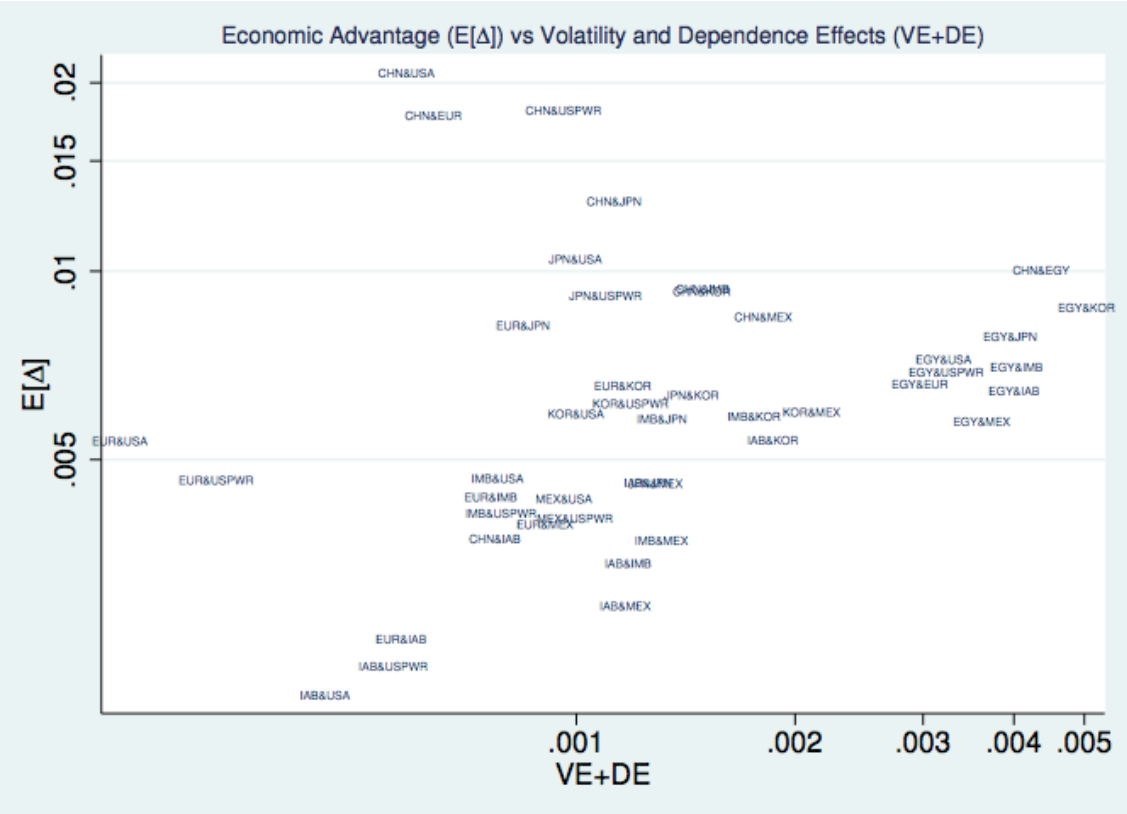
- There is a missing opportunity when markets operate independently.
  - If companies in different markets were able to trade, they could make savings every time the price of allowances varied across markets.
- In a recent paper we analysed the potential cost savings when previously isolated markets are linked.
  - *Carbon dating: When is it beneficial to link ETSs?* Doda and Taschini 2017 JAERE.
- Our study examined how key factors characterizing the jurisdictions determine whether linking carbon markets, what we call *carbon dating*, is worth it.
- So, what does make a good carbon date?

Carbon dating in the real world

- We used data from China, USA, various European countries, South Korea and supranational sectors to model how each would benefit from wider carbon credit trading.
- We found the benefits of links between "large and similar" markets can be dwarfed by those between "small but different" markets.
- So instinctive decisions – such as trading with a large partner, or your neighbour – can actually end up having costly consequences.

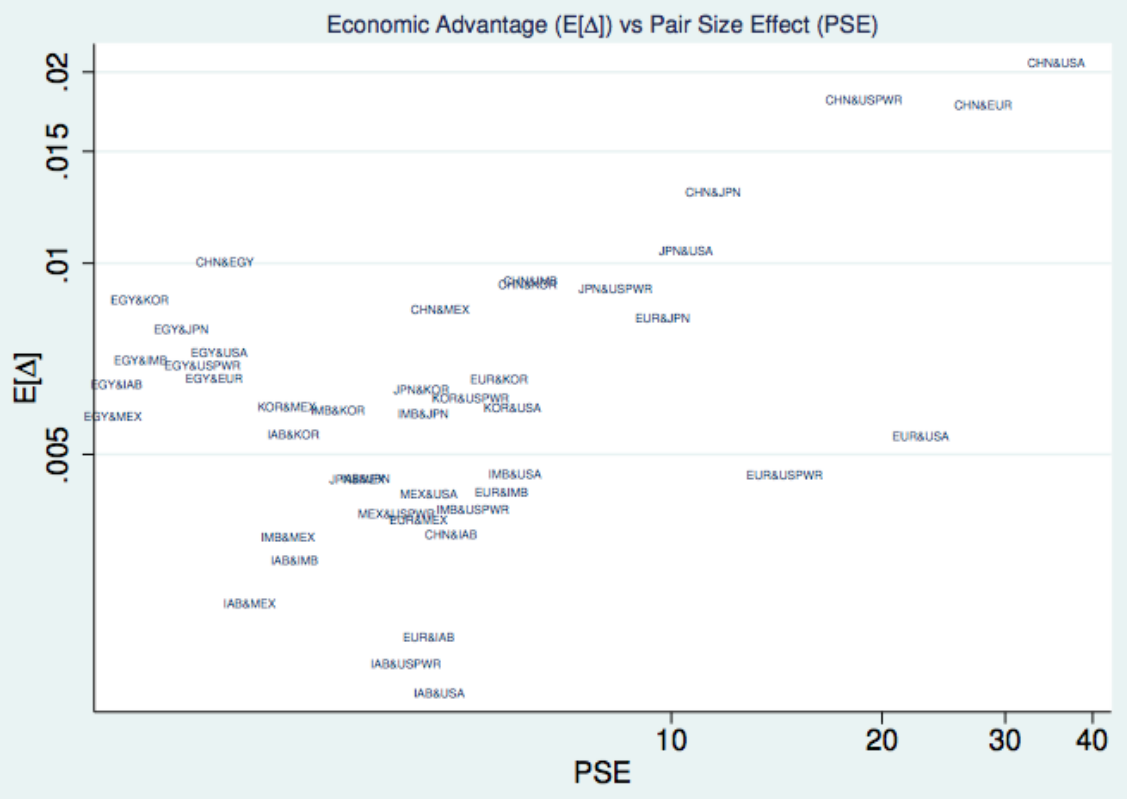
Opposites attract

- We found that opposites attract.
- A country prefers the demand in its partner's market to be more variable (it changes over time) and inversely related to its own (my demand is up when yours is down).



The market size of linking partners matter

- The smaller market tends to benefit most from cost savings.
- In practice, the most mutually beneficial links are likely to be between countries of a similar size, particularly if these markets are subject to different economic fluctuations.

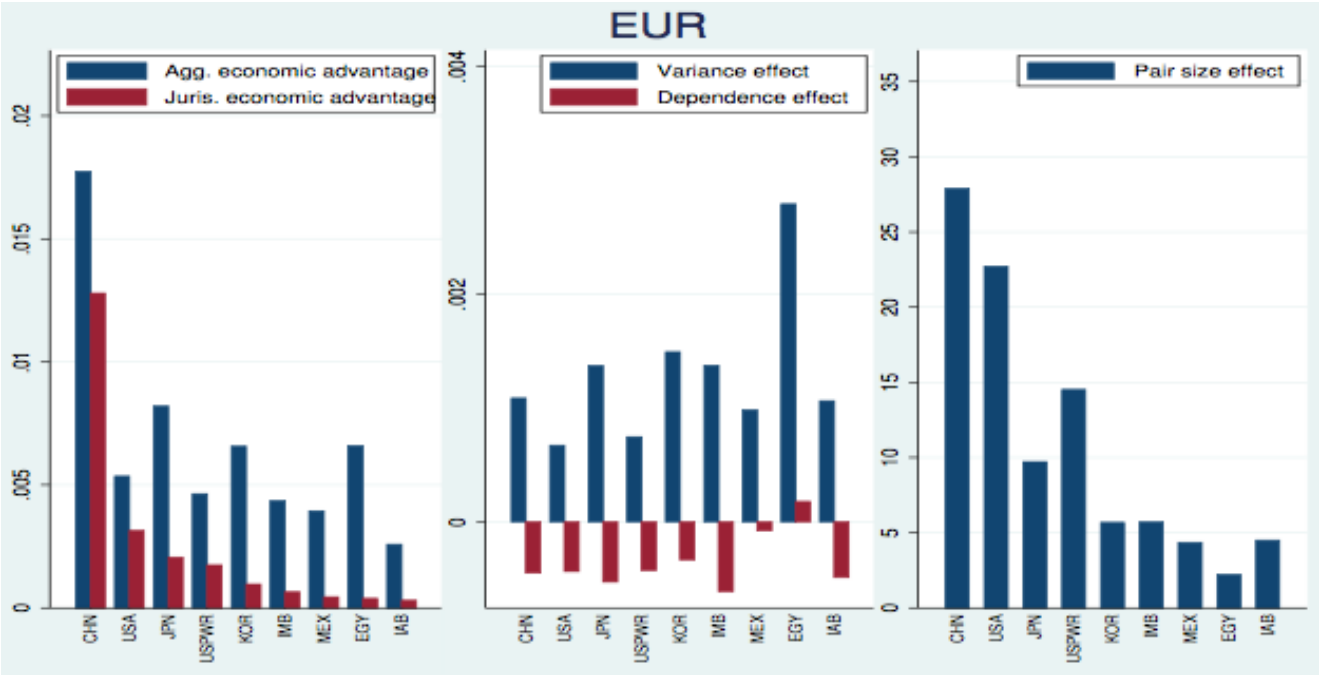


Getting off to a good start

- Negotiating the partnership, harmonising market rules and setting up a platform for international transactions is complicated work, and no link will make economic sense if these upfront costs are too high.
- Conversely, if the costs are negligible, both partners will be better off (similar ETS design = negligible negotiation costs).
- This is likely the reason why negotiations between the EU and China have barely started whereas those between the EU and Switzerland have successfully concluded.

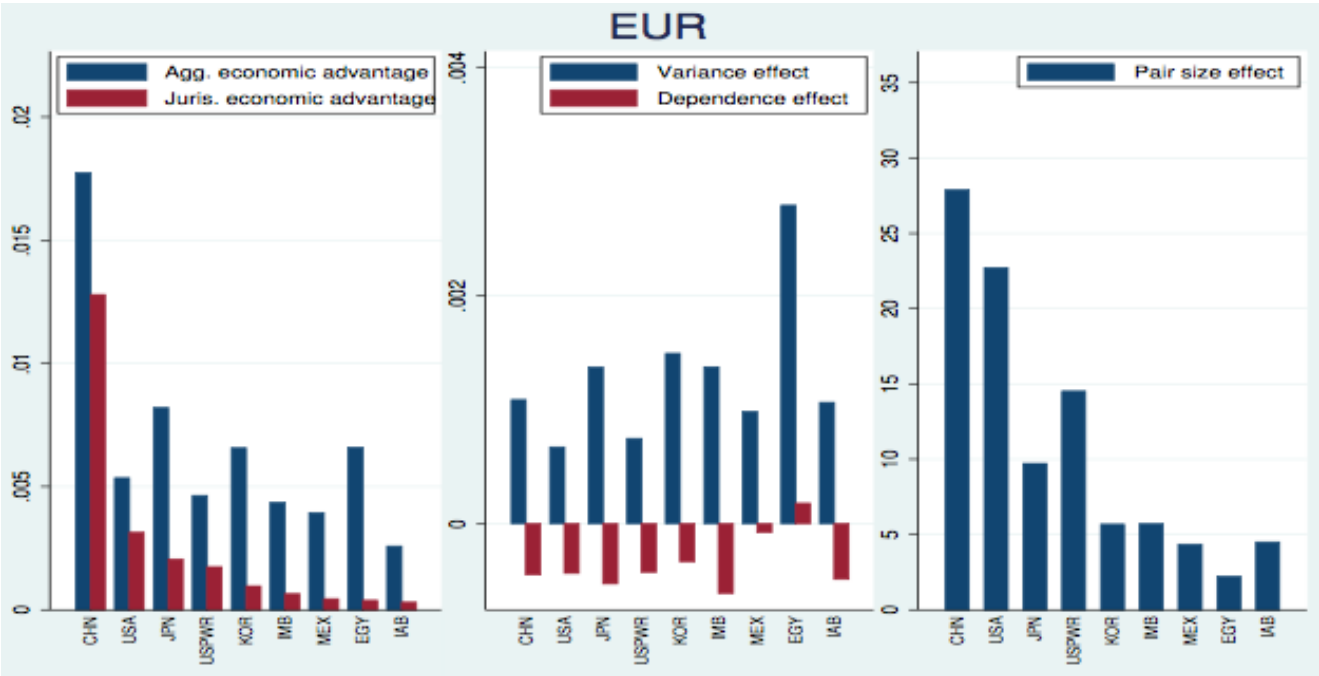
Benefits of linking: global vs. jurisdiction

- The graph exhibits total benefits and jurisdiction benefits (left diagram) and the benefits' components in the mid and right diagrams.
- Linking partners are ordered so that the link with the left-most partner is its most preferred, i.e. has the largest jurisdiction-specific benefit.



Are these factors relevant in reality?

- Under a few strong but not outlandish assumptions, it may appear to make sense for EUR to partner with CHN/US because the latter are so large.
- But from a global perspective, it would make more sense to partner with Japan or Korea or Egypt, in part because they are so different from one another.



Examples of link types

Systems involved	Type of link
California and Québec (Ontario and Manitoba intend to join the system)	Two-way
RGGI	Multilateral link among participating states
Tokyo and Saitama	Two-way
EU and Norway	Two-way (began with one-way link with Norway as buyer)
Intended link between Australia and EU	Intended to be one-way (with Australia as buyer) during first phase, evolving to a two-way link
EU and Switzerland (not entered into force yet)	Two-way

The Paris Agreement

- The Article 6 of the Paris Agreement contemplates three broad mechanisms:
  1. cooperative approaches on a voluntary basis (Article 6(1)–(3));
  2. a mechanism to contribute to the mitigation of greenhouse gases and support sustainable development (Article 6(4)–(7), "Cooperative Measures");
     - decentralised mechanism that allows voluntary bilateral and multilateral linkages of markets, for example, into a "carbon club".
     - linked markets may be able to trade internationally transferred mitigation outcomes (ITMOs).
  3. a framework for non-market approaches (Article 6(8) and (9), "Sustainable Development Mechanism").

Conclusions

- There is a missing opportunity when markets operate independently.
- Linking is always beneficial, but what does make a good 'carbon date'?
  - opposites attract;
  - market size of linking partners matter;
  - negotiation costs could eat up all benefits.
- Carbon dating in the real world
  - "Large and similar" markets can be dwarfed by those between "small but different" markets.
- There is much variation in the data to make the linking match partner exercise worthwhile.
- The Paris Agreement opens a new era in international climate action with much stronger support for ETSs.

Contact details

Thank you very much for your attention.

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