Overlapping Climate Policies

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Motivation: Overlapping climate policies

Carbon pricing often involves multiple jurisdictions

- EU ETS, Regional Greenhouse Gas Initiative (RGGI), Western Climate Initiative (WCI), Canada minimum carbon tax

Additional unilateral policies often overlap with carbon price

- Unilateral carbon price
- Coal phase-out
- Renewable subsidies
- Aviation tax
- Energy-efficiency program

$\Longrightarrow$ **What is the climate benefit of such overlapping policies?**

European Union: EU ETS carbon price

2030 Target Plan Policy Scenarios

	(REG) Policies and measures as main driver for GHG 55% target	(MIX)/ (MIX-50) Policies, measures and carbon pricing combined for GHG 55%/GHG 50% target	(CPRICE) Carbon pricing as main driver for GHG 55% target	(ALLBNK) Inclusion of all bunkers for GHG 55% target
Scope to asses GHG target ambition	All sectors including intra EU bunkers and LULUCF			All sectors including intra and extra EU bunkers and LULUCF
ETS Scope / Carbon Pricing	ETS scope: - Power, Industry, - Intra-EU aviation and navigation*	ETS scope:	- Power, Industry, - Intra-EU aviation and navigation*, - Road transport, Buildings	ETS scope: - Power, Industry, - All aviation and navigation, - Road transport, buildings
EE policies	High intensification policies	Medium/low intensification policies	No additional measures compared to Baseline	Medium intensification policies
RES policies	High intensification policies	Medium/low intensification policies	No additional measures compared to Baseline	Medium intensification policies
Transport measures	High intensification policies (CO2 standards in road transport + RES, aviation and maritime fuel mandates + measures improving transport system efficiency)	Medium/low intensification policies (CO2 standards in road transport + RES, aviation and maritime fuel mandates + measures improving transport system efficiency)	Low intensification policies (CO2 standards in road transport + aviation and maritime fuel mandates + measures improving transport system efficiency)	Medium intensification policies (CO2 standards in road transport + measures improving transport system efficiency) High intensification of RES, aviation and maritime fuel mandates
non-CO2 policies	Medium intensification policies			High intensification policies
LULUCF policies	Baseline policies			

*Carbon pricing and carbon values are applied on extra EU aviation and navigation to represent ETS or other policy instruments regulating these sector's emissions (which can also stand for other policy instruments like CORSIA for aviation and technical and operational measures for both aviation and maritime).

European Union: Other climate policies...

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Contribution of this paper

General framework

1. Wide range of overlapping climate policies
2. Almost all types of carbon-pricing systems

Carbon market

- Textbook ETS: Fixed emissions cap—"waterbed effect" is 100%
- Real world: Hybrid price-quantity regulation—"punctured" waterbed
  - Post-2018 EU ETS Market Stability Reserve
  - Price corridors in RGGI, California, new UK ETS

Product market

- Coal phase-out cuts domestic emissions by 1 tCO_2 but (say) raises imported emissions by 1 tCO_2—"internal carbon leakage" of 100%
  - Pre-2018 EU ETS: Internal leakage did not matter so underresearched

$\Longrightarrow$ *Climate benefit driven by waterbed effect & internal carbon leakage*

Conceptual framework

- System-wide carbon price $\boldsymbol{\tau} = (\tau_1, \tau_2)$

  Unilateral policy by jurisdiction i reduces *domestic* emissions demand, $\Delta e_{it} < 0$ and $\Delta e_i \equiv \Delta e_{i1} + \Delta e_{i2} < 0$

  $\Longrightarrow$ What is its impact on equilibrium emissions, $\Delta e^* \equiv \Delta e_1^* + \Delta e_2^*$?
- **Internal carbon leakage**: $L_{it} \equiv -\Delta e_{\_it}/\Delta e_{it}$ (fixed $\boldsymbol{\tau}$)
- **Waterbed effect**: $W \equiv 1 - \Delta e^*/\Delta e$ (equilibrium $\boldsymbol{\tau}$)

Lemma 1

Equilibrium change in long-run emissions due to i's unilateral policy is:

$$\Delta e^* = [1 - L_i][1 - W]\Delta e_i,$$

where L_i is the average internal carbon leakage across both periods

Internal carbon leakage

Product market with two countries and perfect competition

- Heterogeneity: production cost, emissions intensity, abatement

Proposition 1

Supply-side policy has **positive** internal leakage, $L_i > 0$ (even $L_i > 1$)

- Unilateral carbon price (UK carbon price floor for power generation)
- Reduction in emissions-intensive production (coal phase-out)

Proposition 2

Demand-side policy has **negative** internal leakage, $L_i < 0$

- Renewables support procures extra zero-carbon generation
- Energy-efficiency program cuts emissions demand
- Carbon consumption tax

Intuition: Former leads to substitution; latter displaces imported emissions

Waterbed effect

Flexibility mechanisms based on past allowance prices

- Carbon taxes, pre-2018 EU ETS, new UK ETS, California, RGGI

Proposition 3

$$W = \frac{\varepsilon \text{ of allowance demand}}{\varepsilon \text{ of allowance demand} + \varepsilon \text{ of allowance supply}} \in [0, 1],$$

is independent of specifics of overlapping policy and internal leakage

- Classic principle of tax incidence (Jenkin 1872; Weyl-Fabinger 2013)

Flexibility mechanisms based on past allowance banking

- Post-2018 EU ETS Market Stability Reserve
- Very complex: Waterbed depends on timing of overlapping policy, whether it is anticipated, etc. (see Proposition 4)

Empirical illustration

Framework: Emissions reduction rate $R_i \equiv \frac{\Delta e^*}{\Delta e_i} = [1 - L_i][1 - W]$