Climate policy diffusion: theory, evidence & the international climate change mitigation regime

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The carbon dioxide problem: taking stock

CAT warming projections
Global temperature increase by 2100
December 2019 Update
THE INTERNATIONAL POLICY REGIME

Green from the grassroots?

**UNFCCC (PARIS)**
- Overarching non-binding framework
- 1.5-2°C global temperature warming objective
- Non-cooperative setting: Intended Nationally Determined Contributions
- Technological and policy flexibility
- Focus: mitigation & adaptation

**NATIONAL & REGIONAL**
- Uncoordinated national policy developments
- Some legally binding commitments (Denmark, UK,...)
- Bilateral and multilateral regional initiatives (e.g. US-China Climate Change Cooperation,...)
- Focus: mitigation & adaptation
- GHG-abating and GHG-free technology development

**SUBNATIONAL & LOCAL**
- Informal international alliances of local authorities (e.g. C40)
- Exchange of best practices / knowledge
- Focus: policies with local co-benefits (e.g. reduction in local air pollutants, improvement in road congestion,...)
COUNTRIES WITH CARBON PRICING (1990-2019)

Time clusters:
- 1990-2004
- 2005-2011
- 2012-2015
- 2015-2019

- Finland carbon tax (1990)
- Poland carbon tax (1990)
- Norway carbon tax (1991)
- Sweden carbon tax (1991)
- Denmark carbon tax (1992)
- Slovenia carbon tax (1996)
- Estonia carbon tax (2000)
- EU ETS (2005)
- New Zealand ETS (2008)
- Switzerland carbon tax (2008)
- Ukraine carbon tax (2011)
- Japan carbon tax (2012)
- Australia CPM (2012 - 2014)
- Kazakhstan ETS (2013)
- Mexico carbon tax (2014)
- Korea ETS (2015)
- Chile carbon tax (2017)
- Colombia carbon tax (2017)
- Argentina carbon tax (2019)
- South Africa carbon tax (2019)
- Singapore carbon tax (2019)
Climate policy diffusion

Framework

**Stringency of Foreign Climate Policy Regimes**
- Free riding on others’ emissions reduction
- Leakage: domestic emissions reduction alter relative prices and induce a rise in emissions abroad

**Access to Global Technological Frontier**
- Technical feasibility of abatement
- Cost

**Expected Policy Implementation Cost**
- Political cost of economic restructuring
- Resource cost of policy set up

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**Domestic Determinants of Climate Policy Adoption**

**Open Economy**
- 2 goods (x,y) - 2 factors (L,K)
- At least one 'dirty' good (x)
- Consumer derives utility from both physical goods consumption and environmental quality

**Costly Abatement**
\[
x = B(K_x, L_x) - B(\phi K_x, \phi L_x)
\]
\[
= (1 - \phi)B(K_x, L_x)
\]
\[
e = \chi(\phi)\Omega B(K_x, L_x)
\]

**Fixed Cost of Regulation**
- Policy activity threshold
- For a given level of income, regulation is welfare maximising only below a threshold level of regulatory cost
The Diffusion Framework

International environment ~ domestic political economy ~ policy adoption

ALTERED PAYOFFS

International competition
- More stringent policy by foreign competitors reduces domestic cost of policy strengthening

Mean global policy
- More stringent global policy regime alleviates free-riding effects

Technology
- Improvements in and better access to (global) climate change mitigation technologies pool reduces the cost of abatement
- Standard technology diffusion channels: trade, FDI, licensing

UPDATE INFORMATION
(Policy adoption contains information)

Communication networks
- Institutional affiliations (OECD, EU, RTAs)

Cultural similarity
- E.g. language or religion partner
- Proxied by bilateral trade

Learning from success

Non-cooperative public authority

$$\max_{e_i} V^i(R, E)$$

s.t.: $$R = [G(p, K, L, \frac{e_i}{\Omega})] / \omega(p)$$

$$E = E_{-i} + e_i$$
Empirics of adoption and diffusion

Panel dimensions
- Time: 1990-2014
- Cross-section: 109 national jurisdictions

Diffusion regressors (for country $i$ at time $t$)

\[
\Lambda_{i,t} \equiv \sum_{j \in \Theta_{i,t}} \Gamma_{i,j,t} x_{j,t}
\]

where $\Gamma_{i,j,t}$ is the spatial weights matrix, $x_{j,t}$ is the variable observed in country $j$.

Adoption models
- Duration models (Weibull, Cox, Gompertz)
- This study: probit (right-curtained at year of adoption)

\[
1_{i,t} = \beta \Lambda_{i,t-1} + \gamma C_{i,t} + d_t + \varepsilon_{i,t}
\]
International competition

Figure: Policy stringency in export markets – $\eta$
Global mean policy

Figure: World emissions-weighted average price of CO$_2$
Access to global technological frontier

Figure: Climate change mitigation technological stock of import and export partners – $\psi$
Information from trade partners

Figure: Climate policies of trade partners (total bilateral trade) – $\alpha$
## Table: Policy adoption

<table>
<thead>
<tr>
<th>Category</th>
<th>Mechanism</th>
<th>Variable</th>
<th>Carbon Pricing (1)</th>
<th>Climate Policy (2)</th>
<th>Carbon Pricing (3)</th>
<th>Climate Policy (4)</th>
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<td>Altered payoffs</td>
<td>Foreign stringency</td>
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<td>$\eta(EX)_{t-1}$</td>
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<td>ECP$_{World}^{t-1}$</td>
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<td>Technology diffusion</td>
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<td>$\psi(IM)_{t-1}$</td>
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<td>$\psi(EX)_{t-1}$</td>
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<td>Updated information</td>
<td>Policy learning</td>
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<td>$\alpha_CL(EU)_{t-1}$</td>
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Insights

1. Importance of bilateral and multilateral “relationships”: diffusion of technology, transmission of information

2. Emergence of bottom-up (uncoordinated) climate “clusters”

3. Suggests a role for “key” countries in the diffusion process

Implication

▶ Remove obstacles (e.g. trade policy) to climate change mitigation technologies diffusion

▶ For “climate leaders”, make domestic climate policies less “inward-looking” in order to be globally effective and avoid the ‘leader’s curse’
The leader’s curse
2100 WARMING PROJECTIONS
Emissions and expected warming based on pledges and current policies

- **Baseline**: 4.1 – 4.8°C
- **Current policies**: 2.8 – 3.2°C
- **Optimistic policies**: 2.8°C
- **Pledges & Targets**: 2.5 – 2.8°C
- **2°C consistent**: 1.6 – 1.7°C
- **1.5°C consistent**: 1.3°C

Historical emissions and projected warming from 1990 to 2100.
Climate policy diffusion

Figure: Cumulative climate laws – selected jurisdictions
Figure: Cumulative climate policies of import and export partners