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

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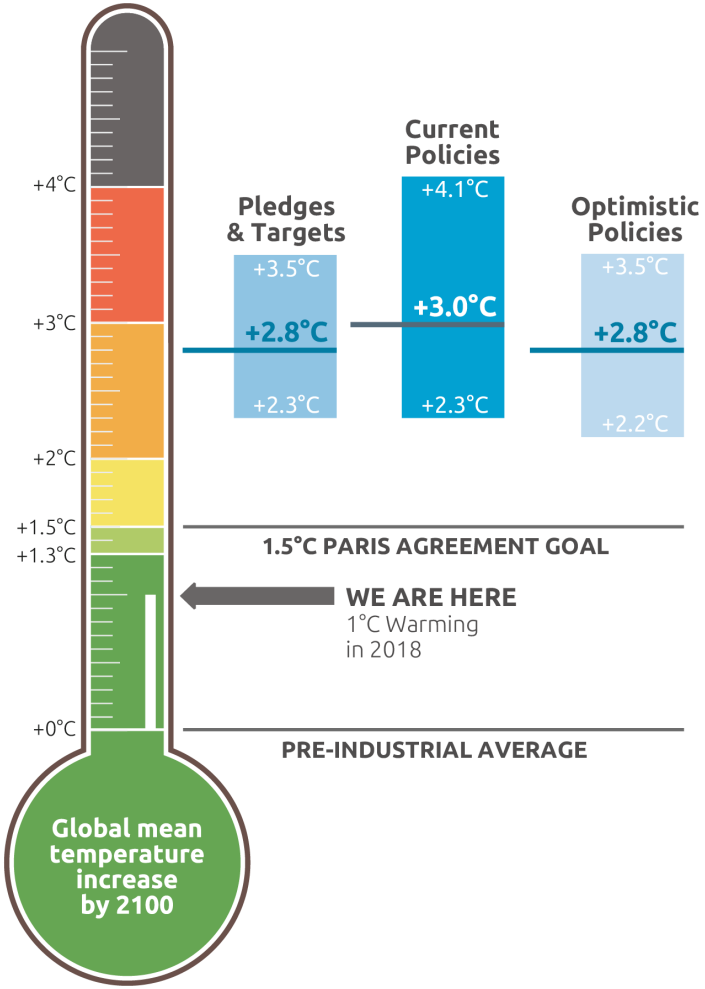
The carbon dioxide problem: taking stock



Climate Action Tracker

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
- 1.5-2C 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,...)

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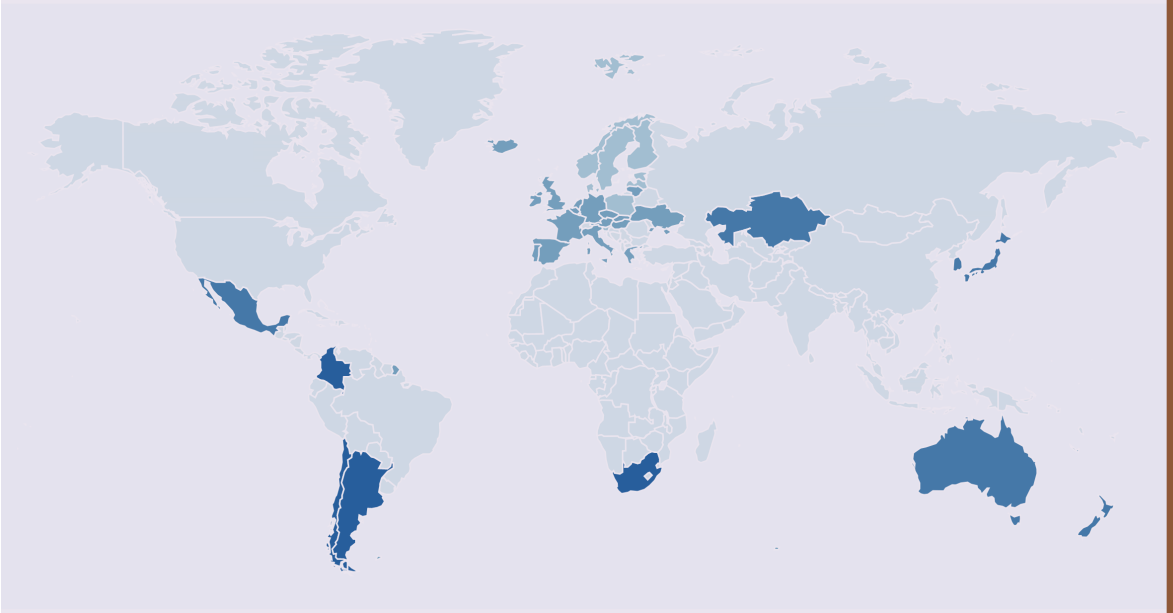
COUNTRIES WITH CARBON PRICING (1990-2019)



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)
- Latvia carbon tax (2004)

- 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)

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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

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

$$
\begin{aligned}
x &= B(K_x, L_x) - B(\phi K_x, \phi L_x) \\
&= (1-\phi)B(K_x, L_x) \\
e &= \chi(\phi)\Omega B(K_x, L_x)
\end{aligned}
$$

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

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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

UPDATED 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

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

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

$$E = E_{-i} + e_i$$

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-curtailed at year of adoption)

$$\mathbb{1}_{i,t} = \boldsymbol{\beta} \boldsymbol{\Lambda}_{i,t-1} + \boldsymbol{\gamma} \boldsymbol{C}_{i,t} + d_t + \epsilon_{i,t}$$

International competition

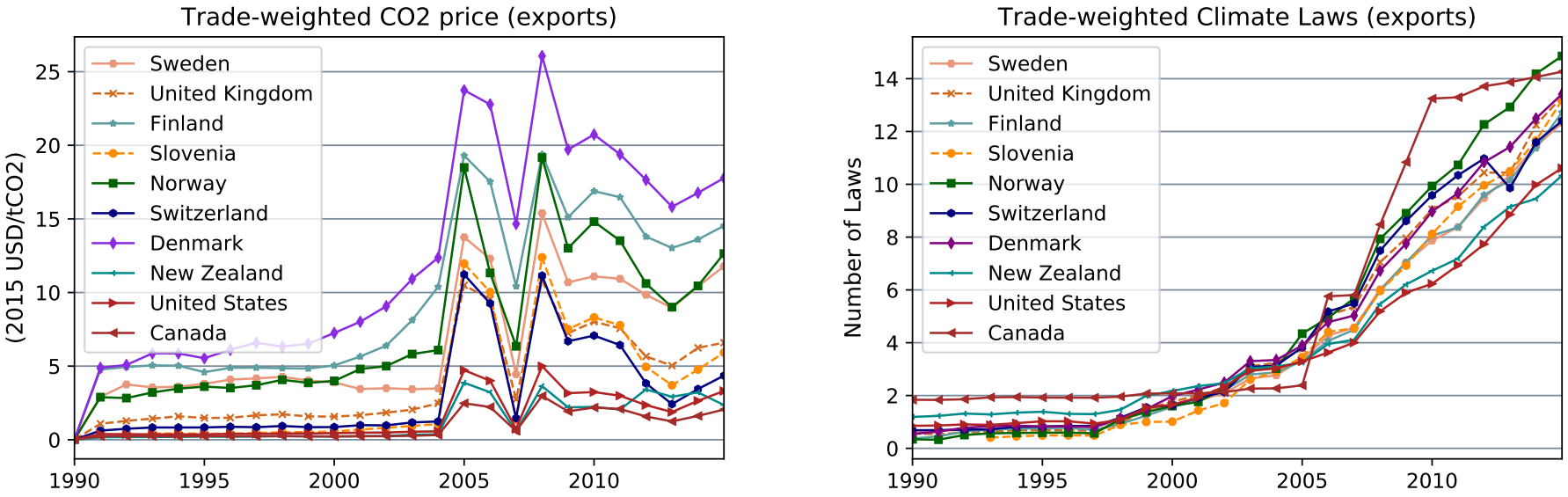

Figure: Policy stringency in export markets – η

Global mean policy

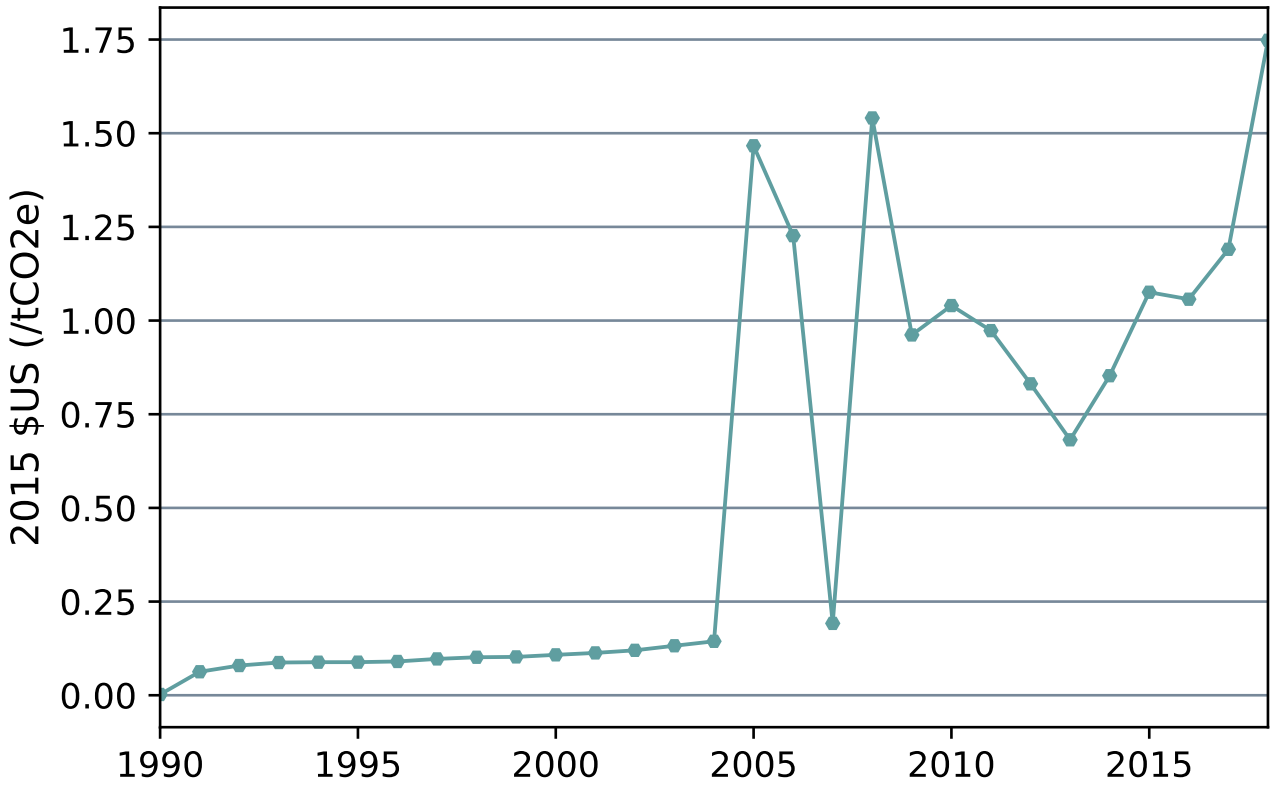

Figure: World emissions-weighted average price of CO_2

Access to global technological frontier

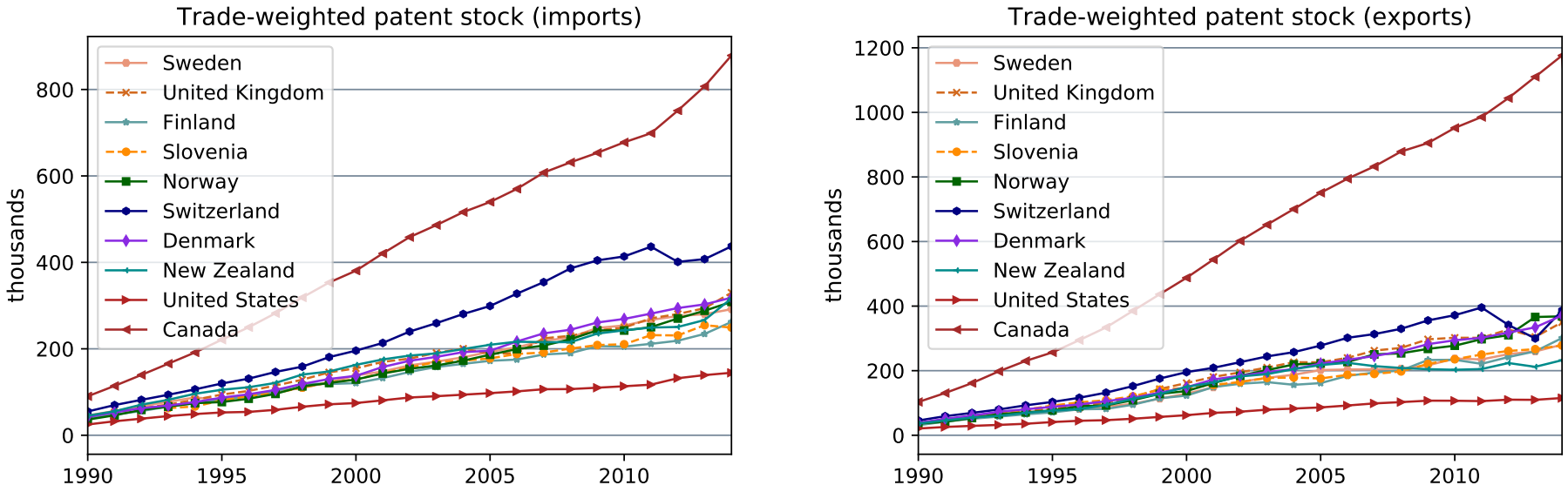

Figure: Climate change mitigation technological stock of import and export partners – ψ

Information from trade partners

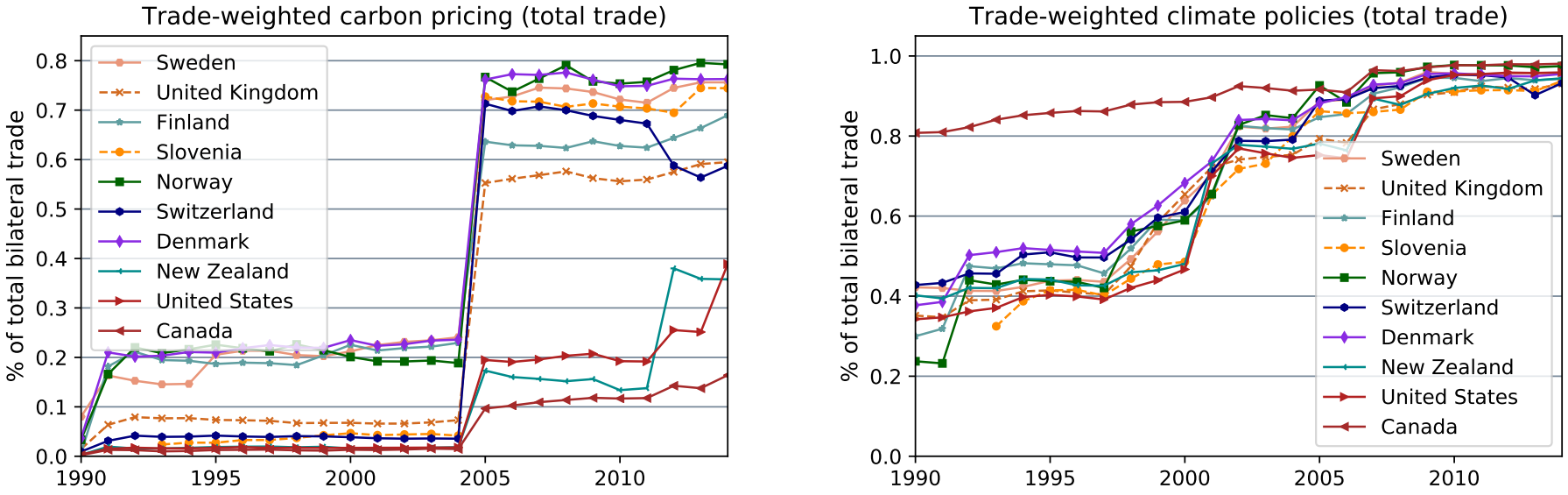

Figure: Climate policies of trade partners (total bilateral trade) – α

Table: Policy adoption

Category	Mechanism	Variable	Carbon Pricing		Climate Policy	
			(1)	(2)	(3)	(4)
Altered payoffs	Foreign stringency	$\eta(\text{IM})_{t-1}$	+	+	+	+
		$\eta(\text{EX})_{t-1}$	+	+	+	+
	Global mean policy	ECP^{World}_{t-1}	+	+		
	Technology diffusion	$\psi(\text{IM})_{t-1}$	−	−	+	+
		$\psi(\text{EX})_{t-1}$	+	+	+	+
Updated information	Policy learning	$\alpha^{P}(\text{IM+EX})_{t-1}$	+	+		
		$\alpha^{P}(\text{EU})_{t-1}$		+		
		$\alpha^{CL}(\text{IM+EX})_{t-1}$			+	+
		$\alpha^{CL}(\text{EU})_{t-1}$				+
Domestic conditions		GDP per cap.	+	+	+	-
		Trade openness	+	+	+	+
		Democracy	+	+	+	+
		Constant		-	-	-
		Year FE	No	No	No	No
		Observations	2165	2141	1200	1197

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'

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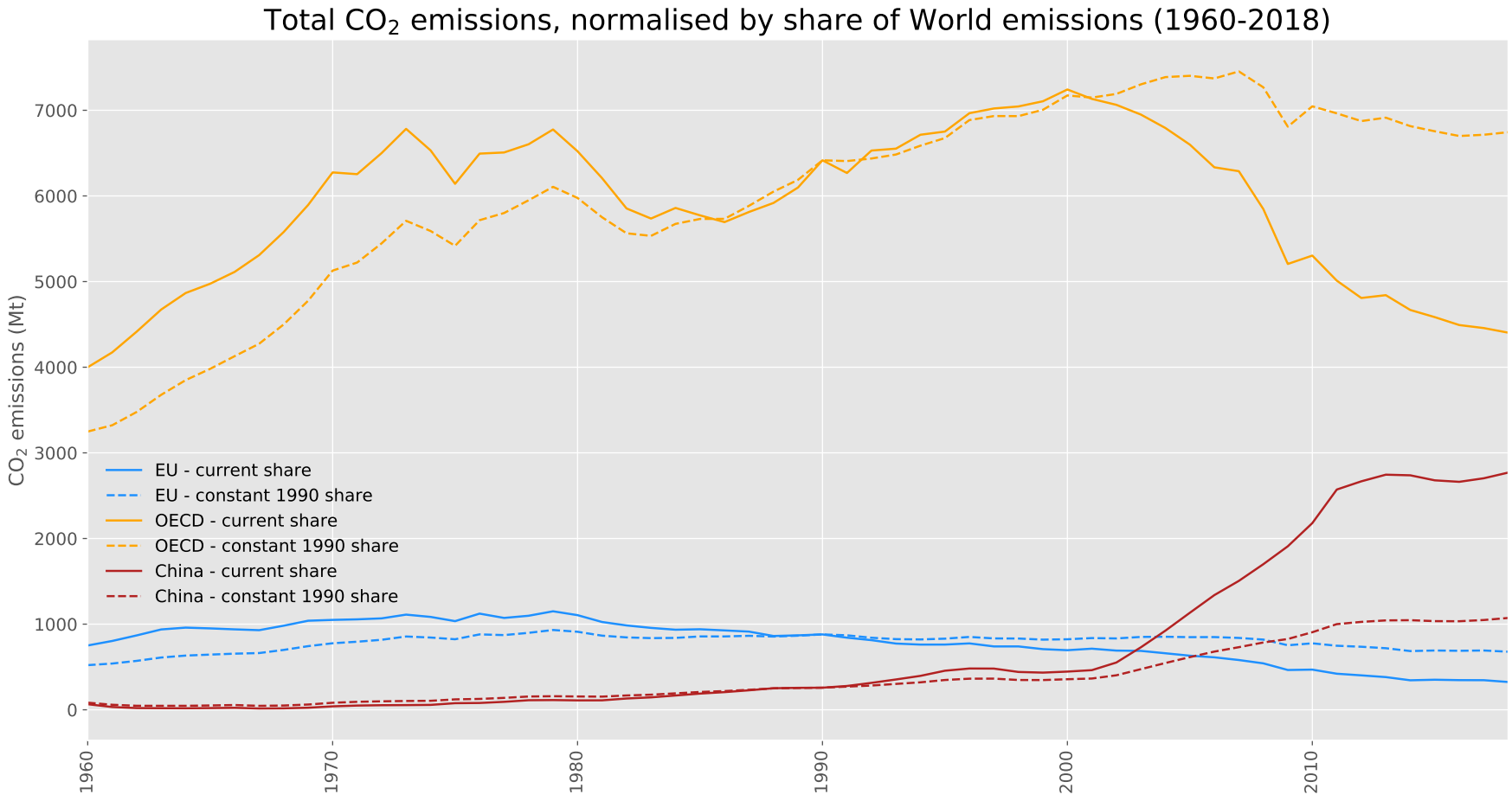
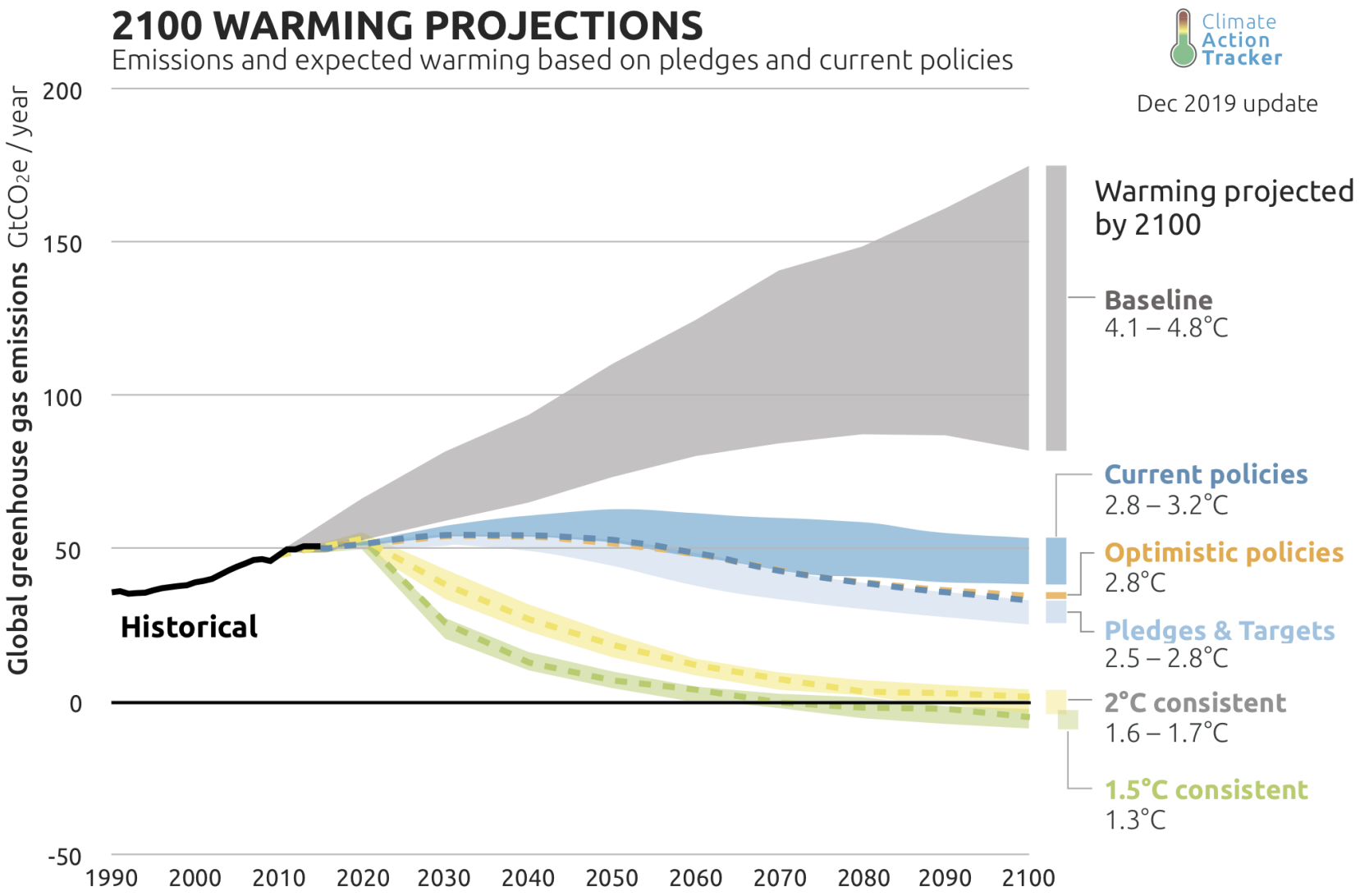
The leader's curse



Appendix


2100 WARMING PROJECTIONS
Emissions and expected warming based on pledges and current policies
Climate Action Tracker
Dec 2019 update
Global greenhouse gas emissions GtCO2e / year
200
150
100
50
0
-50
1990
2000
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100
Historical
Warming projected by 2100
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

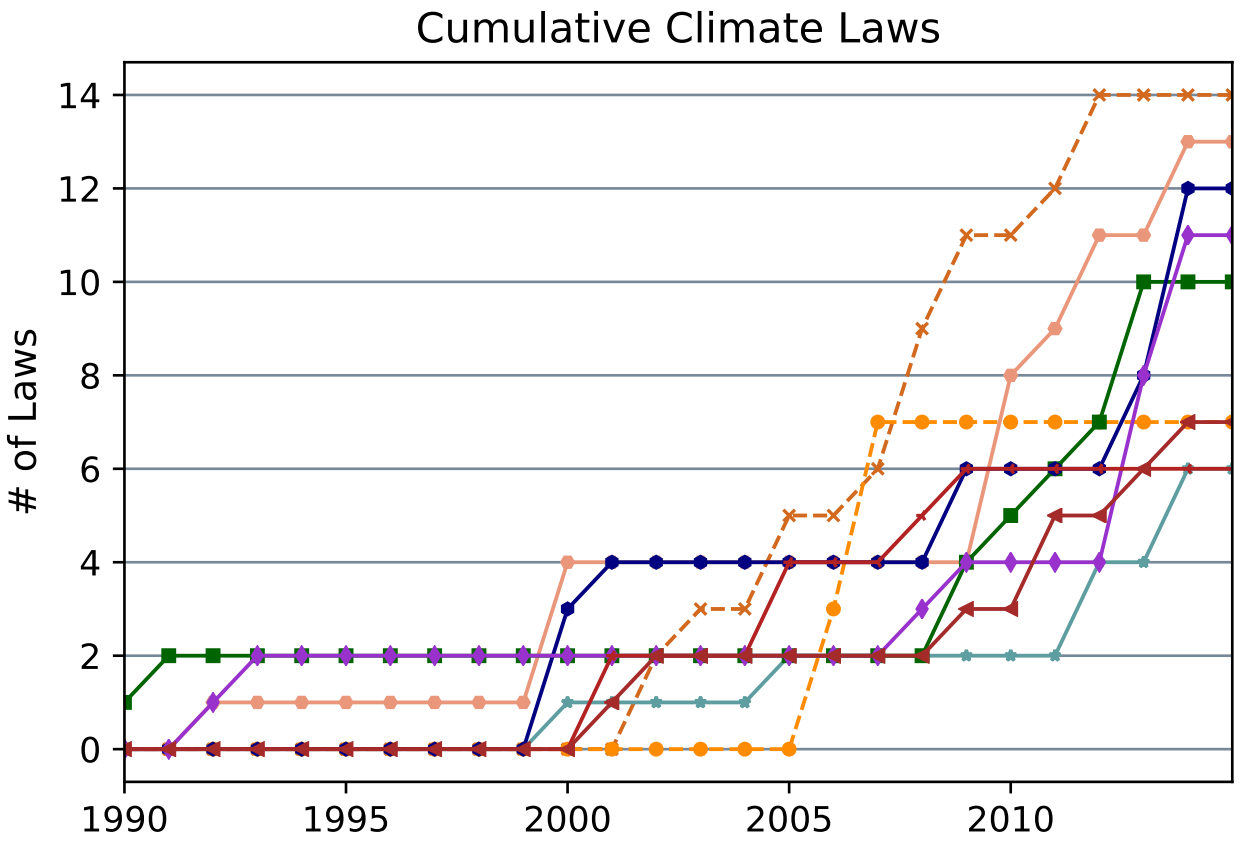


Figure: Cumulative climate laws – selected jurisdictions

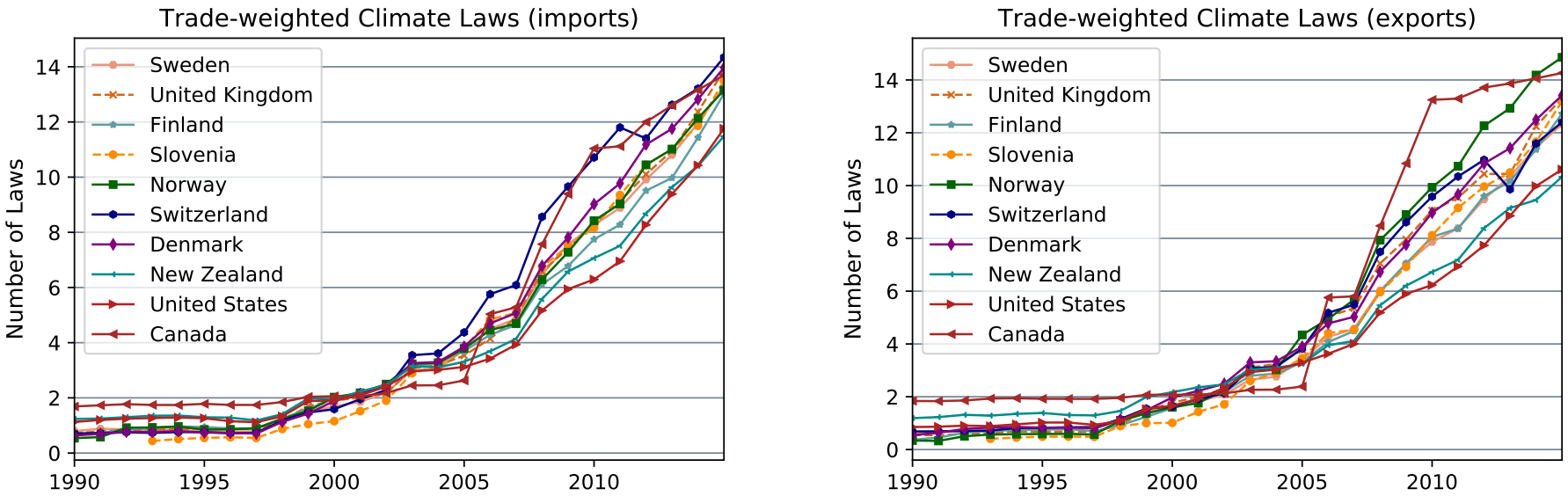


Figure: Cumulative climate policies of import and export partners