Strengthening International Environmental Agreements through Trade Policy

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Selected presentation for the International Agricultural Trade Research Consortium's (IATRC's) 2022 Annual Meeting: Transforming Global Value Chains, December 11-13, 2022, Clearwater Beach, FL.

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Disclaimer

The findings and conclusions in this presentation are those of the authors and should not be construed to represent any official USDA or U.S. Government determination or policy.

Summary

Main Findings

- Linking trade policy to participation in and enforcement of international environmental agreements can strengthen these agreements
- Trade liberalization associated with faster Montreal Protocol amendment ratification
- Including Montreal Protocol participation commitments in trade liberalization associated with even faster amendment ratification
- Linking trade liberalization to the Montreal Protocol strengthens compliance of emissions targets.

Introduction

Deep Trade and Issue Linkages

- Non-trade commitments within Regional Trade Agreements (RTAs) have proliferated in recent decades:
  - average RTA in the 1950s covered **eight** policy areas, in recent years **17** (Hofmann et al., 2017)
  - RTAs increasingly contain detailed provisions on environmental issues and international environmental agreements (Monteiro and Trachtman, 2020) .
- Many of these non-trade provisions are examples of “issue linkages” — linking seperate policy areas together (e.g. Maggi, 2016; Limão, 2005, 2007)
- We focus on linkages between trade and environmental policy: RTAs and international environmental agreements

Theory

Optimal Regulation with Trade and External Commitments

Optimal regulation of emissions

$$\max_{\rho} \left\{ U(Y, \gamma) - \mathbb{E}\Big[v\big(\gamma \underbrace{(e(\rho, Y) - T)}_{\text{target deviation}}\big)\Big]_+ - C(\rho) \right\} \tag{1}$$

ρ is emissions regulatory regime

Y is income/GDP and will proxy trade liberalization

γ reflects depth of integration in international environmental agreement

$\mathbb{E}[v(\cdot)]_+$ is the expected disutility of non-compliance (realized emissions random)

- Frictions to regulatory adjustment: fixed costs of adjustment F

Theoretical Results (in words)

- Trade liberalization can induce accession to the international environmental agreement and conditioning trade liberalization on accession speeds up accession even more (*participation linkage*)
- Many members of the international environmental agreement will "overcomply" with targets due to risk aversion
- Trade liberalization can increase emissions relative to targets due to regulatory adjustment frictions
- Increasing the costs of noncompliance through trade policy linkage can mitigate this increase by increasing the costs of *not* adjusting regulatory regime (*enforcement linkage*)

Background

Trade liberalization — Regional Trade Agreements

- Regional trade agreements (RTAs) arguably the most important trade policy tool: 350 RTAs in the past 30 years (nearly every country in the world)
- Bilateral/plurilateral trade liberalization: include free trade agreements, customs unions, partial scope agreements, and economic integration agreements
- Entry into force is determined by independent ratification processes of signatories—exogenously timed shock to trade openness
- Especially important for agricultural trade (Sun and Reed, 2010)—comparatively protected

Deep Trade — “Issue Linkages”

Non-trade commitments within RTAs have proliferated in recent decades: the average RTA in the 1950s covered eight policy areas, in recent years they have averaged 17 (Hofmann et al., 2017).

- Deep Trade Agreements Database (Mattoo et al., 2020)
- Details on environmental provisions (Monteiro and Trachtman, 2020)

Quasi-experimental literature on the impacts of environmental content in RTAs (e.g. Abman et al., 2021; Abman and Lundberg, 2020)

International Environmental Agreement — Montreal Protocol

Signed in 1987, amended in 1990, 1992, 1997, 1999, and 2016.

Universally ratified, successfully phased out ODS and started repair of ozone layer.

Limits trade in ODS-related goods with countries not party to Protocol.

Kigali Amendment (2016) introduced control measures for HFCs (not ODS but GHG).

Phaseout schedules (“targets”) vary by substance, countries’ historical usage, and development status

Montreal Protocol Substances

Gas	Introduction	0% Date: nonArticle 5	0% Date: Article 5	Use
		Annex A		
CFCs	Montreal Protocol (1987)	1996	2010	Refrigerant, propellant, solvent
halons	Montreal Protocol (1987)	1994	2010	Fire extinguishants
		Annex B		
“other” CFCs*	London Amendment (1990)	1996	2010	Not in Use
CTC	London Amendment (1990)	1996	2010	Feedstock, solvent
TCA	London Amendment (1990)	1996	2015	Solvent
		Annex C		
HCFCs	Copenhagen Amendment (1992)	2020	2030	CFC Replacement
HBFCs	Copenhagen Amendment (1992)	1996	1996	Not in Use
BCM	Beijing Amendment (1999)	2002	2002	Not in Use
		Annex E		
MB	Copenhagen Amendment (1992)	2005	2015	Fumigant, Pesticide
		Annex F		
HFCs	Kigali Amendment (2016)	2036 (85%)	2045 (85%)	HCFC Replacement

Montreal Protocol Today

Montreal Protocol poised to play central role in international climate change policy.

- Recent increase in CFC-11 emissions from China (Rigby, Park, Saito, et al.2019)
- Recent increase in HCFC-141b (2017-2021) (Western *et al.*, 2022)
- Demonstrated adaptability – expanding scope to regulate non-ODS substances (HFCs)

Empirical Analysis

Data

RTA Data provided by World Bank Deep Trade Agreements Database.

- All post-1987 RTAs notified to the WTO as of 2018
- “Does the agreement require states to control ozone-depleting substances?”
- “Does the agreement require states to comply with the Montreal Protocol on ozone depleting substances?”

ODS Consumption Data & Montreal Protocol Ratification dates provided by UN Environment Programme Ozone Secretariat.

- Annual country-level ODP Tonnes from 1990-2020

“Participation Linkage” — Time to Ratification

- Cox proportional hazard models for MP and Amendments

$$\lambda(t|\mathrm{X_{it}}) = \gamma_0(t) exp(\beta_1 cumulRTA_{it} + \beta_2 cumulODS_{it} + \beta \mathrm{X_i})$$

$cumulRTA_{it}$ — # of RTAs country is engaged in

$cumulODS_{it}$ — # of ODS clauses across RTAs

$\gamma_0(t)$ — baseline hazard

X_i: region and income groups

- Corresponding PPML models w/ two-way FE — also controls for time-invariant country characterstics

Participation Linkage Results

	Dependent variable: Ratification Hazard Rate							
	London		Copenhagen		Montreal		Beijing	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cumulative RTAs	0.307***	0.376***	0.130**	0.286***	0.046*	0.475***	0.075***	0.395***
	(0.098)	(0.022)	(0.056)	(0.018)	(0.027)	(0.017)	(0.024)	(0.015)
Cumulative MP/ODS Prov	0.260	0.203***	0.292	1.032***	0.096	0.752***	0.150	0.571***
	(0.279)	(0.059)	(0.338)	(0.054)	(0.138)	(0.040)	(0.224)	(0.034)
Observations	1,313	1,313	1,443	1,443	1,289	1,289	1,319	1,319
Model	Cox	PPML	Cox	PPML	Cox	PPML	Cox	PPML
Baseline Hazard	year	country, year	year	country, year	year	country, year	year	country, year

“Enforcement Linkage” Empirical Strategy

“Stacked” country-RTA-level panel; windows of $\pm$ 3 years around RTA signature

$$ihs(dev_{igt}) = \beta_1 RTA_{igt} + \beta_2 RTA_{igt} * ODS_{ig} + \alpha_{ig} + \varepsilon_{igt}$$

- dev_{igt} — deviation from MP phaseout target for country i in RTA g at time t
- RTA_{igt} indicates signature of an RTA
- ODS_{ig} indicates that agreement g that i is party to includes ODS provisions
- α_{ig} are “country-RTA” fixed effects (“country-event FE”)
- Time: $\emptyset$, $\xi_i t$, γ_t, η_{gt}

“Enforcement Linkage” Empirical Strategy

“Stacked” country-RTA-level panel; windows of $\pm$ 3 years around RTA signature

$$ihs(dev_{igt}) = \beta_1 RTA_{igt} + \beta_2 RTA_{igt} * ODS_{ig} + \alpha_{ig} + \varepsilon_{igt}$$

- Causal identification strategy hinges on: a) plausibly exogenous treatment timing (caveat: signature vs. ratification) and b) Country-RTA FE α_{ig}
- α_{ig} Controls for all country-RTA factors: counterparties, political economy, etc. all time-invariant characteristics that might determine RTA content formation
- Also partially controls for country-year since agreements are located in time (i.e. controls for temporal location of event window)

CFC Target Deviations

	Dependent variable: IHS CFC Target Deviation					
	(1)	(2)	(3)	(4)	(5)	(6)
Post Sig	0.696***	0.443***	0.134			
	(0.154)	(0.146)	(0.134)			
Post × ODS	−1.401***	−1.312***	−1.182***	−1.401***	−1.188***	−1.227***
	(0.381)	(0.376)	(0.348)	(0.381)	(0.349)	(0.306)
Observations	6,118	6,118	6,118	6,118	6,118	6,118
R^2	0.526	0.578	0.604	0.527	0.604	0.604
Mean (ODP tons)	-1402	-1402	-1402	-1402	-1402	-1402
Country-RTA FE	✓	✓	✓	✓	✓	✓
Country time trend		✓				
Year FE			✓		✓	
Event time FE					✓	✓
Synth DiD						✓

Other ODS Target Deviations

	Dependent variable: IHS Target Deviation				
	Annex A		Annex B		
	CFCs	Halons	TCA	CTC	other CFCs
	(1)	(2)	(3)	(4)	(5)
Post Sig	0.134	0.101	−0.146**	0.127	0.056
	(0.134)	(0.095)	(0.064)	(0.101)	(0.049)
Post × ODS	−1.182***	−0.491***	−0.319*	−0.293	−0.019
	(0.348)	(0.185)	(0.167)	(0.228)	(0.078)
Observations	6,118	6,118	6,118	6,118	6,118
R^2	0.604	0.608	0.640	0.514	0.414
Mean (ODP tons)	-1402	-261	-30	-551	-3
Country-RTA FE	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓

Conclusion

- Trade policy can be an effective tool to strengthen international environmental agreements
- Likely mechanisms—introduction of potential punitive measures for non-compliance; trade retaliation as an environmental policy “stick”
- Capacity to strengthen binding and effective agreements like Montreal Protocol. Opportunities to reduce slack in non-binding environmental agreements?