

Trade effects of environmentally related technical measures (and more)

TPRF
7 December 2023

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Motivation

Several intervention to address climate change and protection of the environment.
WTO's EDB collects env.-related notifications submitted by WTO members

Market-based

- Tariff-like mechanisms, such as CBAM (e.g., *Kortum and Weisbach, 2016*)
- Quota-like mechanisms, such as ETS (e.g., *Meng, 2017; Verde and Borghesi, 2022*)

Agreements and regulations

- Standards
- Pref. Trade Agreements and provisions
- (Uni-) Technical measures
 - address NTPO (e.g., environmental protection, *Borchert et al., 2021; Ferrari et al., 2021*)
 - side effects on trade outcomes (*Fontagné et al., 2005*), w/ borderline diff'nce b/w env. prot. vs protectionism (*Shapiro, 2021*)

Trade, Climate and Non-pricing Policies

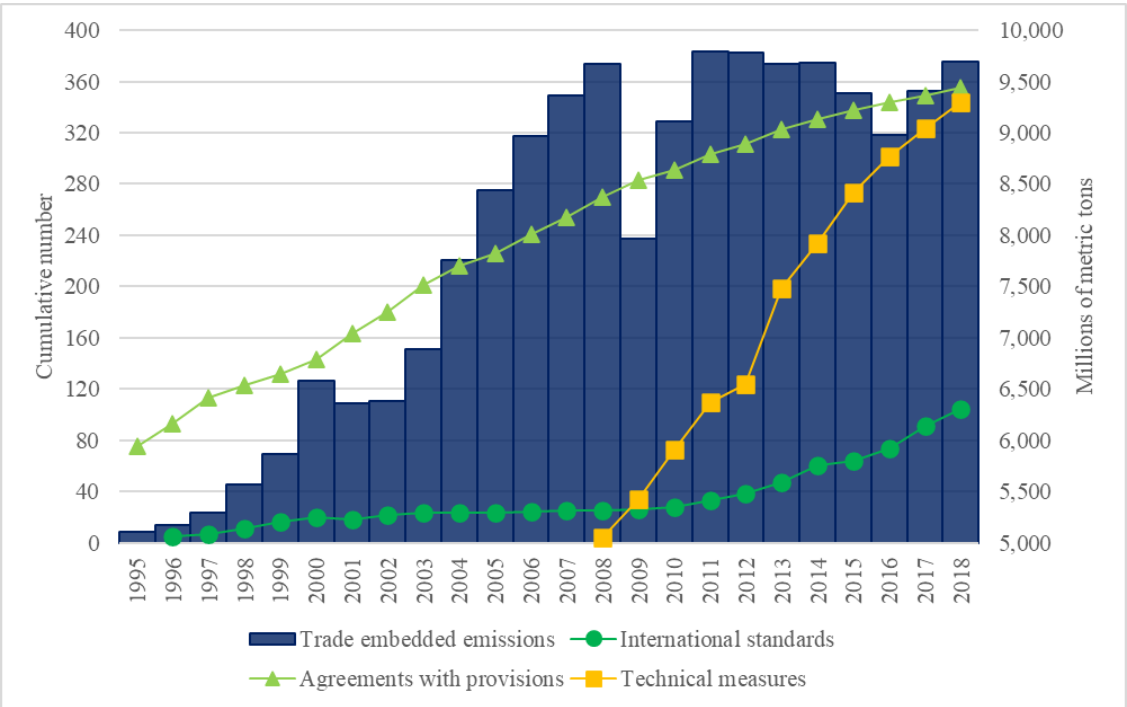
Trade, climate change and policy

- Emissions embodied in traded goods almost doubled in 1995-2018
 - partly due to increase in trade flow, pre-slowbalization era (*Nordström, 2023*)

Trade as CC adaptation/mitigation strategy (*Copeland et al., 2022*)

Leakage effects. Trade and env. impact from cons. vs production (*Grubb et al., 2022*)

Fig. Trade embedded emissions, climate-related trade policies



Source: Elaboration on data from OECD Carbon emissions embodied in trade, WTO TBT Information Management System, ISO Standard Catalogue, and DESTA Database.

Trade, Climate and Non-pricing Policies

Pricing and non-pricing mechanisms

- Pricing mechanisms need to be complemented w/ non-price ones to achieve climate ambitions (*Victor and Sabel, 2022*)
- Unilateral notifications to the WTO are rapidly increasing
 - fostered by the pursuit to attain non-economic objectives (*Hoekman et al., 2023*)
 - reflected in inclusion of env-provisions in trade agreements and development of env-standards (*Santeramo et al., 2023*)
- Synergistic use of different non-pricing policy options, permitted by WTO, benefits trade and climate:
 - WTO regime discourages the use of discriminatory and trade restrictive measures
 - WTO supports the use of international standards
 - Non-pricing policies balance domestic economic interests and international climate goals

Trade, Climate and Non-pricing Policies

Regulatory coordination: essential element of the climate agenda

- Diverse regulatory objectives in the climate agenda → international coordination improve policy coherence/reduce compliance costs via core features of WTO TBT Agreement (*Hoekman et al., 2023*):

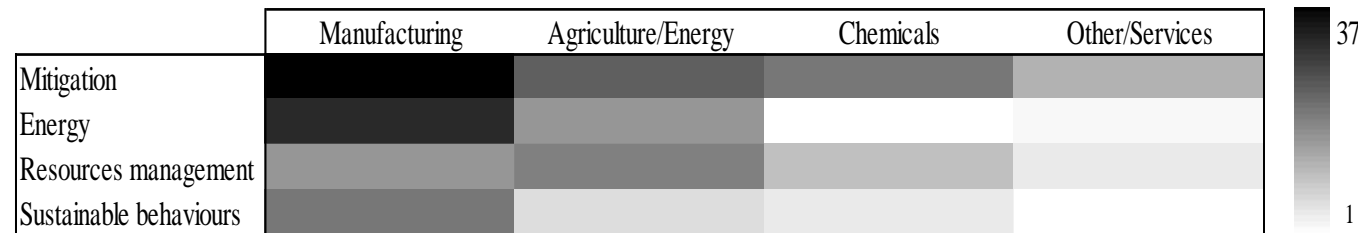


Fig. Number of countries regulating climate-related aspects of production.

Source: Elaboration on data from the WTO TBT Information Management System and WTO Environmental Database.

- Absent int'l standards, regulatory coherence may be achieved through regulatory coop.'on (consultations, concerns on regul.'s, mutual recog.'n, open plurilateral agr's, *Hoekman and Sabel, 2019*)
- “Multilateral cooperation in the WTO is dead and/or irrelevant” → incorrect and dangerously misconstrued perception → WTO tools complement national action to combat climate change

Literature and Contribution(s)

- Barrier effect **vs** catalyst effect
 - Heterogeneous effects across measures, products, countries
(e.g., *Santeramo & Lamonaca, 2019; Disdier and Fugazza, 2020; Beverelli et al., 2022*)
 - TBT reduce trade, price-effect (marg. costs) +5% on avg. (*Cadot & Gourdon, 2016; Ghodsi et al., 2023*)
 - TBT may facilitate existing trade (*Dolabella, 2020*) for large firms (*Ghodsi, 2020*), specifically for binding constraints (close example is *SPS animal health protection, Schlueter et al., 2009*)

Mechanisms

- Additional costs for producers and exporters **vs**
- Demand enhancing effect, comparative advantage
country (e.g., *Cadot & Gourdon, 2016; Ghodsi et al., 2023*) **vs** firm level (e.g., *Fontagné & Orefice, 2018; Singh & Chanda, 2021*)

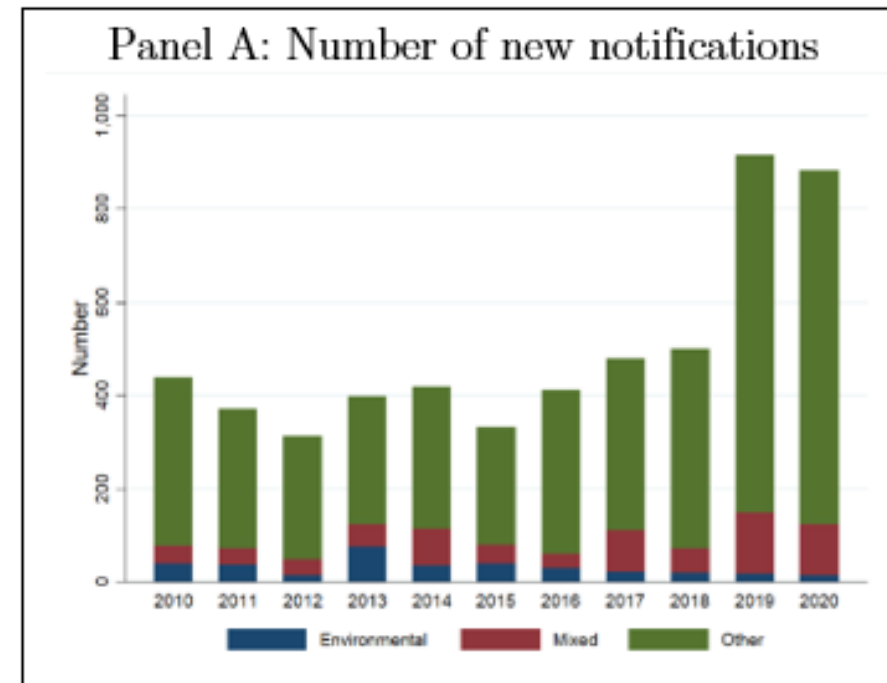
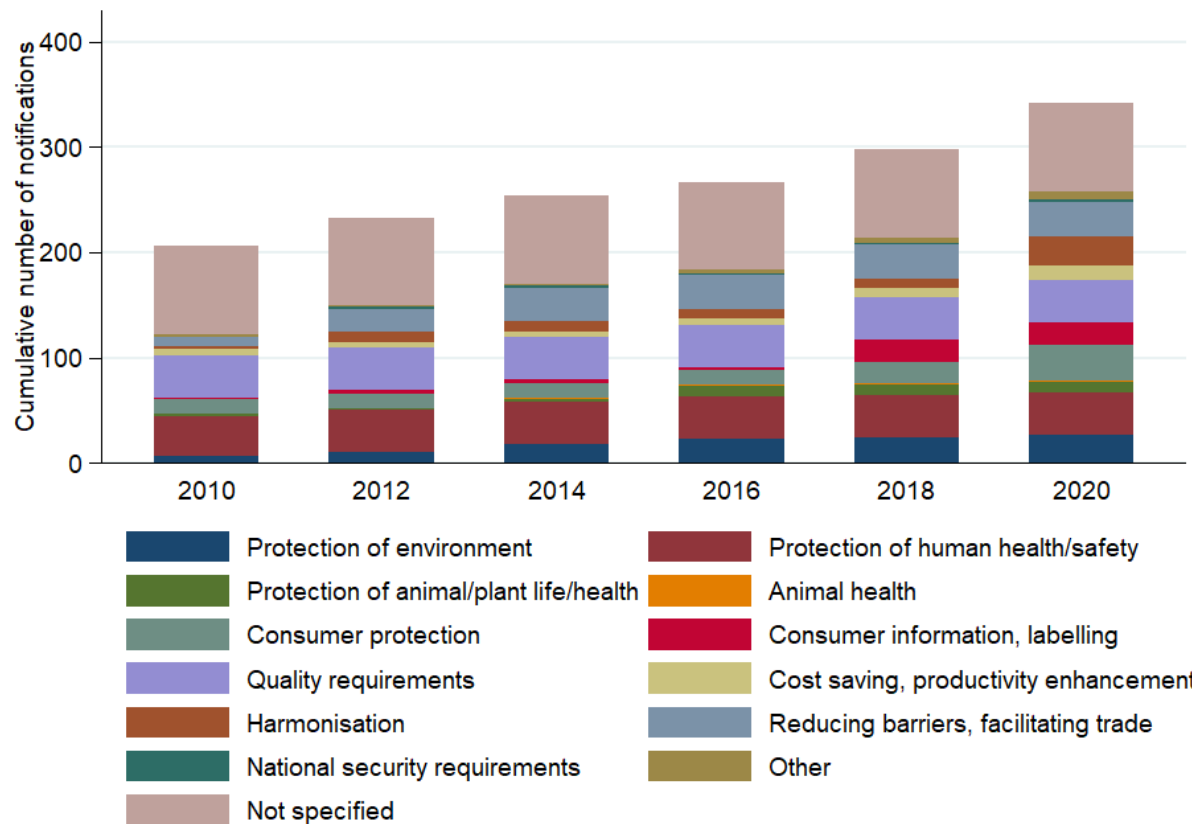
Literature and Contribution(s)

Mechanisms

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 - Demand enhancing effect, comparative advantage country (e.g., *Cadot & Gourdon, 2016; Ghodsi et al., 2023*) **vs** firm level (e.g., *Fontagné & Orefice, 2018; Singh & Chanda, 2021*)
-
- ✓ **Regularity in trade effects of env-TBT** along specific dimensions
-
- Specificity of environmental measures
 - implementation of env-standard correlated w/ economic development (*Copeland et al., 2022*) and membership in clubs (*Nordhaus, 2021*)
-
- ✓ **Heterogeneity** analysis, **by countries and sectors**

Facts and figures

Stylized Fact #1: Environmental technical measures are on the rise, by number and relevance



Facts and figures

Stylized Fact #2: Most of environmental technical measures come from wealthier countries

Mostly horizontal (N-N)
and transversal (S-N) trade

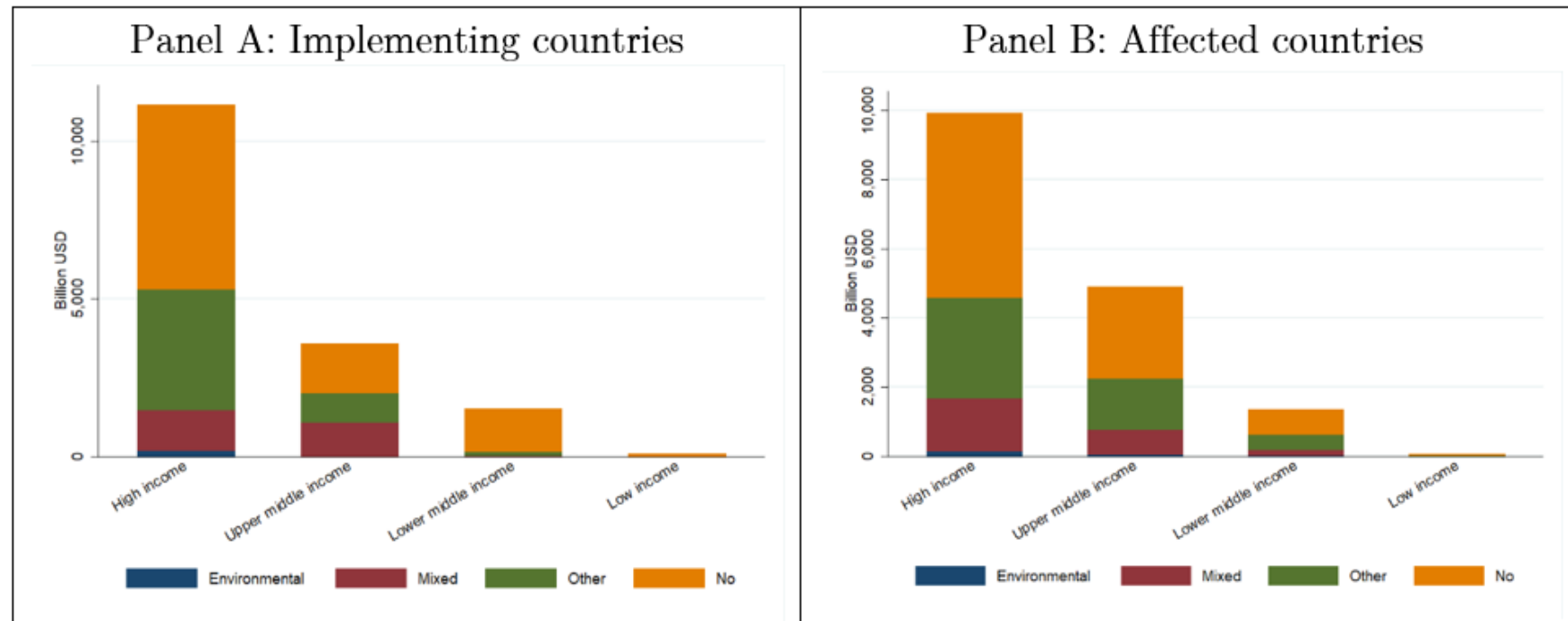
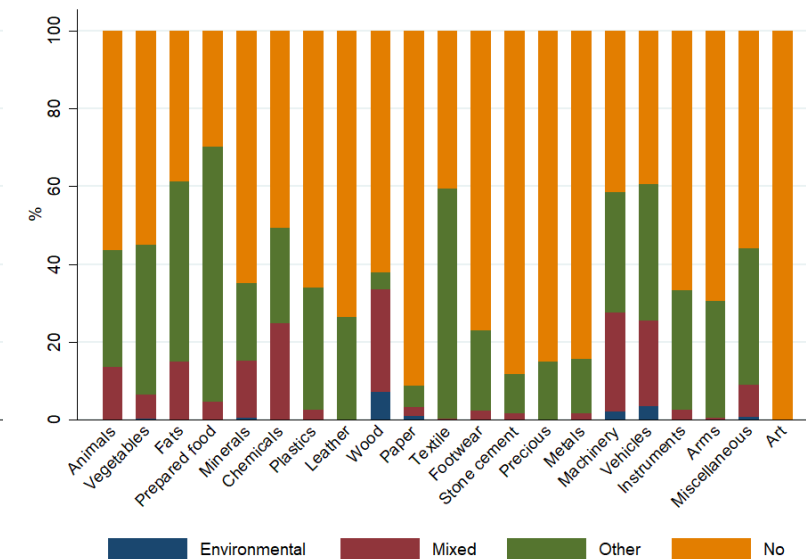
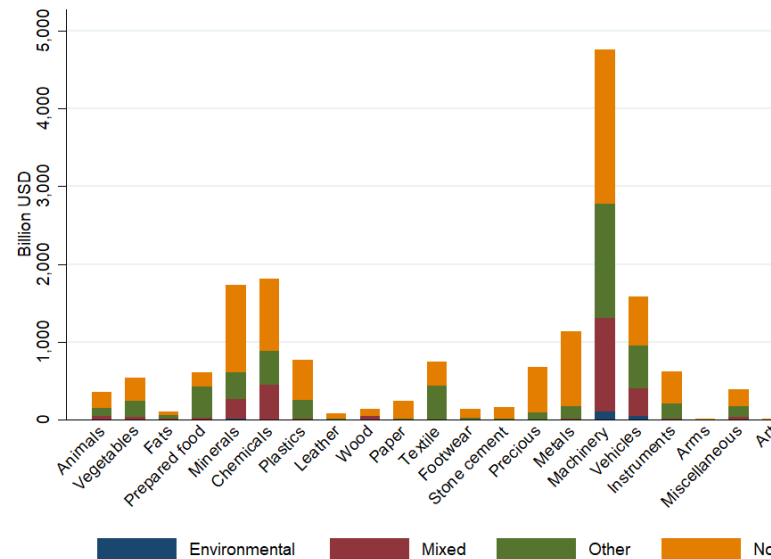


Figure. Trade values regulated by technical measures by groups of countries, 2020.
Source: Authors' elaboration on WTO TBT IMS and BACI.

Facts and figures

Stylized Fact #3: Environmental technical measures differ substantially across sectors

Energy-intensive (e.g. machinery and chemicals) and ag-food sectors more covered



Data: exploiting the informative content of WTO notifications

- Notifications of technical measures (WTO TBT IMS)
 - retrieved for the **period** 2010-2020 and 105 **implementing countries**
 - defined at the HS 2-, 4- or 6-digits **products**
 - ✓ conversion into HS 6-digits products to merge w/ trade (*BACI*) and tariffs data (*MAcMap*)
 - ✓ **final dataset**: ~30 mln obs. (flows b/w 155 potential partners in a decade w/ gaps, 5,000 products)
 - attributed to 13 objectives (e.g., environment, human health, animal/plant life/health, harmonization)
 - ✓ grouping into 3 categories of objectives (**environmental, mixed, other**)

Product category	Fertilizers	Fertilizers
Country (year)	USA (2013)	China (2019)
Objective	Protection of environment	Protection of environment, animal/plant life/health
Description	Establishes conditions when fertilizer is considered organic requiring labeling/registration clarifies sampling/recordkeeping requirements	Specifies terms and definitions, requirements, testing methods and inspection rules for toxic and harmful elements in fertilizers

Effects of environmental measures on trade outcomes

- Unrestricted estimates (on all flows): zero avg. trade effects on values...
 - ✓ trade-impeding and trade-enhancing effects may coexist and offset each other at the aggregate level (e.g., *Li and Beghin, 2012; Santeramo and Lamonaca, 2019; Adarov and Ghodsi, 2023*)
 - ✓ positive (+information) vs. negative (hidden green protectionism) impact (*Fontagné et al., 2005*)
... w/ differentiated impacts on quantities (+2,5%) and prices (-1.2%)
- Cond. on large flows, positive (+2.4%) on values, driven by a price increase (+2.2%)
 - ✓ Compliance w/ TBT increase marg. costs (e.g., *Fontagné et al., 2015*), thus total prod. costs (i.e., unit values, *Adarov and Ghodsi, 2023*)
 - ✓ Price for quality under environmental standards (e.g., *Gaigné et al., 2021*) & sub. Effects
→ Alchian–Allen conjecture (e.g., *Emlinger and Guimbard, 2021; Fiankor and Santeramo, 2023*)

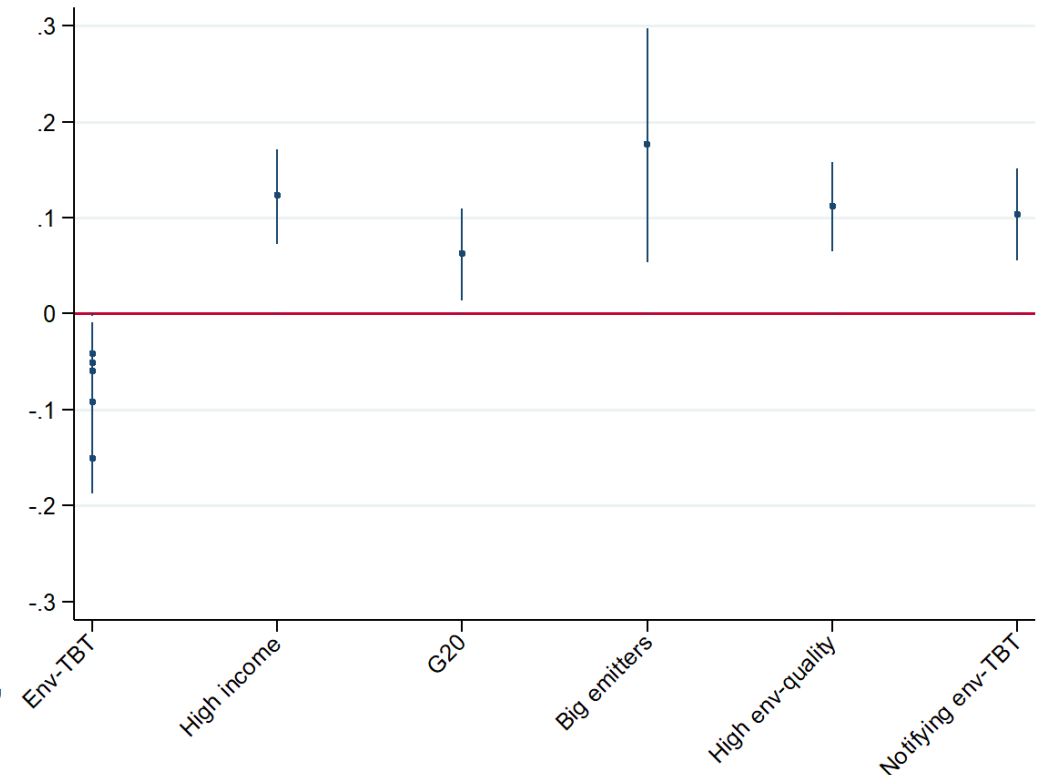
Flows	Values	Volumes	Unit values
Flows > 10,000 USD	+2.4	0	+2.2
Flows (small flows included)	0	+2.5	-1.2

Country-specific heterogeneity

- Self-selection of trading partners (i.e., exports from markets facing TBT dominate, *Marette and Beghin, 2007; Beghin et al., 2012*)
- Trade outcomes for countries w/ favorable assets (*Bratt, 2017*) correlated w/ macroeconomic characteristics and geopolitical connections (*Bao and Qiu, 2012*)
- TBT exogenous to the trade mix → country's ability to comply w/ TBT orthogonal to its content (*Essaji, 2008*), correlated w/ country's characteristics and ability to comply w/ env-TBT (*Fontagné and Orefice, 2018*)
- **Test:** interaction w/ country-specific controls
 - high income and G20; like-minded partners effects (*Bao and Qiu, 2012*)
 - big emitters (economic development corr. w/ emissions, *de Melo and Solleder, 2020*)
 - high env.-quality (// ...and env-standards, *de Melo and Solleder, 2020*)

Country-specific heterogeneity

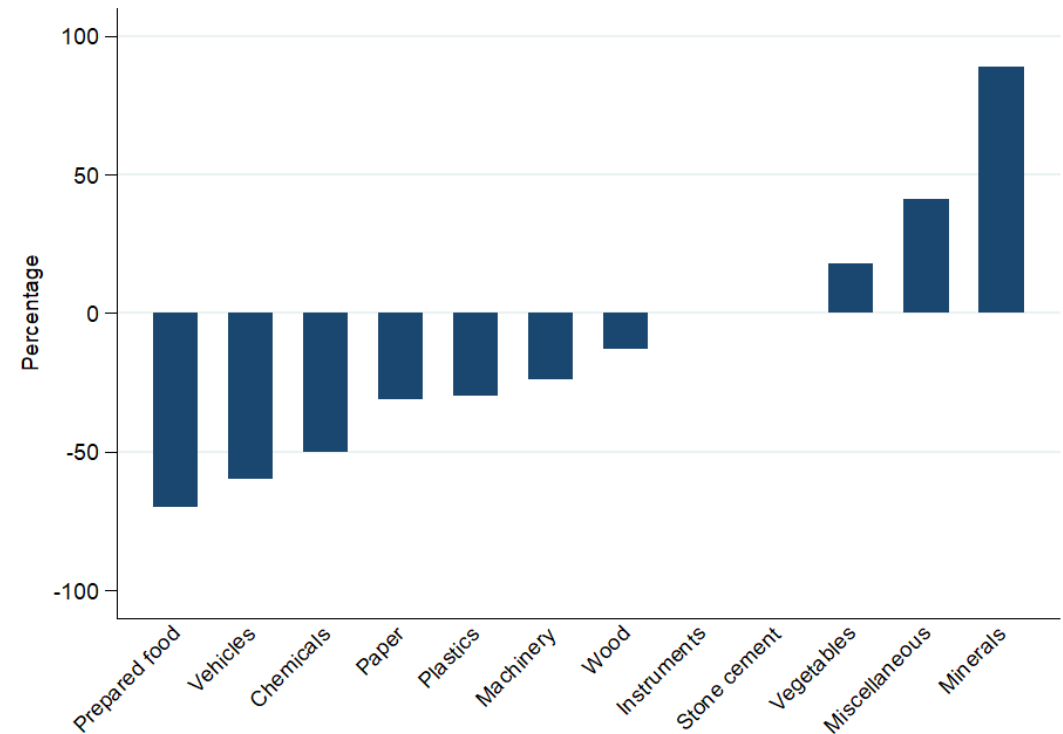
- Effect of env-TBT positive for selected countries
 - ✓ distributional effects of env-TBT
(divergent and opposite for NTMs, *Bratt, 2017*)
 - ✓ capability to comply w/ technical and financial features of env-TBT
(gains in comp. adv., *de Melo and Solleder, 2020*)
 - ✓ lower competitiveness of countries w/ low env-quality standards
(high. compliance costs for greener prod. techniques, *Pegels and Altenburg, 2020*)



Sector-specific heterogeneity

- Effect of env-TBT progressively reduced as soon as sources of time invariant heterogeneity are accounted for
 - larger effect when relying on variations within broader than narrower sectors
 - Product composition effect
(TBT heterog. effects on markets w/ more sensitive products (*Dolabella, 2020*))
 - Neg. trade effect for prepared food, vehicles, and chemicals (in volume terms)

(only exceptions: vegetables, miscellaneous and minerals)



Trade and environmental outcomes of env-TBT

Empirical approach (Yue, 2022) – Intensive vs. extensive margins

$$V_{jst} = \alpha_{js} + \alpha_{st} + \beta TBT_{jst-1}^{env} + \gamma TBT_{jst-1}^{other} + \delta AVE_{jst} + \zeta X_{jt} + \varepsilon_{jst}$$

where

$$V_{jst} = (EM_{jst}) \times (IM_{jst}) = \underbrace{\left(\frac{\sum_{I_{jst}} V_{ijst}}{\sum_{I_{js(t-1,t)}} V_{ijst}} \right)}_{EM_{jst}} \times \underbrace{\left(\sum_{I_{js(t-1,t)}} V_{ijst} \right)}_{IM_{jst}}$$

I_{jst} : exporters from which j import products in the sector s in year t

$I_{js(t-1,t)}$: exporters from which j import products in the sector s both in years t and $t-1$

Trade and environmental outcomes of env-TBT

Some evidence

- Significant effect on general environmental outcomes of countries notifying env-TBT (-4.1% in GHG emissions, -4.5% in CO₂ emissions)
- TBTs “cut” annual emissions by 4 Mt CO₂eq.

Variables	(1) Imports	(2) Imports embedded emissions	(3) Carbon dioxide emissions (CO ₂)	(4) Greenhouse gas emissions (GHG)
TBT_{jst-1}^{env}	-0.0281 (0.0209)	0.0484 (0.0431)	-0.0465** (0.0230)	-0.0424* (0.0225)
Controls	yes	yes	yes	yes
Dep. var.	Imp_{jst}	$CO_2^{Imp}_{jst}$	CO_2_{jst}	GHG_{jst}
Fixed effects	α_{js}, α_{st}	α_{js}, α_{st}	α_{js}, α_{st}	α_{js}, α_{st}
Observations	1,924	1,926	1,418	1,586

Take-home

Trade effects of env-TBTs

- ❖ Policy objectives matter (*Schlueter et al., 2009, Hoekman, Nelson and Mavrodis, 2023*)
- ❖ Mixed effects on prices and volumes (i.e. **quality** for env. prot.)
- ❖ Marked heterogeneity across countries (and sectors)
 - ❑ Pro-trade effect for wealthier and more industrialised countries (*de Melo and Solleder, 2020*)

- ❖ Policy coherence and harmonization of trade policies

- ❖ Trade-offs w/ environmental outcomes

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