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The heterogeneous effects of standards on agricultural trade flows

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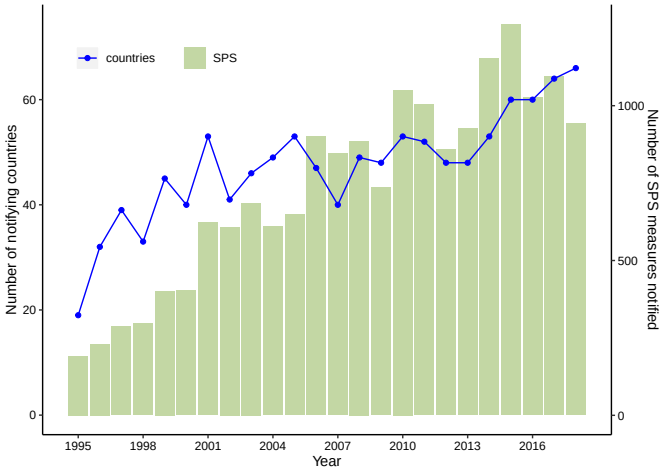
Motivation

- Increasing relevance of NTMs
- Ever falling tariffs
- Tariff $\propto$ NTM?



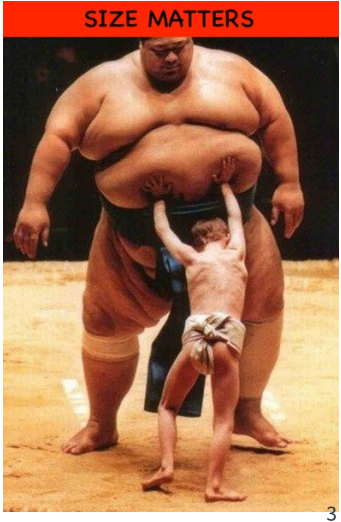
Motivation

- How standards affect trade flows remain nuanced
- But public standards tend to be barriers to agrifood trade
- They reduce the:
  1. probability of trade (Ferro et al., 2015)
  2. value of trade conditional on exports (Disdier et al., 2008a)
  3. number of traded varieties (Fiankor et al., forthcoming)
- These corresponds to the "standards-as-barriers" debate

[1] Image source: Food Safety News https://bit.ly/2HeJAzC

This paper

- Revisits the "standards-as-barriers" debate, with a distinct twist
- The negative trade effect of standards decreases with increasing share of the exporter in the importing country's total imports
- The reasoning is simple; bigger trading partners find it more profitable to invest in meeting importer-specific standards
- Brings to the debate the role of export volumes in determining how food standards affect trade
- Context: Specific trade concerns raised on SPS measures



[1] Image source: https://images.app.goo.gl/QjyNNtyesEsEekUf7

Contributions to the literature I

- Our first contribution is to the empirical literature that assesses the standards-trade effect using the gravity model (Disdier et al., 2008a; Ferro et al., 2015; Crivelli and Gröschl, 2016)
- These studies estimate gravity equations that impose the limiting assumption that the elasticity of trade with respect to trade costs more generally, but standards specifically, is constant.
- "*This feature means that all else being equal, a reduction in trade costs — for instance a uniform tariff cut — has the same proportionate effect on bilateral trade regardless of whether tariffs were initially high or low or whether a country pair traded a little or a lot*" (Novy, 2013, pg. 271).

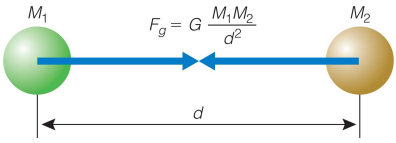
Contributions to the literature II

- We contribute to the literature on the heterogeneous effects of standards across units depending on their sizes.
- Firm level evidence (Fontagné et al., 2015; Fernandes et al., 2019; Curzi et al., 2020)
- Country-level evidence (Anders and Caswell, 2009; Ehrich et al., 2017)
- Our paper differs from this literature in three respects.
  1. We consider the whole agricultural sector.
  2. Heterogeneous trade responses are endogenous to our estimation equations
  3. Alternate CES gravity models yield results consistent with our translog gravity framework

Contributions to the literature III

- Our third contribution is to the literature that assesses the heterogeneity of the standards trade-effect across the development status of the exporting countries.
- Bigger trade reducing effects for developing compared to developed countries (Disdier et al., 2008b; Anders and Caswell, 2009; Xiong and Beghin, 2014; Ferro et al., 2015; Curzi et al., 2018).
- For country-groups, these findings may be correct, but our country-pair specific estimations show that the effects are not always larger for developing countries.

CES Gravity



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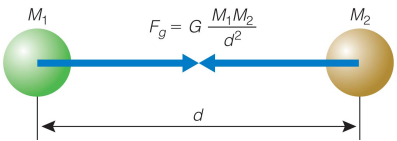

- Expenditure functions that indicate how consumers allocate spending across countries under trade cost constraints

$$X_{ij} = \frac{Y_i E_j}{Y} \left(\frac{t_{ij}}{\Pi_i P_j} \right)^{1-\sigma} \quad (1)$$

- $\eta \equiv \frac{\delta \ln x_{ij}}{\delta \ln t_{ij}} \Longrightarrow \eta^{CES} = -(\sigma - 1)$
- η^{CES} = constant $\Longrightarrow$ "one size fits all"
- $\sigma > 1$ is an assumption of convenience not necessity

Translog Gravity

$$\ln(E_j) = \ln(U_j) + \alpha_{0j} + \sum_{m=1}^{N} \alpha_m \ln(p_{mj}) + \frac{1}{2} \sum_{m=1}^{N} \sum_{k=1}^{N} \gamma_{mk} \ln(p_{mj}) \ln(p_{kj}) \tag{2}$$

$$\frac{x_{ij}}{y_j} = \frac{y_i}{y^W} - \gamma n_i \ln(t_{ij}) + \gamma n_i \ln(T_j) + \gamma n_i \sum_{s=1}^{J} \frac{y_s}{y^W} \ln(\frac{t_{is}}{T_s}) \tag{3}$$

$$\frac{x_{ij}}{y_j} = -\gamma n_i \ln(t_{ij}) + \gamma n_i \ln(T_j) + S_i + \varepsilon_{ij} \tag{4}$$

$$\frac{x_{ij}/y_j}{n_i} = -\gamma \ln(t_{ij}) + S_j + S_i + \varepsilon_{ij} \tag{5}$$

$$\eta_{ij}^{TL} = -\frac{\gamma}{(x_{ij}/y_j)} \Longrightarrow \text{varies across observations}$$

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Sanitary and phytosanitary standards

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Table 1: Comparison of MRLs on selected products in 2014

Chemical	Fruit	Countries						
		EU	USA	Canada	Japan	Vietnam	China	Codex
Carbaryl	Citrus	0.01	10	10	1	7	_	15
Methidathion	Citrus	0.02	5	2	5	5	2	5
Captan	Apple	3	25	5	5	25	15	15
Fenbutatin-Oxide	Apple	2	15	3	5	5	5	5
Acetamiprid	Apple	0.80	1	1	2	_	0.80	0.80
Bifenthrin	Tea	5	30	_	30	_	_	30
Endosulfan	Tea	30	24	_	30	30	_	10
Fenpropathrin	Tea	2	2	2	25	_	5	2

Source: Homologa dataset

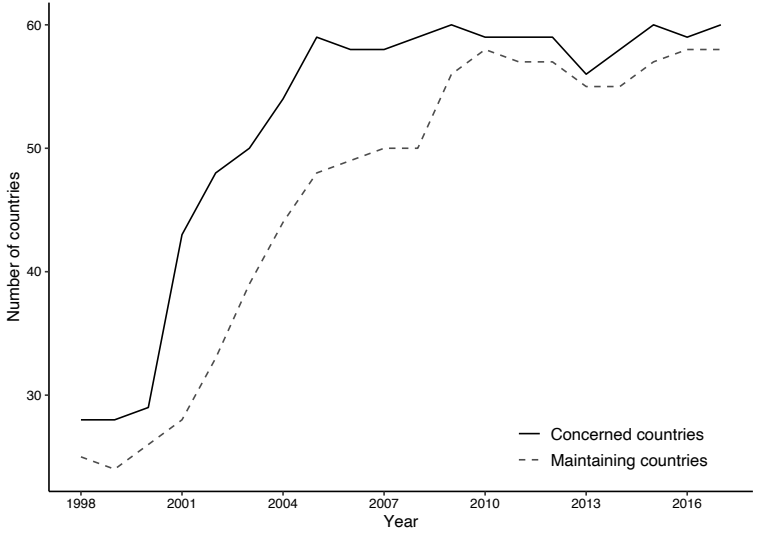
Specific trade concerns (STCs)

- Issues raised at the WTO by exporting countries affected by SPS standards, which they consider unjustified and particularly restrictive (Olper, 2016).
  - Measures motivated by protectionism are likely to be raised as a concern by other members
  - Legitimate measures will receive fewer complaints
  - Policy-makers — no incentive to notify own SPS measures but that of partners (Grant and Arita, 2017).
- This nature of STCs makes them de facto restrictive and thus appropriate to study the standards-trade effect if the focus, like in our case, is on the standards-as-barriers angle (Fontagné et al., 2015; Curzi et al., 2020).

Specific trade concerns (STCs)

- The data we use on SPS STCs come from Ghodsi et al. (2017).
- We treat the agricultural sector as one unit, and aggregate HS6 digit STCs to the country level
- Our sample includes only bilateral pairs where an STC was active at least once over the panel
- 66 importing countries (including the EU15 as a group) and 66 exporting countries over the period 1998 to 2017 with a maximum of 87,120 ($66 \times 66 \times 20$) observations

Specific trade concerns (STCs)



Identification strategy

$$\frac{x_{ijt}/y_{jt}}{n_{it}} = \beta_1 SPS_{ijt} + \beta_2 \ln(1 + Tariff_{ijt}) + \beta_3 RTA_{ijt} + \psi_{it} + \lambda_{jt} + \alpha_{ij} + e_{ijt}. \quad (6)$$

- Eqn (6) is estimated using OLS (with e_{ijt} clustered at the *ij* level)
- Identification of β_1 is achieved from changes in bilateral STCs over time

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Methodological issues in estimating β_1

- Endogeneity of the standards–trade relationship
  - Omitted variable bias: 3-way FEs (Baier et al., 2014)

Theoretical predictions

Standards and trade

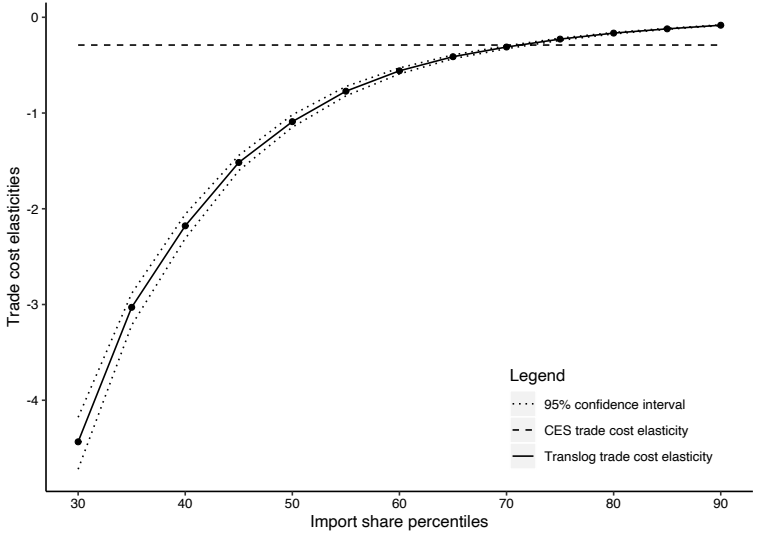
- Firm heterogeneity models (e.g., Melitz, 2003; Helpman et al., 2008) — productivity differences as comparative advantage
- Theoretical predictions of these models imply that standards impose extra costs that affect trade
  - Prohibitive nature of fixed costs will lead to zero trade between some country-pairs
  - Fixed cost $\Longrightarrow$ extensive margin; Variable cost $\Longrightarrow$ intensive and extensive margin

Tab 1: The effect of standards on agricultural trade: translog gravity model

	$\frac{x_{ijt}/y_{jt}}{n_{it}}>0$	$\frac{x_{ijt}/y_{jt}}{n_{it}}$
Dependent variable	(1)	(2)
SPS_{ijt}	−0.013***	−0.013***
	(0.002)	(0.002)
$\text{Log}(1+\text{Tariff}_{ijt})$	−0.001	−0.001
	(0.001)	(0.000)
RTA_{ijt}	0.003	0.003
	(0.003)	(0.003)
SPS estimates		
Mean	−0.187	−0.183
30th percentile	−5.167	−5.060
50th percentile	−1.194	−1.170
90th percentile	−0.075	−0.073
R^2	0.930	0.927
Observations	76,219	87,120

Note: Robust country-pair-product clustered standard errors in parentheses. ***, **, * denote significance at 1%, 5% and 10%, respectively. Importer-time, exporter-time, and importer-exporter fixed effects included in all regressions. Intercepts included but not reported. Columns (2) excludes zero trade shares. The dependent variable are import shares measured as the aggregate of agricultural trade (i.e., HS01–HS24). Except for tariffs all explanatory variables enter

Fig 2: Trade cost elasticities plotted against import shares



Tab 2: Country-pair specific estimates of the effects of EU-15 standards

Exporting country	Trade value (US$ m)	Import share (in %)	Trade cost elasticity	Income status
Fiji	107	0.027	−11.950	Low
Cuba	368	0.091	−2.896	Low
Tanzania	413	0.103	−3.090	Low
Senegal	459	0.114	−2.781	Low
Uruguay	663	0.164	−1.927	High
Israel	1,033	0.256	−1.236	High
Egypt	1,080	0.268	−1.183	Low
Phillipines	1,416	0.351	−0.902	Low
Russia	1,622	0.403	−0.787	High
Colombia	2,236	0.555	−0.571	Low
Australia	2,440	0.606	−0.524	High
Peru	2,767	0.687	−0.462	Low
Thailand	3,050	0.757	−0.419	Low
Ecuador	3,115	0.773	−0.410	Low
South Africa	3,752	0.931	−0.340	Low
Côte d'Ivoire	4,215	1.046	−0.303	Low
India	4,755	1.180	−0.269	Low
Indonesia	5,198	1.290	−0.246	Low
Argentina	5,881	1.460	−0.217	Low
China	7,467	1.853	−0.171	Low
Brazil	12,600	3.126	−0.101	Low
USA	12,800	3.184	−0.100	High

Tab 3: The effect of standards on agricultural trade: unilateral SPS measure

	$\frac{x_{ijt}/y_{jt}}{n_{it}}>0$	$\frac{x_{ijt}/y_{jt}}{n_{it}}$
Dependent variable	(1)	(2)
SPS_{jt}	−0.003***	−0.003***
	(0.002)	(0.001)
$Log(1+Tariff_{ijt})$	−0.006***	−0.009***
	(0.002)	(0.000)
RTA_{ijt}	0.062***	0.059***
	(0.008)	(0.008)
$Log\,Distance_{ij}$	−0.057***	−0.034***
	(0.005)	(0.004)
$Colony_{ij}$	0.092***	0.091***
	(0.031)	(0.031)
$Language_{ijt}$	0.011	0.028***
	(0.013)	(0.011)
$Contiguity_{ijt}$	0.215***	0.254***
	(0.039)	(0.039)
SPS estimates		
Mean	−0.041	−0.038
30th percentile	−1.132	−1.052
50th percentile	−0.262	−0.243
90th percentile	−0.016	−0.015
Observations	76,270	87,120

CES gravity model with heterogeneous SPS effects on trade

- One concern with our findings is whether the results are model-driven
- Estimate a CES gravity model but incorporate heterogeneous effects of SPS measures

$$\frac{x_{ijt}/y_{jt}}{n_{it}} = \exp\left[-\beta' \mathbf{w}_{ijt} + \psi_{it} + \lambda_{jt} + \alpha_{ij} \right] + e_{ijt} \tag{7}$$

$$\frac{x_{ijt}/y_{jt}}{n_{it}} = \exp\left[-\gamma\, \mathbf{r}\, \beta' \mathbf{w}_{ijt} + \delta_{int} SPS_{ijt} \times D_{int} + \psi_{it} + \lambda_{jt} + \alpha_{ij} + D_{int} \right] + e_{ijt}. \tag{8}$$

- We estimate equations (7) and (8) using the Poisson-pseudo maximum likelihood estimator

Tab 4: Heterogeneous effect of standards on agricultural trade: CES gravity model

	(1)	(2)
SPS_{ijt}	−0.051** (0.026)	
SPS_{ijt} × predicted shares (First interval)		−3.470*** (0.145)
SPS_{ijt} × predicted shares (Second interval)		−1.174*** (0.066)
SPS_{ijt} × predicted shares (Third interval)		−0.471*** (0.045)
SPS_{ijt} × predicted shares (Fourth interval)		−0.028 (0.026)
Log (1 + $Tariff_{ijt}$)	−0.021 (0.016)	−0.015 (0.015)
RTA_{ijt}	0.008 (0.034)	0.007 (0.034)
Observations	85,200	85,200

Note: Robust country-pair-product clustered standard errors in parentheses. ***, **, * denote significance at 1%, 5% and 10% respectively. Importer-time, exporter-time, and importer-exporter fixed effects included in all regressions. Intercepts included but not reported. The dependent variables are observed trade values. All models are estimated using PPML. The dummy for predicted shares is omitted due to perfect collinearity with the importer-time fixed effects.

Main Take Aways

- Stricter standards are trade restrictive
- But trade cost elasticity varies depending on how intensively two countries trade
- Hence for countries trading large volumes, standards have limited negative effects
- Thus, standards-related trade costs have a heterogeneous trade-reducing effect
- Smaller trading partners will benefit more from further NTM liberalisation or harmonisation

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- Hence for countries trading large volumes, standards have limited negative effects
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Thank You!!

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Summary statistics

Table 2: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
SPS_{ijt} dummy	0.149	0.356			87120
RTA_{ijt} dummy	0.205	0.403			87120
$Tariff_{ijt}$ (logs)	2.320	1.228	0	7.786	87120
Import shares (%)	1.515	4.369	0	84.618	87120
Extensive margin (n_{it})	23.803	0.904	15	24	87120
Trade value (m USD)	0.171	1.391	0	65.212	87120