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Regulatory Divergence in Non-Tariff Measures Across the Global Value Chains

Fabio Santeramo and Mahdi Ghosi

Selected presentation for the International Agricultural Trade Research Consortium's (IATRC's) 2023 Annual Meeting: The Future of (Ag-) Trade and Trade Governance in Times of Economic Sanctions and Declining Multilateralism, December 10-12, 2023, Clearwater Beach, FL.

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Regulatory divergence in non-tariff measures across the global values chains

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10-12 December 2023 International Agricultural Trade Research Consortium Clearwater Beach, FL, USA



Agenda

- 1. Motivation of research
- 2. Objectives of research
- 3. Measuring regulatory divergence in NTMs
- 4. Regulatory divergence in NTMs along the GVC
- 5. Empirical Methodology
- 6. Estimation results
- 7. Reviving TTIP: the potential impact of trade liberalization between the EU and US
- 8. Summary and conclusions



Motivation of research

- 1. NTMs as important trade policy measures regulating markets for undesirable externalities.
 - Example: recent **COVID-19 pandemic and border closures**
 - proliferation of regulatory **non-tariff measures (NTMs)** such as technical barriers to trade (TBTs) and sanitary and phytosanitary (SPS) measures
 - 46 TBTs citing COVID in their measure description while citing **Protection of Human health** or safety
 - 51 SPS measures citing COVID in all their measure description while **citing animal diseases**, **plant health, or food safety**
- 2. Few studies on **regulatory divergence** (Piermartini and Budetta, 2009; Cadot et al., 2015; Cadot and Ing, 2015, Knebel and Peters, 2019; Nabeshima and Obashi, 2021; Inui et al., 2021).
- 3. In the **presence of GVCs**, trade policy measures like tariffs or NTMs are amplified via backward and forward linkages (Ferrantino, 2012; Rouzet & Miroudot, 2013; Miroudot et al., 2013; Muradov, 2017; Escaith, 2017; Muradov, 2017; Ghodsi & Stehrer, 2022)



Objectives of research

- 1. Constructing a measure on **bilateral regulatory divergence** for each NACE two-digit bilateral relation in **objectives of TBTs and SPS** measures using the keywords cited in WTO notifications.
- 2. Constructing a measure on **bilateral regulatory divergence along the GVC**, to reflect the accumulation of regulatory divergence in previous stages of production of inputs sourced from the trading partner.
- **3.** Econometrics model of gravity to analyse the effects of direct regulatory divergence, and indirect regulatory divergence through suppliers (backward linkages) on bilateral exports.
- Reviving TTIP: the potential impact of liberalization between the EU and US: tariff liberalization and regulatory convergence.



Measuring regulatory divergence in NTMs

- Following Cadot et al. (2015), a binary variable $I_{jht}^{\tau c}$ is defined that indicates whether an importing country *j* has a regulatory NTM of type τ (i.e., $\tau \in \{TBT, SPS\}$) on HS six-digit product *h* in year *t* in force with an objective *c* cited in the keyword of the WTO notifications.
- The regulatory divergence between two trading partners *i* and *j* in that regulatory measure *τc* is then defined as:

$$RD_{ijht}^{\tau c} = \left| I_{jht}^{\tau c} - I_{iht}^{\tau c} \right|$$

• The **aggregation of regulatory divergence** over all classes for a traded sector *s* (including all HS six-digit products) between the importing country *j* and exporting country *i* in year *t* then yields the regulatory divergence that is calculated as follows:

$$D_{ijst}^{\tau} = \sum_{c}^{HC_{h,\tau}} \frac{RD_{ijht}^{\tau c}}{HC_{h,\tau}}, \qquad \tau \in \{TBT, SPS\}$$

- $C_{h,\tau}$ is the total number of classes of NTMs of type τ that are imposed globally on product h and H is the total number of six-digit HS products in sector s.
- This index converges to unity when the two trading partners impose TBT or SPS measures that cover different NTM classes indicating the full divergence, and it converges to zero when the two trading partners impose TBT and SPS measures in the same classes.



Table 1 / List of TBT keywords and keyword classes in WTO notifications

TBT keywords Nr.	TBT keywords	Keyword class
1	Consumer information	
2	Consumer protection	
3	Crime protection	
1	Human health	1- Consumers
5	Prevention of deceptive practices and consumer protection	
6	Protection of Human health or safety	
7	Safety	
3	Food additives	
)	Food standards	
10	Genetically modified organisms	2- Food
1	Nutrition information	
12	Organic agriculture	
13	Conformity assessment	
4	Harmonization	
5	Labelling	3- Trade
16	Trade facilitation	
17	Quality requirements	4- Quality
18	Biofuels	
.9	Plant health	F Environment
20	Protection of animal or plant life or health	5- Environment
21	Protection of the environment	
22	NA	(Other
23	Other	6- Other
24	Cost saving and increasing productivity	
25	Metrology	7- Market
26	Packaging	
27	Electromagnetic compatibility	9 ICT
28	Telecommunication/Radiocommunication	8- ICT
29	Animal feed	
30	Animal health	9- Animals
31	Animal welfare	
32	National security requirements	10- National
		© wiiw 6



Figure 1 / Number of TBT notifications (based on keywords class) in force in 2021 globally

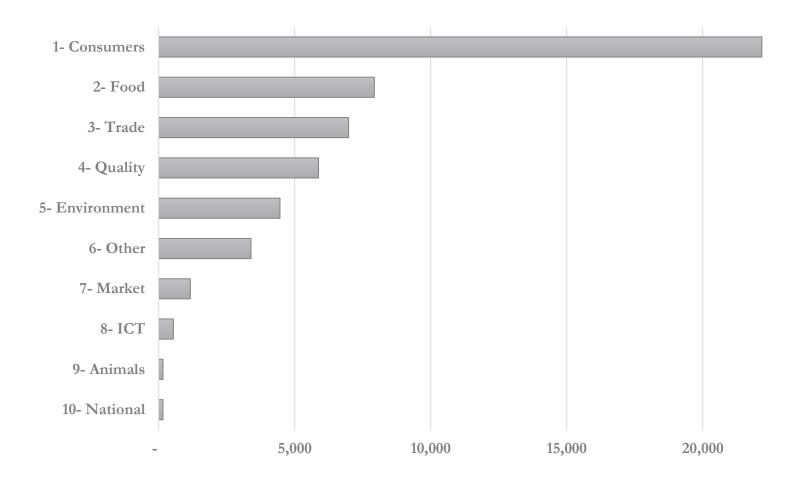






Table 2 / List of SPS keywords and keyword classes in WTO notifications

1 Food safety 2 Human health 1- Consumer 2 Poter Humans from animal/plant pest or disease 4 Matoxins	SPS keywords Nr.	SPS keywords	Keyword class
3Protect humans from animal/plant pest or disease4Aflatoxins5Aflatoxins6Contaminants7Dioxina7Dioxinants8Feed additives9Food additives9Food additives10Heavy metals11Tradiation2- Tolerance limits12Maximum residue limits (MRLs)- Tolerance limits13Mycotoxins- Tolerance limits14Ochratoxin- Tolerance limits15Pesticides- Tolerance limits16Pesticides- Tolerance limits17Tolerance exemption- Tolerance limits18Toxins- Tolerance limits29Animal feed- Tolerance20Animal kealth- Tolerance21Animal kealth- Tolerance22Animal kealth- Tolerance23Animal health- Tolerance24Animal health- Tolerance25Bluetongue- Tolerance26Noirie Songiform Encephalopathy (BSE)- Animal Diseases27Gostand Swine Forer- Animal Diseases28Forti My- Animal Diseases29Forti My- Animal Diseases20Forti My- Animal Diseases21Animal out disease- Animal Diseases22Forti My- Tolerance23Forti My- Tolerance24Forti My- Tolerance25Forti	1	Food safety	
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5Allegens6Contaniants6Contaniants7Boxinants8Feed additives9Feed additives9Food additives10Heary metals11Inadiation2-Tolerance limits12Myotoxins2-Tolerance limits13Ochaxoin	3	Protect humans from animal/plant pest or disease	
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8 Feed additives 9 Good additives 9 Good additives 10 Heavy metals 11 Irradiation 2- Tolerance limits 12 Maximum residue limits (MRLs) 2- Tolerance limits 13 Mycotoxins 2- Tolerance limits 14 Ochratoxin 2- Tolerance limits 15 Pesticides 2- Tolerance limits 16 Ochratoxin	6	Contaminants	
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33 Newcastle Disease	31	-	
	32		
	33	Newcastle Disease	
34 Pests	34	Pests	
35 Scrapie	35		
36 Transmissible Spongiform Encephalopathy (TSE)	36		
<u>37 Zoonoses</u>	37	Zoonoses	® wiiw 8



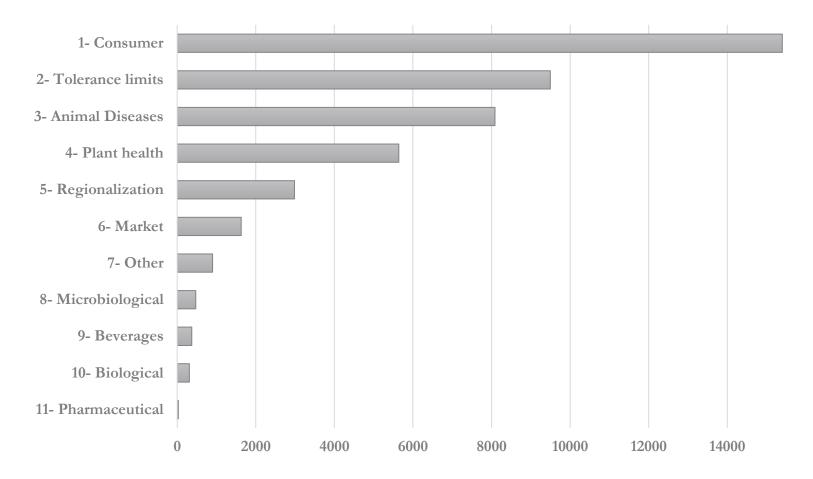
Table 2 / List of SPS keywords and keyword classes in WTO notifications

SPS keywords Nr.	SPS keywords	Keyword class	
38	Citrus canker		
39	Fungi		
40	Plant diseases		
41	Plant health	4- Plant health	
42	Plant protection		
43	Protect territory from other damage from pests		
44	Sudden Oak death		
45	Regionalization	5 Destandingtion	
46	Territory protection	5- Regionalization	
47	Certification		
48	control and inspection		
49	HACCP Plan requirements		
50	Labelling	6- Market	
51	Packaging		
52	Traceability		
53	Wood packaging / ISPM15		
54	Equivalence		
55	Seeds	7- Other	
56	Bacteria		
57	Escherichia coli		
58	Listeria monocytogenes	8- Microbiological	
59	Salmonella		
60	Beverages	9- Beverages	
61	Biological control agents		
62	Biotechnology	10- Biological	
63	Genetically modified organisms		
64	Pharmaceutical products	11- Pharmaceutical	





Figure 2 / Number of SPS notifications (based on keywords class) in force in 2021 globally





Regulatory divergence in NTMs along the GVC

- Following Miroudot et al. (2013), we track tracking the cumulative tariffs and regulatory divergence in NTMs denoted as $\Phi_{\tau,ijst} \in \{T_{jist}, D_{ijst}^{TBT}, D_{ijst}^{SPS}\}$ along the backward linkages within Global Value Chains (GVCs).
- Tariffs or the regulatory divergence causing trade disturbance on the production of a single unit of a product in industry l within country i during year t is computed as $\sum_{js} \Phi_{\tau,ijst} a_{tsl}^{ji}$. The components of vector $\Phi_{\tau,tijW}$ represent the tariffs applied by country i on imports of products from industry s in country j, or the regulatory divergence in TBT or SPS measures between these two trading partners in sector s. It is assumed that these trade policy disturbances are consistent across all using industries in country i that utilize intermediate inputs from country j and industry s.
- a_{tsl}^{ji} represents the direct requirements of industry l in country i for inputs sourced from industry s in country j during year t.



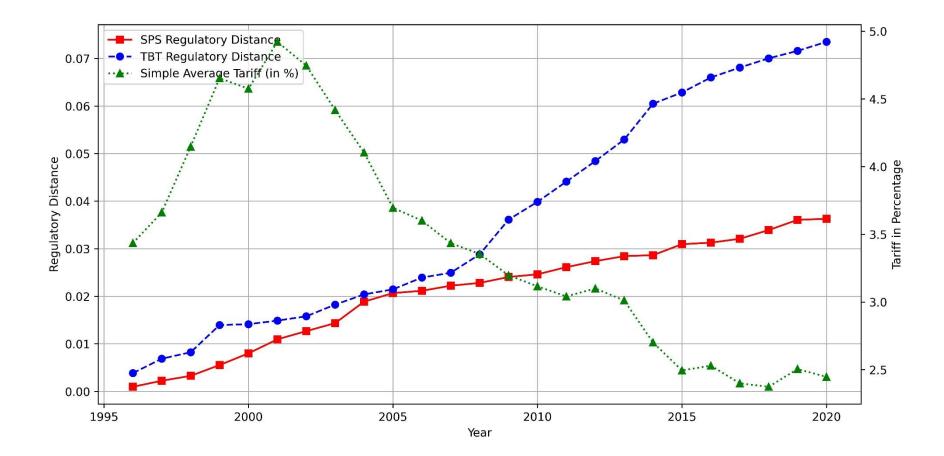
Regulatory divergence in NTMs along the GVC

$\Phi_{\tau,t,GVC} = [\mathbf{I}_{C} \otimes \mathbf{e}_{1N} \times \mathbf{B}_{t} \times (\mathbf{I} - \mathbf{A}_{t})^{-1}]', \forall t = 1, ..., T, \tau \in \{T_{jist}, D_{ijst}^{TBT}, D_{ijst}^{SPS}\}$

- A_t represents the NC×NC matrix of direct requirements in each year t, and $(I A_t)^{-1}$ signifies the corresponding Leontief inverse (Leontief, 1936).
- **B**_t is a NC×NC matrix obtained by element-wise multiplication of each country's direct requirements by its vector of annual bilateral industry-specific AVEs. $\mathbf{B}_t = [\Phi_{\tau,tijW} \otimes \mathbf{e'}_N, ..., \Phi_{\tau,tC} \otimes \mathbf{e'}_N] \odot \mathbf{A}_t$ (where $\mathbf{e'}_N$ represents a 1×N vector of ones, \otimes signifies a Kronecker product, and \odot denotes element-wise multiplication).
- I_C is an identity matrix with the dimension equal to the number of countries, C, while e_{1N} is a row vector of ones with a length corresponding to the number of sectors, N.
- The resulting $\Phi_{\tau,t,GVC}$ forms a $C \times NC$ matrix, indicating the indirect implied trade policy disturbances resulting from the proliferation of NTMs and levied tariffs at the bilateral-industry level.



Figure 3 / Evolution of regulatory distance in NTMs and tariffs over years – 1996-2020



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Figure 4 / Global average tariffs and regulatory divergence in TBTs and SPS measures across non-services NACE sectors in 2020

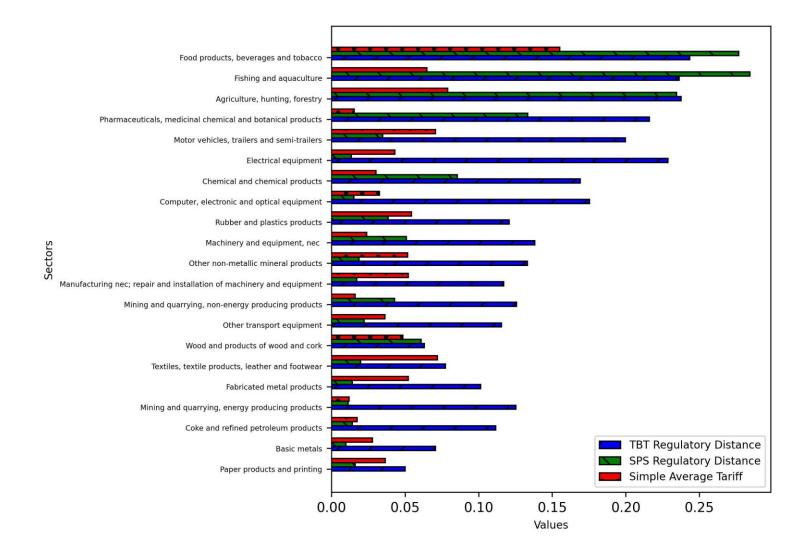
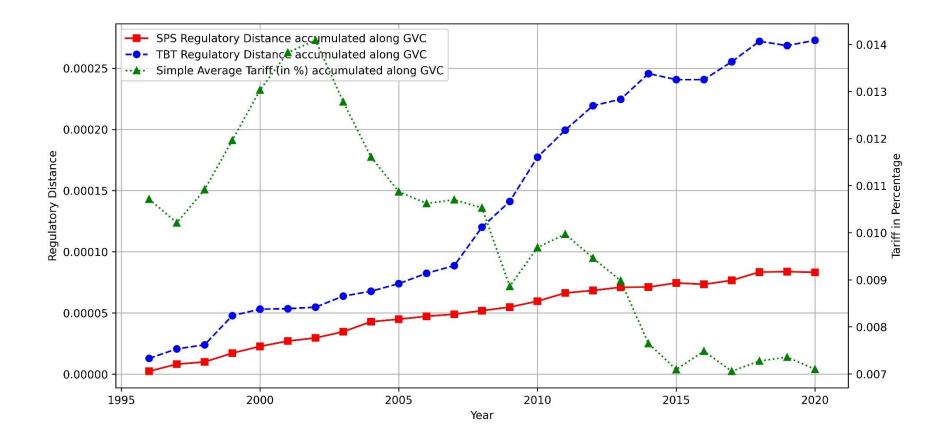




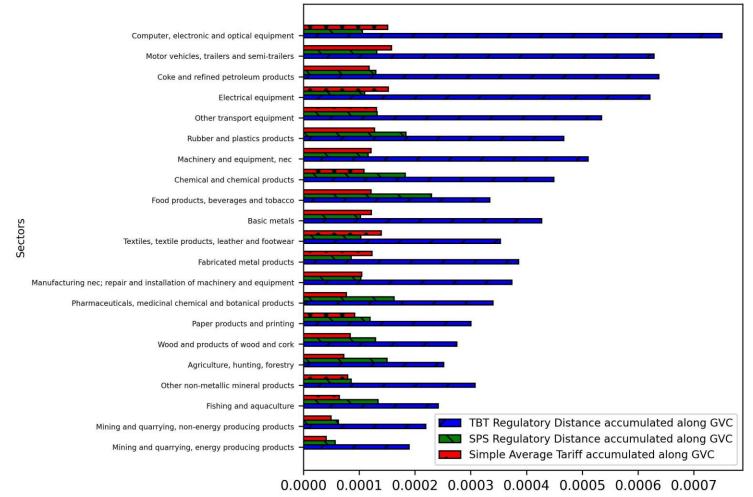
Figure 5 / Evolution of regulatory distance in NTMs and tariffs along GVC over years – 1996-2020



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Figure 6 / Global average tariffs and regulatory divergence in TBTs and SPS measures across non-services NACE sectors in 2020 were accumulated along the GVC





Empirical Methodology

 X_{ijst}

 $= EXP \left[\gamma + \gamma_1 \operatorname{arc} T_{jist} + \gamma_2 \operatorname{arc} S_{ijst}^{TBT} + \gamma_3 \operatorname{arc} S_{ijst}^{SPS} + \gamma_4 \operatorname{arc} D_{ijst}^{TBT} + \gamma_5 \operatorname{arc} D_{ijst}^{SPS} + \gamma_6 T_{ijst} + \gamma_7 \operatorname{arc} GVC_{ijst}^T + \gamma_8 \operatorname{arc} GVC_{ijst}^{TBT} + \gamma_9 \operatorname{arc} GVC_{ijst}^{SPS} + \gamma_{ist} + \gamma_{jst} + \gamma_{ijs} \right] + \varepsilon_{ijst}, \quad \tau \in \{TBT, SPS\}$

- X_{ijst} is the total value of exports of sector s from exporting country i to importing country i in year t.
- arc T_{jist} is the arcsine transformation of import tariffs (divided by 100) levied by importing country j on the imports of sector s from exporting country i in year t.
- arc S_{ijst}^{TBT} is the arcsine transformation of summation of average number of TBTs in sector s (i.e. across all its six-digit products) imposed by both partner *i* and *j* in year *t*;
- arc S_{ijst}^{SPS} is the arcsine transformation of summation of average number of SPS measures in sector s (i.e. across all its six-digit products) imposed by both partner i and j in year t;
- arc D_{ijst}^{TBT} is the arcsine transformation of the **regulatory divergence in TBTs** imposed by both partner *i* and *j* in year *t* that is calculated according to equation (1).
- arc D_{ijst}^{SPS} is the arcsine transformation of the **regulatory divergence in SPS** measures imposed by both partner *i* and *j* in year *t* that is calculated according to equation (1)





Empirical Methodology

X_{ijst}

 $= EXP \left[\gamma + \gamma_1 \operatorname{arc} T_{jist} + \gamma_2 \operatorname{arc} S_{ijst}^{TBT} + \gamma_3 \operatorname{arc} S_{ijst}^{SPS} + \gamma_4 \operatorname{arc} D_{ijst}^{TBT} + \gamma_5 \operatorname{arc} D_{ijst}^{SPS} + \gamma_6 T_{ijst} + \gamma_7 \operatorname{arc} GVC_{ijst}^T + \gamma_8 \operatorname{arc} GVC_{ijst}^{TBT} + \gamma_9 \operatorname{arc} GVC_{ijst}^{SPS} + \gamma_{ist} + \gamma_{jst} + \gamma_{ijs} \right] + \varepsilon_{ijst}, \quad \tau \in \{TBT, SPS\}$

- arc T_{ijst} is the arcsine transformation of import tariffs (divided by 100) levied by country i on the imports of sector s from country j in year t.
- arc GVC_{ijst}^T is the accumulated value of tariffs along the value chains that are used in the intermediate inputs of production in sector *s* of exporting country *i* imported from country *j* in year *t*.
- arc GVC_{ijst}^{TBT} is the accumulated value of D_{ijst}^{TBT} along the value chains that are used in the intermediate inputs of production in sector s of exporting country i imported from country j in year t.
- arc GVC_{ijst}^{SPS} is the accumulated value of D_{ijst}^{SPS} along the value chains that are used in the intermediate inputs of production in sector s of exporting country i imported from country j in year t.
- γ_{ist} , γ_{jst} , and γ_{ijs} are respectively exporter-sector-year, importer-sector-year, and bilateral sector fixed effects to control for multilateral resistances.



Empirical Methodology - data

- The data on bilateral export values are constructed using the Trade in Value Added (TiVA) 2022 edition provided by the Organization for Economic Cooperation and Development (OECD). This dataset includes 76 economies, encompassing all OECD, EU, G20, and ASEAN economies, over the period from 1995 to 2020.
- The tariff data are compiled from various sources through the World Integrated Trade Solution provided by the World Bank. The compilation of tariff data prioritizes effectively applied tariff rates, followed by preferential tariff rates, and lastly, the most-favored-nation (MFN) tariff rates. When available, ad-valorem equivalence of tariffs is utilized in the data.
- The data on NTMs are sourced from the WTO's Integrated Trade Intelligence Portal (I-TIP). This dataset encompasses notifications of NTMs implemented by various countries, with some notifications predating the establishment of the WTO in 1995. While several countries only began notifying their NTMs to the WTO after 1995, some of these regulations had been in effect much earlier. Consequently, our analysis employs the date of implementation as a reference point.



Table 3 – PPML estimation on exports values of goods during the period 1996-2020

	M1	M2	M3
arc T _{jist}	-2.71***	-1.94***	-2.82***
	(0.17)	(0.20)	(0.20)
arc S ^{TBT}	0.12***	0.11***	0.086***
	(0.016)	(0.016)	(0.015)
arc S ^{SPS}	0.0055	0.0062	0.0021
	(0.0089)	(0.0089)	(0.0084)
arc D ^{TBT}	-0.28*	-0.26	-0.75***
	(0.16)	(0.16)	(0.17)
arc D ^{SPS}	-1.04***	-1.06***	-0.73***
	(0.25)	(0.25)	(0.23)
arc T _{ijst}		-1.14***	-1.11***
		(0.15)	(0.15)
$\operatorname{Arc} GVC_{ijst}^T$			45.0***
			(5.44)
$\operatorname{Arc} GVC_{ijst}^{TBT}$			29.1***
,			(3.22)
arc GVC ^{SPS}			12.5*
9 -1			(7.35)
Constant	10.7***	10.7***	10.7***
	(0.0062)	(0.0063)	(0.0064)
Observations	2560290	2443504	2443504
Pseudo R-squared	0.996	0.996	0.996
AIC	19933050.7	19549660.6	19146023.8
BIC	19933114.5	19549736.9	19146138.2

Robust Standard errors in parentheses: * p<0.1; ** p<0.05; *** p<0.01

All models include high-dimensional fixed effects γ_{ist} , γ_{jst} , and γ_{ijs} .



Figure 7 / Potential change in exports values between the EU and US due to trade liberalization

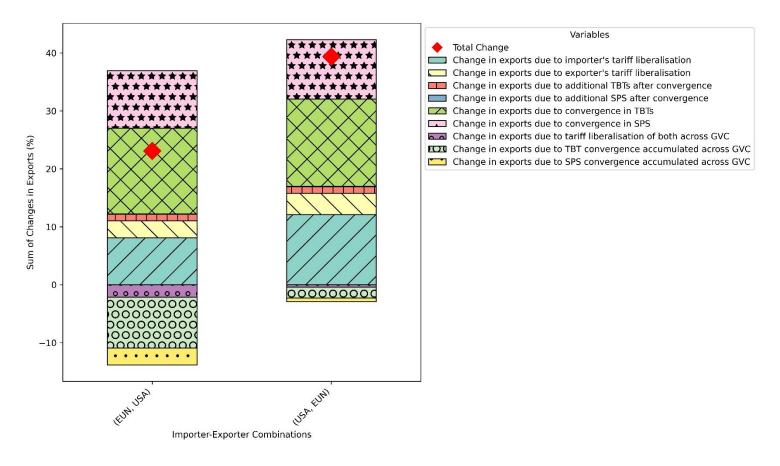
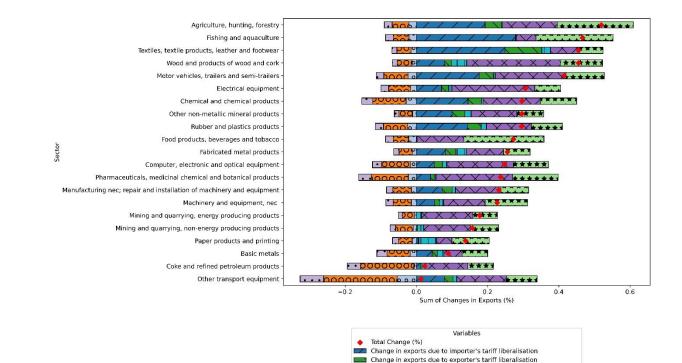




Figure 8 / Potential change in exports values from the US to the EU due to trade liberalization across sectors

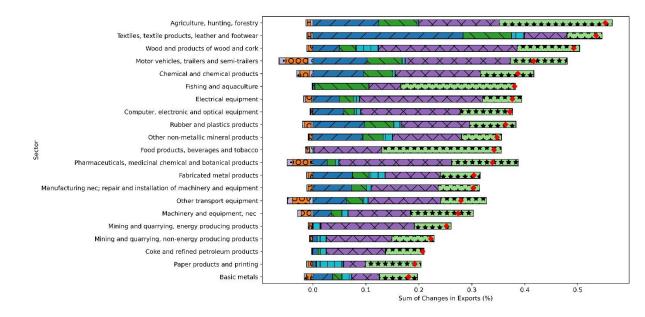


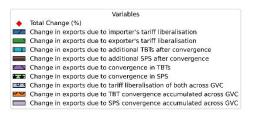
Change in exports due to additional TBTs after convergence
Change in exports due to additional SPS after convergence
Change in exports due to convergence in TBTs
GTC Change in exports due to convergence in SPS

Change in exports due to tariff liberalisation of both across GVC
 Change in exports due to TBT convergence accumulated across GVC
 Change in exports due to SPS convergence accumulated across GVC



Figure 9 / Potential change in exports values from the EU to the US due to trade liberalization across sectors









Summary and conclusions

- Regulatory NTMs such as TBTs and SPS measures are frequently used by policymakers to regulate the importing markets when the market fails to automatically adjust for negative externalities related to bad products or harmful production procedures.
- In this paper we study the effects of international regulatory divergence in non-tariff measures and their traces in GVCs on bilateral exports of non-services.
- Results show a substantial **negative** impact of **regulatory divergence** on exports values.
- The effects of **regulatory divergence through suppliers** of a sector on exports are positive, indicating the **cascading effects** of trade policy.
- The revival of TTIP with full tariff liberalization and regulatory convergence between the US and the EU would bring benefits for both regions.
 - Potential increase in imports of the EU from the US: 23.1%
 - Potential increase in imports of the US from the EU: 39.4%
 - Structure of trade, and trade policy measures across sectors matter.

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Thank you for your attention





Table 3 / List of three-digit TBT subgroups in MAST classification 2019

Three-digit TBT subgroup Nr.	Three-digit TBT subgroup	Two-digit TBT subgroup
B14	Authorization requirements for importing certain products	
B15	Authorization requirements for importers	B1 Import authorization/licensing related to technical barriers to trade
B19	Import authorization/licensing related to technical barriers to trade not elsewhere specified	Di import autionzation, nechšing related to technical barrers to trade
B21	Tolerance limits for residues of or contamination by certain substances	
B22	Restricted use of certain substances	B2 Tolerance limits for residues and restricted use of substances
B31	Labelling requirements	
B32	Marking requirements	B3 Labelling, marking and packaging requirements
B33	Packaging requirements	
B41	Technical barriers to trade regulations on production processes	
B42	Technical barriers to trade regulations on transport and storage	B4 Production or post-production requirements
B49	Production or post-production requirements not elsewhere specified	by rioduction of post production requirements
B6	Product identity requirements	B6 Product identity requirements
B7	Product quality, safety or performance requirements	B7 Product quality, safety or performance requirements
B81	Product registration/approval requirements	
B82	Testing requirements	
B83	Certification requirements	
B84	Inspection requirements	B8 Conformity assessment related to technical barriers to trade
B85	Traceability requirements	
B89	Conformity assessment related to technical barriers to trade not elsewhere specified	
B9	Technical barriers to trade measures not elsewhere specified	B9 Technical barriers to trade measures not elsewhere specified



Table 4 / List of three-digit SPS subgroups in MAST classification 2019

Three-digit SPS subgroup Nr.	Three-digit SPS subgroup	Two-digit SPS subgroup
A11	Prohibitions for sanitary and phytosanitary reasons	
A12	Geographical restrictions on eligibility	
A13	Systems approach	
A14	Authorization requirement for sanitary and phytosanitary reasons for importing certain products	A1 Prohibitions/restrictions of imports for sanitary and phytosanitary reasons
A15	Authorization requirement for importers for sanitary and phytosanitary reasons	
A19	Prohibitions or restrictions of imports for sanitary and phytosanitary reasons, not elsewhere specified	
A21	Tolerance limits for residues of or contamination by certain (non-microbiological) substances	A2 Tolerance limits for residues and restricted use of substances
A22	Restricted use of certain substances in foods and feeds and their contact materials	
A31	Labelling requirements	A3 Labelling, marking and packaging requirements
A32	Marking requirements	A3 Labelling, marking and packaging requirements
A33	Packaging requirements	A3 Labelling, marking and packaging requirements
A41	Microbiological criteria of the final product	
A42	Hygienic practices during production related to sanitary and phytosanitary conditions	A4 Hygienic requirements related to sanitary and phytosanitary conditions
A49	Hygienic requirements not elsewhere specified	
A51	Cold or heat treatment	
A52	Irradiation	
A53	Fumigation	A5 Treatment for elimination of plant and animal pests and disease-causing organisms
A59	Treatments to eliminate plants and animal pests or disease-causing organisms in the final	in the final product or prohibition of treatment
	product not elsewhere specified or prohibition of treatment	
A61	Plant-growth processes	
A62	Animal-raising or -catching processes	
A63	Food and feed processing	A6 Other requirements relating to production or post-production processes
A64	Storage and transport conditions	As other requirements relating to production of post-production processes
A69	Other requirements relating to production or post-production processes not elsewhere specified	
A81	Product registration and approval requirement	
A82	Testing requirements	
A83	Certification requirements	
A84	Inspection requirements	As Conformity appagement related to conitary and phytoconitary and differen
A85	Traceability requirements	A8 Conformity assessment related to sanitary and phytosanitary conditions
A86	Quarantine requirements	
A89	Conformity assessment related to sanitary and phytosanitary conditions not elsewhere specified	© wiiw 27
A9	Sanitary and phytosanitary measures not elsewhere specified	A9 Sanitary and phytosanitary measures not elsewhere specified