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Is the European Union providing a regulatory model for other countries?

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Is the European Union providing a regulatory model for other countries?

Cristina Herghelegiu and Fernando Martin[1,2,3]

Abstract

We examine whether the European Union (EU) is providing a model for other countries for product requirements aimed at protecting health, safety, and the environment. The analysis draws upon information on detailed categories of sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBTs) introduced on specific products by 86 countries across the world over the 2009-2019 period. First, we examine whether the existence of requirements within a given product-level SPS/TBT category in other countries is associated with the prior existence of requirements within the same product-level SPS/TBT category in the EU, and document a positive and significant correlation. Second, we delve into potential mechanisms likely to explain the subsequent adoption of requirements by other countries within the same product-level SPS/TBT categories as the EU. The results indicate the presence of both market-driven forces, such as the importance of the EU as an export market for other countries, and treaty-driven forces, such as the existence of trade agreements between the EU and other countries. Finally, we show that the EU's role in providing a regulatory model for other countries for product requirements aimed at protecting health, safety, and the environment is (1) predominant when compared to the United States or China, and (2) reinforced in the area of environmental protection.

Keywords: European Union, Product Requirements, Health, Safety, Environment, International Trade

JEL classification: F13, F14, I18, K32

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[1] **The opinions expressed are those of the authors only and should not be considered as representative of the European Commission's official position.**

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1. Introduction

The European single market is considered as one of the most important forces of cohesion of the EU as it enables integration through guaranteeing the free movement of goods. Product regulations and other product-related legal instruments have been a powerful tool to foster trade in goods within the single market, while safeguarding health, safety, and the environment. Although the primary goals of the EU as a product regulator have been internal, over time, the EU product requirements have gained an important external role.[4] For instance, the EU has restricted the use of phthalate plasticisers in toys, leading China to revise its rules on toys in 2014, in order to align them with the prevailing EU requirements (Bradford, 2020, p. 204). Following the EU measure in establishing minimum-type sizes for labels, Morocco and Algeria, among other countries, have adopted new labelling rules in 2013 to adhere to the EU requirements (Bradford, 2020, p.190). More recently, a new EU deal to ban the import of goods linked to deforestation appears to have created a blueprint for law proposals in other countries, including the United States.[5] In the same vein, the EU proposal on packaging regulations aiming to reduce plastic waste might pave the way for similar proposals in other countries.[6] For instance, in the context of the United Nations negotiations over a global agreement on plastic waste, the EU is leading by example, proposing various policies such as minimums on recycled content and reusable packaging, limits on the use of labels claiming biodegradability, and "eco-design" criteria. Several other countries, including Australia, Canada, Ghana, Senegal, and the United Kingdom, also adhere to the EU's objectives and might adopt similar requirements in order to end plastic pollution.

This paper seeks to examine whether the EU is providing a model for product requirements aimed at protecting health, safety, and the environment for other countries, relying on a quantitative analysis. To trace product requirements aimed at protecting health, safety, and the environment, the analysis draws upon information on product-level SPS measures and TBTs, which are types of non-tariff measures (NTMs).[7] Gathering quantitative information on NTMs is complex for several reasons. First, many NTMs exhibit a qualitative character, necessitating their classification into predetermined categories to enable cross-country comparisons. Second, NTMs are outlined in legal documents which may be exclusively available in the local language, demanding a deep understanding of their context and purpose. Finally, the legal documents detailing NTMs are often not centralized but dispersed across various regulatory agencies. As a first step to overcome these challenges, UNCTAD has established the Multi-Agency Support Team (MAST) to work on the taxonomy of NTMs in 2006.[8,9] The mandate of MAST encompassed defining NTMs, developing

[4] Several papers investigate the impact of cross-country harmonization of regulatory standards on trade, both within the single market and with respect to third countries. De Frahan and Vancauteren (2006) explore the trade effects of harmonization initiatives in EU Directives on intra-EU trade in food products over 1990-2001 and find a large and positive effect on import intensity both at the aggregate level and for individual food sectors. Chen and Mattoo (2008) analyse the influence of EU Harmonization Directives and Mutual Recognition Agreements on intra- and extra-EU trade and find that harmonization boosts trade among harmonizing countries. They show that exports to the region of excluded developed countries increase, while exports of excluded developing countries decline. Baller (2007) adopts the same approach using data on both EU and ASEAN harmonization and mutual recognition agreements and finds similar results. Shingal and Ehrich (2019) study the replacement of national-level regulation on Maximum Residue Levels (MRLs) in pesticides with harmonized Community-wide regulation in 2008 and find adverse effects of regulatory heterogeneity on intra-EU trade in the pre-harmonization period. Their findings also suggest that the EU's MRL harmonization may have improved access for non-EU, including non-OECD, exporters to the Common Market.

[5] See The Guardian, *EU ban on deforestation-linked goods sets benchmark, say United States lawmakers* available at https://www.theguardian.com/environment/2023/jan/05/eu-ban-on-deforestation-linked-goods-sets-benchmark-say-us-lawmakers. Consulted on April 7, 2023.

[6] See Bloomberg, *The EU is cracking down on plastic: Will others follow?* available at https://www.bloomberg.com/news/features/2023-02-27/the-eu-is-cracking-down-on-plastic-will-other-countries-follow. Consulted on March 27, 2023.

[7] Besides traditional trade instruments such as price controls and quotas, NTMs also encompass instruments of a technical nature, such as SPS measures and TBTs. SPS measures aim at protecting human and animal life, as well as the environment, plant life and biodiversity. TBTs refer to mandatory technical regulations and voluntary standards that lay down specifications for product characteristics, production methods processes, or even some terminology provisions (such as symbols, packaging, marking or labelling requirements) applying to a product, process or production method. These technical NTMs, which are increasingly used in international trade are driven by higher standards of living worldwide, which push consumers' demand for safe and high-quality products, and by growing environmental problems encouraging the use of environmentally-friendly products (WTO, 2021).

[8] UNCTAD stands for United Nations Conference on Trade and Development.

their classification system, optimizing data collection methods based on member agencies' existing practices, and offering guidelines for data utilization, including quantification techniques. MAST's work played a pivotal role in establishing the International Classification of NTMs, which is currently the standard classification for product-related NTMs. When collecting NTM information at the product level in a country, data collectors extensively review all local language legal documents from various regulatory agencies, using this classification to categorize regulations, directives, rules, and other legal texts.[10] Relying on this framework, UNCTAD has led the NTM information gathering since 2012, ensuring a comprehensive and standardized collection across countries. The dataset includes 57 different categories of SPS measures and TBTs (i.e. 34 SPS categories and 23 TBT categories) to classify all legal texts concerning product requirements aimed at protecting health, safety, and the environment in a given country.[11] It also includes information on every product to which a given SPS/TBT category applies, every jurisdiction affected by a given SPS/TBT category, as well as the implementation date of each SPS/TBT category.

We leverage all the information from the dataset to explore whether the EU sets a precedent for the adoption of measures within a given product-level SPS/TBT category in 86 third countries over the 2009-2019 period. For instance, one of the SPS categories refers to the requirement of using irradiation to kill or devitalize microorganisms, bacteria, viruses, or insects that might be present in food and feed products. Assuming that the EU has an irradiation requirement in place for dried fruits, we can identify all third countries that have subsequently introduced irradiation requirements for dried fruits. However, since many other elements might affect countries' regulatory behaviour, we must establish whether third countries are really following the EU's lead or their decision is independent of the EU's behaviour. Effectively accounting for these other factors allows to isolate the role of the EU in establishing a model for third countries' regulatory behaviour. While for some of these factors data are readily available allowing us to directly control for their effect in our analysis (e.g. size of a country, its level of development, its import/export value at the product level, its level of tariff protection at the product level), for many other factors data are unavailable or challenging to obtain (e.g. regulatory environment, product quality, consumer preferences, participation in international agreements, technological innovation). However, we rely on fixed effects techniques to take into consideration these unobserved factors to the extent possible. In other words, our exercise investigates whether the existence of measures within a given SPS/TBT category on a specific product in the EU sets a precedent for the adoption of measures within the same SPS/TBT category on the same product in other countries, after controlling for other confounding factors.

We acknowledge that, despite belonging to the same product-level SPS/TBT category, specific measures might not be identical between the EU and other countries. For example, when it comes to the use of irradiation for dried fruits, a country may adopt measures requiring the use of ionizing radiation and another country may adopt measures requiring the use of infrared radiation. While an ideal scenario would allow us to trace identical measures between the EU and third countries within a given product-level SPS/TBT category, the challenges previously outlined make it impossible to have comparable data across countries at such a level of granularity. Nevertheless, we believe that an analysis focusing on product-level SPS/TBT categories still provides useful insights into the role of the EU in providing a model for third countries in terms of product requirements aimed at protecting health, safety, and the environment. Countries have specific production processes and, while specific measures might be different, they share comparable goals which are broadly reflected by the product-level SPS/TBT category under which they are included.

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[9] The international organizations involved in MAST include: Food and Agriculture Organization of the United Nations, International Trade Centre, Organization for Economic Cooperation and Development, United Nations Conference on Trade and Development, United Nations Industrial Development Organization, World Bank, and World Trade Organization.

[10] See UNCTAD, "*Guidelines for the Collection of Data on Official Non-Tariff Measures 2021 Version*" available at: https://unctad.org/system/files/official-document/ditctab2020d5_en_0.pdf. Consulted on October 14, 2023.

[11] More details about the dataset and the categorization of SPS measures and TBTs are provided in Section 3.

The specific objectives of the paper are twofold. First, as already mentioned, we examine whether the likelihood of third countries to have in place measures within an SPS/TBT category on a specific product is associated with the prior existence of measures within the same SPS/TBT category on the same product in the EU. Second, we investigate potential mechanisms likely to explain why third countries subsequently adopt measures within the same product-level SPS/TBT categories as the EU.

Our results show that the probability of third countries to have in place requirements within specific product-level SPS/TBT categories is positively correlated with the prior existence of requirements in the same product-level SPS/TBT categories in the EU. Specifically, our results suggest that the prior existence of EU measures within specific product-level SPS/TBT categories is associated with a 7% increase in the probability of third countries to implement measures within the same product-level SPS/TBT categories. Furthermore, we find evidence for two mechanisms explaining the subsequent adoption of measures by third countries within the same product-level SPS/TBT categories as the EU. First, market forces appear to play a significant role, as an increase in the EU's share in a country's total exports of a product, as well as an increase in the total export value of a product to the EU, are both positively correlated with the country's adoption of measures within the same product-level SPS/TBT categories as the EU. Second, treaty-driven forces are also important, as the existence of free trade agreements with the EU is positively associated with higher adoption rates of measures by the EU's partners within the same SPS/TBT categories as the EU. Furthermore, we provide additional insights into the role of the EU in establishing a model for measures within product-level SPS/TBT categories around the world. We begin by comparing the EU's role in providing a model for third countries in terms of product-level SPS/TBT categories to the potential role exerted by other major players, such as the United States and China. Our analysis finds no significant evidence for the role of the United States, but we document a significant result for the role of China. However, China's role in providing a model for the adoption of measures in specific product-level SPS/TBT categories in third countries appears to be 35 times less important than the EU's role over the period under analysis. Next, we highlight that the role of the EU in providing a regulatory model for other countries is reinforced in the environmental arena. Specifically, we find that measures in product-level SPS/TBT categories encouraging responsible consumption and production and the protection of marine life are more likely to be adopted by other countries if the EU has measures within the same product-level SPS/TBT categories already in place.

This paper mainly relates to the empirical literature on the determinants of SPS measures and TBTs. Several papers show that the adoption of such measures has considerably expanded following trade liberalization episodes through tariff reductions (Hoekman and Nicita, 2011; Baldwin, 2016). In particular, some authors find evidence that these product requirements are being used to offset the negative domestic effect of the reduction or elimination of tariffs (Corden, 1974; Lavergne, 1983; Moore and Zanardi, 2011; Beverelli et al., 2014; Orefice, 2017; Herghelegiu, 2018; Niu et al., 2018; Kuenzel and Sharma, 2021). While a decrease in tariffs increases the probability of adopting SPS measures and TBTs in general, there is heterogeneity in the adoption of such measures following tariff reductions, driven by the initial level of tariffs, the sector affected (Kuenzel and Sharma, 2021), or a country's income level (Bratt, 2017).[12]

Besides tariff reductions, the literature also analyses the role of other factors in shaping the adoption of SPS measures and TBTs. Belloc (2015) looks at the impact of business groups and shows that consultations organized by the European Commission with business groups have a significant and positive impact on the adoption of such measures. Also, industries with higher employment levels have a higher probability of being covered by these measures (Belloc, 2015; Caves, 1976).

[12] For instance, Beverelli et al. (2014) show that policy substitution between tariffs and TBTs prevails in developed countries, where it is less costly to comply with product standards.

Our paper adds to this literature by analysing yet another factor likely to shape countries' regulatory decisions. More precisely, we explore whether the adoption of SPS measures and TBTs is also shaped by the regulatory behaviour of other countries such as the EU. The economic literature in this area is scarce. To the best of our knowledge, there is one paper by Christen et al. (2022) aiming to quantify the regulatory influence of the EU, but the goal of the authors is different than ours. While we aim at determining the role of the EU in providing a model for third countries in terms of specific product-level SPS/TBT categories and understanding potential mechanisms behind this role, Christen et al. (2022) assume that there is an implicit role of the EU in shaping third countries' regulatory decisions and seek to quantify its trade effects in the network of trade agreements of the EU. To this end, the authors analyse whether: (1) trade between country pairs in which both partners have a trade agreement with the EU increases, (2) countries that have a trade agreement with the EU face lower trade costs with all the other countries, and (3) countries having a trade agreement with the EU put in place a lower number of NTMs and are therefore generally more open to international trade.

The remainder of this article is structured as follows. Section 2 exposes the theoretical arguments that guide our empirical analysis. Section 3 introduces the data used in the analysis and presents descriptive evidence for third countries' alignment with the EU in implementing measures within the same product-level SPS/TBT categories. Section 4 investigates the probability of third countries to adopt measures in specific product-level SPS/TBT categories conditional on the EU already having in place measures within the same product-level SPS/TBT categories, explores mechanisms likely to explain the subsequent adoption of measures by third countries in the same product-level SPS/TBT categories as the EU, and presents additional insights into the EU's role in providing a model for third countries' regulatory behaviour. Section 5 concludes.

2. Theoretical arguments guiding the empirical analysis

Our goal is to understand to what extent the EU provides a model for other countries in terms of product requirements aimed at protecting health, safety, and the environment. While the available data only allow us to conduct this analysis for product-level SPS/TBT categories, our exercise closely aligns with the idea of exploring the "Brussels Effect". The "Brussels Effect" is a phenomenon through which the EU's rules are transmitted to both foreign firms and governments (Bradford, 2020). This section presents this phenomenon, the factors contributing to its emergence, as well as the channels through which it can unfold, and serves as basis for our empirical analysis.

According to Bradford (2020), five elements could explain why certain countries are able to export their rules abroad. First, an important market size is a precondition for unilateral regulatory power, as it is usually associated with global economic influence. The market size is not an absolute concept and should be interpreted in light of the attractiveness of a country's consumer market compared to other markets. It is a necessary but not sufficient condition for a country to become a global regulator. Indeed, not all states with large markets become sources of global rules. The second condition that needs to be fulfilled by a country to be able to exert global regulatory authority is to possess sufficient regulatory capacity to promote and enforce legislation. This requires regulatory expertise and resources. Thus, the power of the market size cannot be activated in absence of developed regulatory institutions. Third, these two conditions have to be augmented by a willingness of these regulatory institutions to actually promulgate stringent rules to protect their consumers, while imposing additional costs on businesses. This phenomenon can therefore more easily be observed in wealthy countries where consumers are willing to pay higher prices for products fulfilling minimum quality criteria and where businesses are willing to weather adverse effects for a period. The preference for stringent rules also explains why some countries with an important market size but with a lower level of per capita income cannot export their rules abroad.

Fourth, a country can exert unilateral regulatory power only if the adoption of stringent rules affects inelastic targets such as consumer markets. The requirements aimed at consumer markets, have to be respected by all domestic and foreign producers wishing to reach these consumers and

cannot be circumvented. Finally, the last condition that needs to be fulfilled for a country to become a global source of rules is non-divisibility. This implies that producers adopt regulatory standards associated with a given jurisdiction and apply them to govern their production and operations across the world. In other words, producers do not customize their production in line with the divergent rules of each jurisdiction even though these rules are laxer, as this can turn to be more costly. Usually, producers adopt stricter rules that automatically fulfil the requirements of all jurisdictions in order to benefit from economies of scale.

Various combinations of these five elements allow to understand the occurrence of the "Brussels Effect" in different policy areas. First, the size of the single market, which is the most important asset of the EU, ensures that the EU can export its rules to third countries. Second, the EU has an important regulatory capacity which has been driven by the objective of completing the single market and has continued to grow over time. Third, the EU is characterized by a large number of affluent consumers with a preference for stringent rules. Fourth, the EU is one of the most important consumer markets in the world and all producers wanting to reach this market have to comply with its rules. Finally, producers complying with the EU rules might choose to apply these stricter requirements to their products and operations across the world, in order to reduce the costs of complying with the conflicting rules of different jurisdictions. To sum up, the EU single market and its characteristics can explain the occurrence of the "Brussels Effect". On the other hand, countries which do not fulfil these five criteria are less likely to shape rules in the global market place. In certain cases, these countries might be more inclined to adhere to the rules imposed by other jurisdictions, essentially functioning as regulatory standards adopters.

Braford (2020) distinguishes two types of the "Brussels Effect". First, the de facto "Brussels Effect" refers to a situation where foreign firms, which have to abide by stringent requirements when exporting to the EU, adopt EU-type rules for their production and operations across the world. This behaviour by private actors does not necessarily lead to a regulatory reaction by the governments of their countries. Second, the de jure "Brussels Effect" refers to a situation where foreign governments adopt EU-type rules to be respected by all firms present in their jurisdictions. The de jure "Brussels Effect" can in fact arise from the de facto "Brussels Effect". For instance, foreign firms adopting EU-type rules for their production and operations across the world are at a competitive disadvantage compared to other firms in their jurisdictions, which benefit from lower costs induced by laxer national rules. Therefore, these firms may have an incentive to encourage their governments to adopt stricter EU-type rules in their jurisdiction, fuelling the de jure "Brussels Effect". However, there could be various other channels through which the de jure "Brussels Effect" unfolds, which can complement or substitute the pure market channel (e.g. bilateral or international treaties). In fact, the market-driven mechanism behind the de jure "Brussels Effect" coexists alongside other treaty-driven instruments and mechanisms and it is often difficult to disentangle the exact forces at play driving the adoption of EU-type rules by third countries.

This framework provides the underpinning of our empirical analysis. First, when exploring the adoption of measures within product-level SPS/TBT categories by third countries conditional on the EU already having in place measures within the same product-level SPS/TBT categories, the factors explaining the emergence of a country as a standard-maker (i.e. market size, regulatory capacity, stringency of policy measures, inelastic targets, non-divisibility of production) need to be considered in the analysis, as they might impact the regulatory decisions of a country irrespective of the EU's behaviour. Second, given that requirements under product-level SPS/TBT categories are mandatory by law, when analysing the channels for the subsequent adoption of measures by third countries within the same product-level SPS/TBT categories as the EU, we are guided by the elements presented to explain the de jure "Brussels Effect". More precisely, we explore whether the market channel (i.e. the importance of the EU single market for a country for a given product) and the treaty channel (i.e. the existence of a trade agreement between a country and the EU) can explain the subsequent adoption of measures by other countries within the same product-level SPS/TBT categories as the EU.

3. Data analysis

This section introduces in more details the data sources used in the analysis and provides descriptive evidence on the implementation of requirements within specific product-level SPS/TBT categories by third countries.

3.1. Data sources

Detailed product-level SPS/TBT categories. As previously mentioned, to trace product-level SPS/TBT categories encompassing requirements aimed at protecting health, safety, and the environment, we rely on UNCTAD's NTM data, collected from official legal sources, such as laws, regulations, directives, decrees and rules, and disseminated via the TRAINS portal.[13] UNCTAD collects complete and comparable information on all types of NTMs in place in more than 100 countries representing more than 85% of world trade (UNCTAD, 2020). Based on the International Classification of NTMs developed by MAST, NTMs are classified in 16 chapters, ranging from more technical instruments intended to ensure consumer protection, such as SPS measures and TBTs, to more traditional trade policy tools, such as quotas, price controls, or contingent protection.[14] Our main focus is on the first two chapters, A and B, corresponding to SPS measures and TBTs, respectively.[15]

This paper relies on a dataset released for research purposes, which has been carefully cleaned by UNCTAD and made publicly available.[16] Although the data collection occurs for more than 100 countries, it is worth emphasising that this dataset contains only 93 countries, including the EU. It encompasses information regarding the detailed SPS/TBT category to which implemented measures belong, the product that falls under the scope of measures within an SPS/TBT category, the affected jurisdiction, and the implementation date.[17] Additionally, the dataset includes the year of data collection, which varies between 2010 and 2019, depending on the country.

Our analysis uses the most detailed classification available for SPS measures (Chapter A) and TBTs (Chapter B), including 34 SPS categories and 23 TBT categories. In fact, chapters A and B are further split into two, three and even four digits. For instance, under chapter A, the subchapter A5 refers to *Treatment for elimination of plant and animal pests and disease-causing organisms in the final product or prohibition of treatment*, and the subchapter A51 refers to *Cold or heat treatment*. As stated by UNCTAD (2019), this could be a measure requiring "cooling or heating of products below or above a certain temperature for a certain period of time to kill targeted pests, either prior to, or upon arrival in the destination country […]." For instance, "citrus fruits must undergo cold (disinfection) treatment to eliminate fruit flies." Also, under chapter B, the subchapter B7 refers to *Product quality, safety or performance requirements*. According to UNCTAD (2019), the measure could introduce "final product requirements concerning safety (for example, fire resistance), performance (effectiveness in achieving the intended or claimed result), quality (for example, content of defined ingredients and durability) or other reasons relating to technical barriers to trade not covered under other measures." For instance, "doors must resist a certain minimum high temperature or toys for children under three years of age shall not contain articles smaller than a certain size." The most detailed categories of SPS measures and TBTs as disseminated by UNCTAD (2019) are shown in Table 1**Error! Reference source not found.**.

[13] TRAINS stands for Trade Analysis Information System.

[14] Table A1 *Table A1*in the Appendix lists the 16 chapters.

[15] All the other import measures will be included as control variables in our study, as they can influence the overall level of protection of a country and therefore the adoption of technical measures. The export measures are left out of the scope of the study.

[16] The NTM dataset has been downloaded on October 15, 2022 at https://api-trains2.unctad.org/get-researcher-file.

[17] In certain cases, the repeal date of a measure is also included.

Table 1 : Detailed classification of NTMs

Chapter	Broad category		Detailed category	
A Sanitary and Phytosanitary (SPS) measures	A1	Prohibitions/restrictions of imports for SPS reasons	A11	Prohibitions for SPS reasons
			A12	Geographical restrictions on eligibility
			A13	Systems approach
			A14	Authorization requirement for SPS reasons for importing certain products
			A15	Authorization requirement for importers for SPS reasons
			A19	Prohibitions or restrictions of imports for SPS reasons, n. e. s.
	A2	Tolerance limits for residues & restricted substance use	A21	Tolerance limits for residues of or contamination by certain (non-microbiological) substances
			A22	Restricted use of certain substances in foods and feeds and their contact materials
	A3	Labelling, marking & packaging requirements	A31	Labelling requirements
			A32	Marking requirements
			A33	Packaging requirements
	A4	Hygienic requirements related to SPS conditions	A41	Microbiological criteria of the final product
			A42	Hygienic practices during production related to SPS conditions
			A49	Hygienic requirements n. e. s.
	A5	Treatment for elimination of plant & animal pests & disease-causing organisms in the final product or prohibition of treatment	A51	Cold or heat treatment
			A52	Irradiation
			A53	Fumigation
			A59	Treatments to eliminate plants & animal pests or disease-causing organisms in the final product n.e.s or prohibition of treatment
	A6	Other requirements relating to production or post-production processes	A61	Plant-growth processes
			A62	Animal-raising or -catching processes
			A63	Food and feed processing
			A64	Storage and transport conditions
			A69	Other requirements relating to production or post-production processes n. e. s.
	A8	Conformity assessment related to SPS conditions	A81	Product registration and approval requirement
			A82	Testing requirements
			A83	Certification requirements
			A84	Inspection requirements
			A851	Origin of materials and parts
			A852	Processing history
			A853	Distribution and location of products after delivery
			A859	Traceability requirements n. e. s.
			A86	Quarantine requirements
			A89	Conformity assessment related to SPS conditions n. e. s.
	A9	SPS measures n.e.s.	A9	SPS measures n. e. s.
B Technical Barriers to Trade (TBTs)	B1	Import authorization/licensing related to TBTs	B14	Authorization requirements for importing certain products
			B15	Authorization requirements for importers
			B19	Import authorization/licensing related to TBTs n. e. s.
	B2	Tolerance limits for residues and restricted use of substances	B21	Tolerance limits for residues of or contamination by certain substances
			B22	Restricted use of certain substances
	B3	Labelling, marking & packaging requirements	B31	Labelling requirements
			B32	Marking requirements
			B33	Packaging requirements
	B4	Production or post-production requirements	B41	TBT regulations on production processes
			B42	TBT regulations on transport and storage
			B49	Production or post-production requirements n. e. s.
	B6	Product identity requirements	B6	Product identity requirements
	B7	Product quality, safety or performance requirements	B7	Product quality, safety or performance requirements
	B8	Conformity assessment related to TBTs	B81	Product registration/approval requirements
			B82	Testing requirements
			B83	Certification requirements
			B84	Inspection requirements
			B851	Origin of materials and parts
			B852	Processing history
			B853	Distribution and location of products after delivery
			B859	Traceability requirements n. e. s.
			B89	Conformity assessment related to TBTs n. e. s.
	B9	TBT measures n.e.s.	B9	TBT measures n. e. s.

Source: UNCTAD (https://trains.unctad.org/).

When it comes to the product(s) affected by measures under a detailed SPS/TBT category, the 6-digit level of the Harmonized-System (HS) classification is used for gathering information. Given that the data collection occurs at different points in time, the information has been recorded using various HS classifications. In order to ensure data comparability over the whole period across all countries in our sample and facilitate matching with other data sources, we transform the data into the HS 2012 classification using correspondence tables. This classification covers approximately 5,200 unique product codes. While some measures within a detailed SPS/TBT category can be specific to a product, other measures affect groups of products. For instance, if measures affect all food products, those measures are assigned to all product codes corresponding to food.

Furthermore, when countries implement SPS/TBT measures, the affected jurisdiction can be a single partner country, in which case the measures are bilateral, or all partner countries, in which case the measures are unilateral. Our focus will be on unilateral measures to capture a wide-ranging effect. NTMs, for the most part, are implemented based on the principle of non-discrimination, applying to all countries without differentiation. Moreover, in many cases, similar bilateral measures exist alongside unilateral ones. Given these aspects, our analysis is not likely to be affected by the exclusion of bilateral measures. When focusing only on unilateral measures, the number of countries included in our dataset is reduced to 91, besides the EU.

Finally, for a specific product-level SPS/TBT category, the implementation date may correspond to either the initial introduction or a substantial modification of measures. The timeline of adoption plays an important role in our analysis, as we study whether the EU provides a model for third countries for product-level SPS/TBT categories. We must therefore examine product-level SPS/TBT categories where third countries implement measures following the EU's implementation of measures within the same product-level SPS/TBT categories. As our observations for the EU pertain to measures introduced or significantly amended after 2009, we are obliged to limit the sample to the period after 2009. Then, since the dataset lacks information data beyond 2019, our analysis stops in 2019. By restricting the period under observation from 2009 to 2019 period for all the other countries, the number of countries included in our dataset is further reduced to 88 third countries and the EU.

While at this stage our dataset includes information on 88 third countries, the availability of other data required for the empirical analysis (i.e. gravity data on GDP) and detailed in the remainder of this section further reduces the sample to 86 third countries. To sum up, the dataset used in the analysis includes information on all unilateral SPS measures and TBTs at the most detailed level of disaggregation available, imposed by 86 third countries and the EU, on around 5,200 unique HS6 products over the 2009-2019 period. This dataset allows to track the time elapsed between the initial implementation of measures in an SPS/TBT category on a product by the EU and the subsequent implementation of measures within the same SPS/TBT category on the same product by third countries.

Trade flows. As previously mentioned, we aim at exploring whether the adoption of measures by third countries in the same product-level SPS/TBT categories as the EU could be market-driven. According to Braford (2020), foreign firms complying with EU product requirements when exporting to the EU might have incentives to encourage their national governments to adopt EU-like measures in their own jurisdictions. We use the importance of the EU as an export market for third countries for each specific product to proxy the market channel. The trade data come from the BACI dataset, developed by CEPII, which provides information on bilateral trade flows for 200 countries at the HS6 product level over the 1995-2020 period.[18]

Trade agreements. Various other factors can influence the decision of third countries to adopt measures within the same product-level SPS/TBT categories as the EU. Besides the market-driven forces, the treaty-driven factors might play a role. For instance, a third country engaged in a trade

[18] CEPII stands for Centre d'Études Prospectives et d'Informations Internationales.

agreement with the EU might be more likely to adopt EU-like measures. Therefore, it is important to take into account the existence of trade agreements between the EU and third countries in the analysis. We construct a database including the various types of trade agreements that the EU has with the third countries from the NTM dataset, relying on European Commission documents.[19] We focus on all trade agreements in place, whether already in force or provisionally applied. The date of implementation of a trade agreement is considered to be the date of provisional application, when the agreement already starts to take effect. In a few cases, the date of entry into force coincides with the date of provisional application. The full list of trade agreements between the EU and the third countries included in the NTM data is presented in Table A2 in the Appendix.

Gravity. Third countries with a low propensity of becoming global regulators themselves might be more likely to align with the rules of other jurisdictions, including the EU. As described in Section 2, there are several elements associated with a country's propensity to be a global regulator, namely market size, regulatory capacity, stringency of policy measures, inelastic targets and non-divisibility of production. Hence, these aspects should be accounted for in the analysis.[20] The market size of a country can be proxied through its gross domestic product (GDP) or population. The regulatory capacity and the preference for stringent regulatory standards of a country are approximated through its level of development, measured as GDP per capita. Data on all these aspects are extracted from the gravity database developed by CEPII, which records information for any pair of countries from 1948 to 2020.

Tariffs. We also use data on Most Favoured Nation (MFN) applied tariffs from UNCTAD's TRAINS database, obtained through the World Integrated Trade Solutions portal of the World Bank. The goal is to control for the protection level of a country on an HS6 product, as a high level of tariffs might be associated with fewer incentives to adopt measures within specific product-level SPS/TBT categories. Even though the primary goal of these policy measures is to protect health, safety, and the environment, a high level of tariff protection might already indirectly do so, as it is costly to reach the markets imposing high tariffs. The level of tariffs is computed as a simple average of MFN applied tariffs on a product across different sources.

3.2. Descriptive statistics

This subsection describes the implementation of measures within specific SPS/TBT categories on HS6 products by third countries over the 2009-2019 period. For simplicity, in this section, we use the terms "product-level SPS/TBT category" and "product requirement" interchangeably. For instance, if there are measures within the SPS category referring to storage and transport conditions (i.e. A64) for oranges (i.e. 2012 HS6 code 080510) and watermelons (i.e. 2012 HS6 code 080711), we consider that there are two different product requirements, since the same SPS category applies to two different product codes. In the same vein, if for oranges (i.e. 2012 HS6 code 080510), there are measures belonging to the SPS category on storage and transport conditions (i.e. A64) and measures belonging to the SPS category on packaging obligations (i.e. A33), we consider that there are two different product requirements, since there are two different SPS categories applying to the same product code.

We start by providing a general overview of the dataset used in the analysis, encompassing 86 countries worldwide, besides the EU. The most well represented world region in terms of number of countries is Asia, with an important coverage of all subregions. Some of the largest and more industrialised Asian countries are included (e.g. China, India, Indonesia, Japan, South Korea),

[19] More information on all EU trade agreements can be found at: https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/negotiations-and-agreements_en. Consulted on October 15, 2022.

[20] The last two conditions allowing a country to become a global regulator are not explicitly included in the analysis. First, regulations regarding health, safety, and the environment apply to consumer markets which are by default inelastic targets. Therefore, this factor does not need to be accounted for in the analysis. Second, the non-divisibility aspect is difficult to measure as data on the behaviour of foreign firms in terms of applied regulatory standards when exporting to foreign jurisdictions are not available. The analysis will thus abstract from exploring this factor.

along with other less developed Asian countries (e.g. Bangladesh, Kazakhstan, Pakistan). Both Northern America and Latin America and the Caribbean are well represented. The dataset covers Canada and the United States in North America, and countries like Argentina, Brazil, Colombia, Ecuador, Peru, and others in Latin America and the Caribbean subregion. The least represented regions are Africa and Oceania. When it comes to Africa, while Northern Africa is well represented, Sub-Saharan Africa is covered to a lesser extent. As for Oceania, the dataset includes information on Australia and New Zealand. In Europe, besides the EU, the dataset covers Belarus, Russia, and Switzerland. Table A3 in the Appendix describes the implementation of product requirements between 2009 and 2019 for each country in the dataset, including the EU. Thus, on average, the third countries from the dataset have requirements in place on around 1,382 products out of all 5,205 products included in the HS 2012 classification of goods. Furthermore, among the products subject to at least one requirement, the average number of requirements per product across all countries is 3.6. As for the EU, there are requirements in place on around 4,886 products out of all 5,205 products included in the HS 2012 classification of goods. Among the products affected by at least one requirement, there are, on average, 8 different requirements per product.

Given our overarching objective of understanding whether the EU provides a model for third countries in terms of product requirements aimed at protecting health, safety, and the environment, we now focus on identifying EU-type product-level SPS/TBT categories among all product-level SPS/TBT categories of a particular country. It is important to note that, at this stage, we refrain from drawing any conclusion regarding the EU's role as a model for third countries in terms of product requirements, as we do not account for potential confounding factors. The following analysis serves as a purely descriptive exercise to assess the extent to which third countries' product requirements resemble those of the EU, without controlling for any confounding factors.

We consider a product-level SPS/TBT category introduced by a third country to be in resemblance to the EU if the following conditions are simultaneously fulfilled: (1) the EU must be the initial entity over the 2009-2019 period to have introduced measures within that product-level SPS/TBT category, and (2) the EU must have first introduced or substantially modified measures within that product-level SPS/TBT category no more than five years before the third country under scrutiny followed suit. The latter condition is motivated by various considerations.

The EU is characterized by a complex and lengthy legislative process compared to other countries. While in some exceptional cases the duration of the ordinary legislative process can be as little as six months, in most cases the duration of the ordinary legislative process can extend beyond eighteen months (European Parliament, 2020). Hence, if we also consider the preparatory steps before the actual date of implementation of requirements in the EU, third countries have more than five years at their disposal to be informed about the new EU proposals and implement requirements within the same product-level SPS/TBT categories as the EU. Thus, considering that governments need resources and legal expertise for their regulatory proposals, we deem a period of five years since the EU implementation as sufficient. A longer time span might be associated with a natural convergence of the world towards certain regulatory objectives. Moreover, Table 2 shows the cumulative share of all product requirements for which the EU was the first initiator, implemented by third countries at different dates after the date of implementation in the EU. Almost the quasi-totality (99.8%) of EU-type product requirements are implemented by third countries no more than five years after the EU took action. Therefore, this is our preferred definition throughout the paper. Based on this definition, we observe that 34.7% of all product requirements introduced by third countries over 2009-2019 resemble those of the EU.

Table 2 : Cumulative share of product requirements resembling those of the EU implemented by third countries for different time spans after the EU

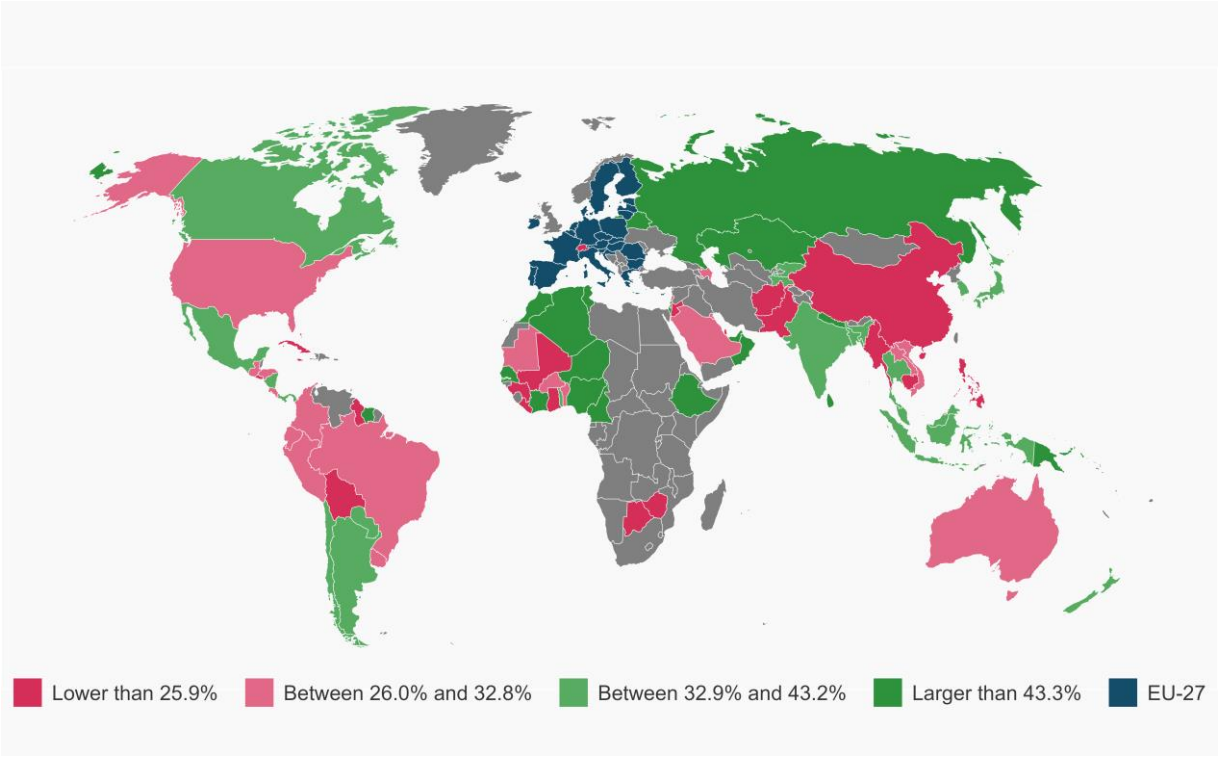
Time elapsed from when the EU implemented product requirements until third countries followed suit	Cumulative share of product requirements implemented by third countries after the EU
1 year	27.019%
2 years	56.784%
3 years	76.629%
4 years	86.906%
5 years	**99.832%**
6 years	99.900%
7 years	99.945%
8 years	99.992%
9 years	99.995%
10 years	100.000%

Source: Authors' calculations based on the NTM data from TRAINS-UNCTAD.

Third countries tend to introduce requirements within the same product-level SPS/TBT categories as the EU with different intensities. To analyse this aspect, we start by computing for each third country the share of EU-type product requirements, as previously defined, in the total number of product requirements over the 2009-2019 period. Then, using the distribution of shares, we create four equally sized groups of countries (i.e. quartiles). Figure 1 shows the split of third countries into quartiles based on the share of EU-type product requirements within their total number of product requirements. Since at this stage we do not control for any other confounding factors, the figures might simply reflect the economic structure of third countries. For instance, some countries in Sub-Saharan Africa might only adopt a few product requirements on agricultural goods, most of which resemble the EU product requirements. In these cases, we might obtain a high rate of adoption of EU-type product requirements. On the other hand, more developed countries with a complex economic structure, might have in place product requirements across a large number of sectors and might be less likely to introduce EU-type product requirements across the board. In these cases, we might see a lower rate of adoption of EU-type product requirements.

Considering this limitation, we analyse to what extent third countries introduce requirements in the same product-level SPS/TBT categories as the EU. The countries belonging to the fourth quartile are characterized by a share of EU-type product requirements higher than 43.3%, and are situated in Northern Africa (e.g. Algeria, Morocco, Tunisia), Sub-Saharan Africa (e.g. Côte d'Ivoire, Senegal, Nigeria), various parts of Asia (e.g. Israel, Kazakhstan, Nepal), Eastern Europe (e.g. Belarus, Russia), among other regions. In the third quartile, with a share of EU-type product requirements between 32.9% and 43.2%, we observe several countries in Latin America and the Caribbean (e.g. Argentina, Chile, Colombia, Mexico), Northern America (e.g. Canada), Oceania (e.g. New Zealand), various parts of Asia (e.g. India, Indonesia, Japan, Thailand), Sub-Saharan Africa (e.g. Gambia, Togo), to name a few. The countries situated in the second quartile, having a share of EU-type product requirements between 26.0% and 32.8%, are located in Latin America and the Caribbean (e.g. Brazil, Ecuador, Guatemala, Peru, Uruguay), various parts of Asia (e.g. Azerbaijan, Bahrain, Lebanon, Vietnam), Northern America (e.g. United States), Oceania (e.g. Australia), amidst others. Finally, at the bottom of the spectrum, the countries with a share of EU-type product requirements below 25.9% belonging to the first quartile, cover various parts of Asia (e.g. Afghanistan, China, Jordan, Pakistan), Latin America and the Caribbean (e.g. Bolivia, Cuba, Jamaica), Sub-Saharan Africa (e.g. Botswana, Ghana, Mali), among others.

Figure 1: Share of EU-type product requirements in the total number of product requirements of third countries over 2009-2019, by quartiles

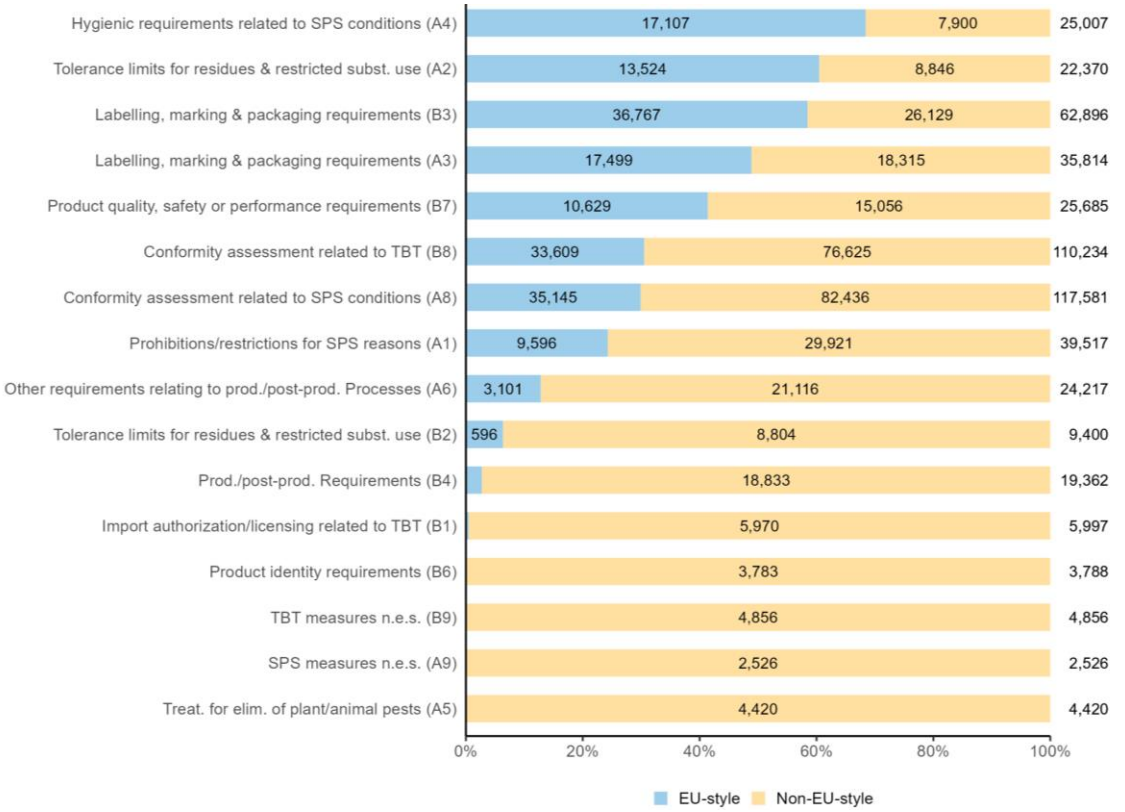


Source: Authors' calculations based on the NTM data from TRAINS-UNCTAD.

Furthermore, Figure 2 shows the distribution of product-level SPS/TBT categories in third countries across broader classes of SPS/TBT measures over 2009-2019, distinguishing between EU-type and non-EU-type product requirements. On the one hand, when it comes to SPS measures, the most significant categories in terms of overall number of product requirements are *Conformity Assessment (A8)*, *Prohibitions/restrictions for SPS reasons (A1)*, and *Labelling, marking and packaging requirements (A3)*. However, the top three categories where requirements resemble those of the EU refer to *Hygienic requirements (A4)*, *Tolerance limits for residues and restricted substance use (A2)*, and *Labelling, marking and packaging requirements (A3)*, with shares of EU-type product requirements of 68.4%, 60.5%, and 48.9%, respectively. On the other hand, the most important TBT categories in terms of overall number of product requirements refer to *Conformity assessment (B8)*, *Product quality, safety or performance requirements (B7)*, and *Labelling, marking and packaging requirements (B3)*. Although not in the same order, these are also the categories with the highest share of EU-type product requirements. More precisely, of all product requirements related to *Labelling, marking and packaging requirements (B3), Product quality, safety or performance requirements (B7)*, and *Conformity assessment (B8)*, 58.5%, 41.4% and 30.5%, respectively, align with the EU ones.

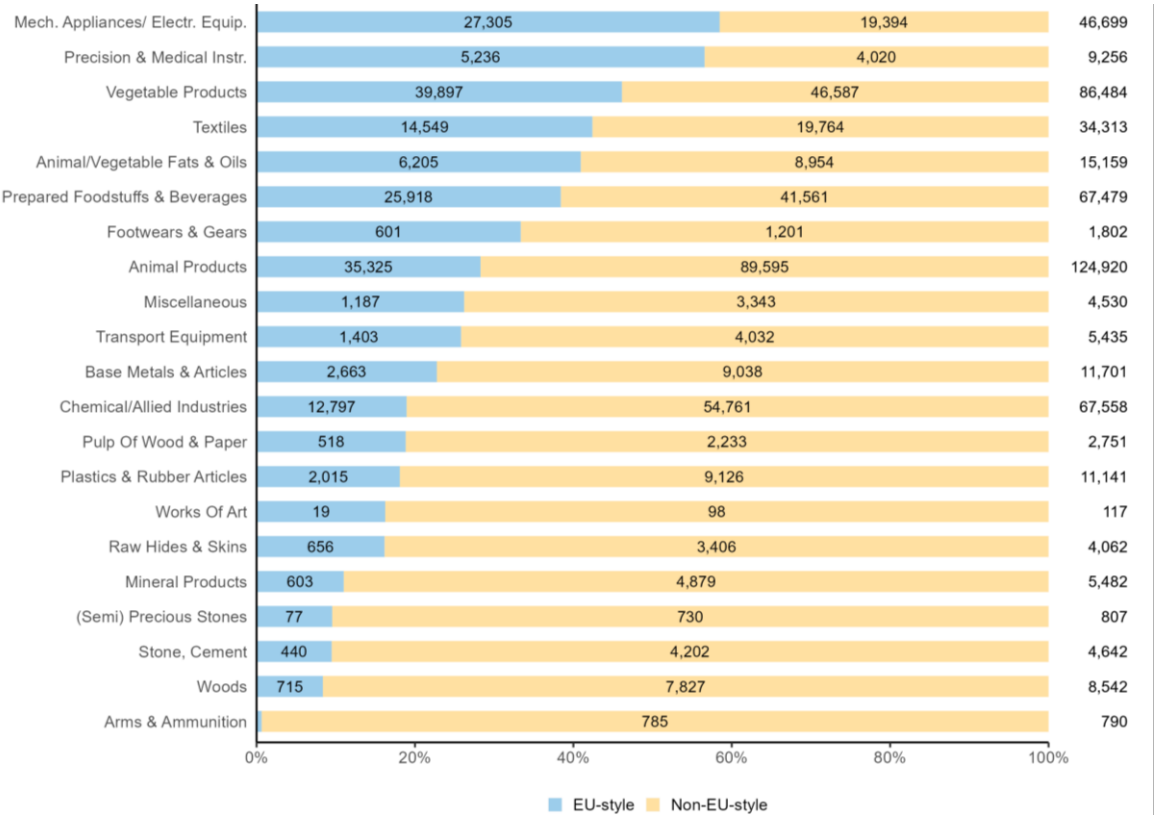
Figure 3 shows the sectoral distribution of product-level SPS/TBT categories in third countries during the period spanning from 2009 to 2019, distinguishing between EU-type and non-EU-type product requirements. The sectors where third countries have adopted the highest number of product requirements over 2009-2019 include *Animal products*, *Vegetable products*, *Products of the chemical or allied industries*, *Prepared foodstuffs & beverages*, *Mechanical appliances; electrical equipment*, and *Textiles*. However, the sectors with the highest shares of EU-type product requirements are *Mechanical appliances; electrical equipment* (58.5%), *Precision & medical instruments* (56.6%), *Vegetable products* (46.1%), *Textiles (*42.4%), *Animal or vegetable fats & oils* (40.9%), *Prepared foodstuffs & beverages* (38.4%), and *Footwears & gears* (33.4%).

Figure 2: Distribution of product requirements adopted by third countries across broad SPS/TBT categories over 2009-2019



Source: Authors' calculations based on the NTM data from TRAINS-UNCTAD.

Figure 3: Sectoral distribution of product requirements adopted by third countries over 2009-2019



Source: Authors' calculations based on the NTM data from TRAINS-UNCTAD.

4. Empirical strategy and results

This section presents the empirical strategy and the results. First, in Subsection 4.1., we aim at providing quantitative insights into the EU's role in providing a model for third countries for product requirements aimed at protecting health, safety, and the environment. To this end, we explore whether the likelihood of third countries to have in place measures within specific product-level SPS/TBT categories is correlated with the existence of measures within the same product-level SPS/TBT categories in the EU, implemented at most five years before the subsequent adoption by third countries. Second, in Subsection 4.2., we investigate the factors associated with the adoption of measures by third countries in the same product-level SPS/TBT categories as the EU. Finally, in Subsection 4.3, we present further insights into the EU's role in setting a precedent for product-level SPS/TBT categories for third countries. We start by putting the EU's regulatory role in an international perspective, drawing a comparison with the influence exerted by the United States and China. Then, we seek to analyse whether third countries are more likely to introduce measures within the same product-level SPS/TBT categories as the EU, if these rules contribute to environmental protection.

4.1. The EU's role in providing a regulatory model for other countries

Empirical Strategy. We explore whether the likelihood that a country has in place measures within a product-level SPS/TBT category in a year is associated with the EU already having in place measures within the same product-level SPS/TBT category, introduced at most five years before the third country in question.[21] For this purpose, we rely on the NTM dataset, including information across four dimensions: the country implementing measures, the category of implemented measures, the targeted product, and the year of implementation. To build the dependent variable and the main independent variable, we first square the NTM dataset for a combination of a country, product, and category measure across all years, and then create a binary variable set to 1 for the year of implementation of measures by a country within a product-level SPS/TBT category and 0 for the years artificially created in the squaring process.

We construct our dependent variable as follows. We trace the existence of measures within a product-level SPS/TBT category in a third country over the 2009-2019 period, relying on the first year of adoption. More precisely, we create a dummy variable set to 1 for all years following the adoption of measures within a product-level SPS/TBT category in a third country and 0 for all years prior to the adoption. We also take into account whether measures within a product-level SPS/TBT category are removed in the meanwhile and assign the value of 0 to all years after their removal. Our dependent variable $\boldsymbol{Req}^{s}_{i,k,t}$ is a dummy variable tracing whether third country *i* has measures in place within the SPS/TBT category *s* on product *k* in year *t*.

Regarding the main independent variable, we need to detect whether, for the existence of measures within a product-level SPS/TBT category in a third country, the EU has measures in place within the same product-level SPS/TBT category, implemented at most five years before the third country in question. Thus, in the case of the EU, to trace the existence of measures within a product-level SPS/TBT category over the 2009-2019 period, we rely either on the first year of adoption or the year of modification. Several scenarios are possible. First, if the EU has adopted measures within a product-level SPS/TBT category no more than five years before a third country and has never modified them, the independent variable is a dummy set to 1 for all years following the EU adoption and 0 for all years before. Second, if the EU has adopted measures within a product-level SPS/TBT category no more than five years before a third country and has also modified them within this maximum five-year window, then the independent variable is a dummy

[21] Products are detailed at the 6-digit level of the HS2012 classification and the associated measures are classified based on the International Classification of NTMs by UNCTAD at the most detailed level.

set to 1 for all years following the EU modification and 0 for all years before. Third, if the EU has adopted measures within a product-level SPS/TBT category more than five years before a third country and has never modified them, the independent variable is a dummy set to 0 for all years. Finally, if the EU has adopted measures within a product-level SPS/TBT category more than five years before a third country and has modified them no more than five years before the adoption by the third country in question, the independent variable is a dummy set to 1 for all years following the EU modification and 0 for all years before. Each scenario also considers whether, over the 2009-2019 period, the EU is the first entity to implement measures within a product-level SPS/TBT category (i.e. first mover). If this is not the case, the independent variable is set to 0 for all years.[22] All scenarios are summarized in Table 3. To sum up, for the existence of measures within a product-level SPS/TBT category in a third country in a year, our main independent variable $\boldsymbol{Req}^{\boldsymbol{s}}_{\boldsymbol{EU,k,}\overline{(\boldsymbol{t-5,t})}}$ refers to the existence of measures within the same SPS/TBT category *s* on the same product *k* in the EU, implemented at most five years before the third country in question, while fully considering whether the EU is the first mover within that product-level SPS/TBT category.

Table 3: Definition of the existence of measures within a product-level SPS/TBT category in the EU in relation to the adoption of measures within the same category in third countries

Measures in a product-level SPS/TBT category in the EU	**No modification**	**Modification no more than 5 years before adoption by third country**
Adoption no more than 5 years before third country	***Scenario 1*** EU dummy = 1 for all years following the EU adoption (0 before)	***Scenario 2*** EU dummy = 1 for all years following the EU modification (0 before)
Adoption more than 5 years before third country	***Scenario 3*** EU dummy = 0 for all years	***Scenario 4*** EU dummy = 1 for all years following the EU modification (0 before)

Note: All scenarios take into account whether the EU is the first mover and whether the measures have been removed in the meanwhile.

To study the probability that a third country has in place measures within a product-level SPS/TBT category in a year conditional on the EU having in place measures within the same product-level SPS/TBT category implemented at most five years before, we use a linear probability model (LPM) with fixed effects.[23] Our baseline model can then be expressed as follows:

$$\boldsymbol{Req}^{\boldsymbol{s}}_{\boldsymbol{i,k,t}} = \alpha_0 + \alpha_1 \boldsymbol{Req}^{\boldsymbol{s}}_{\boldsymbol{EU,k,}\overline{(\boldsymbol{t-5,t})}} + \mathbf{X} + FE_{i,k} + FE_t + FE_s + \varepsilon^s_{i,k,t} \qquad \text{Eq. (1)}$$

Besides the main independent variable $\boldsymbol{Req}^{\boldsymbol{s}}_{\boldsymbol{EU,k,}\overline{(\boldsymbol{t-5,t})}}$, we include a vector $\mathbf{X}$ of explanatory variables, controlling for factors likely to be associated with the existence of measures within a product-level SPS/TBT category in a third country, irrespective of the existence of measures within the same product-level SPS/TBT category in the EU. Since we adopt a five-year period for the definition of EU-type product requirements, we use a five-year lag for all the additional explanatory variables to avoid any simultaneity issues. These variables include various trade policies (i.e. variation in average tariffs applied by country *i* on product *k* between *t* and *t-5*, number of other categories of NTMs applied by country *i* on product *k* in *t-5*), annual internal demand for a product

[22] Also, if measures within a given product-level SPS/TBT category are removed in the meanwhile, the dummy variable corresponding to the existence of EU measures in that product-level SPS/TBT category is set to 0 for all years following the removal.

[23] The choice of an LPM is dictated by the fact that it allows to overcome the incidental parameter problem encountered in the case of probit models when specifications include high-dimensional fixed effects.

(e.g. total imports of product *k* by country *i* in *t-5* in logs), annual external demand for a product (e.g. total exports of product *k* by country *i* in *t-5* in logs), annual country characteristics (e.g. GDP and GDP per capita of country *i* in *t-5* in logs), and participation in bilateral trade agreements (e.g. number of FTAs of country *i* in *t-5)*.

Various sets of fixed effects are also included to capture other unobservable characteristics. We first rely on country-product fixed effects ($FE_{i,k}$) to cover any unobserved country-product characteristics that persist over time (e.g. regulatory environment, product quality, consumer preferences, market structure). We then include time fixed effects (FE_t) to control for any time-varying factors (e.g. factors that can affect the demand for products, changes in consumer preferences). Finally, we include NTM fixed effects (FE_s) to account for different considerations underlying the implementation of various types of regulations (e.g. product safety, labelling).

However, to ensure that our results are not affected by other omitted variables, we also consider a specification with more restrictive fixed effects, allowing to control for a wider range of unobservable characteristics. We first introduce country-product-year fixed effects ($FE_{i,k,t}$), which absorb all the additional explanatory variables included in the previous specification and many other factors likely to affect the probability of third countries to adopt regulations (e.g. participation in international agreements,[24] technological innovation). By encompassing the first specification and accounting for additional unobservable characteristics across multiple dimensions, this specification enhances the explanatory power of the model. We also include NTM fixed effects (FE_s) to account for different rationales underlying the implementation of various types of rules.

Results. The correlation results corresponding to the estimation of Eq. (1) are presented in Table 4. Column (1) presents the results of the baseline specification, which includes country-product, year and NTM fixed effects. Column (2) displays the alternative specification, including country-product-year and NTM fixed effects. In both columns, the coefficient on the main independent variable is positive and significant. This suggests that, after controlling for other confounding factors, the existence of measures within a product-level SPS/TBT category in the EU is associated with a larger probability of existence of measures within the same product-level SPS/TBT category in third countries at most five years later. The likelihood of other countries adopting requirements in a product-level SPS/TBT category conditional on the EU having in place measures within the same product-level SPS/TBT category increases by 6 to 7%, depending on the specification.

As previously mentioned, in Column (1), we introduce more control variables likely to be associated with the existence of measures within product-level SPS/TBT categories in third countries regardless of the existence of measures within the same product-level SPS/TBT categories in the EU. Thus, we notice that both an increase in tariffs and a larger number of other types of NTMs are associated with a lower probability of existence of measures within specific product-level SPS/TBT categories in third countries. In principle, a market protected through other measures might be less likely to implement requirements aimed at protecting health, safety, and the environment, as unsafe products are already less likely to enter. Furthermore, the results show that a larger market size proxied through GDP is correlated with a lower probability of existence of measures within specific product-level SPS/TBT categories, whereas a more important level of development proxied through GDP per capita is positively associated with the probability of having in place measures within specific product-level SPS/TBT categories. The relationship between market size and the probability to implement measures within specific product-level SPS/TBT categories is not clear-cut, thus the negative result is not necessarily surprising. It can be argued that in more sizeable markets consumers have more diverging preferences, therefore it is more difficult to introduce measures satisfying all these diverging preferences. When it comes to the level of development of a country, one would indeed expect that a country with a larger GDP per capita is more likely to

[24] Certain requirements within a product-level SPS/TBT category might originate at the international level through multilateral agreements. While one can assume that the EU's early adoption of such requirements might act as a catalyst for other countries engaging with the EU market and expedite their compliance, it is still important to account for countries' participation in international agreements in our analysis.

implement measures within specific product-level SPS/TBT categories, given that it is characterized by more regulatory capacity, willingness to deploy it, and consumers with more stringent preferences who are ready to pay the extra cost associated with healthier and safer products. In addition, we notice that the higher the internal demand for a good in a country, the less likely a country is to implement measures within specific product-level SPS/TBT categories. On the other hand, the higher the external demand for a good produced by a country, the higher the probability of that country to adopt measures within specific product-level SPS/TBT categories. Finally, having a higher number of FTA partners besides the EU is also associated with a higher probability of existence of measures within specific product-level SPS/TBT categories in third countries.

Robustness Tests. Several sensitivity tests are conducted to further confirm the robustness of our previous findings. Since three sets of fixed effects can be too demanding for some tests, the robustness tests will all be conducted based on the alternative specification of Eq. (1).[25] The results are presented in the Appendix in Table A4. First, instead of using a linear probability model, we rely on a conditional logit model. Second, we focus on a subsample keeping all countries for which the collection of the NTM data has been done after 2014. As already mentioned, the data collection year for each country is different. Therefore, considering countries with a data collection year closer to 2009 could be problematic as these countries might just simply take longer to implement measures in the same product-level SPS/TBT categories as the EU. This robustness test ensures that we allow a sufficient period of time for all countries in the dataset to implement EU-type measures. Third, we also run a test restricting the sample to all Latin American countries for which the data have been collected almost every year. This ensures a proper panel dimension of the data for these countries and provides a full picture regarding the adoption, modification or removal of regulations. Fourth, we also run a test where we exclude from the dataset the top 10% more developed countries in terms of GDP per capita. Thus, the overall results are not driven by countries that might share similar health, safety, and environmental interests as the EU and, therefore, might have a natural tendency to adopt similar types of product requirements. Finally, we use alternative definitions for the dependent and the main independent variables. More precisely, instead of studying the existence of measures within product-level SPS/TBT categories in third countries conditional on the existence of measures within the same product-level SPS/TBT categories in the EU at most five years before, we analyse the implementation of product rules at specific points in time. The dependent variable is a dummy set to 1 for a country implementing measures in a product-level SPS/TBT category in a year and 0 otherwise. The main independent variable is a dummy set to 1 if, for measures implemented by a third country in each product-level SPS/TBT category in a given year, the EU implemented measures within the same category at most five years before, being the first mover for that product-level SPS/TBT category. All these tests validate our previous findings, providing quantitative support for the role of the EU in furnishing a regulatory model for third countries in terms of product-level SPS/TBT categories.

[25] The results for the tests that can be carried out based on the main specification are in line with those conducted for the alternative specification.

Table 4: Probability of third countries to adopt requirements within the same product-level SPS/TBT categories as the EU

	$\boldsymbol{Req^{s}_{i,k,t}}$	
	(1)	(2)
$\boldsymbol{Req^{s}_{EU,k,\overline{(t-5,t)}}}$	0.069***	0.064***
	(0.000)	(0.000)
$\Delta\ MFN\ applied\ tariff_{i,k,\overline{(t-5,t)}}$	-0.151***	
	(0.004)	
$Nb.of\ types\ of\ other\ NTMs_{i,k,t-5}$	-0.119***	
	(0.000)	
$Log\ GDP_{i,t-5}$	-0.135***	
	(0.003)	
$Log\ GDP\ per\ capita_{i,t-5}$	0.202***	
	(0.003)	
$Log\ Import\ Value_{i,k,t-5}$	-0.002***	
	(0.000)	
$Log\ Export\ Value_{i,k,t-5}$	0.000*	
	(0.000)	
$Nb.of\ RTA\ partners_{i,t-5}$	0.006***	
	(0.000)	
Observations	5,477,131	5,065,764
Adjusted R-sq	0.601	0.792
Fixed Effects:		
$Country-Product_{i,k}$	Yes	No
$Country-Product-Year_{i,k,t}$	No	Yes
$Year_t$	Yes	No
NTM_s	Yes	Yes

Note: The dependent variable $\boldsymbol{Req^{s}_{i,k,t}}$ is the probability that country *i* has in place measures within the SPS/TBT category *s* on the HS6 product *k* in year *t*. The main independent variable $\boldsymbol{Req^{s}_{EU,k,\overline{(t-5,t)}}}$ is a dummy set to 1 if the EU has also in place measures within the same SPS/TBT category *s* on the same HS6 product *k*, implemented between *t* and *t-5*, and the EU is the first mover for that product-level SPS/TBT category. Period of analysis: 2009-2019. Robust standard errors in parentheses, with *** denoting significance at the 1% level, ** at the 5% level and * at the 10% level.

4.2. Explaining why third countries follow the EU's model

Empirical Strategy. We now analyse which factors are related to the probability of third countries to implement measures within the same product-level SPS/TBT categories as the EU, over the 2009-2019 period. To this end, we rely on the original non-squared NTM dataset, including all measures implemented by the EU and third countries within product-level SPS/TBT categories in a given year.

In order to build the dependent variable, we proceed as follows. Among all product-level SPS/TBT categories where third countries have implemented measures in a year, we identify those where the EU also implemented measures at most five years before. Thus, our dependent variable $\boldsymbol{EUstyleReq^{s}_{i,k,t}}$ is defined as a dummy set to 1 if the existence of measures within the SPS/TBT category *s* implemented by the third country *i* on the HS6 product *k* in year *t* reflects the existence of measures within the same product-level SPS/TBT category in the EU, implemented at most five years before. This variable is set to 0 if the EU has not implemented measures in the same

product-level SPS/TBT category at most five years before.[26] We use an LPM with fixed effects, which can be expressed as follows:

$$\boldsymbol{EUstyleReq}^{s}_{\boldsymbol{i,k,t}} = \beta_0 + \beta_1 \Delta ExpShrToEU_{i,k,\overline{(t-5,t)}} + \beta_2 \Delta ExpValToEU_{i,k,\overline{(t-5,t)}} + \beta_3 FTAwEU_{i,t-5} + \boldsymbol{X} + FE_{i,k} + FE_s + FE_t + \varepsilon^{s}_{i,k,t}$$

Eq. (2)

where $\Delta\boldsymbol{ExpShrToEU}_{\boldsymbol{i,k,\overline{(t-5,t)}}}$ is the variation in the EU's share in country *i*'s total exports of a product *k* between *t* and *t-5*, $\Delta\boldsymbol{ExpValToEU}_{\boldsymbol{i,k,\overline{(t-5,t)}}}$ refers to the variation in country *i*'s export value of product *k* to the EU between *t* and *t-5*, and $\boldsymbol{FTAwEU}_{\boldsymbol{i,t-5}}$ represents a dummy variable set to 1 if country *i* has a free trade agreement with the EU in year *t-5* and 0 otherwise. These variables capture the main mechanisms we seek to examine to understand the reasons behind third countries' adoption of measures within the same product-level SPS/TBT categories as the EU. First, this regulatory behaviour of third countries can be driven by market forces, which are represented here through: (1) the variation in the EU's share in a country's exports of a product, and (2) the variation in a country's export value of a product to the EU. Second, this regulatory behaviour of third countries can also be driven by treaty forces such as the existence of trade agreements between third countries and the EU. Furthermore, **X** represents a vector of control variables at various levels of aggregation that can impact the decision of third countries to adopt measures within the same product-level SPS/TBT categories as the EU. For all control variables we rely on five-year lags to avoid any simultaneity issues. As in the previous case, these variables include various trade policies (i.e. variation in average tariffs applied by country *i* on product *k* between *t* and *t-5*, number of other categories of NTMs applied by country *i* on product *k* in *t-5*), annual internal demand for a product (e.g. total imports of product *k* by country *i* in *t-5* in logs), annual external demand for a product (e.g. total exports of product *k* by country *i* in *t-5* in logs), annual country characteristics (e.g. GDP and GDP per capita of country *i* in *t-5* in logs), and participation in bilateral trade agreements (e.g. number of FTAs of country *i* in *t-5)*.

Results. The correlation results from the estimation of Eq. (2), corresponding to the factors explaining the adoption of measures by third countries within the same product-level SPS/TBT categories as the EU, are presented in Table 5. First, we notice that both an increase in the EU's share in a country's exports of a product and an increase in a country's export value of a product to the EU are positively and significantly correlated with the adoption of measures within the same product-level SPS/TBT categories as the EU. Second, the existence of a trade agreement with the EU is also positively and significantly associated with the implementation of requirements within the same product-level SPS/TBT categories as the EU. These results support the hypothesis that the EU's role in providing a model for third countries in terms of product-level SPS/TBT categories can be explained through both market- and treaty-driven mechanisms. As for the other control variables, we find that an increase in the average tariffs applied on a product and a higher number of different other NTMs on a product are negatively and significantly associated with the adoption of requirements in the same product-level SPS/TBT categories as the EU. We also obtain a positive and significant coefficient on GDP and a negative and significant coefficient on GDP per capita. On the one hand, bigger countries in terms of GDP are more likely to adopt measures within the same product-level SPS/TBT categories as the EU, and, on the other hand, countries with a higher GDP per capita are less likely to do so. These results are in line with the hypothesis that more developed countries are less likely to be standard-takers, as they have the regulatory capacity to implement product requirements that fulfil the criteria imposed by their consumers. Finally, we obtain a negative correlation between the overall number of trade agreements of a country and the probability to adopt measures within the same product-level SPS/TBT categories as the EU, which suggests that having multiple trade agreements might actually lead to different requirements for consumer protection and a lower probability to adopt more stringent EU rules.

[26] This implies that the EU does not have measures within the same product-level SPS/TBT category at all or that the EU adopted measures within the same product-level SPS/TBT category more than five years before (and has not modified them in the past five years).

Robustness Tests. We perform various sensitivity tests to confirm the robustness of our results. As in the previous case, three sets of fixed effects are demanding for some tests. In order to be able to perform all robustness tests, we use a higher level of aggregation for the set of NTM fixed effects. Thus, instead of relying on detailed NTM fixed effects (FE_s), we introduce NTM broad categories (FE_{s-br}) fixed effects.[27] The results are presented in the Appendix in Table A5. First, instead of using a linear probability model, we rely on a conditional logit model. Second, we focus on a subsample keeping all countries for which the collection of the NTM data has been done after 2014. Third, we also run a test restricting the sample to all Latin American countries for which the data have been collected almost every year. Finally, we also run a test where we exclude from the dataset the top 10% more developed countries in terms of GDP per capita. All these tests validate our previous findings, confirming that the adoption of measures by third countries in the same product-level SPS/TBT categories as the EU is associated with both market-driven forces and treaty-driven forces. More precisely, an increasing share of the EU in a country's exports of a product and the prior existence of a trade agreement with the EU are correlated with an increase in the probability of third countries to implement requirements in the same product-level SPS/TBT categories.

Table 5: Factors explaining the probability of third countries to adopt measures in the same product-level SPS/TBT categories as the EU

	$\boldsymbol{EUstyleReq^{s}_{i,k,t}}$
	(1)
$\boldsymbol{\Delta Export\ share\ to\ the\ EU_{i,k,(\overline{t-5,t})}}$	0.021**
	(0.010)
$\boldsymbol{\Delta Export\ value\ to\ the\ EU_{i,k,(\overline{t-5,t})}}$	0.001*
	(0.001)
$\boldsymbol{Trade\ agreement\ with\ the\ EU_{i,t-5}}$	0.036***
	(0.007)
$\Delta\ MFN\ applied\ tariff_{i,k,(\overline{t-5,t})}$	-0.074**
	(0.033)
$Nb.of\ types\ of\ other\ NTMs_{i,k,t-5}$	-0.034***
	(0.003)
$Log\ GDP_{i,t-5}$	0.461***
	(0.054)
$Log\ GDP\ per\ capita_{i,t-5}$	-0.523***
	(0.053)
$Log\ Import\ Value_{i,k,t-5}$	-0.003**
	(0.001)
$Log\ Export\ Value_{i,k,t-5}$	-0.001
	(0.001)
$Nb.of\ RTA\ partners_{i,t-5}$	-0.004***
	(0.001)
Observations	335,155
Adjusted R-sq	0.478
Fixed Effects:	
$Country-Product_{i,k}$	Yes
NTM_s	Yes
$Year_t$	Yes

Note: Period of analysis: 2009-2019. The dependent variable $\boldsymbol{EUstyleReq^{s}_{i,k,t}}$ is the probability that country *i* has in place requirements within the SPS/TBT category *s* on the HS6 product *k* in a given year *t* if the EU has in place requirements within the same SPS/TBT category, on the same product, adopted at most five years before. Robust standard errors in parentheses, with *** denoting significance at the 1% level, ** at the 5% level and * at the 10% level.

[27] The results for the tests that can be carried out using detailed NTM fixed effects are in line with those conducted using NTM broad categories fixed effects.

4.3. Further insights into the EU's role in providing a regulatory model for other countries

The EU's role in providing a regulatory model in international perspective. As previously mentioned, not every country can be a global regulator for product requirements aimed at protecting health, safety, and the environment. While this capacity is associated with large economies, having a large market alone does not give a jurisdiction the power to regulate globally (Bradford, 2020). Other important factors such as having the regulatory capacity and willingness to adopt stringent standards and regulations are key to the emergence of a country as a global regulator. This might explain why there is mounting anecdotal evidence supporting an important regulatory influence from the EU but not a similar one from the United States or China. Besides a sizeable consumer market, the EU has an important regulatory capacity and the willingness to deploy it. In the case of the United States, despite the existence of a significant consumer market and strong regulatory capacity, there appears to be little inclination towards implementing uniform and stringent standards and regulations throughout the country. Regarding China, while some progress has been made in building domestic regulatory capacity, there is still work to be done to ensure that there is sufficient willingness and capability to effectively implement and enforce stringent regulations.

In this subsection, we aim at understanding whether the United States and China also provide a regulatory model for other countries alongside the EU. For this purpose, we introduce in Eq. (1) two additional explanatory variables, allowing to detect the role exerted by these countries. More precisely, for the existence of measures within a product-level SPS/TBT category in a third country in a year, our additional explanatory variables map the existence of requirements in the same product-level SPS/TBT category in the United States ($\boldsymbol{Req}^{\boldsymbol{S}}_{\boldsymbol{US,k,(\overline{t-5,t})}}$) and China ($\boldsymbol{Req}^{\boldsymbol{S}}_{\boldsymbol{CN,k,(\overline{t-5,t})}}$), implemented at most five years before the third country in question. These variables fully consider whether the Unites States or China are first movers.

The correlation results are presented in Table 6**Error! Reference source not found.**. Our analysis shows that there is a significant and positive relationship between the existence of requirements in a given product-level SPS/TBT category in the EU and the existence of requirements in the same SPS/TBT category in third countries. Specifically, the likelihood of third countries implementing requirements in a product-level SPS/TBT category increases by 7% when the EU has in place measures in the same product-level SPS/TBT category. However, we do not find any evidence for the role of the United States in providing a model for third countries in terms of product-level SPS/TBT categories, as the coefficient is not significant. Regarding the role of China in providing a regulatory model for third countries, we document a positive and significant correlation. Nonetheless, the magnitude of this effect is negligible, as the existence of measures in a given product-level SPS/TBT category in China only increases the probability of third countries to have in place measures in the same product-level SPS/TBT category by 0.2%, which is 35 times less than the EU. Overall, it appears that the role of the EU in setting a regulatory model for third countries for product-level SPS/TBT categories prevails.

Table 6: Probability of third countries to adopt requirements in product-level SPS/TBT categories in relation to the EU, the United States and China

	$Req^{s}_{i,k,t}$
	(1)
$Req^{s}_{EU,k,\overline{(t-5,t)}}$	0.069***
	(0.000)
$Req^{s}_{US,k,\overline{(t-5,t)}}$	-0.003
	(0.002)
$Req^{s}_{CN,k,\overline{(t-5,t)}}$	0.002**
	(0.001)
Observations	5,129,267
Adjusted R-sq	0.603
Fixed Effects:	
$Country - Product_{i,k}$	Yes
NTM_{s}	Yes
$Year_{t}$	Yes

Note: Period of analysis: 2009-2019. This specification includes all control variables included in Eq. (1): $\Delta\ MFN\ applied\ tariff_{i,k,\overline{(t-5,t)}}$, $Nb.of\ types\ of\ other\ NTMs_{i,k,t-5}$, $Log\ GDP_{i,t-5}$, $Log\ GDP\ per\ capita_{i,t-5}$, $Log\ Import\ Value_{i,k,t-5}$, $Log\ Export\ Value_{i,k,t-5}$, $Nb.of\ RTA\ partners_{i,t-5}$. Robust standard errors in parentheses, with *** denoting significance at the 1% level, ** at the 5% level and * at the 10% level.

The EU's role in providing a regulatory model in the environmental arena. The EU is well known for promoting environmental protection and sustainability through its policies. Although environmental policies are diverse and wide-ranging, certain SPS measures and TBTs can also support environmental goals. Some examples include the prohibition of the use of dangerous pesticides for human health and the environment, the reduction of pollutant emissions and composition of pollutant emissions in motor vehicles, or sustainable labelling. Given the data limitations regarding all types of environmental regulations, the focus of this subsection is narrowed down to product-level SPS/TBT categories which support environmental goals and which we refer to as green product requirements. The analysis abstracts from exploring how successful the EU is in transmitting other types of environmental policies, such as the EU Emissions Trading System, for instance.

However, information on which product-level SPS/TBT categories also support environmental objectives is not readily available in our dataset. In order to identify green product requirements, additional information is required. Considering the data limitations, to the best of our knowledge, the only way to identify green product requirements in our dataset is through the identification of product-level SPS/TBT categories which contribute to the achievement of the Sustainable Development Goals (SDGs) related to environmental aspects. Overall, there are 17 SDGs put forward by the 2030 Agenda for Sustainable Development adopted by all United Nations Member States in 2015. Besides protecting the environment and climate, this Agenda emphasizes the need to fight against poverty, enhance health and education, reduce inequality, drive economic growth, and protect the world's forests and oceans. However, this analysis only considers those SDGs that include environmental targets, such as clean water and sanitation (SDG 6), affordable and clean energy (SDG 7), sustainable cities and communities (SDG 11), responsible consumption and production (SDG 12), climate action (SDG 13), life below water (SDG 14), and life on land (SDG 15).[28]

In order to identify which product-level SPS/TBT categories support the achievement of specific SDG targets, Kravchenko et al. (2019) developed a separate concordance matrix leveraging additional qualitative information gathered in the NTM data collection process. This concordance

[28] The classification of environmental SDGs used in this paper is based on the information provided in the course entitled "Trade and Sustainable Development Goals" by the Economic Social Commission for Asia and the Pacific (ESCAP).

matrix can then be merged with the ready-to-use dataset for research purposes in order to identify which product-level SPS/TBT categories support environmental SDGs. In their study, Kravchenko et al. (2019) consider a product-level SPS/TBT category to be directly linked to an SDG target when two specific conditions are met. First, the additional qualitative information gathered during the data collection process for each product-level SPS/TBT category includes a clearly stated SDG target-related objective. Second, it is unlikely that the product-level SPS/TBT category under scrutiny serves any other objective than the one which is relevant to an SDG target. Based on these elements, the derived concordance only considers the stated or implied intended objective of the measure without considering its actual impact. Even if the data do not allow to assess the actual impact of green product requirements, our underlying assumption is that their implementation is beneficial for the environment. As mentioned, this concordance matrix is merged with our dataset in order to tag green product requirements.[29]

As an illustration, SDG 12 which aims at fostering sustainable consumption and production patterns, encompasses several targets. For instance, targets 12.4 and 12.5 focus on ensuring the responsible handling of chemicals and waste from their inception to their disposal in an environmentally-friendly manner. This includes decreasing waste production, as well as limiting the discharge of chemicals and waste into the air, water, and soil, in order to minimize their detrimental effects on human health and the environment. When it comes to the product requirements which contribute to the accomplishment of Target 2.15, the concordance matrix includes, among others, all regulations under categories B31 (i.e. labelling requirements), B32 (i.e. marking requirements), B33 (i.e. packaging requirements), and B7 (i.e. product quality, safety or performance requirements) covering all goods under the sector referring to *Plastics and articles thereof*, with the exception of plastic waste, and a few other products (i.e. soap and organic surface-active products in the form of bars, cakes, moulded shapes, and paper, wadding, felt and nonwovens, impregnated, coated or covered with soap or detergent, for toilet use; organic surface-active products and preparations for washing the skin, in the form of liquid or cream and put up for retail sale, whether or not containing soap; oral or dental hygiene preparations, dentifrices). This is just one example among many others. By following this approach, we can tag the product-level SPS/TBT categories which support the environmental SDG targets and estimate whether third countries tend to adopt measures within these product-level SPS/TBT categories if the EU has measures within the same categories in place.

As previously mentioned, in this subsection, we aim at exploring to what extent third countries adopt measures within the same product-level SPS/TBT categories as the EU if these categories support environmental objectives. To this end, we consider two specifications of Eq. (1). First, we introduce an interaction term between a dummy variable tracing the existence of requirements in the same product-level SPS/TBT category as the EU, as detailed in Subsection 4.1, and a dummy variable set to 1 if the product-level SPS/TBT category in question supports environmental SDGs, irrespective of the specific supported SDG. Second, we introduce several interaction terms between a dummy variable tracing the existence of requirements in the same product-level SPS/TBT category as the EU and various dummy variables for the product-level SPS/TBT category supporting specific environmental SDGs. The results are presented in Table 7.

Column (1) displays the correlation results from the first specification, where all environmental SDGs are considered together. As in the previous case, our findings indicate that the likelihood of third countries to have in place requirements in a product-level SPS/TBT category increases by 6.6% if the EU has in place requirements in the same product-level SPS/TBT category. However, this result appears to be reinforced for product-level SPS/TBT categories that contribute to environmental objectives. More specifically, the probability of third countries implementing

[29] The concordance matrix includes information on all environmental SDGs except for SDG 13 referring to climate action. However, as explained by Kravchenko et al. (2019), SDG 13 does not have any targets allowing to gauge the direct impact of NTMs. The attainment of this SDG will primarily depend on the adoption of national policies, international and intergovernmental cooperation and concerted actions under other SDGs. For instance, the curbing of CO2 emissions can be realised by adopting NTMs that regulate energy efficiency in various sectors of consumption and production, as stipulated in SDG 7 and SDG 12. Similarly, the adaptation to climate change can be achieved by implementing sustainable agricultural practices and building resilient cities, as mentioned in SDG 11 and SDG 15.

requirements in product-level SPS/TBT categories that support the attainment of environmental SDGs increases by 7.1% if the EU has requirements within the same product-level SPS/TBT categories already in place.[30] This suggests that the role of the EU in providing a regulatory model for other countries is enhanced when it comes to product requirements in the environmental arena.

Furthermore, Column (2) displays the correlation results from the second specification, where the various environmental SDGs are considered separately. According to this specification, there is a 6.8% increase in the probability that third countries implement requirements in a product-level SPS/TBT category if the EU has requirements in the same category already in place. However, the reaction of third countries to the existence of product requirements in the EU might differ depending on the specific SDG. For instance, we document a non-significant impact of the existence of EU requirements in the product-level SPS/TBT categories supporting SDGs 6 (i.e. clean water and sanitation), 11 (i.e. sustainable cities and communities) and 15 (i.e. life on land) on the probability of third countries to implement requirements in the same product-level SPS/TBT categories. Furthermore, we show that the existence of EU requirements in the product-level SPS/TBT categories contributing to SDG 7 (i.e. affordable and clean energy) increases the probability that third countries implement requirements in the same product-level SPS/TBT categories to a lower extent. More precisely, the likelihood of third countries implementing requirements in product-level SPS/TBT categories likely to foster SDG 7 increases by only 3.6% when the EU has measures within the same product-level SPS/TBT categories in place.[31] Finally, we document a reinforced effect of the existence of EU requirements in product-level SPS/TBT categories contributing to SDGs 12 (i.e. responsible consumption and production) and 14 (i.e. life below water) on the probability of third countries to have in place requirements in the same product-level SPS/TBT categories. When it comes to responsible consumption and production, the probability of third countries to implement requirements in the corresponding product-level SPS/TBT categories increases by 7.6% conditional on the EU having in place requirements in the same categories.[32] As for life below water, the prior existence of EU requirements in the corresponding product-level SPS/TBT categories increases the likelihood of third countries to implement measures within the same categories by 10.9%.[33] All in all, the role of the EU in providing a regulatory model for third countries in the environmental arena appears enhanced for product requirements that aim at fostering responsible consumption and production (e.g. measures controlling the trading of wastes and chemicals) and protecting life below water (e.g. measures on fishing processes).

[30] This result is obtained by summing up the coefficient on the interaction term (0.005) and the coefficient on the dummy corresponding to the prior existence of product regulations in the EU (0.066).

[31] This result is obtained by summing up the coefficient on the interaction term (-0.032) and the coefficient on the dummy corresponding to the prior existence of product regulations in the EU (0.066).

[32] This result is obtained by summing up the coefficient on the interaction term (0.008) and the coefficient on the dummy corresponding to the prior existence of product regulations in the EU (0.066).

[33] This result is obtained by summing up the coefficient on the interaction term (0.031) and the coefficient on the dummy corresponding to the prior existence of product regulations in the EU (0.066).

Table 7 : The EU's role in providing a regulatory model for third countries for product-level SPS/TBT categories supporting environmental goals

	$Req^{s}_{i,k,t}$	
	(1)	(2)
	Combined SDGs	Detailed SDGs
$Environmental\ SDGs^{s}_{k} \times Req^{s}_{EU,k,\overline{(t-5,t)}}$	0.005***	
	(0.001)	
$Environmental\ SDGs^{s}_{k}$	0.009***	
	(0.001)	
$Environmental\ SDG\ 6^{s}_{k} \times Req^{s}_{EU,k,\overline{(t-5,t)}}$		-0.007
		(0.005)
$Environmental\ SDG\ 6^{s}_{k}$		-0.082***
		(0.005)
$Environmental\ SDG\ 7^{s}_{k} \times Req^{s}_{EU,k,\overline{(t-5,t)}}$		-0.032***
		(0.006)
$Environmental\ SDG\ 7^{s}_{k}$		0.081***
		(0.005)
$Environmental\ SDG\ 11^{s}_{k} \times Req^{s}_{EU,k,\overline{(t-5,t)}}$		0.011
		(0.007)
$Environmental\ SDG\ 11^{s}_{k}$		0.022***
		(0.002)
$Environmental\ SDG\ 12^{s}_{k} \times Req^{s}_{EU,k,\overline{(t-5,t)}}$		0.008***
		(0.001)
$Environmental\ SDG\ 12^{s}_{k}$		0.006***
		(0.001)
$Environmental\ SDG\ 14^{s}_{k} \times Req^{s}_{EU,k,\overline{(t-5,t)}}$		0.031***
		(0.002)
$Environmental\ SDG\ 14^{s}_{k}$		-0.021***
		(0.001)
$Environmental\ SDG\ 15^{s}_{k} \times Req^{s}_{EU,k,\overline{(t-5,t)}}$		-0.002
		(0.002)
$Environmental\ SDG\ 15^{s}_{k}$		-0.002
		(0.001)
$Req^{s}_{EU,k,\overline{(t-5,t)}}$	0.066***	0.068***
	(0.001)	(0.001)
Observations	5,477,131	5,477,131
Adjusted R-sq	0.601	0.601
Fixed Effects:		
$Country - Product_{i,k}$	Yes	Yes
NTM_{s}	Yes	Yes
$Year_{t}$	Yes	Yes

Note: Period of analysis: 2009-2019. This specification includes all control variables from Eq. (1): $\Delta\ MFN\ applied\ tariff_{i,k,\overline{(t-5,t)}}$, $Nb.of\ types\ of\ other\ NTMs_{i,k,t-5}$, $Log\ GDP_{i,t-5}$, $Log\ GDP\ per\ capita_{i,t-5}$, $Log\ Import\ Value_{i,k,t-5}$, $Log\ Export\ Value_{i,k,t-5}$, $Nb.of\ RTA\ partners_{i,t-5}$. Robust standard errors in parentheses, with *** denoting significance at the 1% level, ** at the 5% level and * at the 10% level.

5. Conclusion

This paper explores the role of the EU in providing a model for product requirements aimed at protecting health, safety, and the environment, relying on detailed information on product-level SPS/TBT categories. More precisely, the paper analyses whether third countries are more likely to implement requirements in a product-level SPS/TBT category if the EU has requirements within the same product-level SPS/TBT category already in place. Then, it sheds light on some factors associated with the implementation of requirements by third countries in the same product-level SPS/TBT categories as the EU. Finally, the paper digs further into the role of the EU in providing a regulatory model for other countries for product-level SPS/TBT categories, by (1) comparing it with the role exerted by the United States and China, and (2) investigating whether it is reinforced in the environmental arena.

We find that the probability of a country to implement requirements in a product-level SPS/TBT category is significantly and positively associated with the prior existence of requirements in the same product-level SPS/TBT category in the EU. More specifically, third countries are 7% more likely to introduce requirements in a given product-level SPS/TBT category should the EU have requirements in the same product-level SPS/TBT category already in place. After controlling for other confounding factors, the adoption of requirements by third countries in the same product-level SPS/TBT categories as the EU is associated with direct market forces, namely an increase in the EU's share in a country's total exports of a product and an increase in a country's exports of a product to the EU, as well as treaty forces, namely the existence of trade agreements with the EU. We also show that the role of the EU prevails, as we document a non-significant role for the United States and a significant but limited role for China. Finally, it appears that the role of the EU is reinforced in the environmental arena, particularly for product requirements encouraging responsible consumption and production and protecting marine life.

Finally, analysing the economic significance of the EU's role in providing a regulatory model for product-level SPS/TBT categories for third countries is of utmost importance, maybe even more so than simply documenting this role. Although this aspect is beyond the scope of this paper and opens avenues for further research, it is important to at least theoretically discuss the economic implications of the EU's role in providing a regulatory model for product requirements aimed at protecting health, safety, and the environment for other countries. On the one hand, when the EU adopts such product requirements, they have to be fulfilled by all actors serving the single market, whether of domestic or foreign origin. Thus, beyond protecting health, safety, and the environment, these measures help create a level playing field within the single market as they do not discriminate based on the origin of the firm. On the other hand, when EU firms complying with domestic product requirements export to jurisdictions with laxer product rules, they might be at a competitive disadvantage. Given these considerations, the spread of EU product requirements to third countries might also help create a level playing field for EU firms operating abroad. This may result in greater competitiveness for EU firms, potentially leading to more efficient production processes and enhanced trade. Nevertheless, the competitiveness benefits associated with the role of the EU in providing a regulatory model for third countries are not only limited to EU firms. In fact, the proliferation of EU-like product requirements induces more regulatory harmonisation around the world. This implies a more predictable global environment also for foreign firms, which might see their compliance costs decrease, as they no longer have to fulfil divergent requirements imposed by various jurisdictions. Moreover, foreign firms might also see their demand increase, as clear product rules might also boost consumer confidence in their products. All in all, the adoption by third countries of product requirements aimed at protecting health, safety, and the environment based on the model furnished by the EU has the potential to further reduce trade barriers around the world and promote economic integration.

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Appendix

Table A1: Classification of NTMs, by chapter

Chapter	Description
A	Sanitary and phytosanitary measures
B	Technical barriers to trade
C	Pre-shipment inspection and other formalities
D	Contingent trade-protective measures
E	Non-automatic import licensing, quotas, prohibitions, quantity-control measures and other restrictions not including sanitary and phytosanitary measures or technical barriers to trade
F	Price-control measures, including additional taxes and charges
G	Finance measures
H	Measures affecting competition
I	Trade-realted investment measures
J	Distribution restrictions
K	Restrictions on post-sales services
L	Subsidies and other forms of support
M	Government procurement restrictions
N	Intellectual property
O	Rules of origin
P	Export-related measures

Source: UNCTAD (https://trains.unctad.org/). Note: The main focus of our analysis is on Chapters A and B. All chapters, from C to O, are also used as control variables in the estimations. Chapter P, which refers to export-related measures, is excluded from the analysis.

Table A2: EU Trade Agreements with third countries present in the NTM dataset

Partner Country Name	Partner Country ISO3 Code	Year of provisional application/ entry in force	Type of trade agreement
Algeria	DZA	2005	Association Agreement
Antigua and Barbuda	ATG	2008	Economic Partnership Agreement
Bahamas	BHS	2008	Economic Partnership Agreement
Barbados	BRB	2008	Economic Partnership Agreement
Botswana	BWA	2016	Economic Partnership Agreement
Cameroon	CMR	2014	Interim Economic Partnership Agreement
Canada	CAN	2017	Comprehensive Economic and Trade Agreement (CETA)
Chile	CHL	2003	Association Agreement and Additional Protocol
Colombia	COL	2013	Trade Agreement
Costa Rica	CRI	2013	Association Agreement with a strong trade component
Cote d'Ivoire	CIV	2016	Stepping stone Economic Partnership Agreement
Dominica	DMA	2008	Economic Partnership Agreement
Dominican Republic	DOM	2008	Economic Partnership Agreement
Ecuador	ECU	2017	Trade Agreement
El Salvador	SLV	2013	Association Agreement with a strong trade component
Ghana	GHA	2016	Stepping stone Economic Partnership Agreement
Guatemala	GTM	2013	Association Agreement with a strong trade component
Guyana	GUY	2008	Economic Partnership Agreement
Honduras	HND	2013	Association Agreement with a strong trade component
Israel	ISR	2000	Association Agreement
Jamaica	JAM	2008	Economic Partnership Agreement
Japan	JPN	2019	Global agreement
Jordan	JOR	2002	Association Agreement
South Korea	KOR	2011	Free Trade Agreement
Lebanon	LBN	2006	Association Agreement
Mauritius	MUS	2012	Economic Partnership Agreement
Mexico	MEX	2000	Global Agreement
Morocco	MAR	2000	Association Agreement
Nicaragua	NIC	2013	Association Agreement with a strong trade component
Palestine	PSE	1997	Interim Association Agreement
Panama	PAN	2013	Association Agreement with a strong trade component
Papua New Guinea	PNG	2009	Interim Partnership Agreement
Peru	PER	2013	Trade Agreement
Singapore	SGP	2019	Free Trade Agreement
Suriname	SUR	2008	Economic Partnership Agreement
Switzerland	CHE	1973	Free Trade Agreement
Tunisia	TUN	1998	Association Agreement
Vietnam	VNM	2020	Free Trade Agreement
Zimbabwe	ZWE	2012	Economic Partnership Agreement

Source: Authors' elaboration based on European Commission documents. The summary of these documents can be accessed at: https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/negotiations-and-agreements_en. Consulted on October 15, 2022.

Table A3: HS6 products subject to regulations in the implementing jurisdictions

Implementing country	Nb. of products affected by at least one requirement	Average number of requirements per product	Implementing country	Nb. of products affected by at least one requirement	Average number of requirements per product
Afghanistan	496	3.2	Jordan	1774	2.0
Algeria	769	2.3	Kazakhstan	5055	4.8
Antigua and Barbuda	491	3.0	Kyrgyzstan	3832	6.2
Argentina	2324	2.4	Lao Dem. Rep.	2045	4.3
Australia	1679	3.1	Lebanon	443	4.7
Azerbaijan	2705	4.0	Liberia	463	1.3
Bahamas	260	1.2	Malaysia	1421	4.9
Bahrain	1169	3.6	Mali	1002	2.0
Bangladesh	979	7.7	Mauritania	8	14.5
Belarus	3566	6.5	Mauritius	273	4.4
Benin	758	2.0	Mexico	1205	2.7
Bolivia	704	1.1	Morocco	834	3.8
Botswana	382	1.7	Myanmar	1215	3.0
Brazil	3118	4.5	Nepal	92	2.2
Brunei Darussalam	385	2.1	New Zealand	1578	1.9
Burkina Faso	738	1.2	Nicaragua	1737	3.5
Cabo Verde	985	7.9	Niger	384	1.1
Cambodia	2443	3.4	Nigeria	686	1.0
Cameroon	53	1.0	Oman	278	1.8
Canada	970	1.5	Pakistan	383	1.1
Chile	1468	1.9	Panama	1543	4.3
China	4094	5.1	Paraguay	832	2.3
Hong Kong	832	2.0	Peru	1818	3.3
Colombia	1807	2.7	Philippines	2137	4.2
Costa Rica	1403	2.6	Qatar	126	2.0
Côte d'Ivoire	1653	1.0	Republic of Korea	4386	7.6
Dominica	27	1.0	Russian Federation	3384	6.6
Ecuador	2003	5.9	Saudi Arabia	2433	7.6
El Salvador	777	2.7	Senegal	48	1.4
Ethiopia	1348	4.5	Singapore	725	1.7
European Union	**4886**	**8.0**	Sri Lanka	1310	2.6
Gambia	777	15.8	Suriname	8	2.0
Ghana	1118	4.2	Switzerland	1076	4.3
Guatemala	853	2.8	Tajikistan	3642	2.7
Guinea	4970	1.0	Thailand	1653	4.1
Guyana	226	1.0	Togo	736	3.0
Honduras	1240	2.6	Tunisia	57	4.8
India	1986	5.9	United Arab Emirates	976	2.8
Indonesia	2865	5.2	United States of America	2332	5.5
Israel	61	3.5	Uruguay	786	1.6
Jamaica	11	1.8	Viet Nam	4431	6.6
Japan	3301	5.5	Zimbabwe	553	1.6

Source: Authors' calculations based on NTM data from TRAINS-UNCTAD. This table reports for each implementing jurisdiction over the 2009-2019 period: i) the number of HS6 products affected by at least one regulation; ii) the average number of regulations per product. Regulations include both SPS measures and TBTs at the most detailed level.

Table A4: Robustness checks for the probability of third countries to adopt product requirements conditional on EU product requirements

	$Req^{s}_{i,k,t}$				
	(1) Conditional Logit	(2) Data collection > 2014	(3) Latin American countries	(4) W/o top 10% developed	(5) Adoption
$Req^{s}_{EU,k,\overline{(t-5,t)}}$	1.219***	0.068***	0.075***	0.064***	0.539***
	(0.009)	(0.000)	(0.001)	(0.000)	(0.000)
Observations	1,300,272	4,774,055	765,017	4,848,261	5,130,356
Adjusted R-sq	0.139	0.787	0.767	0.790	0.672
Fixed Effects:					
$Country - Product - Year_{i,k,t}$	Yes	Yes	Yes	Yes	Yes
NTM_{s}	Yes	Yes	Yes	Yes	Yes

Note: Period of analysis: 2009-2019. Robust standard errors in parentheses, with *** denoting significance at the 1% level, ** at the 5% level and * at the 10% level.

Table A5: Robustness checks for the factors explaining the probability to adopt EU-style regulations

	$EUstyleReq^{s}_{i,k,t}$			
	(1) Conditional Logit	(2) Data collection > 2014	(3) Latin American countries	(4) W/o top 10% developed
ΔExport share to the $EU_{i,k,\overline{(t-5,t)}}$	0.298***	0.024**	0.056**	0.058**
	(0.079)	(0.012)	(0.026)	(0.026)
ΔExport value to the $EU_{i,k,\overline{(t-5,t)}}$	0.021***	0.001*	0.000	0.000
	(0.006)	(0.001)	(0.002)	(0.002)
Trade agreement with the $EU_{i,t-5}$	0.476***	0.070***	0.284***	0.275***
	(0.060)	(0.008)	(0.022)	(0.022)
Observations	235,941	325,781	54,385	51,576
Adjusted R-sq	0.233	0.478	0.514	0.509
Fixed Effects:				
$Country - Product_{i,k}$	Yes	Yes	Yes	Yes
NTM_{s-br}	Yes	Yes	Yes	Yes
$Year_{t}$	Yes	Yes	Yes	Yes

Note: Period of analysis: 2009-2019. All columns include the explanatory variables that have been included in Equation *Eq.* (2): Δ *MFN applied tariff* $_{i,k,\overline{(t-5,t)}}$, *Nb. of types of other NTMs* $_{i,k,t-5}$, *Log GDP* $_{i,t-5}$, *Log GDP per capita* $_{i,t-5}$, *Log Import Value* $_{i,k,t-5}$, *Log Export Value* $_{i,k,t-5}$, *Nb. of RTA partners* $_{i,t-5}$. Robust standard errors in parentheses, with *** denoting significance at the 1% level, ** at the 5% level and * at the 10% level.

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