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The Impact of Technical Barriers to Trade and Sanitary and Phytosanitary Measures on Trade in the Forest-Wood-Paper Sector.

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The Impact of Technical Barriers to Trade and Sanitary and Phytosanitary Measures on Trade in the Forest-Wood-Paper Sector. *

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Abstract

Sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBTs) govern trade in several sectors, including the forest-wood-paper sector. Using a gravity model, we analyze the impact of SPS and TBT measures on trade flows in the forest-wood-paper sector by distinguishing between technical regulations and conformity assessment procedures. Our results show that SPS and TBT conformity assessment procedures and TBT technical regulations increase trade flows. We also find that the impact of these measures differs depending on the level of development of imposing countries when imports come from developing countries. In particular, SPS and TBT conformity assessment procedures and SPS technical regulations imposed by developed countries tend to restrict trade with developing country exporters, while TBT technical regulations tend to increase it. In contrast, SPS and TBT conformity assessment procedures imposed by developing countries contribute to increasing such trade. In analyzing the differences or similarities in regulatory patterns between these countries, we find that, on average, developing countries exhibit less regulatory intensity than developed countries. This result suggests that it will require more technical and financial resources for developing countries to comply with measures imposed by developed countries that adopt more stringent technical measures than they do.

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1 Introduction

For several years, the reduction of tariff barriers and trade liberalization have been at the heart of debates and current events. As a result of the various multilateral negotiations conducted under the General Agreement on Tariffs and Trade (GATT) of 1947, there has been a significant reduction in tariffs with slower progress in developing countries.
The Uruguay Round of 1986-1994 was the subject of major trade negotiations and led to real progress in trade liberalization in various areas. The negotiations favored a reduction in the progressiveness of tariffs imposed by developed countries with a 30 percent reduction in wood-based panels, a 50 percent reduction in semifinished products, a 67 percent reduction in wood articles and a more significant reduction in pulp and paper products (Barbier, 1995).

Although there has been a considerable reduction in tariff barriers, this has been followed by the implementation of nontariff measures (NTMs) that can have a greater impact on trade. These measures are defined as "policy measures, other than ordinary customs tariffs, that can potentially have an economic effect on international trade in goods, changing quantities traded, prices or both. " (UNCTAD, 2010, p. 99).
Among these measures, a distinction is made between technical and nontechnical measures. Technical measures include regulations, sanitary and phytosanitary (SPS) measures, technical barriers to trade (TBTs), testing and inspection. Nontechnical measures include quota, licensing, quantity and price control measures.

At the international level, countries have used these measures to achieve their objectives and compensate for the reduction in tariffs. However, the motivations behind the introduction of NTMs are not explicit. Such measures can be either legitimate to correct market failures or protectionist to protect domestic producers or industries (WTO, 2012). Depending on the motivations of governments, these measures may have different effects on trade. In practice, it is difficult to determine the motivations of governments, especially when these measures intended to achieve legitimate objectives are in fact used for national interests. This makes it difficult to determine the impact of such measures on trade.

NTMs are therefore called nontariff barriers (NTBs) to emphasize the restrictive and protectionist nature of such measures. Nicita and Gourdon (2013) point out that this designation of NTMs as NTBs is incorrect. NTMs can take different forms, and the term NTB is very restrictive, as it refers to discriminatory NTMs imposed by governments to favor domestic over foreign suppliers. In addition, it should be noted that these measures, in particular, the technical measures increasingly used by governments, apply to the forest-wood-paper sector and are crucial for international trade in goods and services. These technical measures are SPS measures that aim to protect human, animal and plant life and health, and TBTs cover technical regulations, standards and conformity assessment procedures developed to achieve legitimate objectives (environmental, safety, and consumer protection) other than those covered by SPS measures.

International trade in forest products continues to grow. Economic growth and environmental concerns have led to a renewed interest in wood. Domestic and foreign investment has flowed into the sector, particularly in emerging economies (FAO, 2007).
According to the Food and Agriculture Organization (FAO), the global production and trade of all major wood products in 2018 was the highest on record. For example, global trade

in industrial wood increased by 7% to a peak of 138 million m^3 and global trade in wood pulp increased by 2% to 66 million tons.[1] Forest products are used in most fields, such as furniture, construction, transportation and food packaging.

This expansion has been accompanied by a preponderance of NTMs governing trade in this sector, which presents important environmental issues. Forest products such as raw and sawn wood can contain pests that can pose risks to plant preservation and human and animal health. Similarly, forests and wood play a key role in climate change mitigation. Forests can sequester carbon by absorbing carbon dioxide (CO2). Wood is currently used as a renewable energy source. In UNCTAD and WB (2017) is it shown that NTMs are more important than tariffs for wood products. The share of trade subject to NTMs in this sector is over 60 percent, and the share of imported products affected by one or more NTMs is approximately 40 percent. The authors also point out that the most commonly used measures are SPS measures and TBTs. In Bourke (2000) it is stated that phytosanitary and technical regulations and standards have the greatest effect on forest products.

Given the importance of such technical measures to this sector, it is important to determine their effects, especially on trade. We analyze the impact of SPS and TBT measures imposed by importing countries on trade in the forest-wood-paper sector.

In the economic literature, some authors have analyzed the effect of NTMs on trade, and in particular, that of SPS and TBT measures. There is no consensus on the impact of such measures on trade, which remains mixed. The literature shows both positive and negative impacts of these measures. Disdier et al. (2008) find a negative impact of SPS and TBT measures on trade in the agricultural sector. Crivelli and Gröschl (2016) find a negative impact of SPS measures on the probability of trade subject to market entry and a positive impact on the volume of trade in agricultural and food products. The impact of SPS and TBT measures may be different depending on the sector under consideration and the level of development of exporters. For example, Fontagné et al. (2005) find that SPS and TBT measures have a positive impact on industrial products and a negative impact on food products. Developing countries have been highlighted as the exporters most affected by these measures imposed by importers. Disdier et al. (2008) emphasize that exports from developing countries are significantly more affected than those from developed countries.

To our knowledge, very few studies have analyzed, through econometric analysis, the impact of SPS and TBT measures in the forest-wood-paper sector or the effect of the presence of these measures in this sector on trade between countries. The majority of studies using an econometric model focus on agricultural and food products. Those studies focused on wood products are descriptive and take into account all NTMs and some wood products. Sun et al. (2010) analyze the effect of NTBs on global forest products and compare these impacts to those of tariffs. To do this, the authors use a simulation model, a partial equilibrium model of forest products in which they incorporate information on tariffs and NTMs. The authors emphasize the importance of NTMs for forest products and note that the impact of tariff and NTM reduction often differs by region and product. In a similar vein, Turner et al. (2008) analyze the impact of NTB removal on New Zealand's exports of remanufactured wood products (prefabricated housing and carpentry and joinery) to its three main partners, China, the United States and Japan. The authors use an extended

[1] http://www.fao.org/3/ca7415fr/ca7415fr.pdf

economic model of international trade in secondary processed wood products in the structure of the Global Forest Products spatial equilibrium model. The authors show that the removal of NTBs, which account for a large portion of production costs, would be more beneficial to New Zealand exporters.

Our study differs from those of Sun et al. (2010); Turner et al. (2008). Unlike these studies, we use an empirical model, the gravity model, which allows us to determine the impact of SPS and TBT measures on trade in the sector as a whole and for a set of countries. Our contribution to the literature is as follows: to our knowledge, we are the first to use a gravity model to determine the effects of SPS and TBT measures on trade in the forest-wood-paper sector as a whole and for a set of countries by distinguishing between technical regulations and conformity assessment procedures. In addition, we analyze the effects according to the level of development of importing and exporting countries. To explain the heterogeneous effects according to the level of development of countries, we calculate bilateral indicators of differences/similarities in regulatory structures between importing and exporting countries according to their levels of development. The underlying idea is that given the World Trade Organization's (WTO's) principle of nondiscrimination between domestic and foreign products, import measures should apply equally to domestic producers (UNCTAD, 2017). Thus, to the extent that importing and exporting countries show very few differences in their regulatory structures, one would think that exporting countries would be more likely to comply with measures imposed by importing countries with a similar regulatory structure to their own and to which they export their products. In addition, unlike most studies (Disdier et al., 2008; Fontagné et al., 2005) and building on the work of Peci and Sanjuán (2020), we construct panel data with information from the UNCTAD Trains database. We also take into account bilateral and temporal dimensions. We calculate an indicator, regulatory intensity, which corresponds to the number of measures imposed on a product in the forest-wood-paper sector. This indicator highlights the fact that the same product may be subject to different SPS or TBT measures and thus the prevalence of these measures in this sector. This panel dimension allows us, unlike cross-sectional data, to correct for potential endogeneity biases related to trade policies.

Our results show that SPS and TBT conformity assessment procedures and TBT technical regulations increase trade flows. We find that the effect of these measures on trade varies depending on the level of development of countries imposing them, particularly for imports from developing countries. SPS and TBT technical regulations imposed by developing countries do not have a significant impact on imports from developing countries, while SPS and TBT conformity assessment procedures contribute in increasing them. In contrast, SPS and TBT conformity assessment procedures and SPS technical regulations imposed by developed countries tend to restrict trade with developing country exporters, while TBT technical regulations tend to increase it. The positive effect of SPS and TBT conformity assessment procedures and TBT technical regulations on imports from developed countries is not different depending on the level of development of countries applying these measures. We analyze the similarities and differences of regulatory models using bilateral indicators to explain these results, and we find that the regulatory intensity of developed countries is higher than that of developing countries. Similarly, regulatory overlap, i.e., measures applied by importers that are also applied by exporters, is slightly lower between developed importing countries and developing exporting countries. This suggests that it will take more financial and technical resources for developing countries to comply with measures imposed by developed countries. The remainder of this paper is structured as follows: section 2 provides a literature rewiew, and section 3 and section 4 present our data and econometric model, respectively. In section 5, we present our baseline results and those of our sensitivity and heterogeneity analyses. We conclude in section 6.

2 Literature Review

Finding an appropriate measure to identify NTMs remains one of the most important challenges faced by authors studying their impact on international trade. Indeed, these measures can take different forms and have different effects on trade flows (Ederington and Ruta, 2016), which complicates their identification. Several approaches have been highlighted as means to identify and estimate the impact of NTMs on trade.
Bora et al. (2002); Beghin and Bureau (2001); Deardorff and Stern (1998); Ferrantino (2006) review different means to quantify NTMs and their impact. Approaches used to identify nontariff trade measures and their impact mainly include the inventory-based approach, surveys, gravity models, the price wedge method and price comparison measures.

The inventory method involves identifying observed NTMs by sector. This method provides statistics or variables such as the total number of standards in effect, documents detailing standards, notifications of TBT measures, and frequency and coverage indexes. Swann et al. (1996) analyze the impact of standards on trade performance in the United Kingdom. Using data collected from the Perinorm database, the authors use the total number of British and German standards as a measure of these standards in their study. The Perinorm database provides information on standards, draft standards and technical regulations of countries and international organizations. The authors find that standards improve the balance of trade and can also make the market more open. Moenius (2004) uses the number of documents that detail standards as a measure. The authors examines the impact of country-specific and bilaterally shared product and process standards for 471 industries of 12 countries for 1980-1995. The results show that bilaterally shared standards are favorable to trade and that standards specific to importing countries reduce imports for agricultural goods and promote trade in the manufacturing sector.
Unlike Moenius (2004); Swann et al. (1996), who use the Perinorm database to quantify NTMs (standards), some authors, such as Bao and Qiu (2012), use TBT notifications from WTO member states. Indeed, the TBT and SPS Agreements stipulate that member states have an obligation to notify the WTO Secretariat or inform other members of the development of regulations that differ from international standards or that may affect trade. Apart from counting the total number of observed standards or notifications, more sophisticated statistics such as the frequency index and coverage ratio can be developed to quantify these measures. The frequency index represents the share of products affected by one or more NTMs, and the coverage ratio represents the share of trade subject to these measures (UNCTAD, 2018). Disdier et al. (2008) use these indexes to identify countries that use SPS and TBT measures intensively and the products and exporters most affected. According to the authors, these statistics only take into account the presence or absence of NTBs, and the coverage ratio may be subject to endogeneity bias when NTMs have an impact on trade. One of the limitations of the inventory approach is that it does not quantify the effects of regulations on trade (Beghin and Bureau, 2001). The method also ignores the

restrictiveness of NTMs (Ederington and Ruta, 2016).

A second approach is to use survey data. The main advantages of this approach are that it quantifies difficult-to-measure NTMs, identifies measures that have a greater impact on producers, and provides accurate and relevant information on standards (Beghin and Bureau, 2001). The high cost of this approach and the potential biases (selection and perception bias) associated with surveys remain the main limitations of this approach.

Both approaches are of interest for quantitative or qualitative analyses. The indexes calculated through these approaches are used as explanatory variables in gravity models to determine the impact of NTMs on trade. The gravity model is used to predict the volume of trade between countries using variables that measure the economic size of countries, the distance between them and other geographic and cultural variables such as common language. Melo et al. (2014) estimated the effects of sanitary, phytosanitary and quality standards on Chilean fresh fruit exports. From the information obtained from the surveys conducted, the authors calculate a multidimensional perception index of the stringency of trade requirements that they use as a dependent variable in a gravity model.
Bao and Qiu (2010) analyze the influence of technical barriers imposed by China on these imports. The authors use the frequency index and coverage ratio to quantify technical barriers to trade and find that technical barriers to trade reduce trade in agricultural products but increase trade in manufactured goods. Otsuki et al. (2001) use a gravity model to estimate the impact of European regulations on groundnut exports from African countries. Unlike studies that use frequency or coverage indexes, these authors use a measure of maximum allowed aflatoxin levels to quantify the severity of food standards.

Another means of accounting for NTMs is to determine the price range or tariff equivalent (AVE) of NTMs. The price wedge method and price comparison measures are based on the idea that the effect of NTBs can be estimated according to their impact on the domestic price relative to a reference price. For Deardorff and Stern (1998), the most accurate way to apply this approach is to compare the price that would prevail without NTBs to the price that would prevail on the domestic market in the presence of NTBs if the price paid by suppliers remained unchanged. Since these prices are unobservable, measures of NTBs are obtained by comparing domestic and foreign prices in the presence of NTBs.
Calvin and Krissoff (1998) use this method to calculate a tariff equivalent of technical measures. The price wedge is calculated as the difference between the Japanese domestic price and the price of similar U.S. products delivered to Japan. This price is divided into the known tariff rate and the technical barrier tariff equivalent, which is the residual. This method has a limitation that stems from its underlying assumptions. The method assumes that domestic and imported goods are perfect substitutes, which is a rather strong assumption and not very viable in practice. Additionally, this method does not take into account heterogeneities, such as differences in quality that may exist between the two goods.
Tariff equivalents of NTMs can also be calculated using import demand elasticities (Disdier et al., 2008; Ferrantino, 2006). This approach developed by Kee et al. (2009) involves, on the one hand, estimating for each country the quantitative impact of NTMs (basic NTBs and domestic agricultural support) on imports at the six-digit HS tariff line. On the other hand, this quantitative impact is converted into a price equivalent (or AVE) using import demand elasticities. The authors use the comparative advantage approach of Leamer (1990) based on the Heckscher-Ohlin model to determine the quantitative impact of NTBs.

All of these identified approaches have been used in the literature to quantify the impact of SPS and TBT measures. Among the studies that have analyzed the effects of these measures on trade, mixed results and varied and complex effects on trade are noted.
We observe a positive effect of these measures on the volume of trade or the intensive margin and a negative effect on the probability of trading or the extensive margin (Bao and Chen, 2013; Bao and Qiu, 2012; Crivelli and Gröschl, 2016) and on the volume of trade (Disdier et al., 2008; Otsuki et al., 2001; Karov et al., 2009).
Moreover, unlike these studies that focus on country-level trade flows, several authors use firm-level data to determine the impact of NTMs on trade. These disaggregated data make it possible to highlight how firms' export decisions and trade patterns are affected by such measures. Chen et al. (2008), using the World Bank's TBT survey database, show that the impact on the intensive and extensive margins of developing country firms' exports depends on the types of standards adopted. The authors' results suggest, among other things, a positive correlation between quality standards and average trade volume and the number of export products and markets. Fontagné et al. (2015) study the effect of SPS concerns raised in WTO SPS committees on different components of trade, such as the probability of exporting and exiting the export market, exported value, and export prices. The authors find a negative effect of SPS concerns on exporters' participation in foreign markets imposing SPS measures and on export value and a positive effect on export prices. This negative effect is less significant for large firms. In the same vein, Fontagné and Orefice (2018) analyze the effect of TBT concerns on the export margins of heterogeneous French firms focusing on the export reorientation of multidestination exporters. The authors show that the effect of these measures on participation is amplified for multidestination firms. Fernandes et al. (2015) analyze the impact of importing countries' standards for agricultural and food products on business behavior and export values and quantities for the 2006-201 period. Their analysis differs from the majority of studies that use firm-level data in that they create indexes to quantify the absolute stringency of these standards and focus on differences in the rigor of standards between the importing country and exporting country. Overall, the authors find that the extensive and the intensive margins of exports are negatively impacted by the stringency of SPS measures.

The negative impact highlighted in the literature is explained by the fact that these measures entail fixed costs associated with adapting the product to these standards. Thus, to access markets, exporters have to bear these costs, which can discourage market entry. This effect is all the more important for developing countries with limited financial and technical means to adapt their production processes to comply with NTMs. The authors' argument for the positive impact is that these measures provide information about product quality and safety to consumers, which increases their confidence and demand for the product. The increase in demand and market share offsets the fixed costs of adapting and conforming products to standards. The trade performance of existing exporters may also improve because technical barriers to trade can discourage potential competitors from entering their markets or by driving marginal exporters out of the market (Bao and Chen, 2013). In addition, the impact of these measures can vary depending on the sector under consideration and the specificity of the measure. Sithamaparam and Devadason (2011) study the impact of NTMs on Malaysian exports to the main traditional markets of the European Union (EU), Japan and the Association of Southeast Asian Nations (ASEAN) for 2000-2013. Using a unidirectional gravity model, the authors show that NTMs have a negative impact on Malaysian exports of agricultural products and a positive impact on industrial products. Schlueter et al. (2009) analyze the trade effects of different SPS regulations in the meat sector. Data on regulations were grouped according to SPS areas and their policy objectives. The results show a positive effect of SPS on trade. At the disaggregated level of SPS measures, the authors find that disease prevention measures, tolerance limits for residues and contaminants, conformity assessment and information requirements promote trade while measures related to production process requirements and the handling of meat after slaughter restrict trade.

These studies show the effects of SPS and TBT measures on trade in agricultural and food products. However, similar to the agricultural sector, the forest-wood-paper sector is also subject to these measures that govern trade within it. Our study thus focuses on this sector, whose trade is developing at the same time as technical measures, and determines associated effects on trade, also according to the level of development of importers and exporters. SPS and TBT measures fall under two broad categories: technical regulations and conformity assessment procedures. Technical regulations are documents that define the characteristics of a product or production process. Conformity assessment procedures refer to procedures that aim to determine compliance with or the respect of these technical regulations. Given the specificities of these two broad categories of measures, we determine their distinct impacts on trade. Our study is related to that of Peci and Sanjuán (2020), who construct panel data and a regulatory intensity indicator through the UNCTAD Trains database to account for endogeneity problems present in cross-sectional analyses. To account for these technical measures in our analysis, we use country-level data and specific the UNCTAD Trains database, which is more comprehensive than the WTO Member States' notification database, and we construct an indicator for the number of measures applied to a specific product. Unlike the frequency and coverage indices, this indicator allows us to focus on regulatory intensity within the sector. We use a gravity model estimated with a pseudo-Poisson maximum likelihood (PPML) approach. To explain heterogeneous effects of the level of development of importers and exporters, we also calculate bilateral indicators of differences/similarities in regulatory models or structures between importing and exporting countries according to their levels of development.

3 Data

Our analysis involves determining the impact of SPS and TBT measures applied in the forest-wood-paper sector. Our data on these technical measures come from the TRAINS (Trade Analysis Information System) database of the United Nations Conference on Trade and Development (UNCTAD). The data are available in both searchable and research versions. In this study, we use the researcher database. This database provides information on NTMs imposed by countries and that are in force.

SPS and TBT measures can be imposed unilaterally on any partner or bilaterally on specific countries in rare and exceptional cases. For each type of measure, information is available on the country notifying the measure (importing country), the affected product (at the six-digit level of the tariff line of the Harmonized System classification), the affected partner country, and the nomenclature of the measure. Also included is information on the year of data collection, the number of separate measures imposed, the first year for which there is a measure on the product, and the last year for which a measure can be reported as not being enforced, if applicable. The Harmonized Commodity Description and Coding System or Harmonized System (HS), which came into effect in 1988, is an international nomenclature governed by the International Convention on the Harmonized Commodity Description and Coding System developed by the World Customs Organization. The purpose of this nomenclature is to classify products traded in international trade on a common basis among countries.

According to the Harmonized System classification, the forest-wood-paper sector mainly includes products from chapters (HS2) 44 to 49 and 94, and we consider these chapters as subsectors.[2] Chapters 44 to 46 refer to "wood, wood charcoal and articles of wood; cork and articles of cork; and articles of straw and plaiting materials"; Chapters 47 to 49 refer to "pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard; and paper and articles" and Chapter 94 refers to "furniture; medical and surgical furniture and bedding, mattresses, mattress supports, mattress supports, cushions, cushions and similar articles'.' Furniture and parts of furniture of wood are to be found mainly in headings 9401 (seats), 9403 (furniture) and 9404 (bedding) [3]. We consider data compiled of the SPS and TBT measures that apply to the products covered by these chapters and the headings above.[4] The TRAINS database has an advantage over the WTO notifications. The UNCTAD complements notifications from WTO member countries and uses an approach based on active data collection based on an independent review of legislation. This provides comprehensive information on the regulations in place at the time of collection (UNCTAD, 2018). However, the TRAINS database has some limitations. As the data included in this database provide information on measures that were in place at the time of data collection, we do not have information on measures that existed and were replaced prior to collection, which can make panel analyses difficult to implement. Adopting the same strategy as Peci and Sanjuán (2020), we use information on both the year for which there is a measure on the product and the last year for which a measure can be reported as unenforced to construct a panel database for the period of 2012-2015. These panel data therefore provide information about the measures in effect during this period. However, given the limitations of this database, it still only provides an approximation of time series (Peci and Sanjuán, 2020). To account for the number of measures, we calculate an indicator called "regulatory intensity" for the number of measures that affect a given imported product. Based on the number of measures provided in the Trains database and taking into account bilateral and unilateral measures, we calculate the number of measures imposed by an importer on an exporter for each year of the 2012-2015 period.[5]

UNCTAD's classification is structured in chapters including the letters A to P. Chapters

[2]The Harmonized System has been updated several times and most recently on January 1, 2017.

[3]In chapter 94, we consider only wood furniture and parts of wood furniture.

[4]In the database, the year of data collection for NTMs in several countries is between 2012 and 2016 inclusive. The European Union is considered a single country. In our analysis, we do not consider the European Union as a single region. We consider each member separately and replicate this information aggregated for each member. Similar to Disdier et al. (2008), we exclude intra-EU trade flows from our sample, as EU member states apply the principle of mutual recognition to SPS and TBT regulations.

[5]We do not take into account, for each year considered, measures that may be reported as not being implemented in these years.

A and B group SPS measures (A) and TBTs (B). These measures are grouped into two main categories: technical regulations and conformity assessment procedures classified in different sections. For SPS and TBT measures, technical regulations are the most used by importing countries.[6] For SPS measures, the most common technical regulations are in the form of "Special authorization, registration requirements for importers, packaging requirements, hygienic requirements, storage and transport conditions'.' The regulation related to treatment for the elimination of plant and animal pests mainly affects subsector 44: "Wood and articles of wood and wood charcoal ". Indeed, round wood presents more risks than processed wood. Logs may contain pests that can spread from one country to another through trade. To prevent the spread of these pests, specific wood treatments, such as heat treatment, are necessary and imposed by countries.

For TBT measures, these most widespread technical regulations take the form of " Tolerance limits for residues or contamination, labelling, marking, packaging requirements, product quality or performance requirements'.' Regarding conformity assessment procedures, the most common procedures affecting wood products are: "Product registration, testing, certification, inspection and traceability information requirements'.'

Furthermore, we analyze which subsectors (HS2) are most affected by these technical measures by distinguishing between technical regulations and conformity assessment procedures (SPS and TBT measures). We merge at the six-digit level of the tariff line the technical measures data with trade data. Our import data are from the United Nations International Trade Statistics Database (COMTRADE). Our sample includes 7 subsectors (HS2). We calculate the coverage ratio, which is the ratio of affected imports over potentially affected imports (Disdier et al., 2008). The above authors define potentially affected imports as the value of global imports at the six-digit HS level, which groups tariff lines on which measures have been taken, and affected imports as the value of global imports (in affected products) by countries adopting these measures.

The results are reported in Table A2 and Table A3 of the Appendix. These tables show for each subsector the affected imports, potentially affected imports and coverage ratio. With respect to SPS measures, subsectors HS44 and HS46 are the most affected with a larger share of technical regulations. Subsectors HS48, HS49 and HS94 are the least affected. Similarly, for TBT measures, subsectors HS44, HS47 and HS94 are the most affected. Subsector HS49 is the least affected by these TBT measures. It should be noted that subsector HS44 is equally affected by SPS and TBT measures, with a slight predominance found for TBT measures. The wood furniture and furniture parts subsector (HS94) is largely more affected by TBT measures. In addition, SPS measures are more widely used in subsectors upstream of the whole sector, such as raw wood, log, particle and TBT measures of the subsectors that constitute the paper industry. In fact, raw and minimally processed products present a greater risk of containing harmful organisms that can pose risks to plant preservation and human and animal health. Products of second transformation, including paper, cardboard, and furniture, are more governed by rules of safety and quality.

[6] SPS measures classified under sections A1-A6 are technical regulations, and section A8 includes conformity-assessment procedures related to these regulations. TBT measures classified under sections B2-B7 are technical regulations, and section B8 includes conformity-assessment procedures related to these regulations. Those under section B1 must result from the enforcement of both types of measures.

4 Model

The impact of SPS and TBT measures in the forest-wood-paper sector is estimated using a gravity model. This model is used to predict the volume of trade between countries based on the sizes of the countries and the distances between them. Studies by Anderson (1979); Bergstrand (1985); Anderson and Van Wincoop (2003) have provided theoretical justifications for this model. Anderson (1979) bases his approach on Armington's hypothesis of product differentiation by origin. Bergstrand (1985) shows that the gravity model can be applied to the monopolistic competition model introduced by (Krugman, 1980) in which consumers have a preference for variety.

Following Arita et al. (2015); Fassarella et al. (2011), our theoretical foundation is based on the constant elasticity of substitution (CES) model developed by Anderson and Van Wincoop (2003, 2004). According to Anderson and Van Wincoop (2004), exports from country i to country j related to sector k are expressed as follows:

$$X_{ij}^{k} = \frac{Y_i^k E_j^k}{Y^k}\left(\frac{t_{ij}^k}{P_j^k \prod_i^k}\right)^{1-\sigma_k} \tag{1}$$

where X_{ij}^k represents exports from country i to country j of products k, Y_i^k is the production of country i, and Y^k is global production in sector k. E_j^k represents the expenditure of country j on k products, t_{ij}^k is the trade cost, and σ_k is the elasticity of substitution. P_j^k and $\prod_i^k$ represent price indexes that capture the multilateral resistance term. The term "multilateral resistance" highlights the importance of trade costs not only between the two countries (importer and exporter) but also with other partners. This term is unobservable and can be controlled either by proxies known as "remoteness indexes" such as GDP-weighted distance averages or by country, sector and time fixed effects. These fixed effects control specific characteristics that may affect trade. Our estimated equation is as follows:

$$\begin{aligned} X_{ijt}^{k} = exp[&\alpha_i + \alpha_j + \alpha_k + \alpha_t + \beta_1(\text{SPS/TBT})_{ij(t-1)}^k + \beta_2 ln(d_{ij}) + \beta_3 ln(1 + tariff_{ijt}^k) \\ &+\beta_4 contig_{ij} + \beta_5 comlang_{ij} + \beta_6 colony_{ij} + \beta_7 RTA_{ijt} + \beta_8 ln(GDP_{it} \times GDP_{jt}) + \varepsilon_{ijt}^k] \end{aligned} \tag{2}$$

where X_{ijt}^k denotes imports of country j from country i for products k (six-digit level of the HS) and at time t, $(\text{SPS/TBT})_{ij(t-1)}^k$ is the regulatory intensity level, which is the number of measures (technical regulations or conformity assessment procedures) that affect product k imposed by country j on country i. We consider both unilaterally and bilaterally imposed measures. We use the lag of this measure (one year before t). NTMs can be influenced by imports to the extent that an importing country may decide to impose more technical measures to restrict exports from a specific exporter or sector. This endogeneity problem (reverse causality) can be partially solved by using the lag of our variable of interest. [7]

Control variables include d_{ij} the geographic distance between capitals; dummy variables that indicate whether countries are contiguous ($contig_{ij}$), and share an official language ($comlang_{ij}$), have colonial ties ($colony_{ij}$) and the log of the product of GDPSs of im-

[7]We lose one year of data given the lagged structure of our regulatory intensity variable.

porter j and exporter i ($ln(GDP_{it} \times GDP_{jt})$)[8]. These control data come from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) database. Control variable RTA_{ijt} is a binary variable that indicates whether countries i and j have signed a regional trade agreement and is obtained from Egger and Larch (2008)[9]. We include in our specification the bilateral applied tariff on k products (six-digit level of the HS) ($tariff_{ijt}^{k}$) to distinguish its impact from that SPS and TBT measures. Tariff data are derived from World Integrated Trade Solution (WITS) data provided by the Integrated Database (IDB-WTO) and TRAINS [10]. $\alpha_i + \alpha_j + \alpha_k + \alpha_t$ are exporter, importer, product and time fixed effects. Peci and Sanjuán (2020); Bao and Qiu (2012) also use a set of fixed effects (importer, exporter, and time) without interacting them to account for multilateral resistance. In our specification, we do not interact the importer (exporter) dummies with the product and time dummies. Technical measures are mainly measures applied without targeting a particular country, except in exceptional cases. Although we consider measures applied bilaterally in our database, technical measures are mainly unilateral. Thus, the inclusion of these fixed effects would absorb all the variation within these technical measures needed to estimate the effect and could lead to biased estimates. These fixed effects control the heterogeneity of countries (size effects) and the factors that have an impact on trade. ε_{ijt}^{k} is an error term.

We use the Poisson pseudo maximum likelihood (PPML) estimator recommended by Silva and Tenreyro (2006) to take into account zero trade flows between countries and the selection bias of the sample and to correct for biases that may result from heteroscedasticity problems. Another approach is to use the Heckman selection model (Heckman, 1979). In contrast to the PPML method, the Heckman model allows more focus on the selection issue. However, as pointed out by (Fiankor et al., 2020; Ferro et al., 2015), this model suffers from limitations such as nonrobust results with respect to heteroskedastic errors and misspecification and incidental parameter problems of the first-stage probit equation in panel data configurations. Therefore, we prefer the PPML method.

5 Results

5.1 Baseline Results

The baseline results are shown in Table 1.The set of these estimates includes all control variables, such as the log of distance, the log of (1+tariff), contiguity, common language, colony ties, regional trade agreements (RTAs) and the log of the GDP of importers and exporters. In general, these variables have the expected signs and are in line with the literature.

We observe that distance and bilateral tariffs have a negative impact on trade. Contiguity and economic size (GDP) favor trade. We find that the variables for a common language and colony ties have a positive sign but are not significant. The RTA variable has the expected sign but is not significant. For SPS and TBT measures, the estimated coeffi-

[8]The bilateral GDP product reduces multicollinearity with fixed effects and problems of identifying income elasticities. (Silva and Tenreyro, 2006; Peci and Sanjuán, 2020)

[9]These data are available at https://www.ewf.uni-bayreuth.de/en/research/RTA-data/index.html

[10]These data are calculated as simple tariff line averages and incorporate ad valorem equivalents of nonad valorem rates

Table 1: The impact of SPS and TBT measures on Trade in the Forest-Wood-Paper sector

Dependent variable: imports	**PPML Estimates**			
	(1)	(2)	(3)	(4)
SPS_ Technical Regulations	-0.0236			
	(0.0693)			
TBT_Technical Regulations		0.144***		
		(0.0267)		
SPS_Conformity Assessments			0.0957***	
			(0.0371)	
TBT_Conformity Assessments				0.195***
				(0.0195)
lndist	-0.390***	-0.389***	-0.388***	-0.398***
	(0.0424)	(0.0430)	(0.0425)	(0.0415)
ln(1+tariff)	-0.280***	-0.265***	-0.270***	-0.190***
	(0.0363)	(0.0358)	(0.0373)	(0.0372)
Contiguity	0.768***	0.770***	0.771***	0.763***
	(0.107)	(0.107)	(0.107)	(0.103)
Common language	0.0243	0.0280	0.0274	0.0320
	(0.0905)	(0.0904)	(0.0904)	(0.0901)
Colony ties	0.104	0.108	0.104	0.105
	(0.111)	(0.111)	(0.111)	(0.108)
RTA	0.0199	0.0331	0.0263	0.0595
	(0.0901)	(0.0892)	(0.0901)	(0.0892)
GDP	0.0402***	0.0403***	0.0406***	0.0434***
	(0.00644)	(0.00643)	(0.00645)	(0.00626)
Nbr of Observations	530,549	530,549	530,549	530,549

Note: Robust standard errors in parentheses clustered by country-pair-product.
*** p<0.01, ** p<0.05, * p<0.1. All Columns include importer, exporter, product and time fixed effects. The Stata package ppmlhdfe is used for the estimations (Correia et al., 2019). Singletons observations are dropped iteratively until no more singletons are found. Therefore, There may be a difference in the number of observations between estimates. Keeping groups of singletons in multilevel regressions with fixed effects, where fixed effects are nested in groups could lead to incorrect inferences (Correia, 2015).

cients on SPS and TBT conformity assessment procedures are positive and significant. The estimated coefficient on TBT technical regulations is positive and significant and that on SPS technical regulations is negative and insignificant. These results suggest that trade flows increase in the presence of SPS and TBT conformity assessment procedures and TBT technical regulations. The positive impact of TBT and SPS measures on trade has also been demonstrated in the literature on other sectors. For example, Bao and Qiu (2012) find a positive impact of TBT measures on the value of trade flows. The positive impact of these measures on trade in the forest-wood-paper sector that we find can be explained by the fact that these measures provide consumers with information on the quality and safety of wood products, which will help increase their demand. This is even more apparent given that raw wood and wood products can contain harmful organisms. Consumers, especially of products upstream of the sector such as logs, sawn timber, and wood panels will be more vigilant and will be interested in products with quality characteristics; meeting safety, sanitary and phytosanitary standards and coming from sustainably managed forests. Conformity assessment procedures, although costly for exporters, and TBT technical regulations that focus more on the quality and safety characteristics of products inform consumers that products comply with safety and quality regulations and are safe. This increases their demand for these compliant products, thereby offsetting the costs associated with product adaptation.

5.2 Robustness

In this section, we perform robustness analyses of our results. First, we include country pair fixed effects in our model. As emphasized in the literature (Yotov et al., 2016; Egger and Nigai, 2015), these fixed effects are used to control for the endogeneity of trade policies due to reverse causality bias, which is already accounted for by the lag of our variables of interest and the bias of omitted variables such as trade costs. The results are reported in Table 2.

Table 2: The impact of SPS and TBT measures on trade in the Forest-Wood-Paper sector

Dependent variable: imports	**PPML Estimates**			
	(1)	(2)	(3)	(4)
SPS_ Technical Regulations	-0.0154			
	(0.0743)			
TBT_Technical Regulations		0.139***		
		(0.0263)		
SPS_conformity assessments			0.0964***	
			(0.0374)	
TBT_conformity assessments				0.197***
				(0.0205)
ln(1+tariff)	-0.230***	-0.214***	-0.221***	-0.121***
	(0.0395)	(0.0392)	(0.0401)	(0.0375)
RTA	-0.00811	-0.0124	-0.0115	-0.0802
	(0.0500)	(0.0503)	(0.0496)	(0.0576)
GDP	0.0127***	0.0132***	0.0129***	0.0134***
	(0.00189)	(0.00190)	(0.00187)	(0.00183)
Nbr of Observations	529,528	529,528	529,528	529,528

Note: Robust standard errors in parentheses clustered by country-pair-product.
*** p<0.01, ** p<0.05, * p<0.1. All Columns include importer-exporter, product and time fixed effects. These country pair fixed effects will absorb all bilateral time-invariant variables. We include only control variables in our estimates: RTA, GDP and log of (1+tariff). The Stata package ppmlhdfe is used for the estimations (Correia et al., 2019). Singletons observations are dropped iteratively until no more singletons are found. Therefore, There may be a difference in the number of observations between estimates. Keeping groups of singletons in multilevel regressions with fixed effects, where fixed effects are nested in groups could lead to incorrect inferences (Correia, 2015).

We note that bilateral tariffs, as in our baseline results, decrease trade. The GDP variable is significant with a positive sign. The RTA variable is not significant but has a negative sign, as in the study of Peci and Sanjuán (2020). The estimated coefficients on SPS and TBT conformity assessment procedures and on TBT technical regulations are positive and significant. The coefficient for SPS technical regulations is negative and insignificant. In general, the results of this analysis are consistent with our baseline results, and the magnitudes of the coefficients are slightly lower than those reported in Table 1.

Furthermore, we do not include importer- and exporter-product-time fixed effects in our estimates because SPS and TBT measures do not target specific partners but affect all partners. However, we consider both bilaterally and unilaterally imposed measures in our estimates. These measures are mostly imposed unilaterally. Therefore, these fixed effects, especially importer-product-time fixed effects, would absorb all variation needed to estimate the effect. Yotov et al. (2016); Heid et al. (2017) point out that estimates of structural gravity should be made using data that include international and intranational trade flows (domestic trade flows). This ensures consistency with gravity theory and makes it possible to identify the effects of bilateral trade policies in a theoretically coherent manner. Intranational trade flows are calculated as the difference between gross production data value and total exports. In our analysis, we cannot include these data in our estimates due to the unavailability of these data for the majority of countries and for all products at the six-digit level of the Harmonized System. In addition, the aggregate data available for some countries on the production of wood and wood products do not fully correspond to the classification of products considered in our study, and their use could lead to inconsistent and biased results.[11] Another alternative approach is to estimate the impact of these measures in two steps. We apply the same approach as Kinzius et al. (2019). This two-step procedure proceeds as follows: In the first stage, using the PPML estimator, we estimate our model with importer-product-time, exporter-product-time and importer-exporter fixed effects and the set of control variables: RTA, the log of (1+tariff) without our variable of interest (SPS and TBT measures). In the second stage, using the OLS estimator, the importer-product-time fixed effects predicted in the first stage are regressed on the SPS and TBT measures. The aim is to analyze the impact of these technical measures on the importer's market access.[12] In this second estimate, we include importer-time fixed effects. Kinzius et al. (2019) also point out a disadvantage of using the two-step procedure. Based on the study by Fally (2015), the authors note that "the estimated importer product (time) can be represented as a function of the power transformation of the corresponding inward multilateral resistance and national expenditures if a gravity equation is estimated using the PPML. Thus, in combination, the importer-product (time) inward multilateral resistance and importer-product (time) expenditure will explain 100 percent of the importer-product (time) fixed effects in the second step OLS estimate." We still use this method as part of a sensitivity analysis to confirm the robustness of our results. The results of this two-step procedure are presented Table 3.

[11]We turned to the new International Trade and Production Database for estimation (ITPD-E), which provides information on domestic and international trade flows. However, the amount of missing domestic flow data for the countries and sectors included in our sample over the period considered is too large to use these data.

[12]The second stage estimation equation is as follows: $\hat{\tau}^k_{jt} = b\text{SPS/TBT}^k_{jt} + c_{jt} + (\phi^k_{jt} + \vartheta^k_{jt})$ and ϑ^k_{jt} are the error terms of the first stage, which are included in the estimate of the second stage. We cluster by country-pair-product to take into account the potential heteroskedasticity of the error term of the second stage (Head and Mayer, 2014; Kinzius et al., 2019).

Table 3: The impact of SPS and TBT measures on trade in the Forest-Wood-Paper sector

	First Stage (PPML)	**Second stage (OLS)**			
	(1)	(1)	(2)	(3)	(4)
ln(1+tariff)	-0.0655**				
	(0.0259)				
RTA	0.0232				
	(0.0269)				
SPS_ Technical Regulations		-0.0369			
		(0.0292)			
TBT_Technical Regulations			0.135***		
			(0.0223)		
SPS_Conformity Assessments				0.0103	
				(0.0351)	
TBT_Conformity Assessments					0.123***
					(0.0350)
Nbr of Observations	509,468	509,468	509,468	509,468	509,468

Note: Robust standard errors in parentheses clustered by country-pair-product (column(1)) and importer-product (column(2)). *** p<0.01, ** p<0.05, * p<0.1. Column (1) includes exporter-product-time, importer-product-time , importer-exporter fixed effects. Column (2) includes importer-time fixed effects. The GDP variable is not included in the first stage because it is collinear with the fixed effects. We use command PPMLHDFE (Correia et al., 2019) and REGHDFE (Correia, 2019) in stata. Dependent variable: Imports (column (1)) and importer-product-time fixed effects ((column(2)). we are cautious about including fixed effects in the second stage because, as Ferrantino (2006) pointed out, fixed effects can obscure the information about NTMs that the analysis attempts to infer. Singletons observations are dropped iteratively until no more singletons are found. Therefore, There may be a difference in the number of observations between estimates. Keeping groups of singletons in multilevel regressions with fixed effects, where fixed effects are nested in groups could lead to incorrect inferences (Correia, 2015).

In the first stage, we observe that bilateral tariffs have a negative impact on trade. The coefficient on the RTA variable is positive and insignificant. In the second stage, we find that the estimated coefficients on technical regulations and SPS conformity assessment procedures have the same sign as in our baseline results but are not significant. Those on TBT measures are positive and significant, but of a smaller magnitude. The low magnitude of the coefficients and the non-significance of the coefficient for SPS measures which could be explained by the drawback pointed out by Kinzius et al. (2019). On average, TBT measures promote importer-product market access. In view of these results, we can attest that these robustness analyses confirm our results presented in Table 1. In the rest of our analysis, we include in the etimations the country-pair fixed effects instead of the bilateral invariant variables.

5.3 Heterogeneity

In this section, we first test the heterogeneous effects of SPS and TBT measures on trade as a function of countries' levels of development. Then we determine their effects in each subsector of the forest-wood-paper sector. As noted in the literature, countries at different levels of development may have different SPS and TBT measures, and their trade may be affected differently. To test this hypothesis, we apply the same methodology as Bao and Qiu (2012). We create an interaction variable between our variable of interest and a dummy variable that takes a value of 1 when the importing country is a developed country and 0 otherwise. We include this interaction variable in our model, and the coefficient of this variable enables us to test whether the effects of SPS and TBT measures imposed by developed and developing countries are significantly different. Similarly, we divide all exporting countries into developed and developing countries and estimate our model with the interaction variable for each exporter group.

The results for developed exporting countries are presented in columns (1)-(4) of Table 4, and those for developing exporting countries are presented in columns (5)-(8) of Table 4.[13] First, when we focus on developed exporting countries, we find that SPS and TBT conformity assessment procedures and TBT technical regulations are trade enhancing. The estimated coefficient of SPS technical regulations is not significant. The impact of measures imposed by developed and developing countries is similar (interaction terms are not statistically significant in columns (1)-(4))

For exporters in developing countries, the impact of measures imposed by developed and developing countries on trade varies. SPS and TBT technical regulations imposed by developing countries have no significant impact on trade. The estimated coefficient on SPS technical regulations is positive and insignificant (column (5)) and that on TBT technical regulations is negative and insignificant (column (6)). In contrast, the interaction terms are significant and are negative in column (5) and positive in column (6). On the one hand, this result suggests that SPS technical regulations imposed by developed countries tend to inhibit trade with exporters in developing countries. On the other hand, TBT technical regulations imposed by developed countries are more conducive to trade. In addition, conformity assessment procedures imposed by developing countries promote trade (columns (7)-(8)). However, these measures tend to be trade restrictive when imposed by developed countries. The coefficients of the interaction terms are negative and significant.

In summary, it should be noted that when we do not distinguish between the level of development of importing countries (which impose the technical measures), the trade-enhancing effect of SPS and TBT conformity assessment procedures and TBT technical regulations is weaker for exporters in developing countries than for those in developed countries (Table B5).When we distinguish the levels of development of countries implementing these technical measures, we find that SPS and TBT conformity assessment procedures and TBT technical regulations have the effect of increasing trade with developed country exporters regardless of the development levels of the countries imposing them.

[13]The classification into developed and developing countries is based on the UNCTAD country classification. The dummy variable is omitted in our estimations because it is collinear with the fixed effects. We estimate our model with the interaction variable on all exporters and without the interaction variable for each group of exporters. The results are presented in Table B5 and Table B6 of the Appendix. The results presented in Table B6 show that SPS and TBT conformity assessment procedures and TBT technical regulations increase trade flows for all exporters. However, the positive impact of TBT conformity assessment procedures is less significant when these measures are imposed by developed countries, and SPS conformity assessment procedures imposed by developed countries hinder trade. We also find from Table B5 that SPS and TBT conformity assessment procedures and TBT technical regulations promote trade (as in our baseline result) for both developed and developing country exporters. SPS technical regulations reduce exports from developing countries. The trade-enhancing effect is weaker for developing country exporters.

Table 4: The impact of SPS and TBT measures on trade in the Forest-Wood-Paper sector by country groups

Dependent variable: imports	PPML Estimates							
	Developed	Developed	Developed	Developed	Developing	Developing	Developing	Developing
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SPS_ Technical Regulations	0.0548				0.0855			
	(0.0580)				(0.0525)			
TBT_Technical Regulations		0.166***				-0.00526		
		(0.0465)				(0.0373)		
SPS_Conformity Assessments			0.123**				0.105**	
			(0.0488)				(0.0461)	
TBT_Conformity Assessments				0.197***				0.200***
				(0.0250)				(0.0366)
SPS_Technical Regulations*imp_devped	-0.0201				-0.347***			
	(0.0792)				(0.0858)			
TBT_Technical Regulations*imp_devped		-0.0527				0.183***		
		(0.0606)				(0.0613)		
SPS_Conformity Assessments*imp_devped			-0.0669				-0.851***	
			(0.0779)				(0.152)	
TBT_Conformity Assessments*imp_devped				0.0203				-0.235***
				(0.0791)				(0.0746)
ln(1+tariff)	-0.435***	-0.406***	-0.416***	-0.238***	-0.0654	-0.0629	-0.0642	-0.0240
	(0.0510)	(0.0508)	(0.0507)	(0.0473)	(0.0472)	(0.0485)	(0.0492)	(0.0479)
RTA	0.00521	-0.00654	0.00751	0.0410	-0.0472	-0.0522	-0.0149	-0.0325
	(0.0865)	(0.0884)	(0.0868)	(0.0839)	(0.0716)	(0.0710)	(0.0751)	(0.0762)
GDP	0.0112***	0.0118***	0.0114***	0.0131***	0.00798**	0.00696*	0.00803**	0.00757**
	(0.00212)	(0.00217)	(0.00212)	(0.00221)	(0.00351)	(0.00388)	(0.00339)	(0.00374)
Nbr of Observations	266,843	266,843	266,843	266,843	262,685	262,685	262,685	262,685

Note: Robust standard errors in parentheses clustered by country-pair-product.
*** p<0.01, ** p<0.05, * p<0.1. All Columns include importer-exporter, product and time fixed effects. Columns (1)-(4): Exporters-developed, Columns (5)-(8): Exporters-developing. The Stata package ppmlhdfe is used for the estimations (Correia et al., 2019). Singletons observations are dropped iteratively until no more singletons are found. Therefore, There may be a difference in the number of observations between estimates. Keeping groups of singletons in multilevel regressions with fixed effects, where fixed effects are nested in groups could lead to incorrect inferences (Correia, 2015).

In contrast, SPS and TBT technical regulations imposed by developing countries do not have a significant impact on imports from developing countries, while SPS and TBT conformity assessment procedures contribute to increasing them. SPS and TBT conformity assessment procedures and SPS technical regulations imposed by developed countries tend to restrict trade with developing country exporters, while TBT technical regulations tend to enhance trade. In other words, the effect of these measures on trade is more favorable to exporters in developed countries. This may be because developing countries have limited technical capacity and resources to comply with the measures imposed, which results in significant costs. In addition, developing countries' technical measures may be weaker than those of developed countries, which would require the mobilization of greater resources for compliance. For example, Bao and Qiu (2012) have pointed out that TBTs increase the costs of exporters in developing countries more than those in developed countries. The authors also point out that technical standards in developing countries are lower than those in developed countries. Thus, the cost of product compliance is higher for these countries.

To highlight differences or similarities in terms of technical measures imposed by developed and developing countries to support our results, we calculate bilateral indicators. We rely on the studies of (UNCTAD, 2017; Sanjuán López et al., 2018; Cadot et al., 2015, 2018). The indicators include the regulatory intensity gap (RIG), similarity index (SI) and regulatory overlap (RO).

The regulatory intensity gap is the difference in regulatory intensity (the number of measures applied) between the importer and exporter. The similarity index measures the proportion of technical measures shared by the importer and exporter. Regulatory overlap measures the proportion of technical measures applied by the importer that are also applied by the exporter.

Sanjuán López et al. (2018) emphasize that the regulatory overlap and similarity index are different in that the regulatory overlap looks determines the types of measures imposed by the importer and then whether those measures are applied by the exporter.[14]

These indicators are averaged over the six-digit HS products, the three years considered, and the importers and exporters in our sample. These indicators will highlight regulatory

[14]We apply the same calculation methods as (Sanjuán López et al., 2018) with a few differences. For example, we distinguish between SPS and TBT technical regulations and conformity assessment procedures. The regulatory intensity gap is calculated as $RIG_{ij}^{k} = \frac{1}{M} \sum_{m=1}^{M} RI_{j}^{k,m} - RI_{i}^{k,m}$. $RI_{j}^{k,m}$ is the number of technical measures applied by importer j for each product k, $RI_{i}^{k,m}$ is the number of technical measures applied by exporter i for each product k, and M is the total number of types of technical measures of the different SPS and TBT categories (technical regulations and conformity assessment procedures). If RIG is negative, exporter i imposes more measures than importer j on average in all categories and inversely.

The similarity index is calculated as follows: $SI_{ij}^{k} = 1 - \frac{1}{M} \sum_{m=1}^{M} |d_{j}^{k,m} - id_{i}^{k,m}|$. $d_{j}^{k,m}$ is a dummy variable that takes a value of 1 when importer j applies at least one technical measure to product k and 0 otherwise. $id_{i}^{k,m}$ captures the presence of technical measures in product k applied by exporter i. Vertical lines signify the absolute value. If the regulatory structure between the two countries is similar, the SI indicator is close to 1 and is close to 0 if the structure is different.

The regulatory overlap is calculated as $RO_{ij}^{k} = \frac{\sum_{m=1}^{M} d_{j}^{k,m} \times id_{i}^{k,m}}{\sum_{m=1}^{M^{j}} d_{j}^{k,m}}$. The sum of the numerator is the number of technical measures that the importer and exporter share in the different SPS and TBT categories. The denominator is the number of technical measures applied by importer j for product k. The regulatory overlap is equal to 0 when there is no overlap and 1 when there is regulatory overlap. the RO value is replaced with 1 when no nontariff measures are imposed by the importer (Sanjuán López et al., 2018; UNCTAD, 2017).

differences or similarities between developed and developing importing countries and developed and developing exporting countries. For exporters, we consider the technical measures related to imports adopted in these countries. Given WTO principles of nondiscrimination between domestic and foreign products, most measures applied as import-related non-tariff measures (NTMs) should also be applied domestically for domestic producers (UNCTAD, 2017). Thus, it can be assumed that if importing and exporting countries have similar regulatory models or structures, it will be easier for the exporter to comply with measures imposed by the importing countries to which it exports.

The results are reported in Table 5 and Table 6. In Table 5, columns (1)-(4) show the results for developed importing and exporting countries, and columns (5)-(8) show the results for developed importing countries and developing exporting countries. In Table 6, columns (1)-(4) show the results for developing importing countries and developed exporting countries, and columns (5)-(8) show the results for developing importing and exporting countries.

Table 5: Bilateral Indicators by Country groups (importers-developed)

	Developed	Developed	Developed	Developed	Developing	Developing	Developing	Developing
				Regulatory Intensity Gap				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SPS_ Technical Regulations	0.022				0.190			
TBT_Technical Regulations		0.100				0.679		
SPS_conformity assessments			0.049				-0.146	
TBT_conformity assessments				0.076				0.454
				Similarity Index				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SPS_ Technical Regulations	97%				98%			
TBT_Technical Regulations		94%				94%		
SPS_conformity assessments			98%				97%	
TBT_conformity assessments				93%				93%
				Regulatory Overlap				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SPS_ Technical Regulations	76%				72%			
TBT_Technical Regulations		55%				53%		
SPS_conformity assessments			92%				94%	
TBT_conformity assessments				59%				51%

Columns (1)-(4): Developed exporting countries, columns (5)-(8) Developing exporting countries

Regarding the regulatory intensity gap, when we focus on developed exporting countries, we find that the RIG value is positive and low for all categories of SPS and TBT technical measures in Table 5. In other words, on average, developed importing countries apply more measures than developed exporting countries, but the gap remains small. In Table 6, the RIG value is negative; on average, developing importing countries apply fewer measures than developed exporting countries except for SPS conformity assessment procedures. The gap in regulatory intensity is larger between these two types of partners.

For developing exporting and developed importing countries, the regulatory intensity gap is on average larger and positive, except for SPS conformity assessment procedures (Table 5). For the latter, developed importing countries on average adopt fewer measures than

Table 6: Bilateral Indicators by Country groups (importers-developing)

	Developed	Developed	Developed	Developed	Developing	Developing	Developing	Developing
	Regulatory Intensity Gap							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SPS_ Technical Regulations	-0.209				0.020			
TBT_Technical Regulations		-0.565				0.051		
SPS_conformity assessments			0.157				0.0100	
TBT_conformity assessments				-0.635				-0.032
	Similarity Index							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SPS_ Technical Regulations	98%				98%			
TBT_Technical Regulations		93%				97%		
SPS_conformity assessments			97%				96%	
TBT_conformity assessments				93%				96%
	Regulatory Overlap							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SPS_ Technical Regulations	90%				89%			
TBT_Technical Regulations		91%				91%		
SPS_conformity assessments			90%				90%	
TBT_conformity assessments				90%				90%

Columns (1)-(4): Developed exporting countries, columns (5)-(8) Developing exporting countries

developing exporting countries on their imports. For developing exporting and importing countries, the regulatory intensity gap is on average very small and positive, except for TBT conformity assessment procedures (Table 6). These results show that the regulatory intensity gap is larger between developed importing and developing exporting countries and between developing importing and developed exporting countries. On average, the regulatory intensity of developing countries is lower than that of developed countries. This may partly explain our results; on average, developing importing and developing exporting countries have similar regulatory intensities, while developed countries have higher regulatory intensities. The cost of adapting products to the technical measures imposed by developed countries will be higher and will require a significant mobilization of financial and technical resources for developing countries with limited means to comply. Thus, these developed country measures will have a more trade-restrictive impact on developing country exporters than those of developing countries, which will be more favorable. However, regulatory intensity is only one factor, among others, that can explain our results. As we can see, for SPS conformity assessment procedures, developed importing countries adopt fewer measures on average than developing exporting countries, but these are not very favorable to trade between these types of partners. Thus, we believe that this may be explained by other factors, such as regulatory characteristics and access to technical and financial means to comply.

The results of the similarity index and regulatory overlap are expressed as percentages (multiplied by 100). The similarity index highlights the regulatory patterns between importers and exporters. We find that, on average, regulatory patterns are similar between importers and exporters. The SI value is close to 100 percent for all categories of technical measures. Regulatory overlap highlights the proportion of measures applied by importers that are also applied by exporters. The measure expresses, among other things, the share of the importer's NTMs that the exporter already deals with at the domestic level. It can therefore be assumed that the greater the share of the importer's measures also applied by the exporter is, the easier it will be for the exporter to comply with the importer's measures. We find that for SPS and TBT technical regulations and TBT conformity assessment procedures, regulatory overlap is on average slightly higher between developed importing and exporting countries. For SPS conformity assessment procedures, regulatory overlap is slightly higher between developed importing countries and developing exporting countries (Table 5).Regulatory overlap is also high between developing importing countries and developed and developing exporting countries. Understandably, the coincidence of measures applied by developing importing countries that are also applied by developed exporting countries is important. However, the reverse (developed importing countries/developing exporting countries) is not obvious, as developing countries apply international standards, while developed countries with more technical resources can, in addition to international standards, apply more restrictive measures on the basis of risk justification. We see an average overlap of over 50 percent.

Overall, we find that on average, the difference in regulatory intensity is greater between developed and developing countries. There is little difference in the similarities of regulatory models between them. Regulatory overlap is slightly lower between developed importing countries and developing exporting countries. These results suggest that on average, it will take more effort (technical and financial) for developing country exporters than for developed country exporters to comply with the technical standards imposed by developed countries, which have higher regulatory intensity than they do. However, it should be noted that these indicators are approximations of similarities or differences in regulatory structures or patterns. For example, regulatory overlap refers to measures applied by the importer but also by the exporter. However, in reality, these measures applied by partners may be the same, but their application may be completely different from one country to another. Since the regulatory process is complex and involves a variety of factors that are not easily understood, further analysis, including a survey, will be useful in this context.

Now determine what effects the SPS and TBT measures have on trade in each subsector of the forest-wood-paper sector. To do this, we estimate our equation with country-pair fixed effects for each subsector at the HS2 level separately. This has the advantage of allowing the estimation of the coefficients of all other explanatory variables that differ across subsectors. The results are presented in Table 7. For the HS44 subsector, we find a positive effect of SPS and TBT conformity assessment procedures on trade. For HS45 and HS94 subsectors, a negative effect of SPS measures (technical regulations and conformity assessment procedures) on trade. For subsector HS46, SPS conformity assessment procedures have a negative effect on trade, while SPS technical regulations and TBT measures have a positive effect on trade. For HS47 and HS49 subsectors, SPS and TBT measures (technical regulations and conformity assessment procedures) have a positive effect on trade. TBT technical regulations have a positive effect and SPS conformity assessment procedures a negative effect on trade in the HS48 subsector.

Table 7: The impact of SPS and TBT measures on trade in the Forest-Wood-Paper sector by subsector, HS2

Dependent variable: imports	**PPML Estimates**			
	(1)	(2)	(3)	(4)
	SPS_ Technical Regulations	TBT_Technical Regulations	SPS_Conformity Assessments	TBT_Conformity Assessments
HS44: "Wood and articles of wood; wood charcoal"	0.0249	0.00145	0.125**	0.268***
	(0.0785)	(0.0617)	(0.0546)	(0.0417)
HS45: "Cork and articles of cork"	-0.446**	-0.319	-0.449*	0.0330
	(0.205)	(0.293)	(0.249)	(0.0718)
HS46: "Manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork"	0.213*	0.334*	-0.0523*	0.208*
	(0.116)	(0.184)	(0.0285)	(0.109)
HS47: "Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard"	0.982**	0.301***	0.484**	0.210***
	(0.399)	(0.103)	(0.196)	(0.0599)
HS48: "Paper and paperboard; articles of paper pulp, of paper or of paperboard"	-0.0136	0.0831***	-0.147**	0.0786
	(0.0635)	(0.0313)	(0.0695)	(0.0483)
HS49: "Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans"	0.843***	0.153***	0.426***	0.230**
	(0.219)	(0.0390)	(0.111)	(0.106)
HS94: "Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated name-plates and the like; prefabricated buildings"	-0.132***	0.0292	-0.0454***	-0.155
	(0.0384)	(0.0577)	(0.0126)	(0.0971)

Note: Robust standard errors in parentheses clustered by country-pair-product.
*** p<0.01, ** p<0.05, * p<0.1. All Columns include importer-exporter, product and time fixed effects. All estimates include the explanatory variables: RTA, bilateral tariffs and GDP. For simplicity, we report only the coefficients on the SPS and TBT measures. Details of the estimates are available upon request. The Stata package ppmlhdfe is used for the estimations (Correia et al., 2019). Singletons observations are dropped iteratively until no more singletons are found. Therefore, There may be a difference in the number of observations between estimates. Keeping groups of singletons in multilevel regressions with fixed effects, where fixed effects are nested in groups could lead to incorrect inferences (Correia, 2015).

An interesting result is that SPS and TBT measures have a different effect depending on the subsector considered. In sum, TBT measures are more trade-enhancing, especially in the paper industry.

6 Conclusion

In this paper, we analyze the impact of the presence of SPS and TBT measures on trade in the forest-wood-paper sector. Using a gravity model, we show that in general, SPS and TBT conformity assessment procedures and TBT technical regulations increase trade flows. These results suggest that these measures provide information to consumers about product quality and compliance with standards, thereby increasing consumer demand for these products. The increased demand will therefore offset the fixed costs of product adaptation, resulting in a positive impact. In addition, we find that the trade-enhancing effect of these measures is smaller for developing country exporters. SPS technical regulations reduce imports from developing countries. We also find that the positive impact of these measures on imports from developed countries is not different regardless of the level of development of the countries imposing them. In contrast, SPS and TBT conformity assessment procedures and SPS technical regulations imposed by developed countries tend to restrict trade with developing country exporters, while TBT technical regulations tend to increase it. SPS and TBT technical regulations imposed by developing countries do not have a significant impact on imports from developing countries, while SPS and TBT conformity assessment procedures contribute to increasing them. To explain these heterogeneous effects, we calculate bilateral indicators of differences and similarities in the regulatory patterns (import measures) of developed and developing countries. Our main finding is that, on average, the regulatory intensity gap is larger between developed and developing countries. The regulatory overlap between developed importing countries and developing exporting countries remains somewhat low. This finding suggests that developing countries need more technical and financial resources to comply with developed country technical standards that are more important than their own. Furthermore, when we analyze the effects of SPS and TBT measures for each subsector at the HS2 level, we find that these measures have a different effect depending on the subsector considered. The positive effect of TBT measures on trade is most pronounced in the paper industry.

Future research could seek to further explain these heterogeneous effects that may result from the regulatory process adopted by countries. Surveys will be of great value in this context and may identify qualitative factors that are difficult to measure. We recognize that our study has limitations, including its use of the UNCTAD Trains database, which lacks time series that could allow for more in-depth analysis with greater temporal variation that would contribute to a better understanding of the effects of these trade policies in the forest-wood-paper sector.

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7 Appendix

AppendixA Descriptive Statistics and list of countries

Table A1: Descriptive Statistics

Variable	Mean	SD
SPS_ Technical Regulations	0.295	0.837
TBT_Technical Regulations	0 .483	1.049
SPS_conformity assessments	0.209	0.792
TBT_conformity assessments	0.380	1.016
Imports	2.48	3.35
ln (1+ tariff)	0.972	1.163
lndist	8.512	0 .933
Contiguity	0.070	0.256
Common language	0.181	0.385
Colony ties	0.045	0.208
RTA	0.350	0.477
GDP	726.125	66.519

Table A2: Coverage Ratio of SPS and TBT Technical Regulations, 2012-2015

		Technical regulations TBT			Technical regulations SPS		
HS2	**Description**	**Affected imports (million USD)**	**Potentially affected imports (million USD)**	**Coverage ratio(%)**	**Affected imports (million USD)**	**Potentially affected imports (million USD)**	**Coverage ratio(%)**
44	Wood and articles of wood; wood charcoal	159221.5	332081.9	48%	162837	332081.9	49%
45	Cork and articles of cork	1098.328	2832.36	39%	587.615	2832.36	21%
46	Manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork	2114.094	6803.479	32%	4688.85	6803.479	69%
47	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard	26220.73	141682.6	18%	23215.5	141682.6	16%
48	Paper and paperboard; articles of paper pulp, of paper or of paperboard	122061.3	297456.4	41%	28978.4	297456.4	10%
49	Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans	29635.63	93889.09	31%	1658.53	93889.09	2%
94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated name-plates and the like; prefabricated buildings	113848.8	150193	76%	7656.6	150193	5%

Note: Own calculations made at the HS six-digit level and aggregated to HS two-digit level.

Table A3: Coverage Ratio of SPS and TBT conformity assessment procedures, 2012-2015

		Conformity assessment procedure TBT			**Conformity assessment procedure SPS**		
HS2	**Description**	**Affected imports (million USD)**	**Potentially affected imports (million USD)**	**Coverage ratio(%)**	**Affected imports (million USD)**	**Potentially affected imports (million USD)**	**Coverage ratio(%)**
44	Wood and articles of wood; wood charcoal	197422	332081.9	59%	117750.7	332081.9	35%
45	Cork and articles of cork	699.282	2832.36	25%	124.0526	2832.36	4%
46	Manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork	1448.933	6803.479	21%	2843.058	6803.479	42%
47	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard	91589.66	141682.6	65%	23308.21	141682.6	16%
48	Paper and paperboard; articles of paper pulp, of paper or of paperboard	53974.71	297456.4	18%	6955.081	297456.4	2%
49	Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans	2610.002	93889.09	3%	1226.237	93889.09	1%
94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated name-plates and the like; prefabricated buildings	42962.23	150193	29%	7563.159	150193	5%

Note:Own calculations made at the HS six-digit level and aggregated to HS two-digit level.

Table A4: List of Countries in our sample

Importing Countries		Exporting Countries				
Algeria	Korea, Rep.	Afghanistan	Cote d'Ivoire	Israel	Norway	Ukraine
Argentina	Kyrgyz Republic	Albania	Croatia	Italy	Occ.Pal.Terr	United Arab Emirates
Australia	Latvia	Algeria	Cuba	Jamaica	Oman	United Kingdom
Austria	Lebanon	Andorra	Cyprus	Japan	Pakistan	United States
Bahrain	Lithuania	Angola	Czech Republic	Jordan	Palau	Uruguay
Belarus	Malta	Antigua and Barbuda	Denmark	Kazakhstan	Panama	Uzbekistan
Belgium	Mauritius	Argentina	Djibouti	Kenya	Papua New Guinea	Venezuela
Benin	Mexico	Armenia	Dominica	Korea, Rep.	Paraguay	Vietnam
Bolivia	Morocco	Australia	Dominican Republic	Kuwait	Peru	Yemen
Botswana	Netherlands	Austria	Ecuador	Kyrgyz Republic	Philippines	Zambia
Brazil	New Zealand	Azerbaijan	Egypt, Arab Rep.	Lao PDR	Poland	Zimbabwe
Bulgaria	Nicaragua	Bahamas, The	El Salvador	Latvia	Portugal	
Burkina Faso	Niger	Bahrain	Equatorial Guinea	Lebanon	Qatar	
Cameroon	Oman	Bangladesh	Estonia	Lesotho	Romania	
Canada	Pakistan	Barbados	Eswatini	Liberia	Russian Federation	
Cape Verde	Panama	Belarus	Ethiopia(excludes Eritrea)	Libya	Rwanda	
Chile	Paraguay	Belgium	Fiji	Lithuania	Sao Tome and Principe	
China	Peru	Belize	Finland	Luxembourg	Saudi Arabia	
Colombia	Poland	Benin	France	Macao	Senegal	
Costa Rica	Portugal	Bhutan	Gabon	Madagascar	Seychelles	
Cyprus	Qatar	Bolivia	Gambia, The	Malawi	Sierra Leone	
Czech Republic	Romania	Bosnia and Herzegovina	Georgia	Malaysia	Singapore	
Denmark	Russian Federation	Botswana	Germany	Maldives	Slovak Republic	
Ecuador	Saudi Arabia	Brazil	Ghana	Mali	Slovenia	
Estonia	Senegal	Brunei	Greece	Malta	Solomon Islands	
Ethiopia(excludes Eritrea)	Slovak Republic	Bulgaria	Greenland	Mauritania	South Africa	
Finland	Slovenia	Burkina Faso	Grenada	Mauritius	Spain	
France	Spain	Burundi	Guatemala	Mexico	Sri Lanka	
Germany	Sri Lanka	Cambodia	Guinea	Moldova	Sudan	
Ghana	Sweden	Cameroon	Guinea-Bissau	Mongolia	Suriname	
Greece	Switzerland	Canada	Guyana	Morocco	Sweden	
Guatemala	Tunisia	Cape Verde	Haiti	Mozambique	Switzerland	
Honduras	Turkey	Central African Republic	Honduras	Myanmar	Tajikistan	
Hong Kong, China	United Arab Emirates	Chad	Hong Kong, China	Namibia	Tanzania	
Hungary	United Kingdom	Chile	Hungary	Nepal	Thailand	
India	United States	China	Iceland	Netherlands	Togo	
Ireland	Uruguay	Colombia	India	New Zealand	Trinidad and Tobago	
Italy	Zimbabwe	Comoros	Indonesia	Nicaragua	Tunisia	
Japan		Congo, Dem. Rep.	Iran, Islamic Rep.	Niger	Turkey	
Kazakhstan		Congo, Rep.	Iraq	Nigeria	Turkmenistan	
Jamaica		Costa Rica	Ireland	North Macedonia	Uganda	

AppendixB Other estimates

Table B5: The impact of SPS and TBT measures on trade in the Forest-Wood-Paper sector by country groups

	PPML Estimates							
Dependent variable: imports	Developed	Developed	Developed	Developed	Developing	Developing	Developing	Developing
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SPS_ Technical Regulations	0.0378				-0.0969**			
	(0.0695)				(0.0463)			
TBT_Technical Regulations		0.142***				0.0829***		
		(0.0311)				(0.0313)		
SPS_conformity assessments			0.115**				0.0999**	
			(0.0478)				(0.0485)	
TBT_conformity assessments				0.198***				0.177***
				(0.0232)				(0.0338)
ln(1+tariff)	-0.436***	-0.407***	-0.421***	-0.237***	-0.0801*	-0.0701	-0.0680	-0.0392
	(0.0513)	(0.0508)	(0.0511)	(0.0477)	(0.0483)	(0.0486)	(0.0499)	(0.0472)
RTA	0.00511	-0.00717	0.00730	0.0400	-0.0514	-0.0534	-0.0727	-0.189**
	(0.0865)	(0.0889)	(0.0872)	(0.0840)	(0.0709)	(0.0715)	(0.0690)	(0.0908)
GDP	0.0112***	0.0120***	0.0114***	0.0129***	0.00736**	0.00712*	0.00749**	0.00839**
	(0.00212)	(0.00213)	(0.00211)	(0.00202)	(0.00370)	(0.00383)	(0.00371)	(0.00374)
Nbr of Observations	266,843	266,843	266,843	266,843	262,685	262,685	262,685	262,685

Note: Robust standard errors in parentheses clustered by country-pair-product.
*** p<0.01, ** p<0.05, * p<0.1. All Columns include importer-exporter, product and time fixed effects. Columns (1)-(4): Exporters-developed, Columns (5)-(8): Exporters-developing. The Stata package ppmlhdfe is used for the estimations (Correia et al., 2019). Singletons observations are dropped iteratively until no more singletons are found. Therefore, There may be a difference in the number of observations between estimates. Keeping groups of singletons in multilevel regressions with fixed effects, where fixed effects are nested in groups could lead to incorrect inferences (Correia, 2015).

Table B6: The impact of SPS and TBT measures on trade in the Forest-Wood-Paper sector

Dependent variable: imports	PPML Estimates			
	(1)	(2)	(3)	(4)
SPS_ Technical Regulations	0.0668			
	(0.0435)			
TBT_Technical Regulations		0.119***		
		(0.0400)		
SPS_Conformity Assessments			0.119***	
			(0.0365)	
TBT_Conformity Assessments				0.206***
				(0.0224)
SPS_Technical Regulations*imp_devped	-0.106			
	(0.0916)			
TBT_Technical Regulations*imp_devped		0.0450		
		(0.0520)		
SPS_Conformity Assessments*imp_devped			-0.250***	
			(0.0770)	
TBT_Conformity Assessments*imp_devped				-0.109*
				(0.0618)
ln(1+tariff)	-0.227***	-0.214***	-0.213***	-0.116***
	(0.0390)	(0.0392)	(0.0395)	(0.0378)
RTA	-0.00769	-0.0128	-0.00573	-0.0370
	(0.0498)	(0.0505)	(0.0489)	(0.0569)
GDP	0.0127***	0.0134***	0.0127***	0.0129***
	(0.00188)	(0.00193)	(0.00185)	(0.00184)
Nbr of Observations	529,528	529,528	529,528	529,528

Note: Robust standard errors in parentheses clustered by country-pair-product.
*** p<0.01, ** p<0.05, * p<0.1. All Columns include importer-exporter, product and time fixed effects. The Stata package ppmlhdfe is used for the estimations (Correia et al., 2019). Singletons observations are dropped iteratively until no more singletons are found. Therefore,There may be a difference in the number of observations between estimates. Keeping groups of singletons in multilevel regressions with fixed effects, where fixed effects are nested in groups could lead to incorrect inferences (Correia, 2015).

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