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Comparative Advantages and the Uneven Effects of Non-Tariff Measures

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Abstract

This article investigates the uneven effects of TBT/SPS measures on bilateral trade flows, according to country's income levels. Estimating standard gravity models, we find that the effects of TBT/SPS depend mostly on the exporter's development level (developed, developing or least developed). We find that, on average, SPS measures promote exports from Latin American countries, but harm exports from developed and other developing countries. Moreover, TBT measures raise exports of developed and other developing countries whereas they decrease Latin American (LatAm) exports. Least developed countries are negatively affected by both types of measures. We argue that the effects are in line with pre-existing comparative advantages, i.e., both developed and other developing countries are relatively more efficient in manufacturing exports – where the incidence of TBT measures tend to be greater than SPS measures – while LatAm countries are relatively more efficient in agricultural exports, where SPS measures tend to prevail. Therefore, non-tariff measures tend to exacerbate pre-existing specialization patterns in international trade and may harm prospects for industrialization in less developed economies. We provide suggestive evidence of this channel by controlling for product-exporter fixed effects that help to control for comparative advantages in gravity equations.

Keywords: Non-tariff Measures, SPS, TBT, comparative advantages.
Jel Classification: C01, F13, L13.

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1. Introduction

An important trend in trade policy in recent decades is the remarkable reduction of tariff barriers imposed on international trade. This pattern is both a result of several trade liberalization rounds at the GATT/ WTO level and, more recently, the consequence of the explosion of regional trade agreements worldwide. Just over the last twenty years, more than four hundred preferential trade agreements were notified to the WTO. Over the same period, however, the multilateral trade system has also witnessed a growing number of notifications of non-tariff measures such as TBT (Technical Barriers to Trade) and SPS (Sanitary and Phytosanitary measures) being submitted by its members, with their legal underpinnings claimed to be based on both the TBT and SPS agreements formalized at the Uruguay round.

Despite the fact that notifications of TBT and SPS measures are expected to be grounded in pre-existing international standards and scientific evidence, its widespread dissemination among WTO members raised concerns of a new wave of protectionism, now disguised under the umbrella of trade regulation on product standards and safety.

Surprisingly, there is a scarce literature on the effects of such regulations on international trade, in particular to its likely heterogeneous effects among countries with different income levels. This paper tries to fill this gap by studying two essential points in order to understand the effects of such measures. First, we evaluate if regulatory measures imposed by developed and developing countries are similar in terms of the restrictions they impose on exporters. Second, we analyze if the same measures have different effects depending on the exporter's characteristics.

We use a comprehensive dataset including 177 countries and 1297 products (4-digit HS classification) from 2006 to 2012. This dataset is used to estimate the gravity model which is the standard trade model to evaluate the impact on trade flows. Given some recent criticism on the correct specification of gravity models, we use the Pseudo-likelihood Poisson estimator that allows us to use information from zero trade flows and to correct a potential bias in the estimation caused by the combination of the usual log transformation and heteroscedasticity of the data (see Silva and Tenreyro (2006)).

We consider two groups of countries that have had a substantial increase in the issuance of new regulatory measures over the last decades: developed countries and a set of Latin American countries. We evaluate the effects of those measures on four classifications of exporters: developed countries, Latin American countries, other developing countries (including China) and least developed countries.

We find that the effects of TBT/SPS measures imposed on both developed and Latin American countries' imports have some small qualitative differences among different groups of exporters. More interestingly, the group from where a given exporter country belongs is a key determinant of the NTM effects on its exports. More specifically, agricultural exports from LatAm countries are positively affected by pre-existing SPS measures imposed by importers, while we observe a fall in the agricultural exports from other developing and developed countries. However, when it comes to TBT measures applied on industrial exports, other developing and developed countries' exports are positively influenced while exports from LatAm countries are negatively affected. In general, NTMs have significant and substantial impacts on trade flows and tend to exacerbate pre-existing trade specialization patterns. We argue that a potential explanation for the uneven effects detected for NTMs on countries' exports lies in their pre-existing comparative advantages. LatAm countries are relatively more efficient as agricultural exporters while the groups of other developed and developed countries are relatively more efficient in the exports of industrial goods. In the case of least developed countries, both types of non-tariff barriers (TBT/SPS) have substantial negative effects on their exports of both agricultural and industrial goods. We show evidence that most of the effects of non-tariff barriers on those countries' exports are on their extensive margin of trade, i.e., on the number of goods exported. In other words, non-tariff measures may be restrictive enough for this particular group of exporters such that local firms may decide not to export some of their goods. This is in line with the comparative advantage argument as those countries rely on exports of a few goods (usually natural resources) and they are not particularly competitive, on average, in neither agricultural nor industrial goods exports.

We briefly discuss some of the theoretical backgrounds that could shed some light on why regulatory measures could potentially affect either positively or negatively countries exports based on their sectoral productivities/comparative advantages.

The remaining of this article is structured as follows. The next section discusses the related literature that estimates the effects of regulatory measures on trade flows. Section 3, explains how the database was built and provide some descriptive analysis on the recent evolution of TBT and SPS notifications. Section 4 explains the empirical strategy and briefly, presents a theoretical discussion on the effects of non-tariff measures. Section 5 discusses the results and section 6 concludes.

2. Related literature

According to the WTO (World Trade Organization), Sanitary and Phytosanitary (SPS) measures may be defined as any measures applied: (1) "to protect human or animal life from risks arising from additives, contaminants, toxins or disease-causing organisms in their food; (2) to protect human life from plant - or animal - carried diseases; (3) to protect animal or plant life from pests, diseases, or disease-causing organisms; (4) to prevent or limit other damage to a country from the entry, establishment or spread of pests". By the same token, Technical Barriers to Trade (TBT) "cover all technical regulations, voluntary standards and the procedures to ensure that these are met, from car safety to energy-saving devices, to the shape of food cartons. TBT measures can still cover topics related to human health such as pharmaceutical restrictions or the labeling of cigarettes, nutrition claims and concerns, quality and packaging regulations".

SPS and TBT measures are generally classified as non-tariff measures (NTM). Most of the empirical studies on the effects of NTM on bilateral trade flows are based on standard gravity models. Regardless of the real objectives of the imposition of non-tariff measures such as TBT and SPS by importing countries, several of existing studies have pointed out their likely negative effects on trade (Leamer, 1990; Moenius, 2004; Disdier et al, 2008). However, those studies are, in general, focused on specific sectors and/or specific countries. For instance, Disdier et al. (2008) estimate the effects of TBT and SPS measures on agricultural exports for OCDE countries and finds, on the whole, a decrease of roughly 15% of OCDE imports. Kee et. al (2009) estimate tariff equivalents for a richer variety of non-tariff barriers (and not only technical measures such as TBT and SPS) for a wide range of products and countries. One caveat is that they take for granted in their estimations the effect of those measures on exports to be negative. As usual in the literature, we

allow for effects of any sign and provide a brief theoretical discussion on why those measures could increase trade despite the imposition of regulations that most likely lead to increasing production costs.

A relatively recent debate on the possible existence of misspecifications in standard gravity equations raised serious concerns over the credibility of many previous empirical studies using gravity models and addressing a broad set of issues in trade theory. In the empirical strategic section, we discuss the details of the possible sources of those biases and how to proceed to correct them using alternative econometric specifications. Evidently, this critique also applies to empirical works evaluating the effects on non-tariff measures on trade flows. A few studies that address those misspecifications on the impacts of NTM on trade flows are Disdier and Marette (2010) and Crivelli and Groeschl (2016). Both studies take into consideration the possible existence of sample selection bias in their gravity equations but ignore the issue of firm heterogeneity (see Helpman et al., 2008). For example, Crivelli and Groeschl (2016) find that SPS measures affect negatively the probability to export (extensive margin of trade), but it tends to increase exports conditional on entry (intensive margin of trade). The idea is that some SPS measures may potentially work as entry barriers. However, the authors use data on Specific Trade Concerns (STC), that is, they only consider SPS measures that WTO exporters from countries raising a concerned face in a given export market. By construction, those measures are clearly more likely to be trade restrictive. In the current article, we chose to use all measures available (TBT/SPS) since only a quite small fraction of them are raised on the WTO's STC committee. The work of Bao and Qiu (2012) find similar results for TBTs. Closer to our article, they also consider potential heterogeneous effects of NTM depending on countries' income levels. They find that TBT measures imposed by developed countries have negative impacts on both extensive and intensive margins of exporters, whereas TBT measures imposed by developing countries have no significant impact on developed countries' exports, but have a negative impact on the extensive margin as well as a positive effect on the intensive margin for developing countries' exports. In the current article, we evaluate the potential heterogeneous effects of both SPS and TBT measures depending on the countries' group of origin and we go a step further in splitting up developing countries in two groups (LatAm and other developing) and include the least developed countries in another specific group. Moreover, as we use product data, we evaluate the effects on agricultural and industrial goods separately.

The work by Ferraz et al. (2017) (forthcoming) consider also the effects of TBT and SPS measures on trade, but focusing on Brazilian exports. They take into consideration the potential bias from both sample selection (due to zero trade flows) and firm heterogeneity. On the whole, they find negative TBT/SPS effects on both extensive and intensive margins of Brazil's exports. However, for Brazil's sector level exports, they find positive as well as negative NTM effects.

3. Data

There are two main datasets. The first one contains 2,253,677 observations (from which 360,189 observations are positive trade flows) and describes bilateral imports of Latin American countries from the rest of the world. Latin American importers include five of the largest economies in the region: Argentina, Brazil, Chile, Colombia, and Mexico. Bilateral trade is at the four-digit classification of the Harmonized System (HS04) and there are 4 years of information, from 2006 to 2012, with two-year intervals.

The second dataset follows the same structure of Latin America's one but has developed economies as the group of importers instead. It has 2,133,978 observations (from which 577,182 are positive trade flows). Developed importers include Australia, Canada, European Union,[1] Japan and the United States. Both Time-span and level of disaggregation of bilateral trade flows are the same as for the Latin America's group dataset. All bilateral trade flows are sourced from the World Integrated Trade Solutions (WITS) of the World Bank.

3.1. Non-tariff Measures

Both datasets bring information on non-tariff measures (TBT and SPS) applied by each country belonging to each one of the two groups of importers, as described above. There are three variables of interest: 1. TBT_{mjt}, which is a dummy variable that takes one if importer m applies a Technical

[1] Imports of EU members are aggregated into one sole importer.

Barrier to Trade (TBT) on product j at year t; 2. SPS_{mjt} is a dummy variable defined in the same way but for Sanitary and Phytosanitary Measure (SPS); 3. $Measure_{mjt}$ is a dummy variable that takes one if importer m applies either a TBT or a SPS on product j at year t.

WTO members must notify their non-tariff measures as required by the SPS and TBT agreements. Notifications are multilateral, i.e., they apply to all WTO members. This explains why our variables for the measures are not specific by the exporter. The notifications from 1995 to 2012 are available at the Integrated Trade Intelligence Portal (I-TIP) of WTO. Notification is a document issued by an importing country that describes the requirements imposed on its imports of several products. This includes both the product coverage of the measure and its Harmonized Classification System (HS) code. This classification may be HS02, HS04 or HS06 depending on the details of the requirements. However, only 34.6% of the existing notifications describes its HS code. To circumvent this problem we used additional information available from other sources such as the Brazilian National Institute of Metrology, Quality, and Technology (Inmetro) and the Centre for WTO Studies (CWS). While Inmetro provided us product codes for additional TBT notifications, the CWS provided the codes for the additional SPS notifications. Product codes are available at the HS04 level.

We defined a non-tariff measure as specific criteria imposed by an importing country over the exports of its trade partners with respect to a given product. Therefore, one notification may define several measures. Thus, our measure of NTM was constructed by the following steps. First, we assigned notifications to their respective HS04 products. The following criteria was used: i) notifications with regard to HS02 codes were assigned to all of its breakdowns of HS04 codes; ii) notifications with regard to HS06 codes were discarded since the export data are in HS04 level; iii) the notifications belonging to the European Union were assigned to their respective members taking into account the date of entry for each country.

We assume that once notified, measures do not expire. For instance, an SPS measure issued in 2006 will not only impose restrictions in that year but on all years afterward. In principle, countries may withdraw their notifications, but the WTO database does not provide this information. In practice, however, we believe that new measures usually impose more restrictive requirements over pre-existing ones, so that authorities do not bother to withdraw the less restrictive measures. Therefore, even though our bilateral trade data cover the period of 2006-2012, we use information from non-

tariff measures from 1995 to 2012, since pre-2006 notifications still hold and can be a potential barrier to trade as well.

Table 1 shows the evolution of the incidence of TBT and SPS measures by year, for both Industrial and Latin American country groups. For the Latin American group of importers in the beginning of the sample, roughly 60% of the goods imported were not affected by any technical measure. However, at the end of the sample period, in 2012, this percentage had been reduced to 40%.

Table 1. Evolution of the incidence of non-tariff measures by year

	Importer: Developed countries				Importer: Latin America			
	No measures	Only TBT	Only SPS	SPS and TBT	No measures	Only TBT	Only SPS	SPS and TBT
2006	45.23	32.86	9.16	12.75	61.12	25.17	7.34	6.37
2008	38.71	38.74	8.73	13.82	47.34	36.19	8.65	7.82
2010	36.71	38.47	10.74	14.09	44.03	37.64	8.43	9.90
2012	36.98	36.96	9.94	16.12	39.95	38.85	10.00	11.20

Note: Latin American importers are Argentina, Brazil, Chile, Colombia, and Mexico. Developed countries importers are Australia, Canada, European Union, Japan and the United States.

Throughout the entire sample period, most of the non-tariff measures imposed by the LatAm group of importers were TBTs. Moreover, there was a substantial increase in the incidence of both TBT/SPS measures. A similar pattern can be seen for the group of developed countries, exception made for a relatively stagnant percentage of SPS measures. It is noteworthy that SPS and TBT measures applied to the same imports are more important for industrial countries than for LatAm countries, suggesting a potential for a more restrictive regulatory system. Furthermore, despite clear signs of convergence between the two groups of importers throughout the time frame, developed countries were still more active in terms of the adoption of new regulatory barriers in 2012.

Table 2 shows the incidence by sector for both groups of importers. A similar pattern is also observed within this disaggregation. Agricultural sectors are much more affected by regulatory measures than industrial sectors: Only 8.5% (13.5%) of agricultural imports of Industrial (LatAm) countries are not affected by either a TBTs or an SPS measure while the same measure for industrial imports is roughly 48% (55%). Moreover, agricultural goods are more affected by both SPS and TBT while the majority of measures for industrial goods are TBT only.

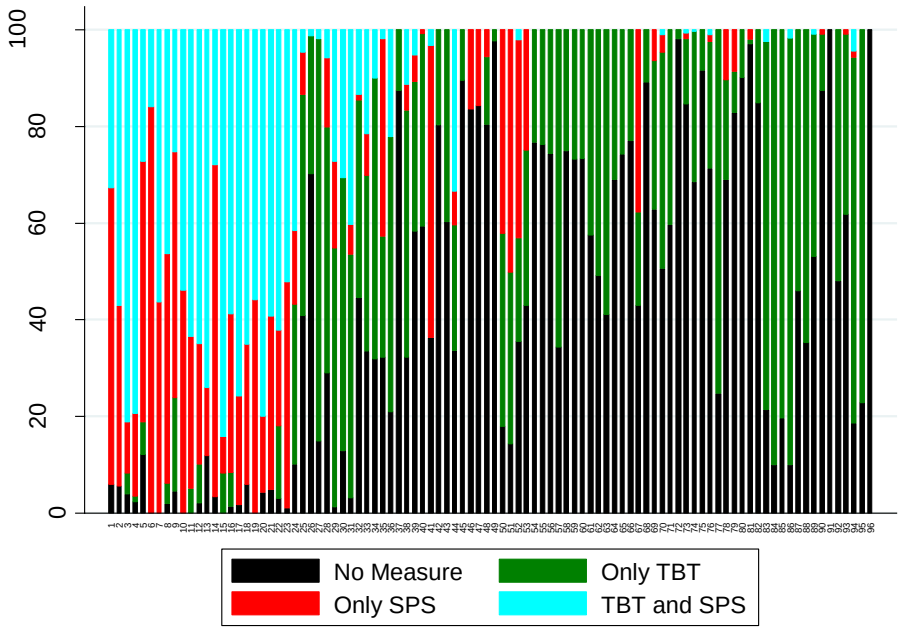
Table 2. Incidence of non-tariff measures by sector

	Importer: Developed countries		Importer: Latin America	
	Agriculture	Industry	Agriculture	Industry
No measures	8.58%	48.21%	13.47%	54.99%
Only TBT	12.64%	43.35%	13.36%	38.60%
Only SPS	29.15%	4.16%	28.89%	4.60%
SPS and TBT	49.63%	4.28%	44.28%	1.81%

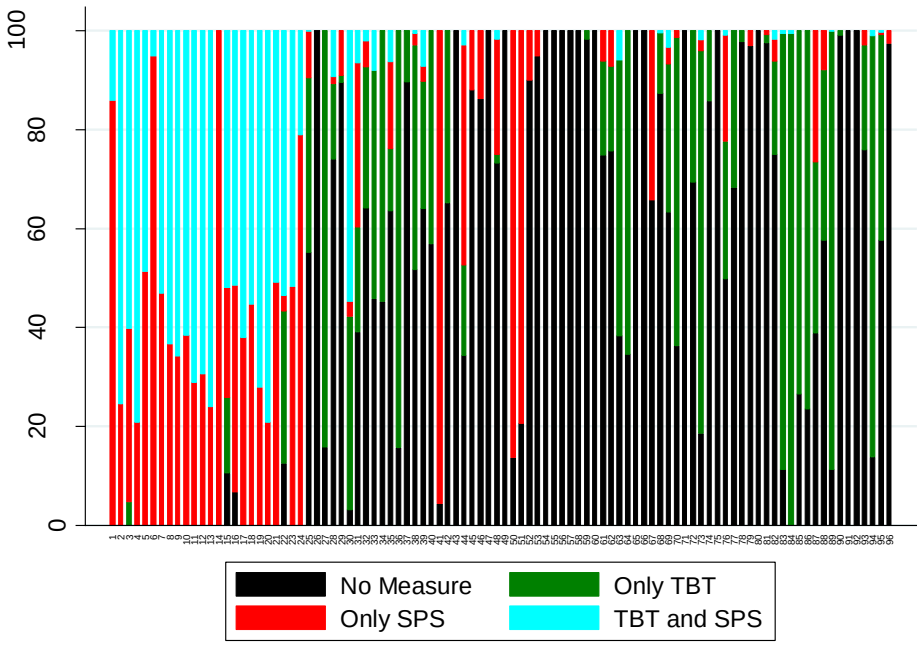
Note: Latin American importers are Argentina, Brazil, Chile, Colombia, and Mexico. Developed countries importers are Australia, Canada, European Union, Japan and the United States. Sectors 1-27 (HS02) were classified as Agriculture and 28-96 (HS02) as Industry.

Figure 1 disaggregates the data even further showing the incidence of NTMs by the classification HS02. Comparing the Industrial and LatAm countries, additional insights can be taken from this figure. First, for the LatAm countries within agricultural sectors (1-27) most of the imports are affect by only SPS or SPS and TBT combined while only a few sectors have an incidence of only TBT. Moreover, most of the sectors are completely affect by some non-tariff measure. Therefore, the 8.5% of non-incidence of measures for agriculture is very concentrated on a few sectors. For Developed countries, both the non-incidence and the incidence of only TBT is more distributed along agricultural sectors. Second, for both type of importers, sectors related to chemicals (28-40) and machinery, electronics and vehicles in general (84-89) are mostly affected by TBTs than other industrial sectors. Sectors related to Agribusiness (41-70) are mostly affected by SPSs. Despite this, some differences are worthy to note. LatAm countries basically do not impose technical restrictions on their imports of textiles (52-60) while this is not true for Industrial countries where roughly 30% of their imports have TBTs associated to them. On the other hand, in sectors such as Skin and Leather (41), Silk (50) and Wool (51) more than 80% of the imports are affected by SPS measures, while this is less pronounced for the Industrial countries. In the econometric evaluation, we only consider heterogeneity in sectoral effects of non-tariff measures by industry and agriculture.

Figure 1. Incidence of non-tariff measures by HS02



Panel (a): Developed countries



Panel (b): Latin American countries

Note: In the econometric evaluation the sectors 1-27 were classified as Agriculture and 28-96 as Industry.

4. Empirical Strategy

In order to evaluate the impact of regulatory measures on the trade, we use the gravity model, which is a benchmark trade model for empirical analysis. However, a relatively recent debate on the possible existence of misspecifications in standard gravity equations raised serious concerns over the credibility of many previous empirical studies using gravity models and addressing a broad set of issues in trade theory. In this regard, the work by Anderson and Wincoop (2003) highlighted the importance of controlling for "remoteness" in gravity equations, being the first article to formally address this issue, based on a theoretical model of monopolistic competition. The work by Silva and Tenreyro (2006) points out to another possible misspecification problem in gravity regressions, suggesting that under heteroscedasticity, the parameters of log-linearized gravity models estimated by OLS may lead to biased estimates of the true elasticities. More recently, another influential work by Helpman et al (2008) raised the issue on the existence of firm heterogeneity and also on the correct treatment of zero trade flows in traditional gravity equations, prompting a quite new generation of empirical studies addressing specification concerns such as the existence of sample selection bias and the influence of heterogeneous firms in gravity estimations.

According to the work by Helpman et al (2008) if the probability to become an exporter is correlated to the decision on how much to export, the estimated impact of NTM on trade flows using standard gravity OLS regressions are likely to be downward biased. Regarding firm heterogeneity, the authors point out that standard gravity equation "confound the effects of trade barriers on firm-level trade with their effects on the proportion of exporting firms". Accordingly, if firm heterogeneity is not somehow included as an explanatory variable in standard gravity equations, its absence may induce an upward bias on the estimated effects of NTM on trade flows. However, the two-stage Heckman selection model proposed by the authors is by far not straightforward to implement. For instance, when it comes to the first stage regression (probit estimation) it is not always easy to find an exclusion variable (instrument) that makes some good economic sense. Moreover, the panel version of the model presents some additional difficulties, especially when dynamic considerations are taken into consideration (Silva and Tenreyro, 2014).

The issue of zero trade flows in gravity models can be also satisfactorily addressed through the Poisson model, according to Silva and Tenreyro (2011). In their work, the authors used a series of

Monte Carlo simulations in order to show that the Poisson Pseudo Maximum Likelihood (PPML) estimator performs quite satisfactorily for very disaggregated datasets when the proportion of zero trade flows tend to be particularly large. This will be the approach that will be pursued in this work.

Let m be the importer, x the exporter, j the product and t the year. The empirical strategy uses a structural gravity equation following the suggestion of Head and Mayer (2014). It relates bilateral imports at the 4-digit level made by m from x at period t with respect to product j to trade policy variables and theory-suggested gravity controls.

The best practices regarding the estimation of a structural gravity equation demand a complete set of fixed effects. Our empirical model brings importer and exporter time-varying fixed effects. Those can adequately control for the "multilateral resistance term" suggested by Anderson and Van Wincoop (2003) in a panel context, as proposed by Baier and Bergstrand (2007). There are also time-invariant country-pair fixed effects to account for unobserved heterogeneity and minimize the endogeneity of trade policy variables, as suggested by Baldwin and Taglioni (2006). As we use disaggregated bilateral trade, product fixed effects are also used. Notice that the econometric model does not bring the usual controls prevalent in the gravity literature, like GDP, colonial status or common language. Once we use all fixed effects, it is impossible to estimate them. As they are not of interest, fixed effects are a better choice because they control for all observable and unobservable trade costs in their respective dimensions.

Altogether, the benchmark specification is given by:

$$\log(m_{mxjt}) = \beta NTM_{mjt} + \xi_{mx} + \alpha_{mt} + \gamma_{xt} + \delta_{jt} + \varepsilon_{mxjt} \quad (1)$$

where m_{mxjt} is bilateral imports that m makes from x at t with respect to product j. NTM_{mjt} is a dummy variable that equals 1 if m applies a non-tariff measure on product j at t. ξ_{mx} denote a country-pair fixed-effect, α_{mt} and γ_{xt} are importer and exporter time-varying fixed-effects, δ_{jt} is a product-time fixed-effect and ε_{mxjt} is random error.

Other variables of interest are an indicator variable for Latin American exporters, an indicator variable for (other) developing countries exporters and two (exhausting) sectoral dummies for

agricultural and industrial sectors. Errors are clustered at the country-pair level in order to allow for interdependence among observations in this particular dimension.

4.1. A brief interlude on the microeconomics of NTMs

Before discussing the main results of our estimations, it is important to keep in mind that an NTM may potentially affect exports through, at least, four main channels (see also Ferraz et al, 2015). First, as it imposes more strict requirements on production process by firms, it may lead to higher marginal costs to export. Second, more strict requirements on production may entail new investments in technology and equipment by firms, increasing fixed costs to export. Third, compliance with an NTM may positively affect consumer preferences in importing countries, shifting import demand or its price sensibility and, consequently, bursting exports. Fourth, more efficient exporters tend to be more resilient to increasing costs of production than less efficient ones. Therefore, higher production costs are expected to be relatively more harmful to the exports of less efficient suppliers. In this case, depending on the magnitude of relative effects, more efficient suppliers may be better off with the imposition of an NTM.

The channels discussed and their interactions can be better clarified using a well-known model described in Helpman, Melitz and Rubinstein (2008) that introduce firm heterogeneity in the monopolistic competition model. We refer the reader to Melitz (2003) and Helpman et al. (2008) for the details on this derivation.

Consider a world with I countries indexed by $i = 1,2, \dots, I$. Using a standard CES utility function, country i's demand for product j, $x_i(j)$, is given by

$$x_i(j) = \left(\frac{p_i(j)}{P_i}\right)^{-\varepsilon} Y_i, \tag{2}$$

where $p_i(j)$ is the price of good j in country i, $\varepsilon > 1$ is the elasticity of substitution across products and P_i is the country's price index given by

$$P_i = \left[\int_{j \in B_i} p_i(j)^{1-\varepsilon} \, dj \right]^{1-\varepsilon} . \tag{3}$$

B_i denotes the consumption basked of country i, that includes all goods j from all countries i.

Firms from country i produce good j at a marginal cost given by c_{ij}/a, where a is the firm-specific productivity. The productivity is draw from a distribution $G(a)$. c_{ij} is good-country specific marginal cost that represents country i comparative advantage in the production of a particular good j. c_{ij}/a is the production cost in case a firm in country i sells domestically. If the same firm seeks to export to country m, it bears two additional costs: a fixed cost f_{mi}, and a "melting iceberg" transport cost τ_{im}. Note that both costs depend on the import-exporter countries, but is not firm-specific.

Since there is monopolistic competition, the optimal price decision for firms is to impose a mark-up on the marginal cost

$$p_i(j) = \frac{\mu \tau_{im} c_{ij}}{a}, \tag{4}$$

where $\mu = \frac{\varepsilon}{\varepsilon - 1}$ is the mark-up. Therefore, the profit related to the export sales of good j from country i to country m is given by

$$\pi_{im} = \frac{1}{\varepsilon} \left(\frac{p_i(j)}{P_m} \right)^{1-\varepsilon} Y_m - f_{mi} \tag{5}$$

The extensive margin decision is defined by the condition $\pi_{im}(a^*_{im}) = 0$. The productivity level a^*_{im} is a threshold that determines which firms from country i exports to country m. Firms with productivity such that $a \geq a^*_{im}$ chooses to export and firms $a < a^*_{im}$ only produce domestically. In words, only the firms that are productive enough to bear the fixed costs of exporting will be the ones that export that product to each destination.

Using the condition above, the productivity threshold is written as

$$a_{im}^{*} = (\varepsilon f_{mi})^{(\varepsilon-1)} \left(\frac{\mu \tau_{im} c_{ij}}{P_m}\right). \quad (6)$$

Therefore, increases in fixed costs f_{mi}, transport costs τ_{im} or in production costs c_{ij}, rise the threshold, leading less firms to export.

Suppose that country m imposes an NTM to product j, which affects all countries $i \neq m$ (recall that NTMs are multilateral). Moreover, suppose that this NTM imposes a higher restriction in the production of goods such that it increases: i) the marginal costs; or ii) the fixed costs, for good *j* for all countries i.

Consider first, a proportional increase of the marginal costs. The increase in the marginal cost, increase de price of good $p_i(j)$ for firms that choose to export from all countries i to country m, while it does not change P_m in the same proportion as the basket includes not only good *j* but all other goods. Therefore, the relative price $p_i(j)/P_m$ increases, implying a decrease in demand for good j for all countries. Moreover, if the increase in marginal cost is proportional, the increase in the relative price is less pronounced for more productive firms (countries with higher comparative advantages on that good) than for less productive ones (countries with lower comparative advantages on the same good). However, there is a general equilibrium effect that may benefit some of the firms. The increase in marginal cost leads to a rise in the productivity threshold, which implies that some of the least productive firms will leave the market. This, in turn, may lead to increase in the demand for the remaining firms, depending on their relative price. Therefore, even an increase in the costs of production due to the imposition of a NTM has potentially ambiguous effects on exports (at least theoretically) that are less restrictive (if so) to the more productive firms.

The effect of an increase in the fixed cost because of an NTM works in the same way as in the general equilibrium effect described above. Some firms stop exporting because of the rise in the productivity threshold, implying that the remaining firms may have higher exports, which may or may not compensate the losses in profit by the increase in the fixed cost.

As for demand side effects, since NTMs relate to product quality, safety or any other desired features by the consumers, they may affect the elasticity of substitution (possibly in addition to the increase in production costs) such that it may increase the market power of relatively more

competitive exporting firms, increasing its profits. It may also affect entry by decreasing the productivity threshold.

It is worthy note that the theoretical model briefly outlined above implies a gravity equation such as equation (1) (for details see Helpman, Melitz and Rubinstein (2008)) that can explain bilateral trade flows. Moreover, it also leads to an equation that describes the probability of imports, which we do not estimate in this paper. Instead, as explained in the previous section, we used the Poisson estimator proposed by Silva and Tenreyro (2011) that allows zero trade flows to be taken into consideration, which in some sense include the extensive margin, but also correct for the potential bias from the log-linear transformation when data has heteroscedasticity.

5. Results

Erro! Fonte de referência não encontrada. shows the results of OLS regressions for different specifications of equation (1) for both groups of importers: Developed countries and LatAm countries. On average, the existence of a non-tariff measure decrease imports for both groups of importers (columns 1 and 5). Columns 2 and 6 distinguish the effects of the dummy NTM between TBTs and SPSs. For developed countries, the main negative effect comes from TBTs, while for the LatAm countries both types of non-tariff measures have negative effects on their imports. Columns 3 and 7 searches for heterogeneous effects of NTMs depending on the origin of the exporter: Developed, Latin American, other developing countries and least developed countries (LDC). In that case, NTMs from developed countries have an insignificant impact on themselves, negative impact on developing countries, but positive impacts on LatAm and LDC (the latter only at 10% significance). Interesting, NTMs from LatAm countries have different impacts. It increases exports from developed countries, while negatively affects the exports from all other groups. According to our previous microeconomic discussion, the positive effect can be the consequence, for instance, of a relatively more competitive group of exporters that can afford to comply with the specific requirements of the non-tariff measures and would benefit from it, since it induces additional costs to other less competitive exporters of substitutable goods. The last specification (columns 4 and 8) shows the heterogeneous effects by type of NTM. This specification reveals an interesting pattern: independently of the importer group, pre-existing TBT measures have a positive effect on

developed countries' exports and a negative effect on all developing and least developed countries' exports. On the other hand, SPS measures have a positive effect on LatAm and LDC's exports and a negative effect on developed and other developing countries' exports.

Table 3. Effects of non-tariff measures – OLS regression

Variable	Importer: Developed countries				Importer: Latin American countries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
NTM	-0.0746***				-0.117***			
	(0.0259)				(0.0311)			
TBT		-0.0502**				-0.0687**		
		(0.0241)				(0.0316)		
SPS		-0.0548				-0.132***		
		(0.0390)				(0.0491)		
NTM × Developed			-0.0569				0.190***	
			(0.0435)				(0.0431)	
NTM × LatAm			0.215***				-0.339***	
			(0.0516)				(0.0600)	
NTM × Developing			-0.214***				-0.324***	
			(0.0328)				(0.0495)	
NTM × LDC			0.135*				-1.433***	
			(0.0814)				(0.219)	
TBT × Developed				0.189***				0.332***
				(0.0419)				(0.0438)
TBT × LatAm				-0.261***				-0.526***
				(0.0509)				(0.0616)
TBT × Developing				-0.120***				-0.242***
				(0.0317)				(0.0506)
TBT × LDC				-0.248***				-1.679***
				(0.0852)				(0.213)
SPS × Developed				-0.629***				-0.494***
				(0.0585)				(0.0612)
SPS × LatAm				1.213***				0.824***
				(0.0693)				(0.0843)
SPS × Developing				-0.239***				-0.405***
				(0.0476)				(0.0689)
SPS × LDC				1.034***				1.242***
				(0.103)				(0.245)
Tariff	-0.00190	-0.00190	-0.00191	-0.00207	-0.0221***	-0.0219***	-0.0231***	-0.0221***
	(0.00166)	(0.00166)	(0.00166)	(0.00171)	(0.00228)	(0.00229)	(0.00222)	(0.00218)
Log GDP importer	0.893***	0.893***	0.899***	0.874***	1.088***	1.083***	1.090***	1.072***
	(0.0360)	(0.0360)	(0.0363)	(0.0362)	(0.0465)	(0.0464)	(0.0470)	(0.0474)
Log GDP exporter	0.0370	0.0374	0.0368	0.0401	0.0463	0.0466	0.150***	0.114***
	(0.0255)	(0.0254)	(0.0258)	(0.0257)	(0.0381)	(0.0380)	(0.0395)	(0.0398)
Obs.	577182	577182	577182	577182	360189	360189	360189	360189
Adj. R^2	0.508	0.508	0.508	0.513	0.400	0.400	0.402	0.406

Notes: Standard errors in parentheses. *, **, *** are 10%, 5% and 1% significance levels. All regressions include country-pair fixed effects, product fixed-effects, and year fixed-effects. Standard errors are clustered by HS02-country pair.

These results hint at some comparative advantage mechanism, where poorer countries can export more efficiently primary products, which are mainly affected by SPS measures while performing worse when it comes to exporting manufactured products. For developed exporters – a group that has comparative advantages in the exports of more sophisticated products – a similar mechanism seems to be in action.

In appendix A, Table A1, we assess the sensitivity of our results to the "multilateral resistance" time-varying importer/exporter/product fixed effects. As can be seen, the results are both qualitatively and quantitatively similar for the two group of importers, suggesting that, at least for the time span considered in our panel (2006 to 2012), the "multilateral resistance" term does not play any fundamental role for the results shown in Table 3. Moreover, working with a more parsimonious specification of equation (1) facilitates the process of convergence for the Poisson regressions that will be shown in the following analysis. Therefore, the discussion of our results will be concentrated in this latter specification. The results using the Poisson estimation are available on Table 4. As already mentioned, estimations using gravity equations are more properly handled using the Poisson Pseudo Maximum likelihood estimator (PPML), instead of traditional OLS estimations. One additional advantage of working with the Poisson model is to use the available information on zero trade flows. However, it is well known that convergence of the PPML estimator can be difficult when there are several dummy variables in the gravity equation. In the current work, that was only possibly achieved when exporter/importer/product time-varying fixed effects were removed from the gravity equation.

As before, Table 4 is divided into two sets of columns: columns (1-4) show different specifications for Developed countries as importers, and columns (5-8) show the same specification but with LatAm countries as importers. Although less clear, we can find a similar picture as before. The Poisson specification mitigates the more aggregate results, leading to some insignificant results in columns (1-3) and (5-7). It worthy note that in column (3), the effects of NTM on LDC turn to, on average, negative and significant at 1% (which in the OLS was positive). Another interesting change is that in column (7), the effects of NTMs on other developing countries became positive (but significant only at 10%).

Searching for heterogeneous effects among exporters by NTM type (columns 4 and 8) reveals a similar pattern as before. SPS measures from both groups of importers have a strong and negative

impact on developing countries (roughly 43% and 62% drop for SPS for developed and LatAm imports, respectively).[2] The effects of SPS measures on LatAm countries' exports to the same group of countries is still positive, but significant at 10%. It leads to an increase of roughly 32% on imports. The effects of SPS measures on the developed countries' exports vanish, while the effects on LCD's exports change its sign: while in the previous OLS regression it was positive, in the more reliable specification using Poisson the effect became negative and quite strong (a drop of roughly 58% and 86% for SPS measures imposed by developed and LatAm countries, respectively).

For TBTs, the effects on developed countries also became insignificant for both groups of importers. The impacts of TBT measures imposed by developed and LatAm importers on LatAm exports are negative and significant at 10% (roughly a drop of 29% and 19%, respectively). The impacts on LCD's exports are quite strong, negative and highly significant.

The results from Poisson regressions, in general, corroborate with the idea that the impacts of non-tariff barriers depend on the comparative advantages of exporters. This picture is less clear for the developed countries as exporters, as all coefficients became insignificant. However, it fits very well for LatAm countries and other developing countries, as long as we consider the other developing countries as relatively more efficient on manufacturing goods. This may be the case since it includes developing countries from Asia and Eastern Europe which arguably have comparative advantages in manufacturing relatively to LatAm and LDC countries.

In this sense, since LDC's exports are negatively affected by both SPS and TBT measures imposed by the two group of importers in Table 4, it is unlikely that this group of exporters has somehow clear comparative advantages in the production of either manufacturing or agricultural goods (as is obviously the case for the group of developed and LatAm exporters, respectively). If one thinks that most of LDC economies' exports are based on a few mineral and/or rather primary goods, that must be the case.

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[2] The effect of a dummy variable with coefficient β is calculated as $exp(\beta) - 1$. In that case, $exp(-0.574) - 1 = 0.4367$ and $exp(-0.981) - 1 = 0.6250$. Other impacts described in the text are calculated in the same way.

Table 4. Effects of non-tariff measures – Poisson regression

Variable	Importer: Developed countries				Importer: Latin American countries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
NTM	-0.0155				-0.0301			
	(0.0745)				(0.0536)			
TBT		-0.00941				0.00721		
		(0.0697)				(0.0540)		
SPS		-0.0829				-0.173		
		(0.143)				(0.112)		
NTM × Developed			0.0106				-0.0944	
			(0.107)				(0.0773)	
NTM × LatAm			-0.203				-0.147	
			(0.195)				(0.132)	
NTM × Developing			0.0432				0.261*	
			(0.131)				(0.139)	
NTM × LDC			-1.107***				-1.016***	
			(0.417)				(0.356)	
TBT × Developed				-0.00246				-0.0285
				(0.100)				(0.0770)
TBT × LatAm				-0.346*				-0.214*
				(0.185)				(0.129)
TBT × Developing				0.118				0.314**
				(0.127)				(0.142)
TBT × LDC				-1.031**				-0.855**
				(0.409)				(0.376)
SPS × Developed				0.222				-0.106
				(0.174)				(0.130)
SPS × LatAm				0.275				0.279*
				(0.225)				(0.158)
SPS × Developing				-0.574***				-0.981***
				(0.164)				(0.223)
SPS × LDC				-0.874**				-1.998***
				(0.371)				(0.681)
Tariff	-0.0172	-0.0171	-0.0176	-0.0152	-0.0416***	-0.0416***	-0.0412***	-0.0410***
	(0.0140)	(0.0140)	(0.0142)	(0.0139)	(0.00734)	(0.00733)	(0.00729)	(0.00738)
Log GDP importer	0.670***	0.672***	0.660***	0.660***	0.346***	0.340***	0.363***	0.348***
	(0.0953)	(0.0952)	(0.0957)	(0.0962)	(0.129)	(0.129)	(0.128)	(0.127)
Log GDP exporter	0.254***	0.254***	0.249***	0.243***	0.0885	0.0893	0.0504	0.0808
	(0.0527)	(0.0527)	(0.0551)	(0.0559)	(0.0836)	(0.0831)	(0.0812)	(0.0825)
Obs.	2133978	2133978	2133978	2133978	2253677	2253677	2253677	2253677

Notes: Standard errors in parentheses. *, **, *** are 10%, 5% and 1% significance levels. All regressions include country-pair fixed effects, product fixed-effects, and year fixed-effects. Standard errors are clustered by HS02-country pair.

In order to evaluate this claim, we estimate a specification that allows not only for heterogeneous effects depending on the NTM type (TBT or SPS) and origin of exports (Developed, LatAm, other developing and LDC) but also depending on the sector. We only use aggregate sectors such as Agriculture and Industry to keep the model parsimonious. We interact the NTM dummies with (exhausting) indicator variables for agricultural and industrial products, that is, $Agriculture_{mxjt} = 1$ if m is importing an agricultural product from x at t. The remaining goods are used to construct

an indicator variable $Industry_{mxjt}$.[3] The results shown in Table 5, when significant, are in general coherent with the comparative advantage story. First we discuss the more obvious cases: TBT for industrial goods and SPS for agricultural goods as their respective incidences are more elevated (recall Figure 1). In the case of TBT measures imposed on industrial goods (columns 2 and 4), it negatively affects both LatAm and LDC exports (both significantly when they export to LatAm countries and only significant for LDC when they export to the group of developed countries) while it positively affect developing countries' exports (significantly at 1%, but only when exporting to LatAm countries). The effects of SPS measures on agricultural goods also show a clear pattern. It harms the exports of developed, other developing and LDC countries (highly significant for developing and LDC, but only at the 10% level for industrial countries' exports to LatAm) while it increases the exports of LatAm to developed countries (insignificant on LatAm-LatAm trade). We find some mixed results for the cases of TBT measures in agricultural goods exports and SPS measures in industrial goods exports. In the case of TBT measures in agricultural goods, exports from developed and developing countries are negatively affected (although significantly only for each one of the importer groups). However, exports from LatAm countries are also negatively affected by SPS measures, which might not be consistent with the comparative advantage idea. One possible explanation for this result relates to the fact that, in general, agricultural goods that are affected by TBT measures tend to be more capital intensive in comparison to ordinary agricultural goods. For this kind of agricultural goods, the argument of LatAm countries having comparative advantages in their production become less clear cut. This explanation is consistent with the positive effects of SPS measures on LatAm countries' exports of agricultural goods, but a negative effect when it comes to TBT measures imposed on the same (more capital intensive) sector goods. One could also simply argue that TBT measures applied to this sector are particularly more restrictive in comparison to SPS measures.

Moreover, in the case for SPS on industrial goods, we see positive effects on developed countries exports (significantly only when exporting to another developed country) while it harms exports from LatAm and LCD countries (the former is significant only when exporting to developed countries).

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[3] Goods from sectors 1-27 in the HS classification are defined as Agriculture and sectors 28-96 as Industrial goods.

Table 5. Effects of non-tariff measures by sector– Poisson regression

Variable	Importer: Developed countries		Importer: Latin American countries	
	(1)	(2)	(3)	(4)
TBT × Industry	0.0963		-0.00773	
	(0.0721)		(0.0585)	
TBT × Agric.	-0.301**		0.0775	
	(0.133)		(0.150)	
SPS × Industry	-0.0953		-0.147	
	(0.166)		(0.114)	
SPS × Agric.	0.0217		-0.610*	
	(0.191)		(0.340)	
TBT × Developed × Industry		0.135		-0.0745
		(0.127)		(0.0798)
TBT × LatAm × Industry		-0.234		-0.381**
		(0.261)		(0.172)
TBT × Developing × Industry		0.184		0.437***
		(0.141)		(0.135)
TBT × LDC × Industry		-1.264**		-3.882***
		(0.557)		(0.664)
TBT × Developed × Agric.		-0.459**		0.129
		(0.210)		(0.179)
TBT × LatAm × Agric.		-0.369**		0.204
		(0.181)		(0.251)
TBT × Developing × Agric.		-0.0693		-0.835**
		(0.192)		(0.415)
TBT × LDC × Agric.		-0.374		1.008*
		(0.332)		(0.597)
SPS × Developed × Industry		0.405**		0.0209
		(0.198)		(0.129)
SPS × LatAm × Industry		-0.863***		-0.119
		(0.295)		(0.188)
SPS × Developing × Industry		-0.551***		-0.551**
		(0.213)		(0.264)
SPS × LDC × Industry		-1.482**		-1.725**
		(0.622)		(0.678)
SPS × Developed × Agric.		0.164		-0.599*
		(0.257)		(0.353)
SPS × LatAm × Agric.		0.718**		-0.0457
		(0.320)		(0.400)
SPS × Developing × Agric.		-0.566**		-1.504***
		(0.227)		(0.422)
SPS × LDC × Agric.		-0.929**		-2.672***
		(0.406)		(0.642)
Tariff	-0.0187	-0.0161	-0.0416***	-0.0435***
	(0.0142)	(0.0144)	(0.00732)	(0.00753)
Log GDP importer	0.655***	0.638***	0.335**	0.362***
	(0.0919)	(0.0947)	(0.131)	(0.128)
Log GDP exporter	0.254***	0.241***	0.0894	0.0641
	(0.0531)	(0.0539)	(0.0833)	(0.0832)
Observations	2133978	2133978	2253677	2253677

Notes: Standard errors in parentheses. *, **, *** are 10%, 5% and 1% significance levels. All regressions include country-pair fixed effects, product fixed-effects, and year fixed-effects. Standard errors are clustered by HS02-country pair.

However, other developing countries as exporters are also negatively affected by those measures. By the same reasoning, pre-existing SPS measures imposed on industrial goods are more concentrated in agribusiness sectors (see Figure 1). We argue that developing countries other than LatAm ones are more competitive on pure manufacturing exports (for instance, China), but it is not so clear-cut how competitive they are on industrial sectors linked to agriculture.

One of the advantages to working with the Poisson model is to use the available information on zero trade flows. Our benchmark results make use of this information. In Table A2 of Appendix A, we compare our benchmark results with another version of Poisson regression that ignores the existence of zero trade flows in our database. It is important to notice that zero trade flows comprise a substantial share of total observations (roughly 73% and 84% for the two groups of developed and LatAm importers, respectively). That happens because we used bilateral import flows at a very disaggregated level (HS04) and, as expected, most countries do not export all kind of goods. This comparison is useful to highlight the importance of the extensive margin (whether to export or not) and the intensive margin (how much to export) decisions of exporting firms. As shown in Table A2, core results are very robust to this comparison, exception made for the group of least developed countries (LDC). For both TBT and SPS measures as well as for both groups of importers, benchmark results imply significant and negative effects on the exports of those countries. When zero trade flows are excluded from the dataset, however, previous negative effects become statistically insignificant. This suggests that the effects of TBT/SPS measures are particularly important for the extensive margin decision of LDC's exporting firms. In other words, the non-tariff measures may be restrictive enough to induce those countries to eventually stop exporting. For all other group of exporters, this seems not to be the case. Again, this is in line with the reasoning of comparative advantages advocated in this article.

5.1. Robustness checks: is it really comparative advantages?

In this subsection, we provide another piece of empirical evidence that corroborates the idea that the uneven effects of non-tariff measures may be really explained by comparative advantages among countries. We use a simple additional specification that aims to control for the differences in comparative advantages for each product and exporter. That is done by using a comparison of results based on which fixed effects we seek to control for the within product differences between

countries. More specifically, we compare the benchmark results that use the country pair, product and time fixed effects with another specification that replaces pre-existing product fixed effects by exporter-product fixed effects. We argue that this new specification helps to control for differences in the comparative advantages among exporters. As long as those comparative advantages are constant along the time span considered in our database (which seems to be the case, as the multilateral resistance term did not play any significant role in our previous regressions), those new fixed effects (exporter-product fixed effects) may indeed control for them. The intuition is clear: adding exporter-product fixed effects to our equation must control for heterogeneity in the efficiency of exporters considered in our dataset. Therefore, our analysis of the impacts of the non-tariff measures on bilateral imports may now compare among exporters that are relatively close in terms of their international competitiveness for each given product.

If exporter-product fixed effects are indeed able to control for comparative advantages among exporters, one would expect that most of the differences in the effects of non-tariff measures that we argued to be related to comparative advantages would vanish once we introduce those fixed effects in our regression. In general, this is what we obtain and is shown in **Erro! Fonte de referência não encontrada.**. For simplicity of exposition, we show only the results corresponding to the last specification used in Table 5 (with heterogeneous effects by measure type, origin, and sectors). Columns 1 and 3 show the benchmark results using Poisson specifications for the two different datasets (equivalent to columns 2 and 4 in Table 5). Columns 2 and 4 show the same regressions, but now including the exporter-product fixed effects that we have proposed. When comparing the results from columns 1-2 and 3-4, it is clear that most of the coefficients become statistically insignificant. The positive effects of non-tariff measures on agricultural exports of LatAm countries and their negative impacts for developed and other developing countries' exports of industrial goods are all vanished. We interpret these results as following. When an advanced economy imposes a TBT/SPS measure on its agricultural imports, all exporting countries face higher variable/fixed costs in order to comply with this requirement. In equilibrium, the final effect will be that it decreases agricultural exports from developed, other developing and LDC countries. However, the same measures will positively affect exports from LatAm countries in that sector. These results are consistence with the fact that the latter group of exporters is relatively more efficient in the production and exports of agricultural goods – and more able to absorb those costs – in comparison to their exporting competitors. Therefore, when we control for comparative advantages (i.e., adding

product-exporter fixed effects), we compare the effects of the TBT/SPS measures on the exports of countries with similar efficiency levels in the production and exports of agricultural goods.

Table 6. Effects of NTMs and comparative advantages – Poisson regression

Variable	Importer: Industrial countries		Importer: Latin American countries	
	(1)	(2)	(3)	(4)
TBT × Developed × Industry	0.135	-0.138**	-0.0745	-0.0279
	(0.127)	(0.0552)	(0.0798)	(0.0629)
TBT × LatAm × Industry	-0.234	-0.0257	-0.381**	0.0174
	(0.261)	(0.105)	(0.172)	(0.101)
TBT × Developing × Industry	0.184	0.0460	0.437***	0.0940
	(0.141)	(0.0361)	(0.135)	(0.105)
TBT × LDC × Industry	-1.264**	0.0565	-3.882***	0.130
	(0.557)	(0.0678)	(0.664)	(0.374)
TBT × Developed × Agric.	-0.459**	-0.0699	0.129	0.251**
	(0.210)	(0.105)	(0.179)	(0.124)
TBT × LatAm × Agric.	-0.369**	-0.131	0.204	0.199
	(0.181)	(0.108)	(0.251)	(0.184)
TBT × Developing × Agric.	-0.0693	-0.0216	-0.835**	-0.150
	(0.192)	(0.130)	(0.415)	(0.403)
TBT × LDC × Agric.	-0.374	-0.609***	1.008*	-1.408***
	(0.332)	(0.0875)	(0.597)	(0.149)
SPS × Developed × Industry	0.405**	-0.130	0.0209	-0.127
	(0.198)	(0.108)	(0.129)	(0.0956)
SPS × LatAm × Industry	-0.863***	0.0286	-0.119	-0.0408
	(0.295)	(0.133)	(0.188)	(0.120)
SPS × Developing × Industry	-0.551***	-0.0226	-0.551**	0.118
	(0.213)	(0.0628)	(0.264)	(0.153)
SPS × LDC × Industry	-1.482**	-0.344	-1.725**	0.789***
	(0.622)	(0.411)	(0.678)	(0.265)
SPS × Developed × Agric.	0.164	0.437**	-0.599*	0.0796
	(0.257)	(0.200)	(0.353)	(0.141)
SPS × LatAm × Agric.	0.718**	-0.239	-0.0457	-0.482
	(0.320)	(0.162)	(0.400)	(0.319)
SPS × Developing × Agric.	-0.566**	-0.161	-1.504***	-0.656**
	(0.227)	(0.156)	(0.422)	(0.320)
SPS × LDC × Agric.	-0.929**	0.0712	-2.672***	-6.134***
	(0.406)	(0.154)	(0.642)	(1.397)
Tariff	-0.0161	-0.0115**	-0.0435***	-0.0340***
	(0.0144)	(0.00559)	(0.00753)	(0.00494)
Log GDP importer	0.638***	0.633***	0.362***	0.326***
	(0.0947)	(0.0768)	(0.128)	(0.118)
Log GDP exporter	0.241***	0.278***	0.0641	0.183**
	(0.0539)	(0.0462)	(0.0832)	(0.0919)
Exporter-Product Fixed effect	No	Yes	No	Yes
Observations	2133978	1214899	2253677	778208

Notes: Standard errors in parentheses. *, **, *** are 10%, 5% and 1% significance levels. All regressions include country-Pair fixed effects, product fixed-effects, and year fixed-effects. Standard errors are clustered by HS02-country pair.

The very same prescription is found when we compare the results for the effects of TBT and SPS measures on industrial exports, with the distinction that the most efficient countries in the production and exports of this type of goods are included in the group of developed economies and the less efficient ones are in the groups of LatAm and developing countries exporters.

6. Final Remarks

The current work provides new evidence on the effects of TBT/SPS measures on country's bilateral trade. More specifically, with two different datasets and disaggregated bilateral trade flows, we investigate if different non-tariff measures have uneven impacts on exports. Overall, we observe a pattern that is coherent with a "comparative advantage" story – developing nations (especially Latin American countries) tend to produce agricultural goods relatively more efficiently and hence their exports of those goods tend to be less affected by pre-existing TBT/SPS measures in importing countries. For those countries, we could observe even positive impacts in some cases (as when SPSs are imposed). This seems to be true regardless of the group of importing countries (either developed or Latin American countries). The opposite seems to be true for the group of developed countries and other developing countries, which have their comparative advantages concentrated in the production and exports of industrial goods. For those countries, while pre-existing TBT measures may burst exports of industrial goods, pre-existing SPS measures tend to hamper their exports of agricultural goods. The developing countries' group of exporters includes the fast-growing economies in Asia, such as China and its neighboring countries, which are mostly specialized in the exports of labor-intensive manufacturing goods. Though still considered developing economies, these countries have their comparative advantages concentrated in industrial goods. Our comparative advantage story has some mixed results for the case of TBTs applied to agricultural goods and SPSs applied to industrial goods since LatAm agricultural exports decline with the imposition of a TBT, while other developing countries exports of industrial goods are also negatively affected by the imposition of an SPS. However, one can reconcile these results with comparative advantages if one takes into consideration that LatAm countries tend to be relatively less efficient in the production and exports of more capital-intensive agricultural goods in

comparison to the less capital-intensive ones, while other developing countries are relatively less efficient in the production and exports of industrial goods that are related to agriculture.

This is study also confirms some of the findings detected in previous literature regarding the likely positive effects of TBT/SPS measures on some specific bilateral trade flows. Our results add to this literature by showing some sounding empirical evidence of macro exporting sectors that are more likely to benefit from pre-existing TBT/SPS measures on destination countries and the ones that, on the contrary, are more likely to be harmed by those measures.

From the perspective of the negotiation of multilateral/bilateral regulatory treaties, the policy implications from this study seem to be straightforward: countries should put the focus of their negotiations on streamlining regulatory export procedures in sectors where they are (in average) relatively less competitive in comparison to its trade partners.

Above all, we provide empirical evidence that regulatory measures, like TBT and SPS, may contribute to reinforce trade specialization patterns among countries, according to comparative advantages. For the less developed economies, in particular, existing regulatory barriers, if not taken into consideration by policymakers, may undermine the full potential of local industrial policies, harming the prospects for industrialization in these economies.

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Appendix A: Robustness checks

Table A1. OLS regressions - Controlling for "Multilateral resistance"

Variable	Importer: Industrial countries		Importer: Latin American countries	
	(1)	(2)	(3)	(4)
TBT × Developed	0.189***	0.176***	0.332***	0.354***
	(0.0419)	(0.0437)	(0.0438)	(0.0467)
TBT × LatAm	-0.261***	-0.267***	-0.526***	-0.500***
	(0.0509)	(0.0524)	(0.0616)	(0.0644)
TBT × Developing	-0.120***	-0.139***	-0.242***	-0.246***
	(0.0317)	(0.0335)	(0.0506)	(0.0535)
TBT × LDC	-0.248***	-0.243***	-1.679***	-1.734***
	(0.0852)	(0.0872)	(0.213)	(0.218)
SPS × Developed	-0.629***	-0.610***	-0.494***	-0.486***
	(0.0585)	(0.0608)	(0.0612)	(0.0659)
SPS × LatAm	1.213***	1.234***	0.824***	0.841***
	(0.0693)	(0.0713)	(0.0843)	(0.0871)
SPS × Developing	-0.239***	-0.222***	-0.405***	-0.433***
	(0.0476)	(0.0504)	(0.0689)	(0.0729)
SPS × LDC	1.034***	1.048***	1.242***	1.172***
	(0.103)	(0.104)	(0.245)	(0.248)
Tariff	-0.00207	-0.00264	-0.0221***	-0.0250***
	(0.00171)	(0.00172)	(0.00218)	(0.00253)
Log GDP importer	0.874***		1.072***	
	(0.0362)		(0.0474)	
Log GDP exporter	0.0401		0.114***	
	(0.0257)		(0.0398)	
Multilateral resistance controls	No	Yes	No	Yes
Observations	577182	577177	360189	360155
Adj. R^2	0.513	0.515	0.406	0.408

Notes: Standard errors in parentheses. *, **, *** are 10%, 5% and 1% significance levels. All regressions include country-pair fixed effects, product fixed-effects and year fixed-effects. Standard errors are clustered by HS02-country pair. "Multilateral resistance controls" includes importer-year, exporter-year and product-year fixed effects.

Table A2. Poisson regressions - Excluding zero trade flows

Variable	Importer: Industrial countries		Importer: Latin American countries	
	Full sample	Excluding zero trade flows	Full sample	Excluding zero trade flows
TBT × Industrial	-0.00246	-0.105	-0.0285	0.0175
	(0.100)	(0.107)	(0.0770)	(0.0744)
TBT × LatAm	-0.346*	-0.312	-0.214*	-0.208**
	(0.185)	(0.327)	(0.129)	(0.104)
TBT × Developing	0.118	0.117	0.314**	0.318*
	(0.127)	(0.144)	(0.142)	(0.184)
TBT × LDC	-1.031**	-0.589	-0.855**	-0.890
	(0.409)	(0.363)	(0.376)	(0.665)
SPS × Industrial	0.222	0.157	-0.106	-0.167
	(0.174)	(0.184)	(0.130)	(0.171)
SPS × LatAm	0.275	0.278	0.279*	0.164
	(0.225)	(0.391)	(0.158)	(0.271)
SPS × Developing	-0.574***	-0.499***	-0.981***	-0.697***
	(0.164)	(0.148)	(0.223)	(0.228)
SPS × LDC	-0.874**	0.201	-1.998***	-0.632
	(0.371)	(0.452)	(0.681)	(0.628)
Tariff	-0.0152	-0.0185	-0.0410***	-0.0329***
	(0.0139)	(0.0146)	(0.00738)	(0.00950)
Log GDP importer	0.660***	0.621***	0.348***	0.361***
	(0.0962)	(0.109)	(0.127)	(0.138)
Log GDP exporter	0.243***	0.262***	0.0808	0.142*
	(0.0559)	(0.0690)	(0.0825)	(0.0843)
Observations	2133978	577182	2253677	360189

Notes: Standard errors in parentheses. *, **, *** are 10%, 5% and 1% significance levels. All regressions include country-pair fixed effects, product fixed-effects and year fixed-effects. Standard errors are clustered by HS02-country pair.

Table A3. Country classification

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