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On the heterogeneous effects of non-tariff measures: Panel evidence from Peruvian firms

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Abstract

Non-Tariff Measures (NTMs) are prominent instruments of contemporary trade policy yet little evidence of their impact on exporting firms exists. This paper present some novel results based on a unique dataset merging information about the implementation of NTMs in member countries of the Latin American Integration Association (LAIA) and Peruvian firms' exports during the period from 2000 to 2014. Large firms are found to benefit from the implementation of NTMs and in particular of Technical Barriers to Trade at the expenses of smaller firms. Both exports value and the probability of exporting increases for above median sized firms, while their probability to exit the export sector decreases. The reverse is true for below median sized firms.

Key words: Non-Tariff Measures, Firms, Exports, Peru, Margins of Trade

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Executive summary

With steadily diminishing tariffs, the focus of trade policy makers and analysts is logically turning towards Non-Tariff Measures (NTMs). Indeed, NTMs and in particular technical measures have become a prominent feature in the regulation of international trade in goods. While technical regulations were imposed on almost 37 per cent of tariff lines in 1999, the equivalent figure for 2015 is more than 60 per cent (UNCTAD, 2015).

The major aim of this paper is to assess how different types of NTMs would affect firms' exports allowing for heterogeneous effects along the firm size dimension. The Peruvian experience within the LAIA (Latin American Integration Association) country group is of particular relevance. Descriptive statistics reveal that the share of Peruvian exports directed to LAIA countries has been increasing since 2000. During the same period, the number of exporting firms to that region has been decreasing. A possible explanation could be an intensification of the implementation of NTMs and in particular of technical regulations.

This conjecture appears to be validated by empirical results. The latter suggest that firms of size above the median of exporting firms' size distribution have gained from the implementation of new measures (or the amendment of existing ones). This is true for all margins of trade considered in the paper. Their export values increase, the probability of export increases and the probability to leave the exports sector falls. These results are robust to changes in sampling and identification strategies.

From the exporting country point of view, the costs of exporting for its firms are directly impacted by the implementation of a technical regulation by a trade partner country. Trade costs are likely to have a fixed and a variable component. The latter could be either ad valorem or additive such as specific tariffs. Proportionally, changes in fixed and additive variable costs affect smaller firms more. Clearly any policy able to reduce the effects of changes in costs to export on small (and medium) firms may dampen the exclusion effect of technical regulations identified previously.

Several dimensions should be considered in implementing policies aimed at reducing the cost of compliance with NTMs and in particular technical regulations in specific international markets. The first dimension is the domestic business and production environment of small and medium enterprises. The second dimension is the customs procedural framework. The third dimension is the intergovernmental political platform.

Within the first dimension, policy could be designed on several complementary grounds. First, access to crucial information concerning export requirements for any specific product should be facilitated for all type of producers, with particular attention paid to smaller ones. Moreover, advisory services related to the implementation, production-wise, of any specific requirements should be made available. Facilitating access to finance is an additional necessary accompanying measure to be considered by policy makers. In addition to technical assistance and capacity building programs, private sector based initiatives should also be considered to promote the participation of small and medium enterprises in export markets.

Within the second dimension, the customs procedural framework, desirable policy actions have been identified extensively in the literature and several already put into practice. The most prominent is the Single Window for Foreign Trade, which aims to reduce the number of agencies at the border. This should reduce fixed business costs and therefore help SMEs expand their cross-border trade. Several countries have set up such single windows. Peru established a Single Window for Foreign Trade (VUCE) in 2010.

The third dimension relates to actions a government would be able to actively pursue beyond domestic borders. As technical regulations have primarily non-trade objectives, it would be misleading to look at technical regulations as we look at tariffs. Streamlining NTMs would consist of reform and harmonization, so as to maintain their objectives but at the lowest possible costs. In practice, streamlining NTMs will reduce

costs and increase the competitiveness of firms engaged in international trade. Governments should ensure that NTM requirements are scientifically based. In addition governments should agree on the conditions for the mutual recognition of certificates delivered by their respective conformity assessment bodies. Without such certificates and their recognition by competent authorities in destinations markets firms would not be able to conclude any transaction.

1. Introduction

With steadily diminishing tariffs, the focus of trade policy makers and analysts is logically turning towards Non-Tariff Measures (NTMs). Indeed, NTMs and in particular technical measures have become a prominent feature in the regulation of international trade in goods. While technical regulations were imposed on almost 37 per cent of tariff lines in 1999, the equivalent figure for 2015 is more than 60 per cent (UNCTAD, 2015).

Some studies argue that NTMs represent a major challenge to international trade policy-making, as they can undermine the progress made so far in liberalizing trade (Evenett and Fritz, 2015; Jensen and Keyser, 2012). Others argue that the impact of NTMs on trade flows remains ambiguous depending on the magnitude of their cost raising effects (Chen and Mattoo, 2008; Maertens and Swinnen, 2009). Finally, if welfare considerations are taken into account, negative trade effects may be very well associated with positive welfare effects (Disdier and Marette, 2010).

Broadly defined, NTMs include all trade-related policy costs incurred from production to final consumer, with the exclusion of tariffs. For practical purposes, NTMs are categorized depending on their scope and/or design and are broadly distinguished in technical measures (Sanitary and Phytosanitary Standards, SPS; Technical Barriers to trade, TBT; and pre-shipment inspection, PSI) and non-technical measures. These are further divided into hard measures (e.g. price and quantity control measures), threat measures (e.g. anti-dumping and safeguards), and other measures such as trade-related finance, anti-competitive and investment measures). In practice, NTMs are measures that have the potential to distort international trade, whether they are aimed to be protectionist or not. For example, measures such as quality standards, although generally imposed without protectionist intent, may be of particular concern to poor countries whose producers are often ill-equipped to comply with them. On the other hand, quality standards might help in information exchange between buyers and sellers, signaling product quality, and thus can reduce transaction costs and facilitate trade. Non-technical measures vary considerably by intent and scope. However, their effect on trade is generally more understood and easier to quantify. The effects of price control measures are relatively simple to measure, especially anti-dumping and safeguards. Quantity control instruments have been extensively examined in the analysis of quotas, tariff rate quotas and their administration (see Boughner, de Gorter, and Sheldon, 2000). Para-tariff measures can be analyzed as conventional tax instruments and their incidence is straightforward to capture. Finance, anti-competitive, and trade related investment measures have indirect effects on trade, and their actual impact is more difficult to assess.

What clearly emerges from the theoretical literature is the need to place the empirical analysis at the level of the firm. Since exporting firms can respond to the imposition of NTMs in numerous ways, it is necessary to explore all the likely reactions and evaluate the net impact of policy change. Evidence at the firm level however still remains very scarce. A major contribution is Fontagné and al. (2015). They consider the heterogeneous trade effects of restrictive Sanitary and Phyto-Sanitary (SPS) measures on exporters of different sizes, and the channels via which aggregate exports fall. In order to do so they matched a detailed panel of French firm exports to a recent database of SPS regulatory measures that have been raised as of concern in the dedicated committees of the WTO. Specific trade concerns refer to standards that are perceived essentially as trade barriers. They analyze their effects on three trade-related outcomes: (i) the probability to export and to exit the export market (the firm-product extensive margin), (ii) the value exported (the firm-product intensive margin), and (iii) export prices. SPS concerns are found to discourage the presence of exporters in SPS-imposing foreign markets. They are also found to affect negatively the intensive margins of trade. An additional important result is that the negative effects of SPS regulatory measures are attenuated in larger firms. Another important contribution is Fernandes and al. (2015). Compared to Fontagné and al. (2015), the set of regulatory measures considered is more specific but country coverage is significantly extended. The paper assesses the impact on firms' exports of pesticide standards using two novel datasets. The first covers all exporting firms in 42 developing countries. The second covers pesticide standards for 243 agricultural and food products in 63 importing countries. Their results show that pesticide standards significantly affect foreign market access of affected products. More restrictive standards in the importing country, relative to the exporting country, lower firms' probability of exporting as well as their export values and quantities. Moreover, they find evidence of heterogeneous effects amongst exporters.

Smaller exporting firms are more negatively affected in their market entry and exit decisions by the relative stringency of standards.

The major aim of this paper is to assess how different types of NTMs affect firms' exports, allowing for heterogeneous effects along the firm size dimension. The Peruvian experience within the LAIA (Latin American Integration Association) country group is of particular relevance. As shown later in the paper, the share of Peruvian exports directed to LAIA countries has been increasing since 2000. During the same period we observe that the number of exporting firms to that region has been decreasing. While the intensification of exports to LAIA countries could be associated with the economic and trade integration process at work in the region over the last fifteen years,[1] the increasing concentration of firms in the export sector remains puzzling. A possible explanation could be an intensification of the implementation of NTMs and in particular of technical regulations. Empirical results allow us to test the validity of this explanation.

The contribution of this paper is twofold. First, we construct a unique set of consistent data on public regulations during the period from 2000 to 2014 for LAIA country members.[2] This part of the contribution is non-negligible as sources of information on NTMs remain scarce. When available, information is either cross-sectional (with the reference year usually varying across countries) or restricted to some specific type of NTMs (e.g. SPS measures or TBTs) when pluri-annual. Our dataset offers a fifteen-(consecutive)-year coverage of exhaustive NTM regulations applied by a set of twelve countries. This is to our knowledge the largest panel of the sort ever used in empirical work. Second, we assess the impact of technical and non-technical NTMs at the firm level using information on exports of Peruvian firms also obtained for the 2000-2014 period. The novelty here is the inclusion of different types of NTMs within the same empirical set-up. Our dataset allows a clear identification of the impact of each of these types thanks to inter alia an almost inexistent overlap of measures.

Our baseline results show that NTMs do impact both margins of trade, and that in the case of technical regulations the impact differs according to firm size. Amongst technical regulations, the effect of Technical Barriers to Trade is the only one which is significant in all specifications. Sanitary and Phytosanitary measures only affect exit rates and Pre-Shipment inspections only affect the intensive margin. When the impact of technical regulations is significant, results further show that not only small exporters are more negatively affected than larger ones but that the latter can actually gain from the application of new or more stringent measures. Gains are observed in terms of export value, participation and duration, and survival. Results obtained from unit value regressions indicate that only TBTs have a significant effect and the latter is globally positive although decreasing with firm size.

The rest of the paper is organized as follows. Section 2 contains a brief review of insights from recent developments in trade theory, suggesting mechanisms consistent with heterogeneous effects of trade policy on firms' export performance, and a discussion of the most important empirical evidence on the impact of NTMs at the firm level. Section 3 presents our two datasets. Stylized facts characterizing these two datasets are shown and discussed in section 4. Section 5 introduces the empirical strategy used. Results are shown in section 6. The last section debates possible implications for policy making bearing in mind the specificity of the empirical exercise.

[1] Fugazza and McLaren (2014) show that a fifth of the increase of Peruvian exports directed to Mercosur countries is due to improvement in preference margins.

[2] LAIA country members are Argentina, Bolivia (Plurinational State of), Brazil, Chile, Colombia, Cuba, Ecuador, Mexico, Paraguay, Peru, Uruguay and Venezuela (Bolivarian Republic of).

2. Heterogeneous effects of trade policy: Insights from trade theory

Fontagné and al. (2015) and Fernandes and al. (2015) both find empirical evidence that the effects of NTMs vary with exporting firms' size. These findings are corroborated by the results of this paper.

The rationale for a heterogeneous impact of trade shocks induced by policy reform put forward in the trade theory literature is not unique. We can distinguish two main classes of model. In order to generate heterogeneous effects one relies essentially on non-constant demand price elasticities and the other on some specific form of trade costs (either variable or fixed). All models however are based on a standard heterogeneous firm trade model, à la Melitz (2003) or Chaney (2008).

A major contribution belonging to the first class of theoretical frameworks is Spearot (2013). He shows that if import demand elasticities vary across product varieties, the liberalization of a common tariff has a natural disparate effect on the composition of aggregate trade flows. More precisely, the liberalization of a common tariff disproportionately increases imports of low revenue varieties, and in some cases, this increase comes at the expense of high revenue varieties within a wide class of demand systems that are consistent with empirical evidence. In other words, countries are less responsive to trade shocks when their exporting firms are relatively large. A major implication of this result is that the liberalization of a common ad-valorem tariff needs not increase bilateral imports of all product varieties.

As to the second class, modelling strategies rely either on some form of endogenous fixed costs or on a specific form of variable trade cost. Arkolakis (2010) presents a framework based on market penetration costs that are endogenous rather than fixed in the sense that paying higher costs allows firms to reach an increasing number of consumers in a given country. In that set up the elasticity of exports with respect to variable trade costs declines with firm size in a market. An important new prediction of the model is that a significant amount of new trade in the event of trade liberalization comes from exporting firms originally small, rather than new, exporters.

Although Arkolakis (2010) and Spearot (2013) reach similar equilibrium predictions, the Arkolakis (2010) framework guarantees that all firms gain from liberalization, which is not the case in Spearot (2013). Moreover, market penetration costs of Arkolakis (2010) are not necessarily easy to relate to or read into NTMs. Irarrazabal, Moxnes and Opromolla (2015) develop a quantitative analytical framework that features both additive and multiplicative trade costs. In this framework, as additive trade costs increase, the demand elasticity in a market becomes less negative and especially so among low price firms. Comparative statics results are thus comparable to those obtained in Spearot (2013) and Arkolakis (2010).

Additive trade costs are easily interpretable in terms of NTMs. For instance, any labelling requirement is likely to imply a cost which is unrelated to the price of the good to which the measure applies. Additive costs are not a new feature in trade theory. Alchian and Allen (1964) pointed out that additive costs imply that the relative price of two varieties of some goods will depend on the level of trade costs, and that relative demand for the high quality good increases with trade costs. Hummels and Skiba (2004) found strong empirical support for the Alchian-Allen hypothesis. Specifically, the elasticity of freight rates with respect to price was estimated to be well below the unitary elasticity implied by the iceberg assumption. Berman and al. (2012) show that the presence of additive trade costs is necessary to reconcile the most commonly used theoretical framework with the empirical finding that individual firms set higher free on board (f.o.b.) prices over long distances than over short ones, a sort of “reverse dumping”.

Additivity proves to be an important feature of trade costs and corresponds to a large set of NTMs. For instance, testing and certification of inspection requirements represent an additive component of trade costs while complying with these requirements in the production process may act as a fixed component of trade costs.

Although our empirical set up does not allow for precisely accounting for the structure of trade costs, we will further explore additivity in the last section of the paper dedicated to implications for policy.

3. Data

The empirical investigation is based on two distinct core datasets. The first contains information on NTMs applied by LAIA countries during the period from 2000 to 2014. This is an exhaustive set of regulations and includes also regulations which took effect before the period under investigation. The second contains information on exports transactions collected by Peruvian customs.
NTM data are collected by the LAIA/LAIA secretariat for its 12 core members. Due to the change in the classification of NTMs as proposed by UNCTAD and other MAST member agencies,[3] 2 sub-periods had to be considered (the 2000-2010 sub-period and the 2011-2014 sub-period), and the two respective NTM classifications reconciled. The pre-2012 UNCTAD classification focused on the distinction between core and non-core NTMs. The post-2012 UNCTAD/MAST classification is based on the distinction between technical and non-technical NTMs. As no official correspondence exists between the two classifications, we used an *ad hoc* classification provided by the LAIA/LAIA secretariat, based on their experience of collecting NTM data for the years 2011 and 2012 using both classifications. We used the new classification as the reference one and measures collected between 2000 and 2010 were thus reclassified at the chapter level (e.g. SPS measures versus TBTs).

Data on annual exports are from Peruvian Customs and the period of coverage corresponds to that of the NTM data. Information on transactions involving exporting Peruvian firms is reported by firm, year, product and destination. Information on export values is expressed in $US and is fob (free on board). Corresponding exported quantities (supplementary quantity – WCO units- and net weight) are also reported, meaning that unit values can be computed.

Both NTM data and Peruvian firms' exports data are collected at the national tariff line (NTL, up to 10 digits). As NTL classifications are not easily reconcilable across countries, we first aggregate both datasets at the HS 6-digit level and then merge them. Attrition remains limited. Moving from the 10 to the 6-digit classification implies a reduction of about 6 per cent in the number of observations included in our reference sample. This reflects the fact that products exported by multi-product firms belong in most cases to different HS subheadings.

Our reference sample includes only firms that exported any product to a LAIA destination for at least four years during the time period under investigation. The main motivation for selecting this sub-sample is to minimize any bias from firms exporting only occasionally and from companies whose rationale for entering and exiting a destination are purely driven by competition at destination.

4. NTMs in LAIA: Stylized facts

Before going into our empirical exercise we review a series of stylized facts on NTMs in LAIA countries and on Peruvian exporters.

[3] The Multi-Agency Support Team (MAST) was established in 2006 to work on the taxonomy of Non-Tariff Measures (NTMs) and it is composed of 8 international organizations: Food and Agriculture Organization of the United Nations, the International Monetary Fund, the International Trade Centre, the Organization for Economic Cooperation and Development, the United Nations Conference on Trade and Development, the United Nations Industrial Development Organization, the World Bank, and the World Trade Organization. Jointly with other experts, the MAST group continues its work to further develop the NTM classification.

4.1. NTMs in LAIA countries

The original NTM data is collected at the regulation level. A regulation may cover different types of measures that correspond to different chapters of the NTM classification. However, as far as the LAIA data are concerned, we found that except in very few cases, each regulation refers to only one type of measure. The database contains 4451 regulations.[4]

Amongst those 4451 regulations, 3145 (70%) were introduced between 2000 and 2014 and are in vigor in 2014; 502 (12%) were introduced and then abolished between 2000 and 2014; 694 (15%) regulations were implemented before 2000 and are still in place in 2014; 140 (3%) were implemented before 2000 and abolished before 2014. Table 1 reports the corresponding figures for each LAIA core country. Except for Uruguay, Paraguay and Chile, the majority of regulations in vigor in 2014 were implemented after 2000.

Table 1. Non-tariff measures "turnover"

Group	*AR*	*BO*	*BR*	*CH*	*CO*	*CU*	*EC*	*ME*	*PE*	*PR*	*UR*	*VE*	*Tot*
*pre_2000_**end***	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
*pre_2000_**act***	0.3	0.2	0.1	0.5	0.1	0.3	0.1	0.0	0.2	0.5	0.6	0.1	**0.1**
*post_2000_**end***	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	**0.1**
*post_2000_**act***	0.6	0.7	0.7	0.4	0.7	0.6	0.7	0.8	0.7	0.4	0.3	0.8	**0.7**

Source: LAIA/UNCTAD NTM database.

Note: Prefixes *pre_2000* and *post_2000* refer to the period during which measures have been implemented and suffixes ***end*** and ***act*** refers to regulation status in 2014 i.e. abolished or active.

Table 2 reports the distribution of implemented regulations across LAIA core countries since 2000. The most frequent users of NTMs during this period are Brazil, Ecuador, Peru, Chile and Argentina. 49 per cent of regulations in vigor in 2014 were implemented in the sub-period starting in 2010. The Plurinational State of Bolivia, Colombia and the Bolivarian Republic of Venezuela are noticeable exceptions to this pattern.

In terms of composition, 83 per cent of regulations effective in 2014 refer to technical measures (45 per cent to SPS measures, 35 per cent to TBTs, and 3 per cent to Pre-Shipment Inspections). Table 3 shows the number of technical regulations active in 2014 and distinguishes between the three types of technical measures. Technical regulations reported in 2014 have been essentially implemented after 2000. For the whole sample, this is the case for 85 per cent of SPS measures, 75 per cent of TBTs and 76 per cent of Pre-Shipment Inspections. Brazil and Ecuador have implemented more than 90 per cent of their SPS measures and TBTs since 2000.

[4] Note that a regulation registered as new can in fact be an amended measure. An amendment is identified as the imposition of additional requirements or a change of requirements with respect to those already in place and as a consequence is recorded as a new regulation.

Table 2. Regulations implemented since 2000 and effective in 2014

	ARG	BOL	BRA	CHL	COL	CU	ECU	ME	PER	PRY	URY	VEN	Total
2000	13	1	17	11	1	1	3	14	11	3	2	7	84
2001	17	3	35	22	7	2	4	2	5	1	11	3	112
2002	24	2	37	15	12	1	3	4	7	5	14	11	135
2003	13	5	31	23	9	2	3	13	11	1	4	1	116
2004	18	6	44	31	21	8	10	11	20	10	11	6	196
2005	19	6	38	19	13	0	2	12	32	2	6	3	152
2006	14	3	37	28	25	3	13	10	15	3	6	8	165
2007	7	0	53	26	10	0	11	5	20	1	17	7	157
2008	19	9	54	17	12	3	35	7	45	1	14	2	218
2009	16	14	58	17	19	1	42	4	87	6	13	2	279
2010	19	3	37	16	17	0	27	11	56	4	6	5	201
2011	32	1	53	12	5	0	11	8	49	1	12	0	184
2012	39	4	64	42	27	0	75	45	58	10	28	0	392
2013	32	3	48	42	37	2	88	31	51	6	44	4	388
2014	22	0	79	25	18	1	123	35	45	0	15	3	366
Total	**304**	60	**685**	**346**	233	24	**450**	212	***512***	54	203	62	3 145

Source: LAIA/UNCTAD NTMs database.

Table 3. Technical regulations in vigor in 2014

	SPS measures		TBTs		Pre-Shipment Inspections	
	2014	*Since 2000*	2014	*Since 2000*	2014	*Since 2000*
ARG	199	*68%*	191	*52%*	14	*79%*
BOL	44	*91%*	21	*57%*	1	*100%*
BRA	405	*95%*	340	*85%*	5	*100%*
CHL	311	*80%*	152	*68%*	4	*25%*
COL	102	*79%*	144	*76%*	9	*78%*
CUB	7	*57%*	15	*80%*	0	
ECU	158	*91%*	313	*90%*	6	*83%*
MEX	65	*69%*	86	*88%*	1	*100%*
PER	468	*97%*	64	*69%*	2	*100%*
PRY	32	*56%*	38	*66%*	2	*50%*
URY	121	*78%*	128	*68%*	7	*100%*
VEN	41	*49%*	51	*47%*	4	*25%*
Total	1953	*85%*	1543	*75%*	55	*76%*

Source: LAIA/UNCTAD NTMs database.

Although the number of regulations in place and the relative importance of each type of applied measures are already some indicators of NTM incidence, a better appreciation of the latter is obtained by considering the number of products affected by the various regulations. Table 4 reports those figures. Argentina is characterized by the highest product coverage: about 83 per cent of products at the HS 6-digit level are affected by at least one SPS measure and 87 per cent by at least one TBT. At the other extreme the

Plurinational State of Bolivia has the lowest product coverage, with 25 per cent of products affected by at least one SPS measure and less than 2 per cent by a TBT.

Table 4. Number of products affected by at least one measure in vigor in 2014

	Technical	*Non-technical*	*Exports related*
ARG	4469	4712	317
BOL	1354	89	15
BRA	3439	737	81
CHL	3222	139	53
COL	2871	3166	8
CUB	557	4625	16
ECU	2745	230	9
MEX	3039	949	257
PER	1531	401	3
PRY	1483	205	4
URY	2943	336	66
VEN	1704	4773	426

Source: LAIA/UNCTAD NTMs database.

Note: The total number of products at the HS 6-digit level is 5394 (HS Combined).

4.2 Peruvian exports

Table 5 shows the overall evolution of Peruvian exports (first row) between 2000 and 2014 and their geographical composition focusing on 4 major destination country groups, namely EU28 countries, LAIA core countries, MERCOSUR countries[5] and NAFTA countries (Canada, Mexico, and the United States of America). Exports reached a peak in 2012 and have declined since, driven to a large extent by the collapse of oil prices. Nevertheless exports increased more than fourfold between 2000 and 2014. In terms of destinations, LAIA countries have become the second most important destination market for Peruvian exports, outpacing EU28 countries in 2012. Although NAFTA countries and in particular the United States of America remain the major destination of Peruvian exports, their importance has significantly decreased since 2000.

The focus of the paper being LAIA countries, the following set of tables investigates how export margins have evolved taking LAIA countries as the core reference destination. Table 6 reveals that the number of firms exporting to LAIA countries has increased significantly over the period under investigation. It reaches a peak in 2011 and then falls steadily until 2014. Column 2 shows the share of firms exporting to LAIA countries in the total number of exporting firms. Column 3 reports the share of firms amongst those exporting to some LAIA countries that export exclusively to LAIA countries. We observe that both the number and the corresponding share of firms exporting to LAIA countries have increased until 2010-2011 to decrease significantly afterwards. At the same time the share of firms exporting exclusively to LAIA countries has increased steadily during the whole period. It was equal to 58 per cent in 2000 and moved to 76 per cent in 2013-2014 clearly indicating some sort of geographical specialization process that started around 2005.

[5] Member countries to this sub-regional bloc are Argentina, Brazil, the Plurinational State of Bolivia, , Uruguay and and the Bolivarian Republic of Venezuela. Other countries in the region participate as associate countries but they are not considered in these calculations.

Table 5. Peruvian exports (2000 base) and selected destinations (share in total exports)

	2000	*2005*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
World	1.00	2.49	4.09	4.56	3.89	5.13	6.65	6.69	6.10	5.53
EU28	0.22	0.17	0.18	0.18	0.16	0.18	0.18	0.17	0.16	0.17
LAIA	0.17	0.20	0.19	0.20	0.14	0.16	0.17	0.18	0.19	0.21
MERCOSUR	0.05	0.05	0.07	0.07	0.05	0.05	0.05	0.06	0.06	0.06
NAFTA	0.32	0.39	0.27	0.26	0.27	0.27	0.23	0.23	0.25	0.25

Source: Peruvian Customs.

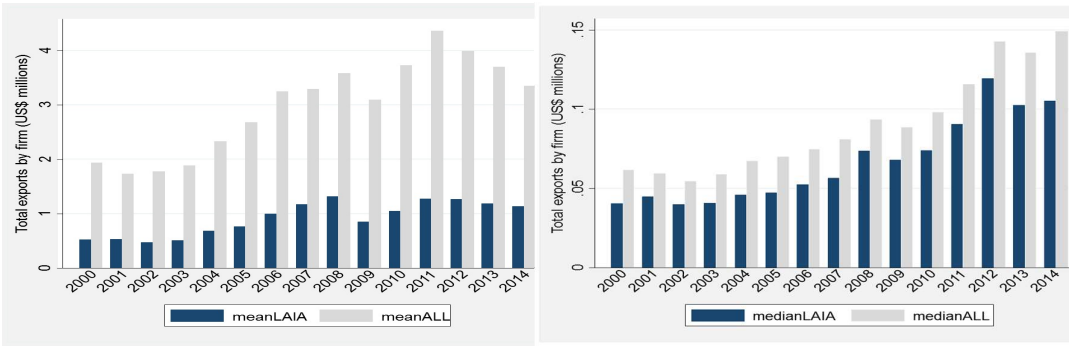
Table 6. Number of exporting firms and destination markets

	Firms exporting to LAIA	*Share in total EX firms*	*LAIA only*
2000	1627	55%	58%
2005	2370	53%	64%
2006	2608	54%	66%
2007	2854	56%	66%
2008	3200	57%	67%
2009	3550	59%	71%
2010	3582	60%	72%
2011	3748	58%	72%
2012	3346	49%	74%
2013	2984	43%	76%
2014	2669	39%	76%

Source: Peruvian Customs/ Authors calculations.

Figure 1 represents the evolution of mean (panel (a)) and median (panel (b)) export values by firms from 2000 to 2014, excluding mineral products. Both overall and LAIA specific figures are represented. General trends are positive in all cases but with an inflexion point for average figures around the years 2010-2011 and a slowdown for median figures around the years 2011-2012. The observed rise in median figures and the slight decline in average figures for LAIA destinations in recent years suggest that the median exporting firm to these markets is becoming steadily larger (small firms have actually grown or disappeared for the median value to increase) however export values by firm contracted over time. This reflects an increasing number of relatively small firms failing to survive on LAIA product markets.

Figure 1. Firm's exports (mineral products are excluded), selected statistics



(a) **(b)**

Source: Peruvian Customs/ Authors' calculations

Table 7 shows statistics regarding the number of products exported by firms. On average the number of products exported by firms exporting to LAIA countries is lower than corresponding figure obtained for the whole sample. The former oscillates between 5.3 in 2000 and 8.2 in 2012 while the latter ranges between 7.7 in 2000 and 9.4 in 2007. Differences across median figures are less striking. In most years the median number of exported products is about 3 whatever the destination. Maximum figures are also comparable across destination groups and went up to 353 in 2008.

As revealed by Table 8 these patterns also apply to the number of destinations reached by Peruvian firms. As far as average and maximum figures are concerned the pattern applies almost by construction as the number of potential destinations is larger when considering the whole world than when focusing on LAIA countries. The maximum of LAIA destinations is 11 while it is more than 180 for the rest of the world. However, median values are comparable across periods and across country groups.

Table 7. Number of exported products per firm

	Mean		**Median**		**Max**	
	LAIA	*ALL*	LAIA	*ALL*	LAIA	*ALL*
2000	5.3	*7.7*	2	*3*	185	*185*
2005	6.6	*9.1*	2	*3*	239	*296*
2006	7.5	*9.3*	3	*3*	302	*302*
2007	7.6	*9.4*	3	*3*	325	*325*
2008	7.4	*8.8*	3	*3*	353	*353*
2009	7.0	*8.4*	2	*3*	245	*245*
2010	7.7	*8.9*	2	*3*	259	*267*
2011	7.6	*8.9*	3	*3*	209	*215*
2012	8.2	*9.2*	3	*3*	282	*282*
2013	7.4	*8.5*	3	*3*	318	*318*
2014	6.8	*8.0*	2	*3*	250	*254*

Source: Peruvian Customs/ Authors calculations.

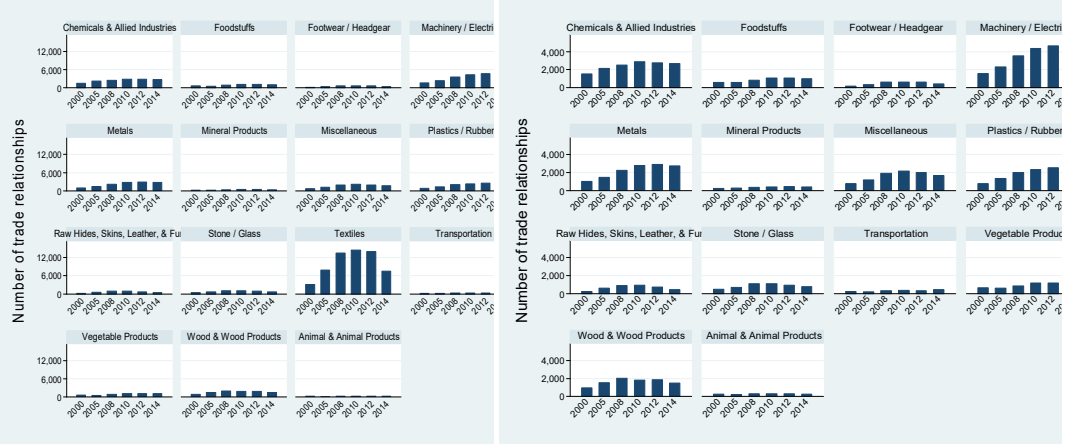
Table 8. Number of destinations per firm

	Mean		Median		Max	
	LAIA	*ALL*	LAIA	*ALL*	LAIA	*ALL*
2000	1.9	*3.4*	1	*2*	10	*69*
2005	1.8	*3.1*	1	*1*	11	*54*
2006	1.8	*3.1*	1	*1*	10	*69*
2007	1.8	*3.1*	1	*1*	11	*65*
2008	1.8	*3.1*	1	*1*	11	*59*
2009	1.7	*3.0*	1	*1*	11	*57*
2010	1.8	*3.0*	1	*1*	11	*58*
2011	1.8	*3.1*	1	*1*	11	*62*
2012	1.7	*3.0*	1	*1*	11	*60*
2013	1.7	*2.9*	1	*1*	11	*56*
2014	1.7	*3.0*	1	*1*	11	*62*

Source: Peruvian Customs/ Authors calculation.

Taken together patterns in Table 7 and Table 8 suggest first that most firms export to a single destination and only a limited number of products and second that only a limited set of firms are multi-product and multi-destination.

Figure 2. Trade relationships by HS sections



Source: Peruvian Customs/ Authors' calculations.
Note: Panel (b) is panel (a) represented excluding the textiles sector.

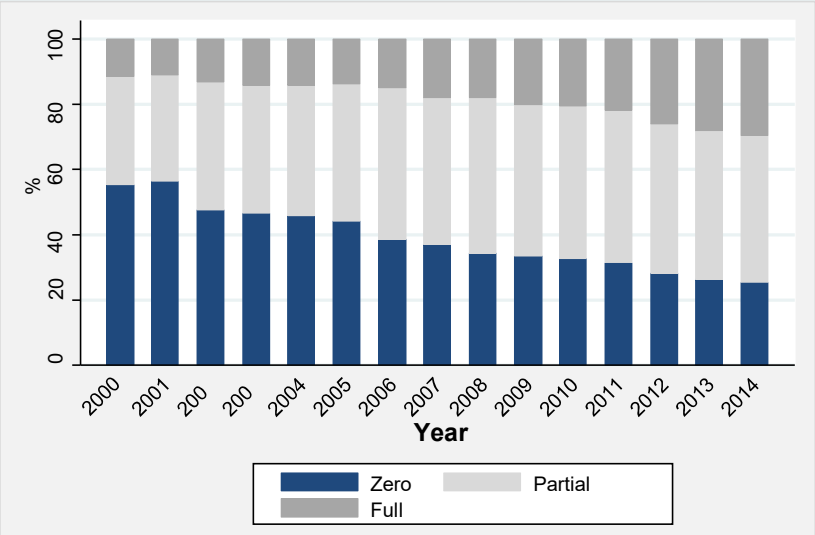
Figure 2 shows the distribution of export relationships across sectors defined by HS sections. The reference dimension is a firm-HS6 product-destination combination. Panel (a) and Panel (b) reveal that the textiles (and apparel) sector is the predominant one, followed by Machinery, Chemicals, Plastics, Metals, and Wood & Wood Products. As we will see below, some of these sectors have been increasingly affected by the implementation of NTMs in LAIA countries over the last decade.

4.3 NTMs in LAIA countries and Peruvian firms

We now combine NTM and firms' export data to quantify the incidence of NTMs applied by LAIA countries which affect Peruvian firms. The focus is on technical regulations.

Figure 3 shows how firms are exposed to NTMs in their trade relationships. Firms are fully exposed (green) if they face at least one NTM on all their export relationships. Firms are only partially exposed (red) if at least one of their export relationships is not affected by any NTM. The last group (blue) is made of firms whose exports do not face any NTMs. The relative importance of these three groups of firms may be biased by the incidence of multi-product, multi-destination firms. However, as suggested by the previous analysis the incidence of multi-product, multi-destination firms remained relatively stable during the period of interest. More firms are affected by NTMs, and more extensively, as represented by an increased share of firms with full exposure. This can be driven both by an increase in NTMs on products exported by Peruvian firms and by an orientation of Peruvian exports towards products affected by NTMs.

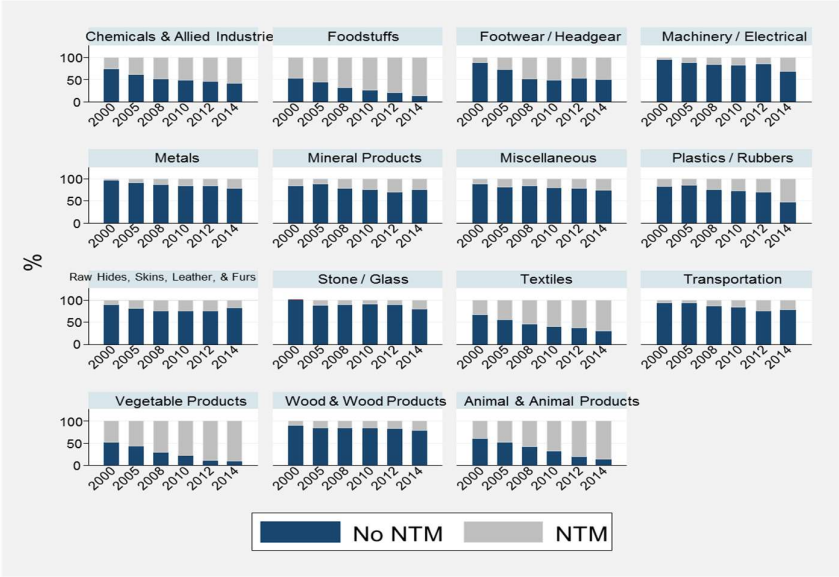
Figure 3. Technical regulations incidence at the firm level



Source: LAIA and UNCTAD Secretariat and Peruvian Customs/ Authors' calculations.
Note: Zero refers to the share of firms facing no NTM on any of their trade relationships. Partial refers to the share of firms facing at least one NTM on one of their trade relationships. Full refers to the share of firms facing at least one NTM on all their trade relationships.

Figure 4 allows us to identify the sectors most affected by NTMs. Export relationships are categorized as either free of NTMs or affected. Taking 2014 as the reference year, Foodstuffs, Vegetable products, Animals and Animal products are the sectors marked by the strongest presence of NTMs in trade relationships recorded by Peruvian firms. Trade relationships recorded in the Chemical and Textiles sectors are also intensively affected by NTMs. As mentioned above, the latter sectors are also among those for which a large number of export relationships exist. For all these sectors we also observe that the incidence of NTMs has increased significantly during the period from 2000 to 2014.

Figure 4. Technical regulations incidence by HS section, share of affected trade relationships



Source: LAIA and UNCTAD Secretariat and Peruvian Customs/ Authors' calculations.

5. Empirical strategy

Previous sections showed that NTMs and in particular technical regulations have become a concern for most firms exporting to LAIA country markets, especially in agricultural and food sectors as well as in textiles and chemicals sectors. This suggests that most firms, independently of their size and trade specialization, confront some form of regulation that will potentially have an impact on their capacity to export to a specific market. We investigate whether, as recent theoretical advances and empirical evidence have suggested, the trade impact of technical regulations is heterogeneous across firms. The empirical strategy aims at explaining exporters' behaviour in terms of export values, participation and market positioning (price range) as a function of newly implemented technical regulations and firm characteristics. To investigate whether technical regulations have heterogeneous effects on exporters, we include an interaction term between firm size[6] and our NTM variable. We control for bilateral tariff levels as the use of technical regulations and their stringency may be related to the level of tariffs. Theoretically, these two policy instruments can be used as substitutes or complements. We also include a set of fixed effects controlling for a number of factors possibly affecting exports.

[6] From an empirical point of view export values appear to be a good proxy for the overall size of the firm and eventually of their productivity. For instance Garcia-Santana and Ramos (2015) observe this relationship within a sample of 104 developing countries. Moreover several other papers have identified a productivity premium for exporting firms compared to non-exporting one (see Bernard and Jensen (1995, 1999) for early contributions).

Our core specification reads

$$y_{i,p,j,t} = \alpha + \sum_{l \subset L_0} \beta_{1,l} NTM^{l}_{p,j,t} + \beta_2 \ln(size_{i,t-1}) + \sum_{l \subset L_1} \beta_{3,l} (NTM^{l}_{p,j,t} * \ln(size_{i,t-1}))$$
$$+ \beta_4 \ln(1 + tariff_{p,j,t}) + \beta_5 (\ln(1 + tariff_{p,j,t}) * \ln(size_{i,t-1}))$$
$$+ BIGS_{i,p,t} + \ln(total\_imports_{p,j,t})$$
$$+ \eta_i + \phi_{p,j} + \delta_t + \varepsilon_{i,p,j,t} \qquad (1)$$

We consider four distinct dependent variables represented in equation (1) by $y_{i,p,j,t}$: (i) the natural log of firm *i*'s export value of product *p (HS 6-digit)* to country *j* at time *t* to capture the intensive margin of trade; (ii) a dummy variable for positive trade flows of firm *i* at time *t* into a certain product-destination market combination *p-j* to capture the (firm-product) extensive margin of trade, or participation; (iii) a dummy variable for the firm *i* exiting at time *t* a certain product-market *p-j* (a dummy equal to one for the firm not exporting in the current year but having exported the year before and zero if the firm continues exporting); and (iv) the price of exported good *p* (in logs) by firm *i* to country *j* at time *t*, proxied by unit export values.

Despite the dichotomous nature of some of our dependent variables, all specifications are estimated using OLS techniques. The choice of using linear probability models (LPM) rather than on nonlinear probit (or logit) is motivated by the desirability of avoiding the incidental parameter problem due to the sizeable set of fixed effects we include in all regressions. In addition, LPMs provide simple direct estimates of the sample average marginal effect.

$NTM^{l}_{p,j,t}$ is a dummy variable that indicates the presence of a technical regulation of type *l* applied on product *p* by country *j* at time *t*. Two sets of NTMs are considered. The first set L_0 includes all NTMs reported in the LAIA NTM data, namely, SPS measures, TBTs, pre-shipment inspections, quantity control measures, price-control measures and finance measures. The second set L_1, which is a subset of L_0 includes technical regulations exclusively.

Firms' productivity, which cannot be observed here, is proxied by the natural log of firm *i*'s total exports observed at time *t-1*. The use a one-year lag is motivated by the fact that firms' past overall performance is expected to affect future export decisions. As mentioned previously we include an interaction term between our NTM variable for L_1 measures and firm's size $(NTM^{l}_{p,j,t} * \ln(size_{i,t-1}))$ to control for an impact of technical regulations possibly varying with firm's productivity. Variable $tariff_{p,j,t}$ refers to the tariff effectively applied by country *j* on Peruvian product *p* at time *t*. We also include an interaction between the effectively applied tariff and firm's size in order to account for a possibly heterogeneous impact of tariffs on exporters.

Variable $BIGS_{i,p,t}$ is a dummy variable that indicates whether firm *i* also exports product *p* to some OECD developed country at time *t*. The fact that a firm is able to export to some of these markets may have some positive repercussions on its capacity and performance on any other market.
We further control for demand conditions at the product level prevailing at the destination. These are proxied by the natural log of $total\_imports_{p,j,t}$, which represents total imports of product *p* in country *j* at time *t*. The latter variable is expected to reflect time varying elements such as business cycles and import demand shocks. Finally, we add three sets of fixed effects. We control for firm-specific and time invariant characteristics that can affect trade performance by including a set of firm fixed effects, η_i. We control for country-HS6-level time invariant factors that may affect trade such as product market regulatory and operational framework by including a set of two-way fixed effects (HS6-Destination) $\phi_{p,j}$. The last set of fixed effects δ_t captures time varying conditions specific to the LAIA region and controls for regional economic cycle related features and region specific shocks.

The use of firm level exports and technical regulations observed at the HS6- level during 15 years does not necessarily guarantee an infallible identification of impacts. As we are working with exporting firms only, our sample possibly suffers from some form of selection bias. The imposition of technical regulations in destination markets may prevent some firms from entering the export sector, meaning that they do not appear in our dataset. This may create some bias that we are unable to eliminate fully because of the restricted firms sample we have. Now, by including two-way product-destination fixed effects, we only retain for estimation those observations where some change in the NTM variable status is observed, that is either an implementation or a removal of a regulation. This implies that the selection bias we just mentioned influences really the intensive margin of trade specification and the unit value specification. This is not to say that participation and exit are not impacted but most probably to a lesser extent.

Table 9. NTMs overlap (selected years) at the product-destination level

Number	*2000*	*2005*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*Pooled*
1	0.977	0.984	0.985	0.986	0.987	0.986	0.983	0.987	0.981	0.980	0.983
2	0.018	0.012	0.012	0.010	0.008	0.010	0.012	0.009	0.013	0.015	0.012
3	0.005	0.003	0.002	0.004	0.003	0.004	0.003	0.003	0.004	0.004	0.004
4	0.000	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.002	0.002	0.001
5	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.001	0.000

Source: LAIA and UNCTAD Secretariat and Peruvian Customs/ Authors' calculations.

Another important issue with NTMs is overlap. If two or more different types of NTMs apply to the same product it may be difficult to isolate their respective effects. The effect of some specific NTM may absorb the effect of any other. The classical example refers to the situation where both an import quota and some TBT are applied. A firm may be able to cope with TBT requirements but because of the quota imposed at destination it might not be able to export to that destination. The TBT impact is clearly altered by the quota presence. Overlap may obviously also occur when two or more measures of the same type (e.g. two SPS measures) are implemented for the same product. However, this is less of a concern as the scope of our empirical assessment is to identify the average effect of the presence of some broad categories of NTMs instead of the impact of some specific regulation. Moreover, Table 9 reveals that even at the measure level overlap is extremely limited in our sample. In almost all years, only about 2 per cent of trade relationships at the product (HS6 level) are affected by more than one type of measure.

6. Results

This section presents our reference results. The focus being on technical regulations only SPS measures, TBTs and pre-inspection measures are included in our core specifications. A series of robustness checks are also discussed.

6.1. Technical regulations and the intensive margin of trade

Theoretical predictions about the impact of technical regulations on the intensive margin of trade remain ambiguous. A negative impact on export volumes is expected and it could be amplified for smaller firms. However, a positive impact on export prices could also be obtained leaving the overall impact on the value of exports uncertain. This ambiguity is comparable to the ambiguity found for the effect of geographical distance on aggregate exports. Larger and more profitable firms are found to export to more distant destinations. As shown in Lawless (2010), this fact translates into an indeterminate effect of geographical distance on the intensive margin.

Results reported in Table 10 suggest that accounting for firms' heterogeneity is crucial in assessing the impact of technical regulations. SPS measures and TBTs are found to significantly and positively affect export values in specification (1), which does not include interaction terms. When including interaction terms, as reported in column (2), primary effects are negative when significant. This is the case for TBTs and pre-shipment inspection measures. The impact of SPS measures is not significant any more. These drastic changes are observed only for NTM variables estimates. Other estimates are also affected but only marginally unless interacted with firms' size.

From column (2) to column (5), the primary effect of TBTs is found to be negative. For a firm with the average size (this is sample specific), the presence of a TBT is associated with a value of exports about 34 to 37 per cent lower. The fact that the coefficient estimated for the corresponding interaction term is positive and significant implies that TBTs have heterogeneous effects on exporting firms. More precisely, the negative effect fades away as firms are larger in size. Figure 5 graphs the TBT marginal effect as a function of the lagged firm size variable. The dotted lines represent the lower and upper bound estimates corresponding to the 95 per cent confidence interval. The vertical lines correspond to the median firm size and the size of the firm at the 90th percentile of the firm size distribution respectively. The graph clearly shows that TBTs applied in destination markets positively affect exports for the 10 per cent largest firms in Peru.

Similar results hold for pre-shipment inspection measures. Their primary impact is also negative, although only significant at the 10 per cent level. As for TBTs, the largest firms benefit from the measure in term of exports value.

Non-technical regulations, when significant (which is the case of quantity and price control measures), are associated with lower export values as standard theory predicts.

Another interesting result from this estimation is the heterogeneous impact of tariffs on exporters. Only when our tariff and firms' size variable are interacted the direct impact of the former becomes significantly different from zero. As expected, higher tariffs are associated with lower export values. But as in the case of TBTs, this negative impact turns into a positive impact for the decile of largest Peruvian firms. This is illustrated in Figure 6 where vertical lines refer to the same thresholds as in Figure 5.

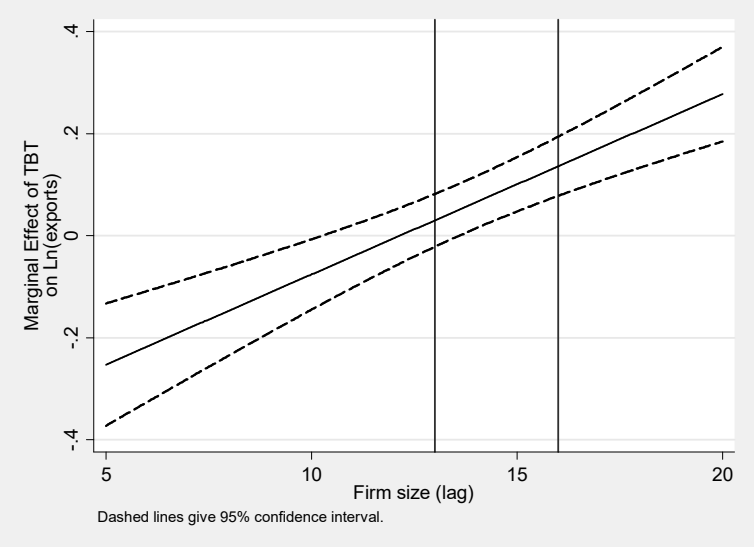
Table 10. Intensive margin

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Firm size (lag)	0.0890***	0.0805***	0.0805***	0.0746***	0.0804***
	(0.00493)	(0.00517)	(0.00517)	(0.00551)	(0.00517)
SPS	0.112***	0.0489	0.0454	0.0902	0.0497
	(0.0273)	(0.0775)	(0.0778)	(0.0835)	(0.0780)
TBT	0.0747***	-0.433***	-0.432***	-0.466***	-0.429***
	(0.0249)	(0.0904)	(0.0907)	(0.0967)	(0.0908)
Pre-Shipment	0.0173	-0.222*	-0.236*	-0.231*	-0.249*
	(0.0304)	(0.131)	(0.132)	(0.140)	(0.132)
SPS*Firm size(lag)		0.00461	0.00467	0.00177	0.00392
		(0.00531)	(0.00532)	(0.00575)	(0.00533)
TBT*Firm size(lag)		0.0359***	0.0360***	0.0381***	0.0353***
		(0.00630)	(0.00632)	(0.00677)	(0.00633)
PreS*Firm size(lag)		0.0172*	0.0182*	0.0169*	0.0181*
		(0.00932)	(0.00935)	(0.0100)	(0.00935)
Ln(1+Tariff)	-0.640***	-2.924***	-2.926***	-2.994***	-2.917***
	(0.0873)	(0.396)	(0.396)	(0.432)	(0.396)

Ln(tot HS6 imports in j)	0.0363***	0.0361***	0.0361***	0.0337***	0.0342***
	(0.00271)	(0.00271)	(0.00271)	(0.00292)	(0.00273)
Ln(1+Tariff)*Firm size(lag)		0.165***	0.165***	0.170***	0.165***
		(0.0287)	(0.0288)	(0.0314)	(0.0287)
X_to_OECD		0.0442***	0.0443***		0.0445***
		(0.0129)	(0.0129)		(0.0129)
Qty Control					-0.0792**
					(0.0389)
Price Control					0.0216
					(0.0537)
Finance					-0.197***
					(0.0320)
Domestic NTM					-0.0194
					(0.0168)
Observations	277126	277126	276891	243110	276891
R^2	0.613	0.614	0.613	0.604	0.613
Adjusted R^2	0.580	0.580	0.580	0.567	0.580

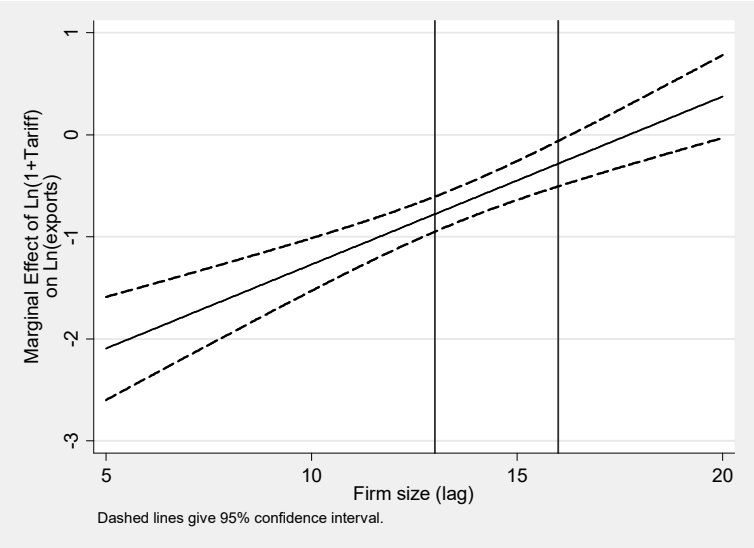
Note: Robust standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1. Firm fixed effects, product-destination fixed effects, and time fixed effects are included in all specifications as well as demand conditions at destination. In Column (1), no interactions are included. Column (2) adds interaction terms and a control for exporters to the OECD. Column (3) excludes observations with overlap in NTM data, Column (4) restricts the sample to exporters to LAIA countries only, and finally Column (5) include controls for other NTMs and NTMs applied by Peru in the same categories .

Figure 5. Interaction between firm size and the TBT marginal effect on firm exports



Source: Authors' calculations.

Figure 6. Interaction between firm size and tariffs marginal effect on firm exports



Source: Authors' calculations.

Other estimated coefficients have the expected sign when statistically significant. Firm size and demand conditions at destination positively affect export values. The fact that a firm exports to some developed country markets is also associated with higher export values. The existence in Peru of NTMs belonging to the same category as NTMs applied in the destination market does not impact the value of firms' exports. We may have expected a positive and significant coefficient reflecting the impact of regulatory proximity. However, the fact that we do not obtain a significant estimate may indicate an inadequate representation of regulatory proximity by binary variables.

6.2. Technical regulations and the extensive margin of trade

Theoretical results obtained in standard heterogeneous-firm models of trade (Melitz, 2003; Chaney, 2008; Crozet and Koening, 2010) predict a negative effect of technical regulations on the extensive margin of trade, measured here by firms' participation in the external sector. Participation reflects both creation and continuation of a trade relationship. Larger firms may be able to overcome the fixed or variable cost of complying with a newly introduced technical measure in the importing country more easily.

Empirical results shown in Table 11 are mostly in line with theoretical predictions as far as TBTs are concerned. Their impact is strictly negative for firms below median size and strictly positive otherwise, as shown in Figure 7. SPS and Pre-shipment inspection measures are not found to affect firms' participation, in particular in our preferred specification (column 5). As found for the intensive margin, the impact of tariffs varies with firm size. Participation of the 25 per cent largest firms appears to be positively affected by tariffs and corroborates the impact estimated for TBTs.

Non-technical regulations when significant, i.e. price control and finance measures, have a negative effect on the extensive margin. This result could easily find a theoretical explanation as these types of measures can be easily associated with an increase in variable costs.

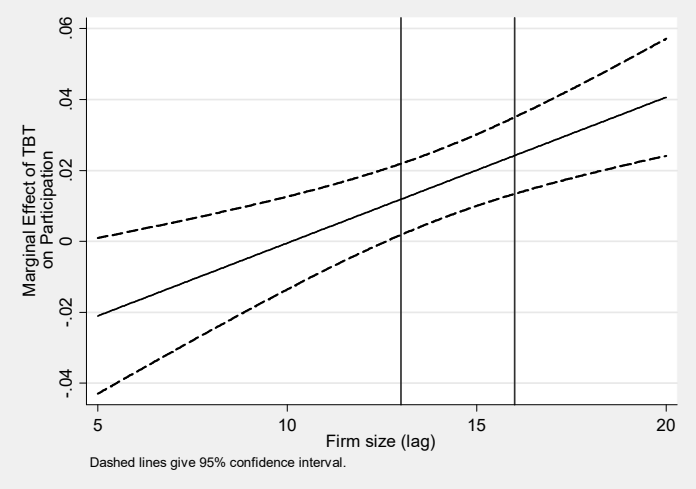
As to other estimates, our proxy for firms' size has a negative primary effect. In other words participation is negatively associated with size. This result may not be fully intuitive. A possible explanation, essentially statistical, could relate to the combination of both entry and duration as determining the extensive margin of trade relationships. New entrants are essentially of small size and the duration of their trade relationships is relatively short during their first export experiences. Ex post, new entrants are present during at least four

year over the whole period. This makes the category of observations characterized by more variability and it may be at the core of coefficient identification.

Demand conditions at destination and being an exporter to some OECD market both positively affect the extensive margin, as one would expect. Both characteristics can be synonymous of either easier entry or longer permanence in a specific market and are thus represented by a positive estimated coefficient.

The existence of similar NTMs both at origin and at destination does significantly affect the extensive margin of trade. We may have expected a positive effect as firms could be more at ease in complying with a measure applied in some foreign market, which are similar to measures applied in the domestic market. As a consequence this could have facilitated their participation and permanence in that specific market.

Figure 7. Interaction between firm size and the TBT marginal effect on firm participation



Source: Authors' calculations.

Table 11. Extensive margin

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Firm size (lag)	-0.0561***	-0.0771***	-0.0770***	-0.0776***	-0.0770***
	(0.000847)	(0.000969)	(0.000969)	(0.00103)	(0.000969)
SPS	0.00119	0.0185	0.0148	0.0222	0.0161
	(0.00523)	(0.0147)	(0.0148)	(0.0158)	(0.0148)
TBT	0.0231***	-0.0379**	-0.0427***	-0.0465***	-0.0416**
	(0.00457)	(0.0162)	(0.0164)	(0.0174)	(0.0164)
Pre-Shipment	-0.0176***	0.0224	0.0123	0.0384	0.0101
	(0.00593)	(0.0265)	(0.0267)	(0.0286)	(0.0268)
SPS*Firm size(lag)		-0.00125	-0.000965	-0.00185c	-0.00111
		(0.000990)	(0.000994)	(0.00107)	(0.000995)
TBT*Firm size(lag)		0.00393***	0.00423***	0.00475***	0.00411***
		(0.00111)	(0.00112)	(0.00120)	(0.00112)
PreS*Firm size(lag)		-0.00271	-0.00211	-0.00395c	-0.00214
		(0.00187)	(0.00188)	(0.00202)	(0.00188)
Ln(1+Tariff)	-0.0906***	-2.631***	-2.630***	-2.711***	-2.628***

	(0.0162)	(0.0716)	(0.0716)	(0.0769)	(0.0716)
Ln(tot HS6 imports in j)	0.0154***	0.00988***	0.00982***	0.00948***	0.00956***
	(0.000394)	(0.000492)	(0.000492)	(0.000522)	(0.000495)
Ln(1+Tariff)*Firm size(lag)		0.186***	0.186***	0.193***	0.186***
		(0.00514)	(0.00514)	(0.00554)	(0.00514)
X_to_OECD		0.0138***	0.0137***		0.0137***
		(0.00260)	(0.00260)		(0.00260)
Qty Control					-0.00669
					(0.00781)
Price Control					-0.0308***
					(0.0106)
Finance					-0.0314***
					(0.00631)
Domestic NTM					-0.00615
					(0.00642)
Observations	473529	425731	424675	376288	424675
R^2	0.187	0.145	0.145	0.149	0.146
Adjusted R^2	0.131	0.086	0.087	0.086	0.087

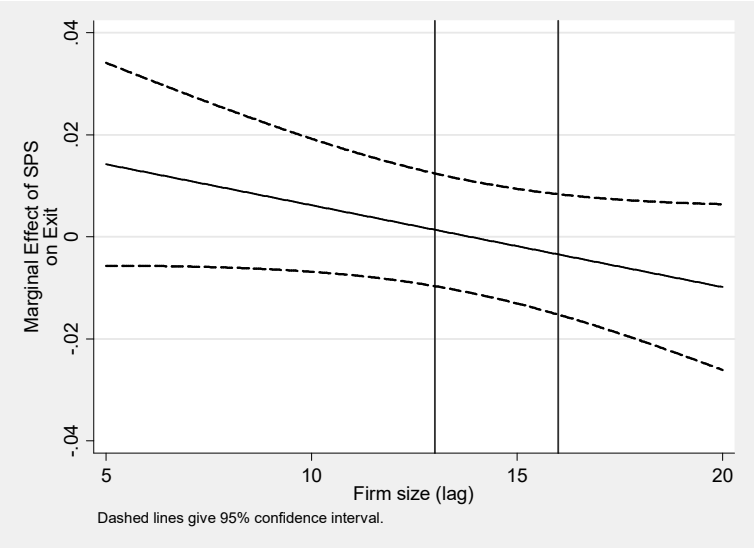
Note: Robust standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1. Firm fixed effects, product-destination fixed effects, and time fixed effects are included in all specifications as well as demand conditions at destination. In Column (1), no interactions are included. Column (2) adds interaction terms and a control for exporters to the OECD. Column (3) excludes observations with overlap in NTM data, Column (4) restricts the sample to exporters to LAIA countries only, and finally Column(5) include controls for other NTMs and NTMs applied by Peru in the same categories.

6.3. Technical regulations and the probability of exit

In the wake of the predictions for the extensive margin of trade discussed previously we would expect a positive impact of the implementation of new NTMs on exit probabilities. Exit should be seen as supplementary of the extensive margin as defined before. New or more stringent regulations may increase fixed and variable costs and therefore force the least productive firms to terminate the affected trade relationships. Once again larger firms may be able to overcome additional costs imposed by new technical regulations more easily.

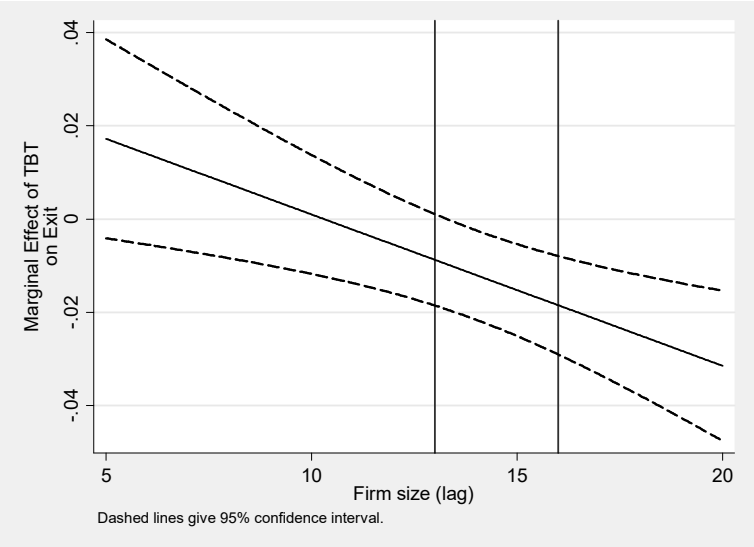
Results reported in Table 12 validate these predictions. Focusing on column (5), both the primary effect of SPS measures and TBTs are positive, but their overall effect depends on firm size. As shown in Figures 8 and 9, larger firms appear once again to be more at ease in coping with cost brought by the implementation of new or more stringent measures at destination. In the case of TBTs, the impact on exit probability is even negative for firms whose size is above the median. In other words, larger firms take advantage of new or more constraining technical regulations and are able to stabilize their export activity as their exit probability falls. The effects of Pre-shipment measures are not significant.

Figure 8. Interaction between firm size and the SPS marginal effect on firm exit probability



Source: Authors' calculations.

Figure 9. Interaction between firm size and the TBT marginal effect on firm exit probability



Source: Authors' calculations.

Table 12. Exit probability

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Firm size (lag)	0.0425***	0.0664***	0.0663***	0.0668***	0.0681***
	(0.000948)	(0.00105)	(0.00105)	(0.00112)	(0.00105)
SPS	-0.00371	0.0239	0.0277*	0.0147	0.0326**
	(0.00583)	(0.0161)	(0.0162)	(0.0173)	(0.0162)

TBT	-0.0167***	0.0390**	0.0444**	0.0500***	0.0509***
	(0.00507)	(0.0172)	(0.0173)	(0.0184)	(0.0174)
Pre-Shipment	0.0225***	0.0136	0.0260	-0.00669	0.0285
	(0.00694)	(0.0310)	(0.0313)	(0.0333)	(0.0315)
SPS*Firm size(lag)		-0.00216**	-0.00245**	-0.00149	-0.00218**
		(0.00109)	(0.00109)	(0.00117)	(0.00109)
TBT*Firm size(lag)		-0.00364***	-0.00400***	-0.00457***	-0.00435***
		(0.00118)	(0.00119)	(0.00127)	(0.00119)
PreS*Firm size(lag)		0.000353	-0.000464	0.00189	-0.000174
		(0.00223)	(0.00224)	(0.00240)	(0.00226)
Ln(1+Tariff)	0.341***	3.152***	3.151***	3.282***	3.020***
	(0.0235)	(0.0843)	(0.0844)	(0.0904)	(0.0827)
Ln(tot HS6 imports in j)	-0.0181***	-0.0199***	-0.0198***	-0.0186***	-0.0113***
	(0.000959)	(0.000998)	(0.001000)	(0.00109)	(0.000555)
Ln(1+Tariff)*Firm size(lag)		-0.203***	-0.203***	-0.213***	-0.208***
		(0.00600)	(0.00600)	(0.00644)	(0.00597)
X_to_OECD		-0.0108***	-0.0107***		-0.0114***
		(0.00290)	(0.00290)		(0.00291)
Qty Control					0.00301
					(0.00907)
Price Control					0.0205
					(0.0141)
Finance					0.0350***
					(0.00691)
Domestic NTM					-0.00101
					(0.00389)
Observations	469755	421974	420956	372949	420956
R^2	0.195	0.150	0.150	0.154	0.143
Adjusted R^2	0.138	0.090	0.091	0.090	0.084

Note: Robust standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1. Firm fixed effects, product-destination fixed effects, and time fixed effects are included in all specifications as well as demand conditions at destination. In Column (1), no interactions are included. Column (2) adds interaction terms and a control for exporters to the OECD. Column (3) excludes observations with overlap in NTM data, Column (4) restricts the sample to exporters to LAIA countries only, and finally Column (5) include controls for other NTMs and NTMs applied by Peru in the same categories.

As to non-technical regulations, only finance-related measures are estimated to significantly affect exit probabilities. Their effect is estimated to be positive as one could have expected by interpreting this effect as a cost effect.

Higher tariffs imply higher exit probabilities. However, their impact is decreasing with firm size. The exit probability of the 25 per cent largest firms decreases with tariffs faced at destination. Favourable demand conditions and being an exporter to some OECD country also reduce the exit probability. The domestic NTM variable has no significant influence on this other dimension of the extensive margin of trade either.

6.4. Technical regulations and firms' product unit values

Theoretical predictions about the impact of technical regulations on unit values do not systematically point into the same direction. Larger firms may be able to charge higher prices if the dropping out of the least productive firms reduces downward price pressure due to a lack of competition and a redistribution of market

shares. However, larger firms may also be able to adjust at a lower cost to a new regulation and as a consequence to charge relatively lower prices.

Results reported in Table 13 first suggest that amongst technical regulations only TBTs affect unit values. Moreover, their impact is not strongly significant from a statistical point of view. As can be seen from Figure 10, the sign of the effect can be identified only at the extremes of the firm size distribution. It is positive for the smallest firms and negative for the five per cent largest ones. It is either positive or negative for the rest of the distribution.

Non-technical regulations are all found to have a significant effect at least at the five per cent level. Quantity control measures depress unit values while both price control and finance measure have an upward effect on the latter. These results are consistent with standard theoretical insights.

Tariffs appear to be passed through exporters' prices. Pass-through decreases as firm size increases, as shown in Figure 11.

As to the remaining controls, larger firms are found to be associated with larger unit values. This may simply reflect higher quality of products exported by more productive firms. Or this can also reflect the effect of stronger market power as firms expand. Demand conditions at destination positively affect unit values as expected. Exporting to OECD markets implies lower unit values. As mentioned previously, firms able to export to OECD markets are likely to be more productive and this could translate into lower prices, as suggested by our empirical finding. Regulatory homogeneity as captured by our variable for domestic NTMs does not seem to play any role in defining unit values.

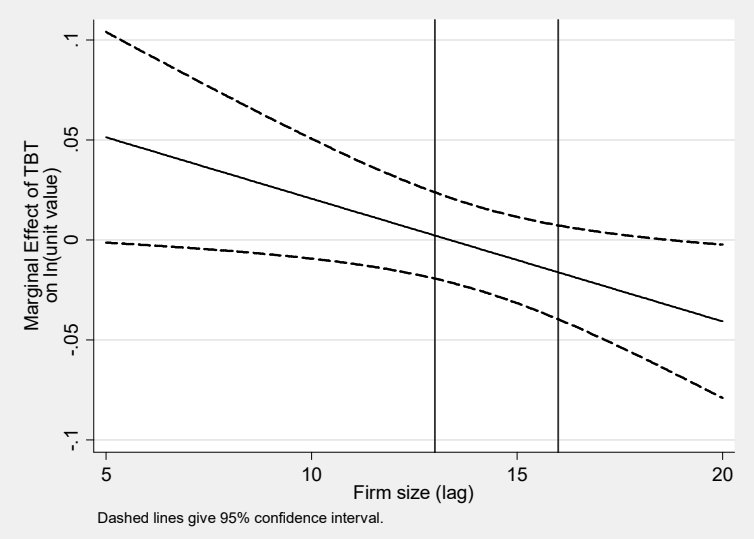
Table 13. Unit value of exports

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Firm size (lag)	0.0148***	0.0142***	0.0142***	0.0145***	0.0141***
	(0.00225)	(0.00236)	(0.00236)	(0.00254)	(0.00236)
SPS	-0.00794	-0.0359	-0.0394	-0.0430	-0.0402
	(0.0105)	(0.0298)	(0.0298)	(0.0325)	(0.0299)
TBT	-0.00679	0.0892**	0.0833**	0.0748*	0.0820**
	(0.0102)	(0.0397)	(0.0398)	(0.0431)	(0.0398)
Pre-Shipment	0.000389	-0.0570	-0.0613	-0.0608	-0.0518
	(0.00819)	(0.0408)	(0.0409)	(0.0436)	(0.0410)
SPS*Firm size(lag)		0.00202	0.00232	0.00242	0.00269
		(0.00200)	(0.00200)	(0.00219)	(0.00201)
TBT*Firm size(lag)		-0.00681**	-0.00645**	-0.00625**	-0.00613**
		(0.00273)	(0.00274)	(0.00298)	(0.00274)
PreS*Firm size(lag)		0.00408	0.00431	0.00444	0.00419
		(0.00287)	(0.00287)	(0.00308)	(0.00287)
Ln(1+Tariff)	-0.114***	-0.771***	-0.773***	-0.952***	-0.784***
	(0.0304)	(0.151)	(0.151)	(0.165)	(0.151)
Ln(tot HS6 imports in j)	0.00162*	0.00163*	0.00163*	0.00163*	0.00278***
	(0.000885)	(0.000885)	(0.000885)	(0.000954)	(0.000886)
Ln(1+Tariff)*Firm size(lag)		0.0476***	0.0477***	0.0587***	0.0480***

		(0.0107)	(0.0107)	(0.0118)	(0.0107)
X_to_OECD		-0.0148***	-0.0147***		-0.0149***
		(0.00490)	(0.00490)		(0.00490)
Qty Control					-0.0493***
					(0.0157)
Price Control					0.0354**
					(0.0164)
Finance					0.127***
					(0.0118)
Domestic NTM					0.00204
					(0.00568)
Observations	277123	277123	276888	243110	276888
R^2	0.810	0.810	0.810	0.804	0.810
Adjusted R^2	0.793	0.794	0.793	0.786	0.794

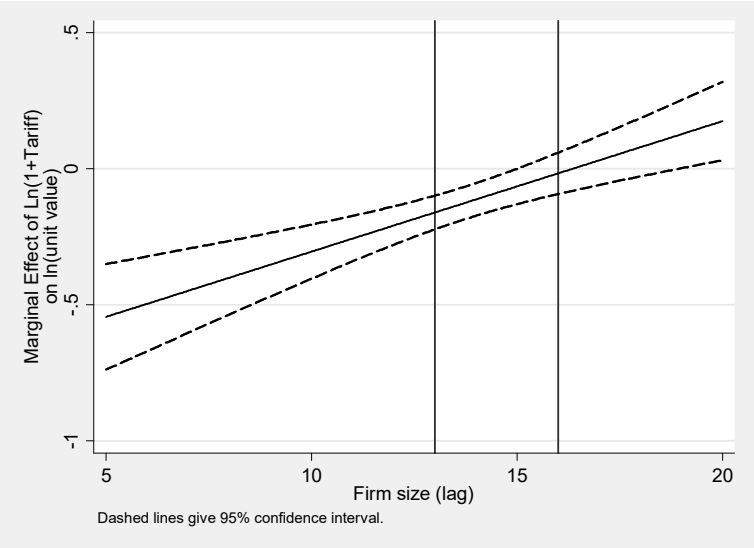
Note: Robust standard errors are in parentheses *** p<0.01, ** p<0.05, * p<0.1. Firm fixed effects, product-destination fixed effects, and time fixed effects are included in all specifications as well as demand conditions at destination. In Column (1), no interactions are included. Column (2) adds interaction terms and a control for exporters to the OECD . Column (3) excludes observations with overlap in NTM data, Column(4) restricts the sample to exporters to LAIA countries only, and finally Column(5) include controls for other NTMs and NTMs applied by Peru in the same categories .

Figure 10. Interaction between firm size and the TBT marginal effect on firm unit value



Source: Authors' calculations.

Figure 11. Interaction between firm size and tariffs marginal effect on firm unit value



Source: Authors' calculations.

6.5. Robustness checks

Several robustness checks have been undertaken.[7] As in any trade related specification and estimation, concerns about some endogeneity bias cannot be totally excluded.

All specifications estimated previously included three sets of fixed effects: firm fixed effects, product-destination fixed effects and time fixed effects. We are confident in the fact that this strategy considerably reduces any omitted variable bias. However, we re-ran our core specifications by including some alternative sets of fixed effects. First, we include firm fixed effects together with sector (i.e. HS 4-digit categories)-destination country-year fixed effects and found that our core results are not affected. Signs and amplitude are maintained for most the coefficients of most controls and in particular for those of technical regulations. Second, we include firm fixed effects together with product-destination fixed effects as in our reference regressions but allowing our time fixed effects to be also destination-country specific. Once again no major deviation from our core results is observed. Finally, we dropped firm fixed effects from our core set of specifications in order to verify that our results do not reflect within-firm variation in size. The main difference observed is the gain in significance of the SPS variable coefficient estimate.

Reverse causality could be another source of endogeneity bias. Such bias would exist if exports from some Peruvian firms affected trade policy decisions in other LAIA countries. If exports from some Peruvian firm represent a threat to some domestic market (either on the production or consumption side or both) in a LAIA country, the latter may decide to implement some NTM in order to limit the volume of goods imported from that specific firm. However, as trade flows amongst LAIA's members are regulated by an inter alia agreement established in 1998 on the use of technical obstacles to trade it is unlikely that protectionist measures have been put in place in any systematic manner. Nevertheless we tested the robustness of our results by first including our technical and non-technical regulations variables lagged by one year. We could expect that the use of an NTM at time t-1 is essentially exogenous to firms' exports at time t. Results obtained with lagged regulation variables are perfectly in line with our baseline regressions. We still find that TBTs predominantly affect both the intensive and extensive margins of trade and that their overall impact varies with firms' size.

[7] Results are available upon request.

We run a fully-saturated version of our core set of regressions where firm size and its interaction with technical regulations variables are dropped. We estimate two alternative versions. We first split the sample distribution of firm size into two bins taking the median size as the dividing threshold. We then split it into 4 bins that is, into quartiles. Results are again consistent with baseline estimations. TBTs effects are significant on both margins of trade. They are stronger for firms below median size and even stronger for those in the first quartile. These effects could even be positive for firms above the median and in most specifications for firms in the 75th size percentile.

Baseline results are obtained using a specific subsample of firms. We re-ran our core specifications first with a sub-sample that does not include non-switcher firms and second using the full sample of firms. The reason for dropping non-switcher firms relates to the possible downward bias their presence would create on coefficients of NTMs variables and in particular technical regulations ones. Results obtained without non-switchers do not show any evidence of any significant bias. Similar conclusions are reached for the whole-sample set of estimates.

Our variables of primary interest are the interaction terms. The latter, like our dependent variables, vary at the firm-HS6-destination-year level. As a consequence clustering should not be necessary. However, as a robustness check we re-ran our core specifications with standard errors clustered at the HS6-destination-year level. Results continue to hold although estimates as expected lose part of their statistical significance. However, when interaction terms are significant it is always below the five per cent level.

7. Implications for Policy

Previous empirical results suggest that exporting firms above median size have gained from the implementation of new measures (or the amendment of existing ones). This is true for all margins of trade considered in this paper. Their export values increase, the probability of export increases and the probability to leave the exporting sector falls.

These findings are consistent with stylized facts. More precisely, the increased incidence of NTMs and in particular that of technical regulations can explain, at least partially, trends observed in indicators of Peruvian export performance in LAIA countries. First, total exports have increased in both absolute and relative terms. Second, the number of firms exporting to the LAIA region has decreased. Finally, the share of larger firms (above the median size) has increased. This is perfectly in line with the outcome predicted by our empirical results. Market shares of large firms have risen because of the implementation of new technical regulations and most probably at the expense of smaller firms.

Higher concentration in export markets may not necessarily turn into aggregate economic gains. Theoretical predictions are not consensual about the consequences of such outcome. On the importer side, higher concentration could represent a threat to competition and lead to price increases that outpace the gains brought by compliance with technical regulations. In other words, what consumers gain in terms of better product quality and safety may be cancelled out by large price increases. On the exporter side, the above outcome may constrain the reactivity of the extensive margin of trade and could thus affect aggregate export performance in the longer term. If access to international markets becomes increasingly difficult for small and medium firms, their development and growth potential may vanish. As small and medium firms are crucial in maintaining a dynamic extensive margin of trade, longer term prospects in terms of export performance may be compromised.

Policy intervention is justified if its main objective remains to attenuate the effects of possible negative spill-over effects. Any policy able to reduce the effects of changes in costs to export on small (and medium) firms may dampen the exclusion effect of technical regulations identified previously.

Several dimensions should be considered in implementing policies aiming at reducing the cost of compliance with NTMs and in particular technical regulations in specific international markets. The first dimension is the

domestic business and production environment of small and medium enterprises. The second dimension is the customs procedural framework. The third dimension is the intergovernmental political platform.

Within the first dimension, policy could be activated on several complementary grounds. First, access to crucial information concerning export requirements for specific products should be facilitated by all means for all types of producers, with a particular attention paid to smaller ones. Moreover, advisory services related to the production-wise implementation of any specific requirements should be made available. This is a rather complex, and most probably costly, activity to be established and maintained. The idea would be to adopt the Single Window approach to international trade transactions but with a broader scope. In practice, firms should be able to find product specific information not only in terms of required technical, sanitary and phytosanitary characteristics but also in terms of the production process which would enable them to satisfy these requirements. Ideally some customized advisory consultations could also be provided. The success of such a policy approach is likely to be determined not only by the availability of public funds to cover the cost of advisory activities but also by the possibility offered to firms to finance eventual upgrades of their productive technology. Facilitating access to finance is an additional accompanying measure to be considered by policy makers. In addition to technical assistance and capacity building programs, private sector based initiatives could promote the participation of small and medium enterprises in export markets. Governmental and non-governmental organizations could instigate the establishment of cooperatives within which small and medium enterprises could exchange and collaborate on issues related to the compliance with technical regulations on international markets.

Within the second dimension, the customs procedural framework, desirable policy actions have been identified thoroughly in the literature[8] and several of them have already been put into practice. The most prominent of them is the Single Window for Foreign Trade, which aims at reducing the number of agencies at the border. A direct consequence is a reduction of the resources that firms need to dedicate to customs clearance. This should reduce fixed business costs and therefore help SMEs expand cross-border trade. Several countries have set up such single windows. Peru established a Single Window for Foreign Trade (VUCE) in 2010. It was expected to improve coordination by connecting eight government institutions that issue export and import permits, as well as shipping-related entities. However, the last ITC NTM survey suggests that its effectiveness could be improved through closer cooperation amongst the State agencies involved. Another example is the Trade Facilitation Agreement recently signed by WTO members, which contains provisions for expediting the movement, release and clearance of goods, including goods in transit. This may not be seen as related to NTMs per se. However, the existence of NTMs increases significantly the exposure of exporting but also importing firms to procedural obstacles as shown by the NTM surveys conducted by the International Trade Centre in several countries.[9]

The third dimension relates to actions a government is able to actively pursue beyond its borders. As technical regulations have primarily non-trade objectives, it would be misleading to look at technical regulations as we look at tariffs. This also implies that in any intergovernmental negotiation in the context of a trade or economic integration agreement involving NTMs and in particular technical regulations cannot consider the removal of the latter as an objective. In this context, discussions may focus on identifying a consensual streamlining approach. Streamlining NTMs would consist in reforming and harmonizing them so as to maintain their purposes but at the lowest possible costs. “Efficient regulations” should be the ultimate objective of NTM reform, as efficient regulations are essential for increasing competitiveness. In practice, streamlining NTMs will reduce costs and increase the competitiveness of firms engaged in international trade. Streamlining NTMs involves two distinct tasks. The first consists of improving the nature of existing NTMs. The second consists of improving the process through which new ones are introduced. Governments should ensure that NTM requirements are scientifically based. Public authorities should also accelerate the standardization process. Regional experience in streamlining NTMs suggests that harmonization should be limited to essential health and safety standards, with details left to national authorities to be set according to

[8] See WTO (2015) for a comprehensive discussion.

[9] See the various country case studies reports available at http://www.intracen.org/itc/market-info-tools/non-tariff-measures/publications/#Technical_paper.

local needs and whenever international standards are available, they should be preferred. In addition governments should agree on the conditions for the mutual recognition of certificates delivered by their respective conformity assessment bodies. Without such certificates and their recognition by competent authorities in destinations markets firms would not be able to conclude any transaction. In the context of regional integration policy actions, technical assistance and capacity-building should be provided as early as possible for less developed partners.

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