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Quantifying the trade effects of NTMs: A review of the empirical literature

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Abstract. In recent years, the imposition of Non-Tariff Measures (NTMs) has increased rapidly both in quantity and importance. This development, with its considerable economic impact, particularly within the area of global trade, has prompted numerous scholars to explore the direction and magnitude of the trade effects of NTMs. Moreover, increased efforts are being placed on further exploring the determinants behind the use of NTMs, as well as their policy implications. The current paper aims to survey the empirical trade literature, in order to uncover the available responses to major questions regarding the trade effects of NTMs, principally of TBT and SPS measures. Among these questions posed are: (1) How do specific types of NTMs affect imports and exports? (2) Are developing countries more sensitive to NTMs? (3) Are small-medium sized firms more adversely affected by NTMs? (4) How are particular sectors/products affected by NTMs? And (5) Do Harmonization and Mutual Recognition necessarily impact trade positively?
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1. Introduction

During the second half of the 20th century, a rapid pace of global trade growth has been observed. This trend is paired with a reduction in the level of tariff rates, albeit with an expansion of usage of Non-Tariff Measures (NTMs), particularly of Technical Barriers to Trade (TBTs) and Sanitary and Phytosanitary (SPS) measures. Evidence show that, while excluding specific trade concerns, the share of notified TBT and SPS measures accounts, nowadays, for over than 85% of all notifications to the WTO (I-TIP data, 2017). In general, NTMs are imposed by governments for a variety of legitimate objectives that may have nothing to do with international trade, but still create trade frictions and serve protectionist motives. These public policy objectives include the correction of market imperfections such as asymmetric information or environment and public health externalities, protection of consumers, pursuing better national security and other purposes.

Policy instruments, such as TBT and SPS measures, may have an enhancing import demand impact, due to various justifications, primarily, the quality assurance that they provide to consumers with respect to standards compliance and risk mitigation. Such measures also offer consumers the information disclosure which arrive with trademarks or various labelling requirements. Nevertheless, as suggested earlier, the adoption of NTMs may also have an adverse impact on imports as the extensive as well as the intensive margins of trade change, due to the increased compliance costs levied on foreign exporters. A particular NTM is said to increase trade if its demand-enhancing effect dominates its trade-cost effect,

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while it is said to hinder trade if the former falls short of the later. Disregards who are the economic beneficiaries of the specific policy measure, the answer to whether the dominant effect of a specific NTM is expected to promote trade or restrictiveness, is not always evident prior to its application. Moreover, policy makers are not necessarily knowledgeable concerning the economic outcomes and the potential trade shortcomings associated with each policy measure. For these reasons, a growing number of countries in recent years, challenge other WTO members, under dispute settlement body, for the necessity of the use of NTMs.

As the empirical literature reveals, the direction, as well as the extent to which NTMs impact trade, depend on multiple elements, among which the specific type of measure, the product or sector, size of exporting firms and the country affected. The cumulative evidence highlight that for a successful quantification of the trade-effect of NTMs, a great importance goes to the chosen methodological approach, along with the specific assumptions made by the researchers in these quantification (see section 2). The second imperative feature in analysing the trade impact of a NTM, are the dataset sources used to perform these quantifications, which are diverse, and often not all of equal quality. For these reasons, recent efforts to collect and organize information on NTMs, were conducted by various institutions. However, often, each data source still sheds light on a particular aspect, while lacking the comprehensive coverage, as well as the consistency required to conduct an accurate comparison between all these trade effects. Nevertheless, these factors determine how, and to which level of precision, these policy measures are transformed into quantitative values, and, frequently later, converted into ad-valorem equivalents of tariff or trade restrictiveness index.

The assessment of the trade effects of NTMs among and within regions, countries or firms, remains a significant challenge for scholars worldwide. Therefore, the economic literature continuously seeks to provide theoretical as well as empirical conclusions to the ongoing discussion on the actual impact of NTMs on trade performance. This paper aims to present an updated review of the empirical literature, to uncover the available responses conveyed by the most prominent scholars, to selected questions on the trade effects of NTMs. Among the questions: How do specific types of NTMs affect imports and exports?; Do developing countries face a disadvantage in market access, compared to richer countries?; Which products/sectors face more prohibitive import barriers?; Are small sized firms more adversely affected by NTMs?; Do harmonization and mutual recognition necessarily increase trade?

Providing a clear and comprehensive landscape of the empirical literature on the trade impact of non-tariff measures, is a not an easy challenge. Nevertheless, this paper aims to contribute to the existing knowledge, by presenting a summary of the most widely accepted propositions that the empirical literature provides to the major economic questions on the trade impact of NTMs. Moreover, it underlines the patterns that emerge from the set of case studies, and which could hopefully provide direction for better trade policy. Notably, as each of the empirical studies is multidimensional, in the sense that it captures various aspects, such as NTM/country/product/period, the responses to some of the questions may overlap to a considerable degree and could be expressed in diverse manners. Nevertheless, the paper attempts to highlight the major findings of each study, with the hope that it contributes to the knowledge of the trade effects of non-tariff measures.

The paper is comprised of four sections. Following an introduction, the second section presents a short description of the methodologies used for the quantification the trade-effects of NTMs in the empirical literature. The next section reviews the responses provided by the empirical literature to several questions which relate to the trade impact of NTMs. Following the third section, which is divided according to questions, are the main conclusions of the paper.

2. The quantification of trade effects of NTMs

With recent theoretical progress in international trade, the literature landscape is constantly filled with studies, aiming to provide valuable approaches for the quantification of trade effects by NTMs. The main objectives of these approaches are to offer quantitative estimations of the level of restrictiveness that these trade measures impose. Nonetheless, several methodologies even go beyond, and allow the identification of the main beneficiaries and losers, in term of firms or countries, based on different level of product aggregation. These quantifications of the trade effects of NTMs are becoming much easier nowadays, due to the advancement in analytical techniques, paired with the considerably improved computers and the availability of strong data processing technologies.

Among the most commonly applied quantitative approaches, one can find the frequency-type measures, price-comparison measures, and quantity-impact measures which are based on econometric estimations of actual trade flows. While frequency-type measures and import coverage are typically helpful in providing insights regarding the incidence of NTMs, these measures have several disadvantages. Among these limitations are the inability to quantify the actual trade restrictiveness of specific measures, as well as the fact that these data disregard the bilateral dimension. The price-comparison technique, which is also called price wedge, calculates the gap between the domestic price of a good and the international price of a comparable good, however it also has several drawbacks. Among which are the assumption that imported products are perfect substitutes for domestic ones, and in addition the belief that the price gap should be associated exclusively with the impact of NTMs, regardless other potential factors, as the market settings.

In recent years, the most predominant approach for the quantification of trade effects, is the quantity-based methodology, which allows estimating the extent to which a given NTM impacts trade flows. These models which often use the gravity models are widely employed to estimate bilateral trade flows and their determinants, and given the proper assumptions, serve for estimating the impact of policy measures such as NTMs. Moreover, when import demand elasticities are available, these estimations can be later transformed into price effects or ad-valorem tariff equivalents, which offer a comparable measure that can be used for additional comparisons among and within countries, firms and products. An imperative example for the implementation of the quantity-based methodology, is the work of Kee et al. (2009), who offer a systematic approach to quantify the trade impact of NTMs. They evaluate econometrically the restrictiveness of each individual country's trade policies, at all available tariff lines of the HS classification, and offer an overall trade restrictiveness index (OTRI). The index serves to quantify the uniform tariff equivalent that if imposed on domestic imports instead of the existing protection would keep aggregate imports on their current level? On the other hand, they offer the Market Access OTRI (MA-OTRI) to specify the exact impact of other countries' trade policies on each individual country's exports at the product level. Notably, while Kee *et al.* (2009) base their analysis on the theoretical foundation of the neoclassical perfect competition model, it may be so that other empirical studies rely on the theoretical frameworks of the Ricardian technology differences (Eaton & Kortum, 2002), firm heterogeneity (Melitz, 2003) and others.

3. Economic literature on the trade-effects of NTMs

3.1. How do specific types of NTMs affect imports and exports?

This subsection aims to present the key findings, in the empirical literature, on the trade-effects of Sanitary and Phyto-Sanitary measures (SPS) and Technical Barriers to Trade (TBT), whether from the aggregate perspective or specific types of measures which fall under their definitions. Studies demonstrate that although the magnitude of the trade effects may vary, the majority of the empirical work

validate the dominance of the trade-restricting effects of SPS and technical measures, especially on the agriculture and food sector.

In a meta-analysis of 27 empirical studies on technical regulations, Li & Beghin (2012) find that the demand effects of TBT and SPS on the agriculture-food sector are less likely to be positive than other sectors. Predominantly, a larger negative effect is found on agriculture and food which arrive from developing countries. Similarly, an adverse trade-effect is shown by Bown & Crowley (2013) and Grundke and Moser (2014) who emphasis that the use of NTMs, such as TTBs and customs enforcement of product standards, are counter-cyclical, and by that suggest a protectionist motive, at least for some NTMs. Likewise, Swinnen & Vandemoortele (2011) assert that food safety measures often affect trade in a negative manner, however, this does not necessarily mean protectionism, but could be a response to consumers' demand for better health assurance.

Nevertheless, a growing share of studies suggests that given the increasing potential of food safety standards to reduce domestic health risks, and offer quality assurance - the opposite direction may prevail. Particularly, extensively growing evidence validate that NTMs may be beneficial to consumers' welfare, and at times, be anti-protectionist while yielding growth of imports. This stream of studies often use new methodologies and techniques that address quantitative issues such as the existence of zero trade and others. Swann *et al.* (1996) who distinguish between national and international standards, find a positive and significant effect of national standards, where a 10% increase in their number increases UK imports by 3.3% and exports by 2.3%. Also, UK international standards had a positive and weakly significant effect on UK exports and a negligible effect on UK imports. Swann (2010) argues that the use of international standards in a given country usually increases exports from, and imports into that country.

Furthermore, the use of national standards often increases specific countries' exports, while the implications for imports into countries are less straightforward. Standards may facilitate imports, but sometimes, restrict such imports. In the case of SPS, the national domestic standards are more likely to restrict imports; especially those from developing countries. Crivelli & Groschl (2012) show that while SPS measures imposed on agricultural goods tend to negatively affect the extensive margin, their aggregate effect is positive, conditional on market entry (intensive margin). Their paper also shows that the impact of SPS measures on the intensive margin of trade varies across exporters, in a way that some exporters benefit while others lose from such measures. Similarly, Bao & Qiu (2012) observe an adverse effect of TBT measures on the extensive margin of trade, while a boosting effect on the intensive margin of trade. In general, the overall net effect depends on whether the importing or exporting firms belong to a developing or developed country.

Regarding studies which explore the impact of specific standards, a significant share is devoted to address food safety standards. For instance, Foletti (2011) examines the variation in maximum residue limits (MRLs) for various pesticides and products across many countries. She analyses the relative contribution of "consumer protection" (at the pesticide-level) and "producer protection" (at the product-level), showing that compared to health motives which explain a significant amount of the variation in MRLs, protectionism is associated with approximately one-third of the variation. As far as MRL levels are concerned, she finds that higher levels of toxicity, result in stricter regulation. However, when a pesticide is produced domestically, a more lenient regulation exists. Her finding is consistent with the view that although NTMs may hamper trade, the intension is not necessarily protectionism. Furthermore, Ferro *et al.* (2015) determine the impact of food safety standards on agricultural exports, by creating a standards restrictiveness index, using new data on MRLs of pesticides for 61 importing countries in a gravity model.

The real trade impact of a NTM, often change according to the level of aggregation of the policy measure in the analysis. Fassarella *et al.* (2011) show

that, while from a broad perspective, the trade impacts of technical and SPS measures on the Brazilian poultry meat exports are insignificant, a closer look reveals that conformity assessment procedures have a significantly negative impact. Moreover, packaging and labelling requirements, and disease-prevention measures, have a positive and significant impact on the probability that firms will export, as well as on the volumes of Brazilian poultry trade.

3.2. Are developing countries more sensitive to NTMs?

Whether the trade restrictiveness of countries depends on their level of economic development is at the heart of trade literature. Particularly, the quantification of the trade impact of NTMs on developing countries has dramatic implications due to the substantial technological, financial constraints, and insufficient market access they already face. Studies show that, in general, these trade-effects vary, given the heterogeneity in trade structure and characteristics of the trade policy measures across countries. Yet, a significant share of the empirical studies underpins the trade stringency that developing countries face, when attempting to access international markets. The majority of these studies demonstrate that exports from developing countries are more likely to be negatively affected by NTMs, compared with similar exports from developed countries.

A considerable body of evidence affirms the comparative vulnerability of developing countries to the impact of NTMs. The predominant explanation is that technical and SPS measures have a larger impact on traditional sectors, such as agriculture and food, textile, garment, iron and steel, which are often at the heart of the export activity of developing countries. Disdier *et al.* (2008) validate the adverse trade effect of standards and other NTMs when imposed by OECD countries on agri-food trade. They differentiate exports by country of origin group and by level of economic development, and use NTMs tariff equivalent to find that a 10% increase in the restrictiveness of NTMs increases agri-food exports from OECD countries by approx. 1.6%, but reduces exports from LDCs and DCs by approximately 2.3%. For the sub-sample of EU imports, NTMs reduce exports from other OECD countries by 0.14% and those from LDCs and DCs by 0.37%. The authors find an overall significant adverse effect of the notified SPS and TBT measures adopted by the USA, the EU, Japan, Canada, Australia and Switzerland, on total exports from Africa, the Pacific, Caribbean and Latin American.

In addition, Fontagne *et al.* (2005) classifies 61 product groups, into categories of "sensitive", "suspicious", and "remaining" products, which comprise a large share of processed agri-food products. They find that NTMs, including standards, have a restrictive trade impact on agri-food trade, but not on trade in other products. While no significant trade effects exist for suspicious products, negative trade effects are observed for pork meat, cut flowers, vegetables and wheat/pastry belonging to the "sensitive products", as well as for a variety of processed agri-food products (e.g. chocolate, beverages) in the group of "remaining products". Over the entire product range, all countries, seem to be equally affected, however, OECD agri-food exporters tend to benefit from NTMs, at the expense of exporters from developing and the least developing countries.

In a recent study, Ghodsi *et al.* (2017) show that although richer countries apply more NTMs than poorer countries, there are smaller effects of NTMs for richer countries compared to developing countries. By calculating the average number of NTMs over all imported HS 6-digit products, for a sample of 124 countries, they assert that 60% of all trade effects are trade-impeding effects of NTMs, particularly for quantitative restrictions and TBTs. The greatest trade-restricting effects of SPS measures were found for Sub-Saharan Africa, while in technical measures, the most affected are the Latin America and the Caribbean countries. The most trade-enhancing effects were found for the region of South Asia for SPS measures. Moreover, standards and restrictions adopted by Europe and Central Asia appear to be more import-restricting than North American policies.

When studying the trade effect of specific standards such as the maximum residual levels (MRLs) of pesticides, on developing countries exports, the result is often restrictive. Otsuki *et al.* (2001), for instance, estimate that moving from the Codex Alimentarius standard, to the more stringent uniform EU standard on aflatoxin, decreases African exports of cereals, dried fruits, and nuts to the EU. Similarly, Wilson & Otsuki (2004) find a negative effect of chlorpyrifos MRLs on bananas exports from Asia, Latin America, and Africa to the OECD countries. Chen *et al.* (2008) study how regulations of pesticides and medicated fish feed impact Chinese exports of fresh vegetables, fish and aquatic products. They find an adverse effect of these measures, particularly, a 10% increase in pesticides levels is associated with an export decrease of fish and aquatic product.

The empirical studies provide additional plausible reason for why developing countries are hindered more severely by NTMs and that is their lack of resources to efficiently influence the multilateral trade arena. Developing countries could have gained more influence, increase their interests and reduce their concerns, had they participated more actively in designing the WTO agreements on SPS and TBTs and the relevant institutions (Henson & Loader, 2001; Gebrehiwet *et al.* 2007).

Lastly, it is also important to check the substitutability between tariffs and non-tariff measures, in light of the fundamentally differences in the economic development levels of nations. Since the main objective of the WTO is to reduce any possible forms of obstacles to trade, it is useful to study how countries alternate between the two trade policy measures, when differentiated based on their income level. Hoekman & Nicita (2008) find that the trade restrictiveness of NTMs (relative to tariffs) increases with the level of GDP per capita. Ronen (2017a) shows that the substitutability between tariffs and NTMs decreases with the rise in the economic development of nations. In particular, a significant complementarity correlation exists between the two trade policy measures among the wealthiest nations, implying a stronger commitment to freer trade. Beverelli *et al.* (2015) find that the substitutability between tariffs and STCs increase with the level of economic development, meaning that higher probability for NTMs is found in high-income countries.

3.3. Are small-sized firms more adversely affected by NTMs?

According the empirical literature, whether the negative trade impact, which is associated with increased costs of compliance of a new NTM, is greater than the benefits obtained from selling products which fulfil an individual or multiple NTMs, depends on the numerous characteristics of the exporting firms. Among these features one can find the type of products which are exported, the marketing experience in the market, and the relative size of the exporting firm. The trade restricting effect typically moves through two main channels. The first involves a potential reduction of the export volumes, of those firms who continue to serve the export market (the intensive margin). The second channel, often regarded as the extensive margin of trade, implies that the probability of entrance of new firms, as well as the number of firms who continue to export decrease, since costly compliance crowds out some of the least efficient incumbent firms from the markets.

Firm-level studies usually validate the negative trade impact of TBT and SPS measures on foreign firms, typically on the smaller firms. Moreover, standards and technical regulations tend to have a significant stringent impact on exporting firms that import inputs, since compliance with standards in destination markets is challenging when the inputs imported from various sources fail to meet the requirements in the destination market for the final product. Furthermore, outsourcing firms are less likely to diversify their export markets compared to companies that do not outsource.

Chen *et al.* (2006) estimate the trade effect of standards, using firm-level data of the World Bank TBT Survey. They find that export's access to information has the greatest negative impact, as it reduces the average firm's export share in total sales

of individual firms by 18%. Testing procedures and lengthy inspections reduce exports by 9% and 5%, respectively. Access to information about standards requirements is relatively more important for exporters of manufactured goods, than of agri-food products. By contrast, testing procedures and lengthy inspections have a stronger negative impact on the export share of agri-food producers. Standards and labelling requirements have an insignificant impact on firm exports, since the increased production costs for producers are offset by lower information costs for consumers. TBT and SPS measures impede developing-country exporters' entry into developed markets, as they reduce the likelihood of firms to export to more than three markets by 7%, and in general, cause firms to export to fewer markets.

Fontagne *et al.* (2015) examine the heterogeneous trade effects of restrictive SPS measures on French exporters of different sizes. Notably, they study the channels through which aggregate exports fall: firm participation, export values, and pricing strategies. They show that SPS compliance costs, create market entry prohibition, and increase the probability to exit the restricted market by 2%. While using specific trade concerns to capture the restrictiveness of product standards, they analyze the effects on three trade-related outcomes: (1) the probability to export and to exit the export market (the firm-product extensive margin); (2) value exported (the firm-product intensive margin); (3) export prices. Their findings suggest that SPS concerns discourage the presence of exporters in SPS-imposing foreign markets. Moreover, they find a negative effect of SPS on the intensive margins of trade which are weakened in larger firms.

Maertens & Swinnen (2009) demonstrate that Senegal exporting firms of agriculture products, have benefited dramatically from the increasing sanitary requirements in the EU. However, the stringent regulation also provoked a shift in the profile of exporters from smallholder farming firms to large-scale integrated estate production. Grant *et al.* (2015) find that SPS measures are significantly more restrictive for U.S. exporters with no treatment experience, showing that an SPS treatment reduces the trade of inexperienced exporters by 44% to 81%, depending on the model's specifications. They underline that this adverse effect diminishes as U.S. exporters accumulate the necessary treatment experience in the global marketplace and completely vanishes when they reach two to three years of exporting.

Reyes (2011) focuses on the electronics sector, and finds that the harmonization of EU product standards with international norms, increases the entry of US firms. This effect is stronger for US firms that already export to developed countries, but not to the EU. These firms are, on average, smaller relatively to others that already export to the EU. Volpe Martincus *et al.* (2015) study the effects of customs processing times on firms' exports and imports and find that Pre-shipment inspections at the customs create delays, which have a significant negative impact on firms' exports. Particularly, a 10% increase in customs delays lowers firms' exports by 3.8%.

3.4. How are particular sectors and products affected by NTMs?

The type of sector affected as well as the level of product aggregation may also account for some of the trade impact variation across countries. The greater trade-restricting impact of NTMs is found, in general, in the agricultural goods, while in manufactured products, the trade effect of NTMs varies widely across sectors and products. Studies confirm that exporters of the agricultural sector, are mostly concerned about SPS standards and requirements in addition to conformity assessment procedures. Moreover, as these standards often differ by country, it makes the compliance costs even larger, as it is multiplied by the number of the export markets.

Kee *et al.* (2009) report on significant variation in the ad-valorem equivalents of NTMs across products (at the 6 digit-level of the HS), amounting to an average level of 27% for agricultural products compared with 10% for manufactured goods.

The greater trade-restricting impact of NTMs for agricultural goods relative to manufactured products is reinforced by the results of Hoekman & Nicita (2008). They also show that the restrictiveness of NTMs for agricultural trade is especially important in developed economies. Giordani *et al.* (2014) highlight the contribution of export restriction measures on the global price volatility of various food products. Yet, Andriamananjara *et al.* (2004) see almost no statistically significant influence on the agricultural sector, but identify the apparel industry as the sector with the largest number of significant NTMs. Other sectors such as paper products, leather products, and vegetable oils and fats, have been identified as impacted by multiple NTMs.

By contrast, several studies reinforce the demand-enhancing impact of NTMs on various sectors. Moenius (2004) finds that although import-specific standards have an adverse effect on imports of non-manufacturing sectors, a positive impact is found on imports in the manufacturing sector. Standards provide exporters with valuable information about market preferences, and despite imposing compliance costs, the information costs-reducing effect outweighs adaptation costs-increasing effect, and that results in the expansion of trade. Similarly, Blind (2001) finds a significantly positive effect of standards on trade in "instruments for measurement and testing". Ronen (2017b) who explores the trade effects of a variety of NTMs on virgin olive oil imports, finds a significant demand-enhancing impact, particularly of MRLs. Anders & Caswell (2009) focus on mandatory "Hazard Analysis and Critical Control Points" (HACCP) requirements for seafood products in the USA, and find significantly different trade effects between developed and developing countries. As a group, the impact on developing countries amounted to a reduction of 0.9% in exports, while developed countries as a group gained under HACCP standards. Particularly, larger exporters gained trade shares at the expense of smaller exporters. While focusing on notified TBTs and SPS of environment-related measures (ERM), Fontagné *et al.* (2005) find a demand-enhancing impact of ERM on manufacturing trade, but an impeding trade impact in fresh and processed food.

Gruebler *et al.* (2016) acknowledge the difference between the impact of NTMs on imported products which are used for final consumption, compared to intermediate inputs. They show that TBT as well as SPS measures play a more significant role for the manufacturing sector, especially for intermediate goods. By contrast, they find that quantitative restrictions have strong import prohibitive impacts, predominantly for intermediates. Notably, those quantitative restrictions are only applied on imported goods, while technical regulations are typically imposed upon both imported and locally-produced goods.

3.5. Do harmonization and mutual recognition necessarily impact trade positively?

Harmonization and mutual recognition of TBTs and SPS measures tend to simplify procedures and reduce informational asymmetries between consumers and producers, thus widely shown to contribute positively to trade. The harmonization of standards may enhance trade, as it positively affects the diversification of export markets (extensive margin of trade), meaning that it increases the number of exported varieties and export destinations. This enhancing effect is typically for exports from developing to industrialized countries, as this is where information asymmetries are largest. Nevertheless, harmonization can also hinder trade in cases where to harmonize standards, one of the sides is required to tighten its domestic regulatory policy or impose additional compliance cost, which may result in an effective reduction of import volumes (intensive margin of trade). Therefore, the net trade effect of the harmonization of standards depends on various determinants such as the specific markets harmonizing the standards, the particular standard involved, the product or sector affected and other considerations.

Shepherd (2007) who study the impact of harmonization of standards on the variety of exports of textiles, clothing, and footwear, finds that harmonization is

associated with higher export variety, primarily for low-income countries' exports to the EU. Specifically, a 10% increase in the total number of EU standards is associated with about a 6% decrease in the product variety of exports to the EU market. Similarly, Reyes (2011) examines the response of US manufacturing firms to the harmonization of EU product standards with international ones, using the share of non-harmonized standards, as a measure of trade costs due to a variety of standards. Expanding harmonization is found to increase US exports to the EU, particularly due to new US firms that enter the EU market (extensive margin). At the same time, exports from US firms which are already present in the EU market prior to the harmonization decrease (intensive margin). The overall net effect drives exports to increase. Reyes also finds that new exporting firms are smaller than those already exporting to the EU before harmonization, suggesting that harmonization of product standards across countries could be beneficial for small- and medium-sized firms who wish to enter new export markets.

Additional support to the trade-creating effect of harmonization and mutual recognition (MRAs) is provided by Chen & Mattoo (2008) who discover that harmonization agreements increase trade between the country parties to the agreement, but not necessarily with other countries. In particular, they show that harmonization increases exports from developed countries while reduces exports from developing countries outside the region. In addition, they demonstrate that MRAs tend to increase trade within the region, as well as trade with countries outside the region if they are not associated with rules of origin (ROO). However, when the MRAs contain ROO, trade with countries outside the region is adversely affected, especially exports from developing countries.

Moenius (2004) notices that, when aggregated across industries, trade significantly increases with the rise in number of bilaterally common standards. Contrary to the commonly held belief that importer-specific standards impede trade, due to the supplementary compliance costs, Moenius finds that national standards, whether of the importing or the exporting country, have a demand-enhancing effect on average. Moreover, at the industry-level, the only variation to the aggregate results is that importer-specific standards have a positive impact on trade in the manufacturing sectors, compared to an adverse trade effect in non-manufacturing sectors, such as the agriculture.

Foletti & Shingal (2014) find evidence that regulatory heterogeneity of MRLs diminishes trade at the extensive margin when the exporter faces more rigorous regulation abroad. However, a strong significant support reveals that regulatory heterogeneity increases trade at the intensive margin for exporting countries that set the stringent standards.

Michalek *et al.* (2005) analyze the effects of three different generic EU policy approaches for dealing with technical measures for the new member states (CEEC) and the Mediterranean countries. Their results show that when the approach to removing TBT is harmonization or the new approach, then that is successful in increasing trade flows. But when the approach is mutual recognition, the estimated effect is to reduce trade flows. Baller (2007), however, observes a positive impact of MRAs on a firm's decision about whether or not to export as well as on the volume exported. The evidence for harmonization is less evident, as the impact of harmonization on trade in telecoms equipment and medical devices is often insignificant and of variable sign. These results seem to suggest that standards and associated testing procedures represent mostly a fixed rather than variable cost for OECD firms.

On the other hand, Cadot & Malouche (2012) assert that it may be more beneficial for exporting firms to develop their strengths in regional market, in order to gain scale and learning economies, prior to make efforts in complying with international standards. Another example for the counterproductive effect of harmonization is conveyed by Jensen & Keyser (2012), who show that the new adoption by the East African Community of the tightened dairy standards based on

the international food codex, has resulted in a decrease of the regional trade in dairy products.

4. Conclusions

Since the early attempts to develop economic tools that estimate the trade restrictiveness of non-tariff measures, using traditional inventory practices, notable progress has been made. This advancement, which is further demonstrated in the empirical trade literature of the past two decades, emphasizes the growing presence, but even more importantly, the substantial role that NTMs have on the global trade as we know it. While employing diverse econometric methodologies, this large body of literature strives not only to explore the channels by which multiple non-tariff policy measures affect trade, but moreover the direction and magnitude of these trade effects among countries and between firms, at various levels of product aggregation.

The current paper surveys the relevant empirical literature in order to identify the major policy implications related to the trade effects of NTMs. Particularly, it aims to highlight the key factors that determine whether these policy instruments increase trade restrictiveness, or possibly impact demand favourably, which suggests that the trade-enhancing effect prevails. Furthermore, it uncovers the extent to which various NTMs may influence trade patterns of countries, depending on their level of economic development, or on firms based on their relative size. Lastly, it disentangles sectors, upon different aggregation levels, in order to portray how bilateral or regional trade is influenced by the existence of national versus shared standards and regulations.

The paper asserts that a great importance in establishing the net trade effect of NTMs should be attributed to the export composition of a country. That is to say, that the relative share of agricultural goods versus manufactures, as well as the difference between final goods and intermediate components, play a significant role in determining the accurate trade impact of NTMs. Although the majority of studies find the restrictive trade effect is more dominant, a growing evidence emphasis the trade benefits associated with quality assurance and information disclosure that are provided to consumers. Secondly, the relative size of the exporting firm and the experience it has in serving the market, significantly influence the trade effect of the policy measure. In addition, the level of the economic development of the exporting and the importing countries, seems to be vital for that matter. Notably, the empirical literature validates that developing countries are more likely face stringent requirements on their exports, compared with developed countries. Finally, the empirical studies, although with some exception, find it beneficial to encourage better cooperation in regulatory policy through mutual recognition and harmonization of regulations amid countries.

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