Policy Implications of Non-Tariff Measures on International Trade

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Ph.D. Dissertation

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Introduction

During the past two decades, international trade has been increasing rapidly which overlapped with a significant gradual elimination of tariff protection implemented by most countries. Tariff reduction has been achieved as a result of successive rounds of multilateral trade negotiations, or by the creation of preferential trade agreements (PTAs), and occasionally, by unilateral trade liberalization. Alongside the worldwide reduction of tariff rates, accumulated evidence shows a growing propensity in the use of non-tariff measures to trade (NTMs), which may partially offset the advancements achieved by lower tariffs. Traditionally, tariff measures are imposed to pursue economic and trade objectives, while the intention behind the use of non-tariff measures is to realize policy objectives, which are non-economic, by nature. Among these purposes can by environmental protection, public health, consumer safety, homeland security, etc. The growing trend of using NTMs, in turn, has led to a consensus among scholars, also supported by several empirical analyzes, that NTMs de facto serve countries to achieve mainly economic goals. These goals are the enhancement of import restrictiveness, the improvement of terms-of-trade, and the compensation for possible economic losses in the presence of tariffs liberalization.

Contrastingly, evidence based on several sources, among them a unique dataset on ad-valorem of NTMs, elaborated by Kee et al. (2009), imply that there may be a more complicated picture. A cross-country portrait shows that countries with low tariffs, also apply lower ad-valorem NTMs, and vice versa, suggesting complementary relations between those two types of policy instruments. A similar positive correlation between tariffs and NTMs is also found by results of data analysis of NTMs coverage ratio, in number of products affected by NTMs, at various levels of aggregation. Taken together, these results demonstrate how a protectionist tariff policy is often paired with tougher regulated measures. The positive correlation between the two policy measures creates at first glance a paradox, which requires further investigation.

The PhD dissertation aims to uncover various policy implications of NTMs on the international trade, across countries and products. It does so by, firstly, reviewing the state of the art in the empirical work which revolves around the trade impact of NTMs. Secondly, the dissertation addresses three particular dimensions related to trade policy implications of NTMs. The first dimension examines the policy substitution and complementarity between NTMs and tariffs in various groups of countries. The second part provides a comparison framework of the legal and economic assessments in the WTO dispute settlement mechanism that involve the use of specific NTMs. In the last part, an empirical analysis is performed, on the virgin olive oil sector, to examine whether particular NTMs can actually serve as trade boosters rather than trade-restricting measures.

The first chapter of the dissertation provides an up-to date review of the empirical literature on the trade impact of NTMs, particularly, the Sanitary and Phytosanitary Measures (SPS) and Technical Barriers to Trade (TBT). It displays the available responses that the empirical literature provides to the major questions regarding the trade effects of NTMs. For instance: How do specific NTMs affect imports and exports? What is the trade-effect of NTMs on developing countries? Do small- and medium sized firms suffer more from compliance costs associated with NTMs compared to larger firms? How are particular products/sectors affected by NTMs? Do harmonization and mutual recognition agreements necessarily enhance trade? The article is "**Quantifying the Trade Effect of Non-Tariff Measures: A Review of the Empirical Literature**" has been published in the *Journal of Economics and Political Economy. (2017)*

The second chapter of the PhD research presents an empirical study, designed to investigate the correlation between tariffs and NTMs, by studying the country variation in the context of economic development differences. It builds on a dataset constructed by Kee et al (2009), which calculated the ad-valorem equivalent of NTMs at a very disaggregate product for about 100 (developing and developed) countries. By exploiting the country variation, the paper demonstrates that the strong substitutability in low-income countries, gradually diminishes with the rise in the economic development of countries, until it transforms to complementarity in high-income countries. The article **"Tariffs & Non-Tariff Measures: Substitutes or Complements. A Cross-Country Analysis"**, has been published in *Bank i Kredyt. (2017)*.

The third chapter analyzes the legal and economic assessments that have been applied to re-solve WTO disputes that involve the use of NTMs. In particular, it provides an analysis of assessments of the contribution of the measures to the objective pursued, along with identifying any reasonably available alternatives. In doing so, it focuses on those disputes relevant in encompassing an interpretation of GATT Article XX(b), SPS Agreement Art. 5.6 and TBT Agreement Art. 2.2. This paper reveals that although there are no significant differences between the legal tests, relating to the interpretation of the term "necessary", the same cannot be said for the economic assessments that need to be undertaken to determine whether the contribution of the measure it seeks to support, is necessary. The paper, written jointly with Dr. Kamala Dawar of the Sussex University demonstrates that the economic analyses of disputes vary widely depending on whether a quantitative or qualitative assessment is undertaken. After setting out the legal tests that regulate assessments of a contribution of a measure or its necessity, it identifies those economic assessments that have been undertaken to complement or substitute the legal tests used to resolve disputes involving these different provisions of the GATT/WTO legal framework. The article **"How 'Necessary'? A Comparison of Legal and Economic Assessments Under GATT Dispute Settlements, Article XX(b), TBT 2.2 and SPS 5.6",** has been published in the *Journal of Trade, Law and Development. (*2016*)*.

The fourth chapter of the PhD research aims to examine whether and to what extent NTMs can serve as trade boosters rather than trade restrictive measures. It uses the virgin olive oil sector data in order to estimate an empirical model and identify which NTMs affect the level of bilateral trade the most. Moreover, it allows differentiating which regulation measures could be associated with trade enhancement compared to those that impede trade. The hypothesis of this paper is that the majority of the non-tariff measures actually fulfil the purposes which they were originally designed to achieve. By doing so, these NTMs respond to the consumer's demand for food safety and human health, while increasing available information and transparency, and in turn, expand the magnitude of imports of virgin olive oil products. The article **"The Trade-Enhancing Effects of Non-Tariff Measures on Virgin Olive Oil",** has been published in the *International Journal of Food and Agricultural Economics. (2017)*.

By way of conclusion, the dissertation asserts that TBT and SPS measures impact international trade in a more substantial manner than meets the eye. In the outset, a review of the empirical literature on the trade-effects of NTMs is put forward, in order to uncover the key findings that it provides to various possible aspects regarding the trade effects of NTMs. In the second part, it validates that, in contrast to the consensus among scholars on the substitutability between tariffs and NTMs, the substitutability trend actually diminishes with the rise in the economic development, while a strong complementarity between the two import policy measures appears amid developed countries. The third part highlights the insufficient consideration of the economic effects of NTMs by the dispute settlement bodies, compared to legal assessments, which could regrettably undermine the WTO's objectives to freer trade. Finally, unlike the majority of scholars' claim, the fourth part asserts that NTMs do not necessarily restrict trade. It does so by demonstrating that in the case of virgin olive oil, NTMs can actually achieve the purposes they were originally designed to fulfil, while contributing to the bilateral trade among countries favourably.

The current status of publications in peer-reviewed journals:

1) The article "Quantifying the Trade Effect of Non-Tariff Measures: A Review of the Empirical Literature" has been published in the **Journal of Economics and Political Economy**.

   Ronen, E. (2017). Quantifying the trade effects of NTMs: A review of the empirical literature. Journal of Economics and Political Economy, 4(3), 263-274.

2) The article "Tariffs & Non-Tariff Measures: Substitutes or Complements. A Cross-Country Analysis", has been published in ***Bank i Kredyt. Journal of the National Bank of Poland.***

   Ronen, E. (2017). Tariffs and Non-Tariff Measures: Substitutes or Complements: A Cross-Country Analysis. Bank i Kredyt, (1), 45-71.

3) The article "How 'Necessary'? A Comparison of Legal and Economic Assessments Under GATT Dispute Settlements, Article XX(b), TBT 2.2 and SPS 5.6", has been published in the ***Journal of Trade, Law and Development***. *8(1): 1-28.*

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4) The article "The Trade-Enhancing Effect of Non-Tariff Measures on Virgin Olive Oil", has been published in ***International Journal of Food and Agricultural Economics***.

   Ronen, E. (2017). The Trade-Enhancing Effect of Non-Tariff Measures on Virgin Olive Oil. International Journal of Food and Agricultural Economics, 5(3), 9-26.

Quantifying the Trade Effects of NTMs:
A Review of the Empirical Literature

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 on the global trade arena, has prompted numerous scholars to explore the actual 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 TBTs and SPS measures. Among these questions: (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? (5) Do Harmonization and Mutual Recognition necessarily impact trade positively?

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 objects 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, 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 quanti-

fication (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 litera-

ture 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 the 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 equiva-

lents, 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 (OT-RI). 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 and 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 and 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 and Crowley (2013) and Grundke and Moser (2014) who emphasis that the use of NTMs, such as TTBs (Temporary Trade Barriers) and customs enforcement of product standards, are counter-cyclical, and by that suggest a protectionist motive, at least for some NTMs. Likewise, Swinnen and 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 and 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 and 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 and 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 and 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 and Nicita (2008) find that the trade restrictiveness of NTMs (relative to tariffs) increases with the level of GDP per capita. Ronen (2017) 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 (Specific Trade Concerns) increase with the level of economic development, meaning that higher probability for NTMs is found in high-income countries.

3.3 Are Small-Medium 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 and 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 and 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 (2017) 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 and 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.

Grubler 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 and 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.

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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 and 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 (2006), 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 and 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 and 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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Tariffs and Non-Tariff Measures: Substitutes or Complements: A Cross-Country Analysis

Abstract

Alongside the global tariff liberalization, a growing body of evidence demonstrates the rise in the use of non-tariff measures (NTMs), which suggests a substitution effect between these two import policy instruments. Yet, detailed economic data reveals that in countries with lower tariff rates (developed countries), the use of NTMs is significantly lower compared to developing countries, which implies a possible complementary effect between tariffs and NTMs across nations. Using a dataset of Kee et al (2009) on ad-valorem tariff equivalents of NTMs, at a very disaggregated product level, this paper explores the determinants of NTMs and their substitutability/complementarity relations with tariff barriers. While exploiting the country variation, it demonstrates the decreasing trend of substitutability between the two import policy instruments with the rise in economic development. In particular, a significant complementarity correlation exists between the two trade measures among the wealthiest nations, implying a stronger commitment to freer trade.

1. Introduction

Over the past two decades, international trade has increased rapidly, largely due to a significant gradual elimination of tariff protection. Tariff reduction has been achieved either by successive rounds of multilateral trade negotiations, by unilateral liberalization, or by the creation of preferential trade agreements (PTAs). Since a notable share of PTAs was among developing countries, which originally commenced with higher tariff levels, it is no surprise that these countries in particular have pursued more far-reaching tariff elimination. Yet, the average tariff levels in low-income countries are still significantly higher than developed countries (WTO, 2016).

Alongside the reduction of tariff rates, accumulated evidence shows a growing propensity in the use of non-tariff measures to trade (NTMs[1]) by many countries, which partially offsets the advancements achieved by lowering tariffs. Contrary to tariff measures, which were originally introduced in order to realize economic and trade objectives, the purported intention behind the imposition of NTMs was to design public objectives which are non-protectionist by nature. These policy measures often serve as the first-best instrument to advance various social, political or environmental protection objectives, as well as health and consumer protection. Nevertheless, these instruments have become popular in achieving economic goals, mainly claiming to correct market inefficiencies which arise from information asymmetries or imperfect competition. However, as the imposition of such procedures creates a beneficial advantage for players who participate in the trade arena, it is no wonder that the use of NTMs has expanded. The political economy literature demonstrates how policymakers, who face pressures to protect domestic producers, may choose to use NTMs more extensively. At the same time, it claims that NTMs are merely alternative channels of protectionism in disguise. These actions may even be intensified when the reduction of tariffs adversely affects the local producers' performances or in times of economic downturn.

The use of NTMs varies considerably across countries, differing according to the specific type chosen, affecting diverse products, and fluctuating over time. Nevertheless, a common motive in various approaches which study their incidence validates the accelerated expansion of

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[1] Despite minor differences, the terms non-tariff measures and non-tariff barriers are often used interchangeably. In this paper the term non-tariff measures will be used.

NTMs over time. In particular, some practices such as Technical Barriers to Trade (TBTs) and Sanitary and Phytosanitary (SPS) measures, which account for a large share of all NTMs, have been on the rise since the mid-90s, as shown in the increasing number of notifications of SPS and TBT measures reported to the WTO (Figure 1). Moreover, this upward direction is well demonstrated by the substantial increase in the use of anti-dumping measures over the last two decades, mostly by developing countries.

As the continuous reduction of tariffs and the expanding use of NTMs move in opposite directions, increasing attention has been drawn to the possible substitution effect between these two import policy measures. The common consensus shared among scholars and supported by several empirical analyses claims that NTMs often enable countries to enhance restrictiveness, manipulate the terms-of-trade and reclaim possible economic losses due to tariff liberalization. These studies, which focus mostly on specific countries or particular NTMs, demonstrate the substitutability relation between tariffs and NTMs. This negative correlation emphasizes that new NTM restrictions simply replace the traditional ones (namely tariffs), in order to achieve similar objectives.

This paper tests the proposition that although from the broad perspective a negative correlation may be found, a deeper analysis would reflect heterogeneity among countries. In particular, it will verify the diminishing trajectory of the substitutability between the two import policy instruments with the rise in GDP per capita. It will provide evidence that the more developed a country is, the less likely that NTM practices occur. In low-income countries, the substitutability effect is dramatically high; however, the rationalization is counter-intuitive, since high levels of applied tariffs are found alongside a modest imposition of NTMs. Low levels of NTMs are the outcome of the complexity and high costs associated with operating administrative and regulatory systems. Secondly, low-income countries are more revenue oriented, thus depending mostly on tariff income. Thirdly, their dependency on world trade as well as their commitment to freer trade is less robust than the richest countries. Lastly, low-income countries enjoy greater flexibility in terms of binding overhang gaps, which significantly decreases their motivation to impose NTMs. The binding overhang gaps are essentially the differences between the bound levels and applied tariff rates on each product granted to countries under WTO rules.

On the other hand, high-income countries that generally levy lower levels of tariffs are comparatively more committed to transparency and non-discrimination practices that result in lower

levels of NTMs. Those developed countries are generally at the frontline of WTO discussions, hence they are more involved in the process of eliminating TBT and SPS measures. This means taking upon themselves the removal of trade barriers more extensively than elsewhere. Moreover, since high-income countries tend to rely more profoundly on international trade, it leads them to seek better conditions, both for domestic importers, as well as for their local exporters in foreign markets. Such interests co-exist with the necessity to attract imports at the lowest costs possible for the benefit of domestic consumers as well as for importers of intermediate goods. These reasons are expected to lead to less substitutability or even a greater complementarity correlation between the two import policy measures.

The proposition mentioned above is further supported by evidence based on a recent dataset of Kee et al. (2009) accompanied by the authors' calculations. Figure 2 portrays how countries with lower levels of tariffs also impose lower NTMs. This cross-country analysis demonstrates that complementary correlation exists between the two import measures, alongside negative correlation with the level of economic development. Moreover, data on NTMs coverage ratio draw similar conclusions regarding the positive correlation of tariff levels and the number of products affected by NTMs. Additionally, a strong correlation is found between the average number of NTMs at the chapter level and the tariffs (UNCTAD, 2013). Taken together, these results demonstrate how a low tariff regime may be paired with a less stringent NTM policy. Such findings reinforce the complementary relation between the two import policy instruments, hence creating a paradox with the shared consensus on substitutability.

Despite their significant impact on trade and the reporting requirements to notify NTMs to the WTO with clear information regarding the products affected, systematically collected data regarding their implications is still hardly available. Economic studies address NTMs in a narrow setting, mainly in a qualitative approach, whereas in practice NTMs are broadly employed and change over time alongside the constant appearance of new types of NTMs that may require other analytic methodologies. Throughout the years, several attempts were made in order to collect information on NTMs (i.e. MAST, TRAINS). Nevertheless, to some extent, these quantifications usually address specific types of measures, countries, and products, and it is still not sufficiently comprehensive or lacks the broader perspective.

Recently, this gap has been addressed by Kee, Nicita and Olarreaga (2009) who tried to overcome various challenges and created a unique dataset of ad-valorem equivalents (AVE) of NTMs

at a disaggregated product level (i.e. the 6-digit level of the HS classification). Their work provides estimations for tariff equivalents of NTMs of 104 countries (developing and developed), while comprising information regarding more than 30 types of NTMs. Among these measures are price control, quantity restrictions, monopolistic measures and technical regulations, agricultural domestic support and others. The extensive data set consists of observations on ad-valorem equivalents of NTMs expressed as a percentage of the value of the product, making them directly comparable with tariffs.

The possible direct comparison provides the starting point for this paper, as it allows an econometric-based analysis of the substitutability/complementarity correlation of NTMs and tariff barriers to be undertaken. Moreover, the current analysis will outline the heterogeneity across countries and emphasize the diminishing negative correlation between the two import measures with the rise in countries' level of economic development. By performing an in-depth and comprehensive analysis which differentiates between country groups, this paper aims to add an important dimension to the basic correlation analysis offered by Kee et al. (2009), which focuses on the broad perspective. Secondly, it will contribute to the existing knowledge by investigating some additional determinants of NTMs, providing a more precise characterization and motivation behind their pervasiveness. One imperative explanatory variable for that matter is the binding overhang ratio, which represents the flexibility between bound and applied tariffs, and in turn the incentive to alternate to NTMs. Other control factors which are taken into consideration and influence the restrictiveness of NTMs are trade openness, import revenues, and others.

The paper is comprised of five sections. Following an introduction, the second section portrays the characterization of the use of NTMs across countries. The third section outlines the literature review, starting with the relations between tariffs, NTMs and trade, followed by a description of the approaches used to quantify the restrictiveness of NTMs, succeeded by the particular methodology of Kee et al. (2009) which served for obtaining the data on AVE of NTMs in the analysis. The fourth section presents the methodology which was chosen to conduct the econometric analysis in the paper, accompanied by a discussion of the results of the estimations, along with several robustness checks. The last section of the paper underlines the main conclusions which can be drawn from the research.

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2. The Characteristics of the Use of NTMs Across Countries

The scope of use of non-tariff measures varies significantly according to their type, nature or the objectives to be achieved. Evidence indicates that, in general, the average country imposes technical barriers to trade (TBT) on about 30 percent of products and trade. Sanitary and Phytosanitary (SPS) measures, which are exclusively related to agriculture and food products, are imposed on more than 60 percent of agricultural products, which in fact represents slightly less than 15 percent of overall trade. Among non-technical measures, pre-shipment inspections, for example, affect on average approximately 20 percent of trade and products (UNCTAD, 2013).

NTMs also differ considerably across countries, depending much on each country's comparative advantage and political economy preferences. NTMs imposed on agricultural products are likely to be greater and more restrictive in countries with a stronger comparative advantage in producing agricultural products. These factors are demonstrated in the use of SPS measures and quantity and price control measures, which tend to be more predominant in developing countries. Countries, which rely heavily on domestic production of traditional sectors such as agriculture will use these instruments more extensively compared to developed countries. At the same time, richer countries, which are often concerned about shielding import-competing industries, or preserving the interests of infant industries, are found to impose TBTs more extensively than elsewhere.

The descriptive statistics presented in Table 2 point out the differences between the impositions of NTMs across country groups. They provide a snapshot of the average statistics on various variables such as tariffs, NTMs, and others. These figures are grouped according to the level of economic development of the countries (based on GDP per capita categories). The figures indicate that except for the lowest income group, the richer a country is in terms of GDP per capita, the lower its use of NTMs. While the AVE of NTMs in lower-middle income countries is roughly 15 percent, in upper-middle income countries and in high-income countries the average is 10 percent and less than 9 percent, respectively. The exception to this rule is the case of low-income countries, where although the average AVE of NTMs is relatively low (4 percent), as demonstrated in Figure 3, there is a large variance across these countries. For example, in the African continent, Rwanda (0.3 percent) and Kenya (1.3 percent) are at the lowest end, while Sudan and Nigeria are on the highest end with an average AVE of NTMs which reaches 40 percent. Complemen-

tary studies show that although on average NTMs are utilized for slightly less than half of the list of 5,000 products, in the African continent Tanzania and Senegal use NTMs substantially less than Egypt or Uganda. In Latin America, the use of NTMs by Argentina is double that of Chile or Paraguay. Also in Asia, Bangladesh, Syria and the Philippines utilize NTMs much more than Cambodia or Indonesia.

Furthermore, as seen in the descriptive statistics, richer countries are more committed to the reduction of all types of barriers to trade, as internationally agreed under the general principles of the WTO. Therefore, the average use of NTMs among the richest countries is the lowest found across all countries. These countries are typically more open and dependent on international trade, and consequently are less likely to employ NTMs compared to more self-reliant countries. On the other hand, with some exceptions, the less developed a country is, the less likely it will be open to competing for import flows. The low-income countries, which rely profoundly on revenue generating tax measures such as import tariffs, prefer not to operate a costly and complex administration. Furthermore, low-income countries also enjoy a bigger overhang gap (difference between bound and applied tariffs), which allows them the flexibility to increase their level of actual tariffs legally.

While exploring the use of NTMs across countries, it is essential to tackle specific characteristics of countries such as export performances as well as those who are the natural trading partners. In general, high-income countries tend to export more than lower income countries (by share of GDP), and their exports are mostly directed to other rich nations. The low and middle-income countries still trade mostly among themselves, though in the last decade these countries increasingly expand their exports to higher income countries at the expense of their traditional markets. Trade data shows that the developing countries' share in world merchandise exports have expanded dramatically from 17 percent to 43 percent during the last 25 years (WTO, 2016).

Moreover, although the low-income countries may enjoy better market access conditions relative to the past, they still face larger financial and manufacturing constraints. These capacity constraints make it even harder to overcome the barriers posed by NTMs. Given the fact that low-income countries specialize in traditional exports such as agriculture, textile, and apparel goods, and suffer from higher capacity constraints, it is even more worrisome that these countries face substantial obstacles in the form of high substitutability of tariffs with NTMs in their main exporting markets. This problem is further amplified by evidence of recent ITC business surveys on

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NTMs, which indicate that exporters of agricultural products report more problems related to TBT/SPS measures than exporters of manufactured goods (59 percent compared to 34 percent respectively) (WTO, 2012).

3. Literature review

3.1 NTMs, Tariffs and Trade in the Literature

In recent years, a growing interest has emerged around the characteristics of NTMs and particularly, over their impact on trade restrictiveness and on the welfare of nations. This paper builds both on existing political economy theories, as well as on the empirical literature on the determinants of governments' imposition of NTMs in response to decreasing tariffs. It primarily attempts to contribute to the strand of literature analysing the political economy environment of trade policy, which is based on Grossman and Helpman (1994), and has been tested empirically in several studies. While the authors laid down the foundations of the role of domestic interest groups, others, such as Mansfield and Busch (1995), have focused on the domestic political influence of institutions and the impact of deteriorating macroeconomic conditions. The later found that these factors explain the variance between countries in the demand for NTMs protection by pressure groups. Lee and Swagel (1997) establish that countries pair these two trade measures in order to protect vulnerable industries which are politically important or those threatened by import competition. Yu (2000) highlights the importance of transparency and the presence of informed consumers on the government's decision to substitute voluntary export restraints (VERs) with tariffs. Furthermore, Yu claims that an increase in foreign competition will not cause the government to substitute NTMs for tariffs; however, a rise in the government's valuation of political contribution might do.

The vast majority of the literature suggests that substitutability between NTMs and tariffs exists alongside the implementation of preferential trade agreements (PTAs). These agreements lower the rate of protection, but often do not reduce the domestic pressure for protectionism. The Law of Constant Protection phenomena suggests that producers who are well-protected by tariffs may care less for NTMs relative to industries adversely affected by the economic impact of decreasing tariffs, which may often receive NTMs protection as a substitute (Bhagwati, 1988). By employing data on Turkey's tariffs and NTMs, Limao and Tovar (2011) exploit the variation in

tariff constraints generated by multilateral agreements and PTAs. They establish a causal impact of the resulting tariff constraints on the likelihood and restrictiveness of NTMs. By considering the differences in the size of EU Member States in a PTA, they show that if the common EU tariff had constrained Turkey in its tariff setting, this could have had a causal impact on protection via NTMs on non-EU exporters. They find evidence of policy substitution between tariff commitments imposed via the WTO and the PTA with the EU and the increasing probability of Turkish NTMs.

An important role in the country's decision regarding the extent of the use of NTMs is accredited to the market power it has over its trading partners. Broda et al (2008) demonstrate that significantly higher NTMs are used in import-competing sectors, where there is a greater ability to affect foreign exporters' prices. Moreover, countries with sufficient market power, or even small countries (mainly non-WTO members), who in certain products face lower export supply elasticities (inelastic supply), will charge higher tariffs and also be driven to force a more protectionist approach by imposing NTMs. Aisbett and Pearson (2012) establish the substitutability correlation between SPS measures and tariffs, by suggesting that countries manipulate their environmental and health standards for protectionist purposes. The authors claim that there is a Race to the Bottom, meaning that tariff liberalization puts downward pressure on standards in countries which already have low standards (namely developing countries) and upward pressure on countries with high-standards (developed countries). Bagwell and Staiger (2014) introduce the Globalization Fatigue hypothesis and claim that developed countries suffer from insufficient bargaining power in the multilateral and bilateral negotiations arena, relative to developing countries. That, in turn, may trigger them to tighten the imposition of NTMs in order to form trade policy space (or make room) for future negotiations with developing countries.

Using data on specific trade concerns (STCs), Beverelli, Boffa and Keck (2014) find clear substitutability between past reductions in applied tariffs and SPS measures in both developed and developing economies, and same negative correlation between tariffs and TBTs only in developed countries. In line with these results, however, from the exporting country perspective, Orefice (2015) shows that lowering tariff by 10% corresponds to a 0.18% and 0.36% higher probability of observing an STC on SPS and TBT respectively. This figure is even further magnified when the raising and the imposing country belong to the same income group.

While interest in studying TBT and SPS has been growing in recent years, much of the relationship between tariff liberalization and the detailed level of specific NTMs focus mainly on anti-dumping (AD) measures. Moore and Zanardi (2011), who study how past trade liberalization impacts the decision to adopt antidumping laws, demonstrate that except for heavy users of AD among the developing countries there is no statistically significant substitution effect of trade liberalization on AD initiatives. By contrast, Feinberg and Reynolds (2007), who based their analysis on 24 countries for the period from 1996 to 2003, identify that tariff reductions increased both the likelihood and number of AD petitions, especially for developing countries. Their concept of Quid-Pro-Quo implies a quiet agreement which exists between nations on switching traditional tariff policies by NTMs. They conclude that multilateral trade reductions are the cause of the recent growth in new users of anti-dumping policies. Bown and Tovar (2011) reaffirm the substitution effect by analysing India, which recently became a heavy user of antidumping measures. They demonstrate how India's liberalization reforms in the early 1990s have resulted in a higher probability of AD filings and increased safeguard restrictions.

In the reviewed literature, it is not always evident that substitutability between tariffs and NTMs prevails. At times, the two measures follow the same direction, i.e. when countries charge high tariffs, they also employ high NTMs and vice versa. Support for the existence of complementarity correlation is predominantly accredited to the necessity to protect domestic production of sensitive consumer goods, textiles, apparel, and agriculture (Ray, 1981). Moreover, Trefler (1993) and Lee and Swagel (1997) provide evidence for the positive correlation, showing that the measures are often used together to increase the protection granted to import-competing sectors. Both argue that NTMs are less likely to be imposed on export-oriented industries, at least partly because of fear of foreign retaliation. Trefler uses a two-equation structural model of the determinants of NTMs and imports across U.S. industries, taking into account variables such as import penetration and factors like capital and labour. Lee and Swagel (1997) use disaggregated cross-country, cross-industry data for wages, production, trade barriers and trade flows of manufactured goods across 41 countries. After accounting for industry and country-specific factors, countries tend to protect especially the weak industries, declining sectors, politically important sectors or those threatened by import competition. Lee and Swagel conclude that the causality between the motives for using the trade measures might be reversed, or that trade barriers could influence industry conditions rather than policymakers responding to industry-specific calls for protection.

Both papers argue that import penetration, or its growth, is positively correlated with the willingness of policymakers to impose NTMs.

Dean et al (2009), in their cross-country analysis, find that in the case of fruits and vegetables, as well as for apparel products, the joint use of tariffs and NTMs significantly reduces the impact of NTM on price. They use city level retail price data to directly estimate the average impact of core NTMs on the prices of 47 consumer products grouped into four separate sectors for more than 60 countries in 2001. Their model attempts to explain the observed price gaps due to NTMs, given observed differences in local markups, transport costs and differences in tariffs, in addition to some random unexplained factors. Moreover, they suggest that in some sectors, the restrictiveness of NTMs is highly correlated with country income; however, they do not provide interpretations as to this relationship.

Essaji (2010) proves that the motivation to increase the use of TBTs reflect the growing awareness of consumption externalities. His conclusion puts a question mark over the aspiration of governments to protect domestic firms profits in a tariff constrained environment. Essaji uses a two-country Cournot duopoly model in order to demonstrate how governments will choose to increase technical regulations, on condition that the net marginal benefit of the regulation increases with falling tariffs. It further reinforces the intuition that tariffs and regulations may be complements, in cases where tariffs fall and cause a substantial increase in the consumption externalities.

As already seen, the literature review provides various viewpoints regarding the correlation between particular NTMs and individual countries or country groups. Yet it lacks an overall perspective along with an in-depth analysis of the determinants of NTMs, and the correlation between all NTMs with their corresponding tariffs, while differentiating country groups. The current paper aims to address this gap by adding to the existing literature an analysis of the correlation between the use of both trade policy measures, while uncovering the heterogeneity across countries. In particular, it will provide evidence for the diminishing negative trajectory of the correlation between the two import measures, with the rise in the country's level of economic development. Furthermore, it will supplement common knowledge by providing additional determinants for the use of NTMs, such as the overhang gap, which can further explain the motivation behind their occurrence.

3.2   Quantification of NTMs

The quantification of NTMs is required in order to measure their impact on trade restrictiveness and on welfare as well as their relation with additional macroeconomic variables. Unlike tariffs, for which the available quantitative databases enable the evaluation of their levels and changes, NTMs are much more challenging to quantify. The main explanation for this difficulty is that NTM restrictions may take many different forms and often the information regarding these measurements are not publicly available or satisfactorily transparent. In order to better investigate aspects regarding the impact of NTMs, one must use reliable methods, which allow the transformation of qualitative practices into measurable quantities. Generally, these methods allow the calculation of the ad-valorem equivalents of NTMs, i.e. the ad-valorem tariff rate that would induce the same level of imports.

3.2.1 Approaches for Quantification of NTMs

Along the years, several analytical approaches were developed in order to tackle the challenging task of quantification of NTMs. The approaches use various methodologies to overcome the heterogeneous nature of NTMs and particularly the lack of available detailed information regarding their implementation across products. The approaches differ in the various assumptions adopted, as well as by the econometric tools which were used for estimating their value, conclusiveness, and changes over time. The most common methodology is the inventory approach presented by the frequency index and the coverage ratio. This approach allows the quantification of the incidence of NTMs and captures the percentage of products that are subject to one or more NTMs in the case of the frequency index. The coverage ratio basically measures the percentage of imports that are subject to one or more NTMs.

An additional approach, called the price (or wedge) gap, approximates the degree to which a specific regulatory measure or policy intervention raises domestic prices above international prices. These approximations are built on comparing prices of goods affected by an NTM with goods unaffected by the NTM. The main disadvantage of the price gap method is that it is often difficult to create two price measurements for the same good and establish that one fully reflects the effects of an NTM, whereas the other is unaffected. Several price-based econometric techniques attempt to build on the foundations behind the price gap method and expand it to several countries

and products simultaneously. An example for such an exercise on various OECD countries is found in Deardorff and Stern (1997).

Alternatively, the literature proposes the quantity-based econometric approaches, which allow the estimation of the impact of trade policies, such as NTMs, on trade flows. These methods usually employ analysis of trade data using the gravity model, factor content model or combinations of features from both models. The trade data may be comprised of import values or quantities, or similarly, export measurements. Helpman, Melitz, and Rubinstein (2004) used the famous gravity equation in their empirical framework, in which given estimations of import demand elasticities serve to drive price effects or ad-valorem equivalents of NTMs.

Notwithstanding the many advantages of these approaches in the quantification of NTMs, they also attract certain criticism. The most common critique is that estimations of NTMs should be crafted with detailed knowledge of products and markets. Ferrantino (2006) adds that estimations should be done while analysing one product and country at a time; however, the collection of data requires excessive resources and often disallows the capturing of many products and countries at once. This leads to a trade-off between handicraft and mass-produced estimates of NTM effects.

Moreover, in recent years, thanks to technical improvements some computable modelling simulation methods were developed in order to measure the effects of changes in NTMs on a wide variety of economic parameters. These simulations were originally developed in order to estimate the effects of policy changes such as tariffs on prices, production, or on macroeconomic indicators such as GDP or welfare. The most familiar example in that respect is the Computable General Equilibrium (CGE) simulation employed by the Global Trade Analysis Project (GTAP). Lastly, several external sources of information, such as business surveys, may complement the approaches mentioned above. These surveys aim to address the difficulties that exporting firms face, mainly in developing countries. An example is the International Trade Centre (ITC), which assembles responses from firms to the most burdensome NTMs and ways in which they are affected. Additionally, the CoRe NTMs Database assembles information from various sources, among them, the U.S. Trade Representatives – National Trade Estimate Reports on Foreign Trade Barriers and the EU's Market Access Trade Barriers database.

3.2.2 Ad-Valorem Equivalents of NTMs by KNO (2009)

The model that will be employed in the current paper uses observations from a dataset of ad-valorem tariff equivalent of non-tariff measures (AVE of NTMs) developed by Kee, Nicita, and Olarreaga (2009). The authors estimated the AVE of NTMs using a quantity-impact approach combined with approximations of import demand elasticity of nearly 5,000 products in 104 countries. Their non-linear least square estimation, which is based on the gravity model, allows the capture of information regarding the impact of various NTMs on each country's imports. The NTMs include, among others, price control measures, quantitative restrictions, monopolistic measures, anti-dumping and countervailing measures, technical regulations and agricultural domestic support. The dataset consists of ad-valorem equivalents of NTMs, specified at the tariff line level (6 digit Harmonized System of classifying goods).

- At the outset, the authors use the following equation:

$$\ln m_{n,c} = \alpha_n + \sum \alpha_{n,k} C_c^k + \beta_{n,c}^{Core} Core_{n,c} + \beta_{n,c}^{DS} \ln DS_{n,c} + \varepsilon_{n,c} \ln(1 + t_{n,c}) + \mu_{n,c}$$

$m_{n,c}$ is the import value of good n in country c evaluated at exogenous world prices, which are all normalized to unity so that imported quantities equal $m_{n,c}$. t is the tariff and $\varepsilon_{n,c}$ is the import demand elasticity, which was obtained extraneously. C_c^k are a set of variables that control for k factor endowments (agricultural land, capital, labour force, GDP, etc). The effect of core NTMs at the country level is estimated by the interaction term between the NTM dummy (for the presence of an NTM) and the vector of factor endowments of the country C_c^k, while $DS_{n,c}$ denotes the agriculture domestic support given to a product. α are tariff line dummies that capture any good-specific effect, while β is the parameter that captures the impact that the NTM imposed on good k in country i has on the corresponding imports.

- At the second stage, the estimators are transformed into price equivalents, using the elasticities of import demand.

$$\frac{\partial \ln m_{n,c}}{\partial \ln Core_{n,c}} = \frac{\partial \ln m_{n,c}}{\partial \ln p_{n,c}^d} \frac{\partial \ln p_{n,c}^d}{\partial \ln Core_{n,c}} = \varepsilon_{n,c} \, ave_{n,c}^{Core}$$

$$ave_{n,c}^{Core} = \frac{1}{\varepsilon_{n,c}} \frac{\partial \ln m_{n,c}}{\partial Core_{n,c}} = \frac{e^{\beta_{n,c}^{Core}} - 1}{\varepsilon_{n,c}}$$

The main advantage of the model is that it goes beyond the traditional approach relying on coverage and frequency indices. It is far more informative than other gravity-based approaches, which have dominated the evaluation of the effects of specific NTMs. Furthermore, the methodology allows a direct comparison of the relative effects on imports of removing tariffs versus removing NTMs, and providing a particular tariff equivalent of NTMs affecting each product, at any   country.

4. Econometric Methodology and Data

In this research paper, the determinants of the government's use of NTMs are examined as a compensative reaction to the existing low levels of MFN applied tariffs. Moreover, the Government's decision regarding the magnitude of the imposition of NTMs is studied with respect to the extent of the binding overhang, as well as to several supplementary control variables, which are described below. The size of the sample which was developed is comprised of approximately 200,000 observations, encompassing data on 61 countries and between 3,500 to 4,500 tariff lines per country. The reason for the exclusion of certain countries from the original dataset is the lack of information on certain independent variables. Moreover, it allows some of the explanatory variables to interact with each other, and improve the goodness of fit of the model.

The sample used in the estimation includes a non-negligible part of the world economy and therefore, it is representative of the world as a whole in some dimensions. The sample comprises 61 countries from all continents, while the average per capita GDP in the sample is $7,300, which is slightly higher than the world average of $6,400. The list of countries comprises 75 percent of the world's population and close to 80 percent of its GDP (in PPP). This is due to the fact that it includes 14 out of the world's 20 largest economies, among them the USA, Japan, France, China, Italy, Canada and others.

The econometric methodology used in this analysis is the following:

$$\ln\left(1 + AVE\_NTM_{i,n}\right) = \alpha_{i,n}^1 + \alpha_{i,n}^2 \ln\left(1 + Tariff_{i,n}\right) + \alpha_{i,n}^3 \ln\left(1 + OverHang_{i,n}\right)$$
$$+ \alpha_{i,n}^4 \ln\left(Openess_{i,n}\right) + \alpha_{i,n}^5 \ln\left(Cus\_\mathrm{Re}\,v_{i,n}\right) + \alpha_{i,n}^6 \ln\left(1 + Tariff\right) \times \left(D\_NonAgri\right)$$
$$+ \alpha_{i,n}^7 \ln\left(1 + Tariff\right) \times \left(D\_Econ\_Dev\right) + \varepsilon_{i,n}$$

For the purpose of this study, a log-linear transformation of the ordinary least squares (OLS) model has been employed. The dependent variable used in all the specifications is ln(1+AVE_NTMi,n), which is the natural logarithm transformation of the ad-valorem equivalents of NTMs. It is important to note that the number 1 has been added in order to control the zero values. As mentioned previously, the dataset on the AVE of NTMs was obtained from the econometric estimations of Kee et al. (2009). Although the authors use information on NTMs from the period 1992 to 2002, the data on the AVE of NTMs employed in the current analysis is for one particular year during 2001 and 2003, since the original estimation builds on the average trade data between the latter years. Each observation in the current analysis represents a tariff equivalent of NTMs in a specific country i on tariff line n. Regrettably, since the original dataset on the AVE of NTMs is specified exclusively for one year per country, it lacks the time-series dimension needed for creating a panel data analysis. Consequently, the econometric approach used in this analysis uses a cross sectional dataset based on the cross-country product-level.

The econometric analysis is comprised of a vector of variables, which may account for control variables explaining the use of NTMs. The main control variable in the analysis is denoted as *ln*_(1+Tariffi,n), which is a vector of the Most Favoured Nations (MFN) applied tariff rates. Similar to the calculation of the dependent variable, the number 1 has been added to the tariff values in order to control the zero values. Data for the variable is provided for each of the countries and expressed at the 6-digit HS level. The data source is the UNCTAD Trade Analysis and Information System (TRAINS) database accessible via the World Bank, World Integrated Trade Solution (WITS) software. In order to maintain the required consistency with the methodology used for the calculation of the AVE of NTMs, the tariffs used are for the most recent year for which data is available between 2001 and 2003. As the theory predicts, the correlation between Tariffs and NTMs is expected to be negative for the whole sample of countries. However, the

heterogeneity among countries when grouped according to their level of economic development is predictably significant. Here, it is anticipated that the less developed group of countries will tend to substitute their tariffs with higher levels of NTMs. As the level of economic development increases, the substitutability decreases and the correlation becomes positive for the richest countries.

The second major control variable used in the analysis is Tariff Binding Overhang (denoted as $ln\_(1+OverHang_{i,n})$, which represents the difference between the MFN applied tariff and the Bound Tariff. Data on the Binding Overhang was collected from the World Integrated Trade Solution (WITS), which provides data from two different sources of WTO and TRAINS database (maintained by UNCTAD). Similar to the calculation of the dependent variable, the number 1 has been added to the overhang values in order to control the zero values. In the analysis, a disaggregated data on Binding Overhang was used at a 6-digit level of HS to be compatible with the data on the AVE of NTMs and Tariffs. It measures the degree of flexibility available in each country within its WTO obligations and often-called tariff water. The excess binding overhang is generally low in developed countries and in manufacturing sectors; however, it may reach very high levels in developing economies or in agricultural products. These stylized facts are well demonstrated in the descriptive statistics, where the more advanced the economy, the significantly higher the MFN bound rates are than the MFN applied rates (i.e. higher binding overhang). Moreover, it is expected that in cases of high binding overhang rates, countries may raise tariffs legally without breaking their WTO commitments, hence they will not alternate them by using NTMs.

A third control variable is Openness, which represents the share of Trade in goods and services as a percentage of GDP. The data is collected from the Global Development Network Growth Database, for the similar specific year of the previous variables. This ratio is frequently used to measure the importance of international transactions relative to domestic transactions. Although this ratio is referred to as trade openness, the term openness may be slightly misleading, since a low ratio does not necessarily imply high barriers to foreign trade, but may refer to factors such as the size of the economy and geographic remoteness from its current and potential trading partners. It is likely that countries that are dependent on international trade (mostly the more developed countries) will employ fewer NTMs compared to countries that are more self-reliant.

The next variable Cus_Rev represents the share of revenues of countries from imports taxes, as a percent of their total tax revenues. The data source is The World Bank, and refers to each of the countries according to the year specified. In general, NTMs differ from tariffs by the fact that these measures do not generate revenues to countries. Nevertheless, this analysis allows an examination of whether losses of tariff revenues to countries could explain the motivation for increasing their AVE of NTMs. It is expected that the low-income countries that rely on import revenues are less likely to use NTMs since those are significantly less of a source of income.

Several dummy variables are included in the econometric analysis. These dummies are mostly used in the interaction terms in order to validate the hypothesis that substitutability decreases with the rise in GDP per capita. Moreover, these dummies allow an examination of whether there is a substantial difference between the correlation in tariffs and the AVE of NTMs for the agriculture products compared to non-agriculture products. The first dummy variable is $\overline{D}$ $\overline{Econ}$ Dev, which refers to the level of economic development of countries (i.e. GDP per capita, according to the classification of the World Bank). It takes the following values: 0=Low-income countries; 1=Lower-Middle income countries; 2=Upper-Middle income countries; 3=High-income countries. The dummy D Econ Dev is used in the analysis as part of an interaction term, together with $ln\_$ $(1+Tariff_{i,n})$. The reason the interacted variables were also not included separately is that the effects of these variables are captured by country dummies. By creating the interaction term, it allows the capture of the particular correlation between tariffs and NTMs of each country group. By estimating the coefficients of the 4 groups, differentiated correlations reinforce the hypothesis that the less developed the countries are, the more likely that NTMs are served in order to substitute for tariff protection.

Additional dummy variables are D_Non_Agri, which is a binary dummy which takes a value of 1 if the tariff line is associated with a non-agriculture product, and equals 0 if the tariff line refers to agriculture products. D_EU is also a binary dummy that takes a value of 1 if the country i is a Member State of the European Union, and equals 0 otherwise. Although at the time that the research was conducted there were 28 member states, since the data refer to earlier years (i.e. 2003 is the latest), and some data on NTMs were missing for some member states, only 10 member states are included in the sample. D_OECD is a binary dummy that takes a value of 1 when the country i is a member of the Organization for Economic Cooperation and Development

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(OECD), and 0 otherwise. The sample used in the analysis is comprised of 15 OECD members, and the source of the information is the OECD website. Both EU member states and countries belong to the OECD are the more advanced economies, and as such it is likely that they are strongly committed to the WTO's objectives to facilitate trade, hence they impose relatively lower NTMs.

5. Estimation Results

5.1 General Regressions Results

The results of the regression analysis for the entire sample of countries are presented in Table 3.

The first two columns report the findings of the basic specification, which include simply the main explanatory variables Tariffs and Binding Overhang, while both country and product fixed effects are controlled simultaneously. Country fixed effects allow to control for the fact that some countries may have higher levels of both tariffs and NTMs than others due to their stronger participation in multilateral and bilateral trade agreements. Controlling for tariff line fixed effects indicates that some products may differ by their levels of both tariffs and NTMs due to domestic political economy strengths. From the third column onwards, additional plausible control variables which potentially determine the prevalence of NTMs, are included. This was designed in order to test for the sensitivity of the results to the inclusion of additional explanatory variables, such as trade openness and customs revenues. As a caveat, while these correlations are relatively robust, econometrics alone cannot exclude the possibility of reverse causality between particular variables (i.e. trade openness) and the dependent variable. Therefore, an additional analysis of the partial correlation has been performed in order to prove the strength and direction of the correlation between the variables employed in the analysis. It shows that whilst controlling for the effect of other variables, the correlation is sufficiently significant and robust (The results are shown in tables 5 and 6). In column 4, the evidence is provided for the coefficients of tariffs and binding overhang for non-agricultural products relative to agriculture products. Column 5 presents an interaction term of tariffs and Econ Dev, which shows the distinction between different country groups according to the level of economic development (i.e. GDP per capita). The goodness of fit of the model is satisfactory as approximately 35.6-38.0 percent of the variations in the NTMs are explained by the regressors specified.

Since the primary focus of this paper is to unveil evidence of a substitution effect between the applied tariffs and restrictiveness of NTMs, attention should first be drawn to the two control variables Tariffs and Binding Overhang. The findings are consistent with the expectations by most of the literature of trade protection theory. It shows that from an overall perspective which covers all countries in the sample the predetermined tariffs have a statistically significant and negative correlation with the import policy to impose NTMs. The result reinforces the idea that although countries agreed to lower tariffs during the Uruguay Round negotiations, they subsequently replaced some of this liberalization with a stringent NTM regime. The coefficient for the model estimating this correlation to the whole sample of countries implies that a 1 percent tariff decrease, leads to a 4.7 percent higher AVE of NTMs. In terms of economic magnitudes, it suggests that an increase in tariffs from 1 percent to their mean level of 9.3 percent (an 830 percent increase) decreases the AVE of NTMs by 39 percent, which is a considerable impact.

The degree of flexibility provided by the tariff binding schedules is considerably different across countries. It is generally lower in developed countries and in the manufacturing sector but reaches high levels in developing economies or in specific agricultural products. In column 2 the control variable OverHang is introduced and while the coefficient of tariffs (first row) does not change, the estimator for the binding overhang is found to be high and inversely associated with the use of NTMs. This clearly reinforces the notion that a bigger overhang gap allows countries to legally raise tariffs without breaking their WTO commitments. Without such a necessity, countries with a bigger binding overhang are less likely to substitute tariffs with NTMs.

From column 3 onwards, an additional set of variables is revealed in order to account for other determinants of the use of NTMs. These control variables include ln Openness, which denotes the level of participation in world trade; *ln*_Cus_Rev, which is the share of revenues from imports, expressed as a percent of total tax revenues. Moreover, the specification of these models includes an interaction term between the country's GDP and a dummy for each sector (HS section classification). This interaction term allows to control for similar political economy influences of same size economies at the sectoral level. As political economy theory suggests, specific interest groups may push governments to impose higher NTMs compared to other industries which are less organized. Adding this term increases the goodness of the whole model, from R-squared of 35.6 percent to 37.5 percent. Notice that the tariff coefficient remains relatively un-

changed and significant at the one percent level, while it slightly increases the negativeness of the second control variable OverHang.

Countries differ by their degree of reliance on international trade, and more specifically developed countries, which depend more on trade, generally impose on average fewer NTMs. By reducing their overall barriers to trade in their own borders, these countries gain better market access and enhance their ability to penetrate easily to their counterpart markets. Moreover, the fear of retaliatory measures on the foreign demand for their exports similarly results in fewer NTMs. Other countries, typically the less developed ones, demonstrate a more self-reliant trade policy based on domestic production, and therefore these countries prefer to increase their barriers to protect sensitive industries from foreign competition. Consequently, as predicted, the estimators of the control variable Openness are found to be negatively correlated and statistically significant with AVE of NTMs, at the one percent level. The coefficient is found to be 0.3 percent, meaning that an increase of 1 percent in the share of trade in goods and services (as a percentage of GDP) will result in an 0.3-0.4 percent decrease in the use of distortive NTM restrictions. The results are in line with Mansfield and Busch (1995), who use a different control variable, i.e. the ratio of a country's imports to world imports, for measuring countries participation in world trade. The findings are also consistent with Michalopoulos (1999), who notes that frequency ratios of quantity and price control measures tend to be higher in countries with lower levels of per capita income and lower degrees of openness.

When explaining the restrictiveness of NTM restrictions, the coefficient on the share of revenues from imports (percent of total tax revenues) is found to be statistically significant, negative and relatively small. The negative sign of the coefficient indicates that an improvement in the country's revenue from tariffs induces a fall in NTM protection. The coefficient shows that the AVE of NTMs are inversely associated with changes in the share of revenues from imports and that a 1 percent rise in this variable induces a 1.1 percent fall in NTM protection. The higher the import revenue as a share of total tax revenues, the less likely a country is to apply NTMs (and vice versa: a lower share of revenues from customs is associated with a higher prevalence of NTMs). Since NTMs differ from tariffs by the fact that these measures are not designed to generate revenues to countries, it seems worrisome that losses of revenues are in fact a source of concern for countries and a motivation for an increase in the imposition of NTMs.

Naturally, a considerable diversity among countries consists in the sensitivity towards local producers' interests. Some may favour protecting import-competing industries at the expense of the exporting sectors. This is particularly predominant when protection of agricultural products is involved. Evidence shows that tariffs on agricultural products are on average much higher than those on non-agricultural products, although there is considerable divergence between countries. Countries with a special interest in agricultural products would most probably pair their high level of applied tariffs with a more regulated trade regime. This way, countries may keep all options on the table, meaning that when global pressure rises to remove one form of protection, they could still keep the other measure active. An empirical validation is given in column 4 displaying a comparison between the correlation of tariffs and the AVE of NTMs for non-agriculture products relative to agriculture products. This comparison yields the result that a 1 percent reduction of tariffs on non-agri-products generates a rise of 5.7 percent in the restrictiveness of NTMs, and this coefficient is statistically significant. The conclusion is that while the two import instruments are found to be paired in the two cases, the substitutability is stronger for non-agriculture products compared to agriculture products.

5.2 Correlation Across Country Groups

The most important results of the model are presented in column 5 of table 3. The specification of this estimation introduces a supplementary interaction term between $ln\_(1+Tariff_{i,n})$ and the dummy variable D Econ Dev. The objective of this exercise is to allow to differentiate between country groups while controlling for the heterogeneity driven by the extent of economic development. The data is disaggregated into four groups; based on the World Bank classification each group represents a relatively homogenous cluster of countries, grounded on their level of GDP per capita. The results of the estimation suggest that controlling for the applied tariffs jointly with the level of economic development plays a substantial role in determining the correlation between tariffs and the AVE of NTMs across country groups. From a broad perspective, the model provides evidence which reinforces the substitutability between NTMs and tariffs for the majority of countries. However, a deeper examination renders some additional conclusions about the trajectory of this correlation in the light of the country variation.

The results of the estimation validate the main proposition of the paper. They confirm that although the correlation between tariffs and NTMs is negative, the scale of substitutability diminishes gradually the more developed a country is. This trend continues until the negative correlation changes to positive for the group of high-income countries. Despite the fact that part of the estimators may be affected by the sample size, the trend seems to be evident, and the estimations are statistically significant in all groups. The estimators indicate that a 1 percent decrease in the tariff rate leads to approximately a 13.4 percent increase in the AVE of NTMs in low-income countries. In lower-middle income and in upper-middle income countries, a 1 percent decrease in tariff rate is associated with an 11.4 percent and 9.4 percent increase in the restrictiveness of NTMs respectively. While in all country groups mentioned above, the estimators are found to be negatively correlated and statistically significant, the correlation between the two import measures is found to be significantly positive in the high-income countries. A similar decrease in tariffs is associated with a dramatic fall of 23.8 percent in the restrictiveness of NTMs. These last results confirm that in high-income countries, NTMs are more likely to be restrictive, the higher the tariff on a product is, and vice versa.

The applied tariffs are relatively high in the least developed countries; thus, the estimations imply that the restrictiveness of NTMs in these countries is typically low. Although the correlation is found to be negative, the interpretation is fairly counter-intuitive. The cost of operating an administration system which deals with NTMs is usually high and it is naturally complex. Moreover, these countries rely on revenues generated from import taxes. Consequently, low-income countries use NTM restrictions less extensively, and therefore the correlation is negative. Nevertheless, the correlation also implies that for specific products where tariffs are low, the imposition of some restrictions on imports still exists, mainly in order to preserve domestic protection.

Since most of the middle-income countries have undergone the deepest process of tariff liberalization, there is no wonder that they practice NTMs more excessively. As supported by the political economy theory, this negative correlation is mainly a subsequent reaction to tariff liberalization. Governments that are subject to pressures from domestic interests, adversely affected by the dismantling of tariff barriers, are often impelled to increase alternative channels of protectionism.

That, in turn, is demonstrated in the strong substitution correlation between the two import policy instruments. Claims against these countries for using NTMs excessively are being rejected

by the increasing awareness of health and environmental causes. However, the negative and significant correlation demonstrates the compensative effect between the two import measures.

As for the case of the richest countries, it is evident that the correlation is strongly positive, meaning that if a country belongs to the high-income country group, it will most likely pair the two trade measures. Since the average applied tariffs in high-income countries are relatively low, it implies a low restrictiveness of NTMs as well. Several reasons could support these findings. Firstly, these countries are at the frontline of the WTO negotiations on TBT and SPS measures, and are generally more involved in designing large parts the world trade regime. This multilateral arena aims to achieve the goal of facilitating trade obstacles, as well as simplifying market access to the developing world. Therefore, the most developed countries take upon themselves these objectives genuinely, which naturally means removing trade barriers more extensively than elsewhere. Moreover, since high-income countries tend to rely more profoundly on international trade, it leads them to seek better conditions, both for domestic importers, as well as for their local exporters in foreign markets. Lastly, these interests coexist with the necessity to attract imports at the lowest costs possible for the benefit of domestic consumers as well as for importers of intermediate products.

5.3   Robustness Checks and Additional Specification

Several robustness checks were performed in this last part of the paper. These checks were designed to test the validity of the results obtained in the general model when estimating different country groups according to geographical or organizational clusters. The results of these checks are robust and they reinforce the proposition of the paper. The developing countries demonstrate a strong substitution correlation in comparison to the rest of the world, while the richest countries such as the EU Member States complement tariffs with an NTM regime. The results of the regression analysis are presented in Table 4.

MENA: A special geographical group that was examined is the Middle East and North African group (MENA countries). Despite the geographical and regulatory proximity, alongside increasing trade relations with the EU, most of these countries are still considered developing by nature. These countries' GDP per capita is relatively low and the level of tariffs is rather high. Therefore, it is interesting to check whether the level of economic development influences more of the MENA countries' NTM policy, compared with the mentioned proximities to the EU. The

model estimate that tariff is inversely correlated with the AVE of NTMs, suggesting that a MENA import line whose tariff is 1 percent higher than another MENA member's import line tariff has 6.7 percent lower AVEs for its imposed NTM. The estimator is found to be statistically significant; however, it is relatively smaller than that found for the low-income country case. The negative coefficient implies that the correlation between tariff and AVE of NTMs is substitutable and despite the low level of GDP per capita, the influence of the EU has a positive impact on the restrictiveness of NTMs. Meanwhile, an MENA country tariff line whose binding overhang is 1 percent higher than other MENA country tariff lines exhibits 2.5 percent higher AVEs of NTMs relative to the other tariff line.

OECD: The OECD organization is comprised of a heterogeneous group of countries. However, these developed countries typically have open economies and a relatively low level of applied tariffs. Despite some minor exceptions, this rule applies also to the low level of binding overhang. The estimation for the tariff correlation with the AVE of NTMs suggests that an OECD import line whose tariff is 1 percent higher than other OECD members' import line tariffs has 15 percent higher AVEs for its imposed NTM. The estimator is found to be statistically significant, and the positive high coefficient implies that the correlation between tariff and AVE of NTMs is complementary, for the reasons mentioned in the previous sub-section.

EU: The most remarkable positive correlation between the two import policy measures is found in the group of countries that belong to the European Union. These countries are constrained to a single customs union regime, meaning that the MFN applied tariffs for all these countries are similar for each product. The similarity, however, does not apply to all NTMs, which vary to some extent according to each country's national regulations and domestic administration. The coefficient in the case of the EU demonstrates how an EU import line whose tariff is 1 percent higher than another EU Member State's import line tariff has 25.3 percent higher AVEs for its imposed NTM. The estimator is found to be statistically significant, and the high positive coefficient implies a strong complementarity between the tariff and the restrictiveness of NTMs. The fact that the EU does not substitute between the two import measures is fairly reasonable. The EU is part of an extensive network of PTAs, and the elimination process of the restrictiveness of NTMs started as early as in 1973, the year in which all internal tariffs were abolished. Furthermore, the EU has been one of the promoters of trade facilitation issues within the WTO and has taken upon itself the role of eliminating distortive measures to trade mostly, in fa-

vour of the developing world. With respect to the binding overhang, it is found to be inversely correlated with the AVE of NTMs at the one-percent level. Since the binding overhang of the EU is relatively small, this suggests that a 1 percent change of the gap is associated with a 5.5 decrease in the restrictiveness of NTMs.

6. Conclusions

The main objective of this research is to reject the common hypothesis that non-tariff measures (NTMs) serve as protectionist instruments in light of the global obsolete use of tariffs in a similar manner across all country groups. Moreover, it seeks to establish that the commitment to lower all forms of trade barriers increases with the country's level of economic development. In order to realize these objectives, an econometric analysis has been undertaken, while exploiting a unique dataset of ad-valorem tariff equivalents of NTMs at the 6-Digit HS classification. The empirical results reaffirm that from a global perspective the correlation between tariffs and NTMs is negative and statistically significant. Yet, the study asserts that while taking into account the country variation, the substitutability effect diminishes with the rise in the country's level of economic development. This proves that the higher a country's GDP per capita, the less likely that it compensates for the adverse effects of tariff elimination with a growing restrictiveness of NTMs, while alternative considerations become relevant. Furthermore, the relationship between the two import policy measures changes its sign from negative to strongly positive in high-income countries at the lowest levels.

The paper argues that the most advanced economies have taken upon themselves stronger international commitments than less developed countries in order to achieve protectionist relief in a genuine manner. Such complementarity is also attributed to the fact that these countries are highly dependent on international trade, as well as to the response of policy makers to consumer's interests to freer trade. This outcome is shown in the regression estimation, which clearly demonstrates the significant extent to which high-income countries tend to pair their low levels of tariffs with similarly less restrictive NTMs. The empirical results of the analysis are further confirmed by the robustness checks of the correlation between the two import policy instruments when different country clusters such as the MENA countries, OECD and EU Member States are examined.

Moreover, the analysis allows for additional control variables to serve as determinants for the extent of the restrictiveness of NTMs. Among these variables, an imperative role is given to the binding overhang gap and its effect on the AVE of NTMs. The binding overhang, which represents the difference between countries binding commitments and their actual applied tariffs, is a significant policy measure practiced by WTO member states. The results of the estimations validate that the less developed a country and the bigger the overhang gap, the less likely that the country imposes restrictive NTMs. The negative estimators reinforce the notion that countries that enjoy a larger binding overhang gap may raise their tariff legally without breaking their WTO commitments, hence they do not need to resort to compensatory measures such as NTMs.

The empirical framework employed in this study was based on a broad dataset, although it was limited in years. Therefore, in future studies and based on the availability of the AVE of NTMs it would be useful to investigate whether the findings reported in this paper held over recent years.

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Appendix

Table 1: Variables and Sources

Variable	Definition	Source
AVE_NTMs	Ad-Valorem Equivalents of Non-Tariff Measures	The World Bank (Kee et al. 2009)
Tariff	Average applied tariffs (6-digit HS classification)	Tariff Download Facility (WTO)
OverHang	Gap between MFN applied tariff rate and bound rate (6-digit)	Tariff Download Facility (WTO)
Openness	Share of Trade in goods and services, as % of GDP	Global Development Network Growth Database
Cus_Rev	Customs and other import duties, as % of tax revenue	The World Bank
GDP	Gross Domestic Product, Current prices (Bil. $)	International Monetary Fund
GDPpc	Gross Domestic Product per capita, in current prices ($)	International Monetary Fund
D_Econ_Dev (dummy)	0=Low income countries. 1=Lower Middle income countries. 2=Upper Middle income countries. 3=High income countries	The World Bank
D Non_Agri (dummy)	0=Agriculture products 1=Non-Agriculture products.	The World Bank
Tariff X Non_Agri	Interaction Term of Tariff and D Non Agri	
D_OECD (dummy)	0=Non OECD country. 1=OECD member country	OECD website
D_EU (dummy)	0=Non EU Member States. 1=EU Member States	The European Commission
D_MENA (dummy)	0=Non MENA country. 1=MENA country	
country FE	Fixed effects of country variables	
product FE	Fixed effects of products lines (6-digit HS classification)	

Table 2: Statistical Description

Country Group	Variables	Mean	Std. Dev.	Min	Max	Observations
Low income countries	Tariffs	0.135	0.1089	0	3.21	57,742
	AVE of NTMs	0.0399	0.1711	0	2.99	57,742
	OverHang	0.6343	0.3596	0	1	16,202
	GDP	5.648	8.091	0.4	30.5	53,221
	GDPpc	0.3099	0.1643	0.139	0.829	57,742
	Openness	0.5303	0.1993	0.288	0.945	57,742
	Tr_Non_OECD	0.3827	0.2157	0.759	0.826	48,827
	Cus_Rev	0.2630	0.1275	0.1577	0.535	40,174
Lower Middle income countries	Tariffs	0.1534	0.3829	0	10	112,474
	AVE of NTMs	0.1475	0.3055	0	4.56	112,474
	OverHang	0.6513	0.3203	0	1	61,768
	GDP	31.62	66.04	0.3	323.5	112,474
	GDPpc	0.8140	0.483	0.306	2.31	112,474
	Openness	0.6906	0.2634	0.219	1.24	112,474
	Tr_Non_OECD	0.3414	0.1478	0.155	0.658	108,080
	Cus_Rev	0.1581	0.0864	0.030	0.355	99,041
Upper Middle income countries	Tariffs	0.1296	0.1471	0	10	109,068
	AVE of NTMs	0.0988	0.2618	0	4.79	109,068
	OverHang	0.5439	0.3135	0	1	61,172
	GDP	87.42	126.87	2.09	465	104,522
	GDPpc	3.167	1.777	1.04	7.42	109,068
	Openness	0.6917	0.4623	0	2.10	104,522
	Tr_Non_OECD	0.2575	0.1114	0.0596	0.457	109,068
	Cus_Rev	0.0942	0.075	0.0139	0.344	99,984
High income countries	Tariffs	0.0510	0.1437	0	10	145,135
	AVE of NTMs	0.0893	0.2636	0	4.61	145,135
	OverHang	0.2528	0.3742	0	1	94,852
	GDP	538.51	1,137.9	1.1	5,800.5	145,135
	GDPpc	18.20	9.956	2.096	37.82	145,135
	Openness	0.739	0.325	0.197	1.62	145,135
	Tr_Non_OECD	0.2241	0.147	0.058	0.613	140,589
	Cus_Rev	0.0427	0.101	0	0.438	131,815

Table 3: Regression Results. Dependent Variable: Ln_(1+AVE_NTMs)

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Ln_(1+Tariff)	-0.047*** (-11.06)	-0.047*** (-11.06)	-0.049*** (-11.56)		
Ln_(1+OverHang)		-0.286*** (-7.00)	-0.369*** (-17.45)	-0.368*** (-17.42)	-0.312*** (-14.72)
Ln_Openness			-0.003*** (-3.60)	-0.003*** (-3.66)	-0.004* (-0.42)
Ln_Cus Rev			-0.011** (-3.83)	-0.011** (-3.94)	-0.004* (-1.36)
Ln_(1+Tariff) X D_Non_Agri				-0.057*** (-13.68)	
Ln_(1+Tariff) X Low Income Countries					-0.134*** (-6.18)
Ln_(1+Tariff) X Lower-Middle Income Countries					-0.114*** (-22.24)
Ln_(1+Tariff) X Upper-Middle Income Countries					-0.094*** (-8.80)
Ln_(1+Tariff) X High Income Countries					0.238*** (8.03)
Constant	-0.022*** (-3.64)	0.147*** (8.04)	0.851*** (13.20)	0.854*** (13.24)	0.724*** (11.10)
country FE	Yes	Yes	Yes	Yes	Yes
product FE	Yes	Yes	Yes	Yes	Yes
R2	0.356	0.356	0.375	0.375	0.379
Adjusted R2	0.342	0.342	0.360	0.360	0.365
F-Statistics	391.332	391.332	361.599	361.861	351.880
Observations	206,554	206,554	206,554	206,554	206,554

note: t statistics in parentheses.
p-value (* p<0.05, ** p<0.01, *** p<0.001)

Table 4: Regression Results, Robustness checks. Dependent Variable: Ln_(1+AVE_NTMs)

	(6) MENA	(7) OECD	(8) EU
Ln_(1+Tariff)	-0.067***	0.150***	0.253**
	(-6.56)	(4.90)	(2.84)
Ln_(1+OverHang)	0.025***	0.006	-0.055***
	(3.37)	(1.73)	(-7.49)
Ln_Openness	-0.690***	-0.007**	-0.004
	(-31.51)	(-2.79)	(-1.22)
Ln_Cus_Rev	-0.038***	-0.001***	-0.008***
	(-18.79)	(-3.56)	(-10.17)
country FE	Yes	Yes	Yes
product FE	Yes	Yes	Yes
R2	0.359	0.338	0.457
Adjusted R2	0.359	0.338	0.456
F-Statistics	370.161	759.083	629.716
Observations	21,443	71,657	47,289

note: t statistics in parentheses.

p-value (* p<0.05, ** p<0.01, *** p<0.001)

Table 5: Correlations between variables

(obs=206,554)

Variable	*Ln* (1+AVE_NTM)	*Ln* (1+Tariff)	*Ln* (1+OverHang)	*Ln* Openness	*Ln* GDP	*Ln* GDPpc	*Ln* Cus_Rev
*Ln*_(1+AVE_NTMs)	1						
*Ln*_(1+Tariff)	0.078	1					
*Ln*_(1+OverHang)	0.005	0.0163	1				
*Ln*_Openness	0.035	-0.1521	-0.0569	1			
*Ln*_GDP	0.071	-0.0904	-0.4603	-0.248	1		
*Ln*_GDPpc	0.041	-0.2801	-0.4633	0.126	0.645	1	
*Ln*_Cus_Rev	-0.031	0.2974	0.5727	-0.188	-0.568	-0.75	1

Table 6: Partial and semipartial correlations of Ln_(1+AVE_NTMs) with

(obs=206,554)

Variable	*Partial Corr.*	*Semi partial Corr.*	*Partial Corr.^2*	*Semi partial Corr.^2*	*Significance Value*
*Ln*_(1+Tariff)	0.0989	0.0983	0.0098	0.0097	0.0000
*Ln*_(1+OverHang)	0.0615	0.0610	0.0038	0.0037	0.0000
*Ln*_Openness	0.0718	0.0712	0.0052	0.0052	0.0000
*Ln*_GDP	0.0820	0.0814	0.0067	0.0066	0.0000
*Ln*_GDPpc	0.0009	0.0009	0.0000	0.0000	0.0689
*Ln*_Cus_Rev	-0.0114	-0.0112	0.0001	0.0001	0.0000

Figure 1: World Average MFN Applied Tariff Rates vs. SPS & TBT Notifications
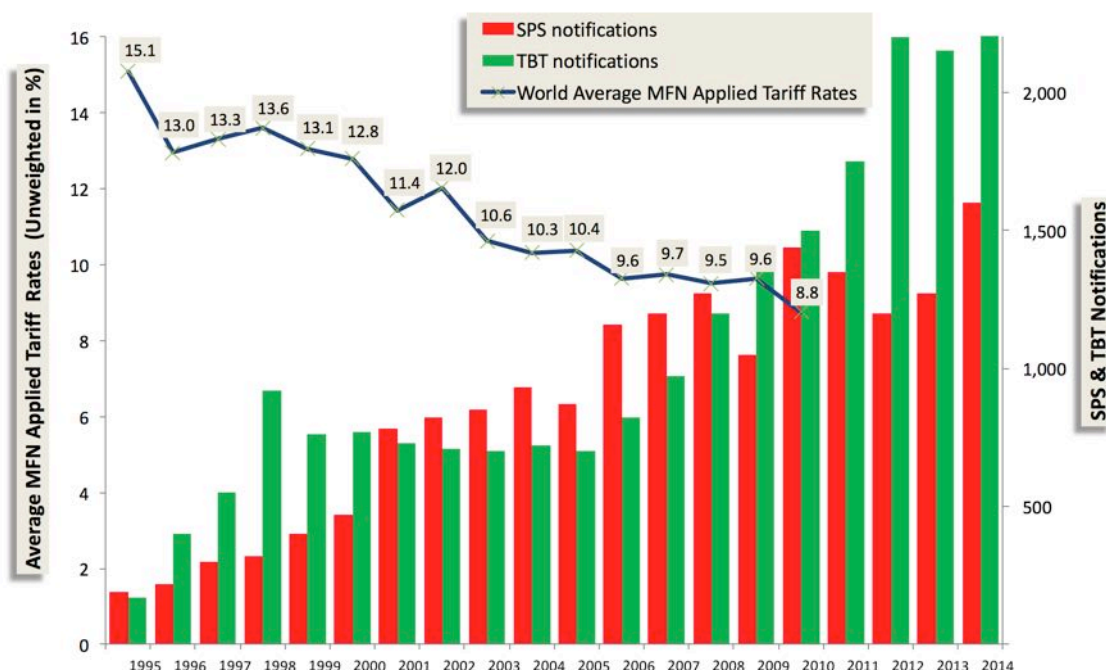
Source: authors calculations based on data of the World Bank and WTO I-TIP.

Figure 2: MFN Tariff Rates and Ad-Valorem Equivalent of NTMs, By Country
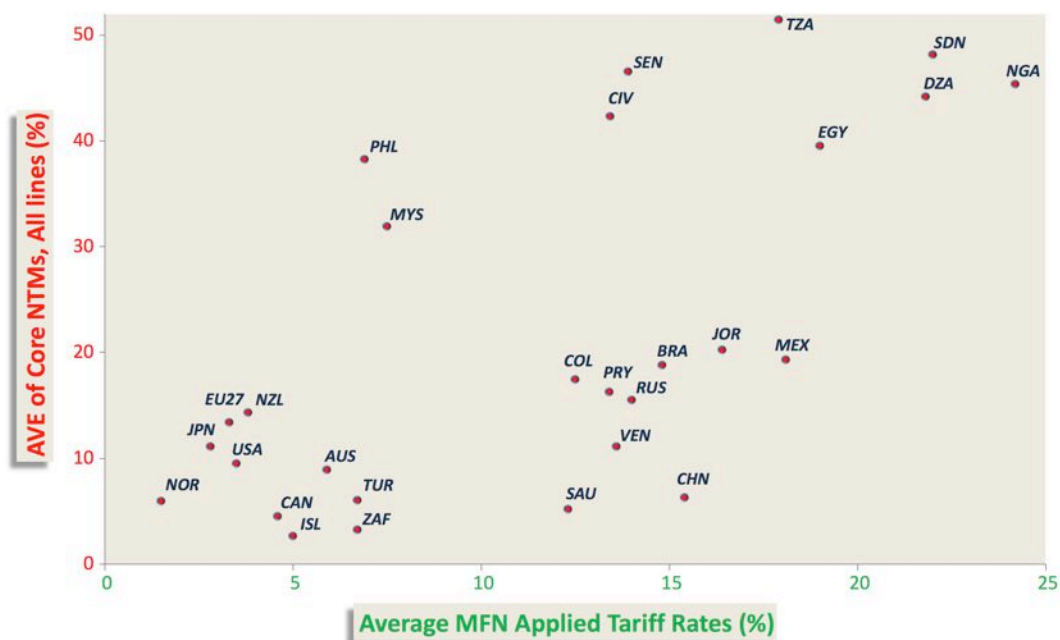
Source: authors calculations based on Kee, Nicita and Olarreaga (2009).

Figure 3: Mean of Ad-Valorem Equivalent of NTMs Across Countries
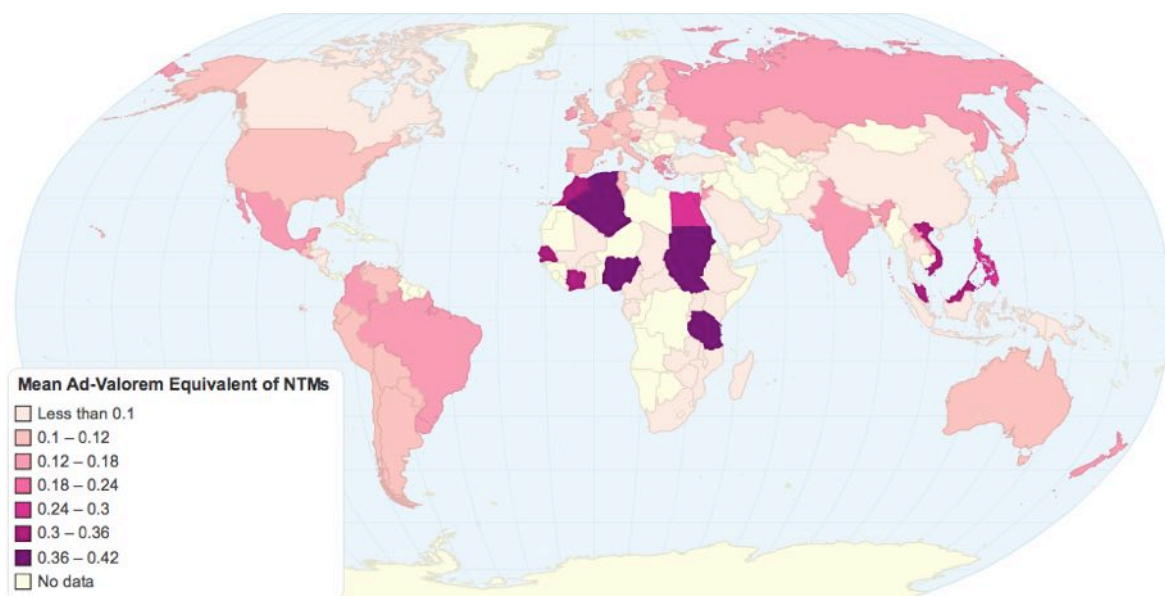
Source: authors calculations based on Kee, Nicita and Olarreaga (2009).

How 'Necessary'? A Comparison of Legal and Economic Assessments GATT Dispute Settlements under: Article XX(b), TBT 2.2 and SPS 5.6

Abstract

This paper identifies the legal and economic assessments applied to resolve WTO disputes requiring an assessment of the contribution of the measure to the objective pursued, along with identifying any reasonably available alternatives. It focuses on disputes encompassing an interpretation of GATT Article XX (b), Sanitary and Phytosanitary Agreement (SPS) Article 5.6 and the Technical Barriers to Trade (TBT) Agreement Article 2.2. This narrow focus is because the WTO DSB has opined that there are no significant differences between the tests developed under Art. XX(b) of the GATT 1994 and Art. 5.6 of the SPS Agreement, nor that any aspect of the Art. XX(b) jurisprudence relating to the interpretation of the term "necessary" would be inapplicable to Art. 2.2 of the TBT Agreement.[2] This provides an opportunity to compare the legal and economic assessments applied in disputes falling under these provisions.

The paper identifies no significant differences between the legal tests relating to the interpretation of the term "necessary". A WTO Panel is under no obligation to quantify the measure's contribution to the objective pursued and 'a risk may be evaluated either in quantitative or qualitative terms'. However, the same cannot be said for the economic assessments determining whether the necessity of the contribution of the contested measure. After setting out the legal tests, the paper identifies those economic assessments undertaken to resolve disputes involving these three different GATT/WTO provisions. The paper finds that quantitative economic models are rarely employed in WTO dispute cases. The lack of coherent guidelines for assessing the economic dimensions of a dispute in a transparent and robust manner potentially undermines the effectiveness and the reputation of WTO Dispute Settlement Body (DSB) recommendations.

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[2] Panel Report, *United States–Standards for Reformulated and Conventional Gasoline*, ¶ 6.20, WT/DS2/R (Jan. 29, 1996) [hereinafter *US-Gasoline*] (cited in Panel Report, *EC–Asbestos*, ¶ 8.169; Panel Report, *EC–Tariff Preferences*, ¶ 7.197; Panel Report, *Brazil–Retreaded Tyres*, ¶ 7.40).

1. Introduction: Comparing Legal and Economic Approaches

This paper compares the available jurisprudence of the necessity test, under both GATT XX(b), the SPS Agreement Article 5.6 and the TBT Agreement Article 2.2. This comparative approach is taken in order to highlight the variations in the economic analysis of trade disputes despite similar legal assessments. All three of the GATT/WTO provisions discussed in this article address the trade restrictiveness of a contested measure and the findings of various Panels and Appellate Bodies (AB) have supported a similar approach towards these different provisions. The Panel in *EC–Asbestos* concluded that Art. 2.2 of the TBT Agreement should not be given a radically different interpretation from Art. XX(b) of the GATT 1994. Furthermore, it was unable to identify any significant differences between the tests that have been developed under Art. XX(b) of the GATT 1994 and Art. 5.6 of the SPS Agreement, or any aspect of the Art. XX(b) jurisprudence relating to the interpretation of the term "necessary" that would be inapplicable to Art. 2.2 of the TBT Agreement.[3]

On the other hand, a comparison of the quantitative and qualitative economic analyses that were undertaken in different disputes requiring the same legal assessment tests, indicate otherwise. WTO tribunals have been reluctant to embrace quantitative economic practices in their decision-making, and rarely one finds economic methodologies complementing the legal analysis in dispute settlements. Furthermore, in WTO DSB proceedings, it has been the parties, who undertake such analysis. If parties include quantitative economic analysis in their arguments, the Panel/Appellate Body may or may not find it useful or necessary to their own analysis.

The DS cases surveyed in this paper indicate that the tribunals often complement legal analysis by using purely basic economic data or descriptive evidence. Such analysis is certainly neither exhaustive, nor able to provide a conclusive evaluation of the real cost (restrictiveness) of the specific measure when imposed to achieving its desirable objective. Furthermore, it is insufficient to assess the trade restrictiveness of potential alternative measures and other economic impacts in realizing the same goal. A broader perspective is required in order to complement the legal analysis and for that economic analysis could be useful. Since empirical evidence are rarely submitted to the Panel

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[3] Panel Report, *US–Gasoline*, ¶ 6.20 (cited in Panel Report, *EC–Asbestos*, ¶ 8.169; Panel Report, *EC–Tariff Preferences*, ¶ 7.197; Panel Report, *Brazil–Retreaded Tyres*, ¶ 7.40).

or the Appellate Body, this paper provides several suggestive studies, which could shed light or add further insights to the tribunal's adjudications.

Over the past two decades, the imposition of technical and regulatory policy measures is increasingly expanding, especially in light of the dramatic decline in the use of tariffs. Evidence regarding the incidence of Non-Tariff Measures (NTMs) demonstrates that technical barriers to trade (TBTs) are by far the most frequently used NTM, with the average country imposing them on about 30 percent of products and trade. Sanitary or phytosanitary (SPS) measures are imposed on average on about 15 percent of trade.[4]

The economic theory regarding the trade effects of NTMs implies that expansion of their use, lead to a decrease of domestic demand, hence creates trade restrictiveness. Albeit, NTMs may increase information and confidence provided to consumers, as well as willingness to pay for these goods, consequently, affect positively on the demand for imports. The empirical literature, however, reinforces the negative overall impact of NTMs on imports. NTMs, in general, add on average an additional 87% on the restrictiveness imposed by tariffs.[5] Moreover, the level of restrictiveness is significantly higher for exports of developing countries to OECD members,[6] particularly in food products, which are typically subject to SPS.

Considering that WTO Panel/Appellate Body is expected to evaluate whether a NTM is more trade restrictive than necessary to fulfil its objective – a decisive and comparable level of trade restrictiveness is essential. Yet, measuring trade restrictiveness is a difficult task to perform when regulatory or technical measures are imposed. Unlike tariffs, for which the available quantitative databases enable the evaluation of their effect on various economic indicators; NTMs are more challenging to quantify, due to their numerous forms; qualitative nature, insufficient public available information and unsatisfactory transparency. As a result, the complexity of measuring, in a quantitative systematic manner, the impact of NTMs, remains a significant obstacle for their inclusions in the tribunals' consideration. Nevertheless, in recent years, a significant advancement in

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[4] A. Nicita & J. Gourdon, *A Preliminary Analysis on Newly Collected Data on Non-Tariff Measures*, UNCTAD POLICY ISSUES IN INT. TRADE AND COMMODITIES (2012).

[5] H. L. Kee, A. Nicita & M. Olarreaga, *Estimating Trade Restrictiveness Indices*, 119 ECON. J. 172-199 (2009).

[6] A. C. Disdier, L. Fontagné & M. Mimouni, *The Impact of Regulations on Agricultural Trade: Evidence from the SPS and TBT Agreements*, 90(2) AM. J. AGRIC. ECON. 336–350 (2008).

both the theoretical and empirical fields could relieve this averseness, allowing to quantifying the impact of NTMs in various countries, sectors and even at the product level, while comparing to other less trade restrictive alternative measures.

Several analytical approaches, which are well grounded on economic theory, were introduced along the years, in order to tackle this issue. Among them are price-based techniques (i.e., price-wedge or econometric approach) and quantity-based methods. The price-wedge method approximates the degree to which a specific regulatory or policy measure raises domestic prices above international prices. Despite some conceptual and empirical drawbacks, this method serves as a suitable proxy for their restrictive impact.

The most predominant approach in the relevant economic literature, which is present in few DS cases where quantitative analysis is provided, is the quantity-based econometric method. It allows observing how the presence of NTMs affects trade, by employing statistical analysis of trade data. The approach uses gravity models, factor-content models or models which combine features of both – in order to identify the trade effects of a particular policy measure. An imperative requirement is a reasonable period of time prior to and after the measure has been implemented (Ex-Post analysis). Results are often expressed as tariff equivalents, and depend on the assumptions and specifications of the models.

Moreover, in recent years, built on quantity-based approach, economic studies have developed novel quantitative tools, which allow measuring the trade restrictiveness index (TRI) of NTMs, at a very disaggregate product level of HS classification. These instruments, which take into account the presence of many NTMs, provide estimations of the ad-valorem equivalents of these measures. The levels and changes over time, across different countries and products, may complement other more traditional or less accurate techniques, which were insufficient for the purpose of economic analysis in dispute settlements. An example for a recent work of this kind is the study of Kee, Nicita and Olarreaga in 2009,[7] which is based on the framework of the Trade Restrictiveness Index (TRI) of Anderson and Neary in 1992 and 1994.

Finally, the simulation methods, which have been long used to model the effects of changes in tariffs on various macroeconomic variables, are recently implemented for NTMs. Such simulations,

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[7] *Supra*, note 5.

which have a clearer explanation of causal factors, are designed as ex-ante analysis tools. They may apply static models, which compare specific points in time, or dynamic models (evolution from initial to the final equilibrium). Simulations are either based on General Equilibrium (GE) models, meaning linking several industries and countries, or Partial Equilibrium models, which analyse specific defined products or single markets.

In the paper, we survey the dispute settlement cases, where some of the mentioned economic techniques were provided by the disputing parties. These methodologies are presented along with the reasoning given by the Panel/Appellate Body to the reluctance approach to adopt these analyses in their consideration. In addition, we establish that for almost each of these DS cases, the economic literature can provide at least one study which demonstrates how the impact of the chosen measure can be potentially quantified econometrically. Consequently, these estimations may serve in order to compare the measures' impact to possibly less trade restrictive alternative measures. The paper highlights the valuable importance and the benefits of these methodologies in complementing the existing resolutions of the DSB.

2. GATT Article XX(b)

2.1 The 'Necessity' of a Non-Conforming Measure

Non-compliant trade measures may be exempt from GATT/WTO rules, if justified under specific public interest conditions set out in GATT Article XX on General Exceptions. The exception assessed in this paper is paragraph (b) of Article XX. Pursuant to this paragraph, WTO members may adopt policy measures that are inconsistent with GATT disciplines, to pursue legitimate non-trade objectives reasonably and in good faith. These measures are deemed "necessary" to protect human, animal or plant life or health.

Clearly much hinges on the interpretation determining the word 'necessity'. The requirements of the necessity test, as contained in paragraph (b) of Article XX of GATT 1994, have been interpreted in several previous disputes.[8] According to this body of case law, the necessity of a measure should be determined through the analysis of a series of factors:

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[8] Appellate Body Report, *Korea –Measures affecting imports of fresh, chilled and frozen beef*, ¶ 164, WT/DS161/AB/R, WT/DS169/AB/R (Dec. 11, 2000) [hereinafter Appellate Body Report, *Korea-Beef*]; Appellate Body Report, *EC–Measures affecting Asbestos*, ¶ 172, WT/DS135/AB/R (Mar. 12, 2001); Appellate Body Report, *US–Measures affecting the Cross-Border*

a) The importance of the interests or values protected by the challenged measure.

b) The contribution of the measure to the realization of the objectives pursued by it.

c) The restrictive impact of the measure on international trade.

Once these three factors have been assessed, an analysis of possible alternatives to the challenged measure should be undertaken and a process of 'weighing and balancing' of the factors and the alternatives should be carried out with the aim of determining whether the challenged measure is "necessary".

The Panel in *China–Raw Materials* dispute highlighted that a measure falling within Article XX(b) must be visibly intended to achieve the objective perused - the protection of health. A mere linkage is insufficient. The Panel found that China's export restraints on energy-intensive, highly polluting, resource based products (EPRs) could not be described as measures designed to protect health. To accept the argument that the measure was part of a general program of pollution reduction would mean that Article XX(b) could "be interpreted to allow the use of export restrictions on any polluting products on the ground that export restrictions reduce the production of these products and thus pollution".[9]

Elsewhere in *China-Rare Earths* dispute, China asserted that a measure relates to conservation whenever the measure "contributes" to the realization of a Member's conservation goals. A measure's contribution to such goals might be demonstrated through a showing of that measure's aptness to contribute to conservation, since the results of regulatory actions aimed at conservation may not be immediately observable. The Appellate Body rejected this approach and maintained the Panel's legal focus on the design and structure of the export quotas in assessing whether the measures relate to the conservation of exhaustible natural resources within the meaning of Article XX(g). Removing the need for economics, the AB found that the Panel did not err in stating that "the analysis under subparagraph (g) *does not* require an evaluation of the actual effects of the concerned measures".

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supply of Gambling and Betting services, ¶ 306, WT/DS285/AB/R (Apr. 7, 2005) [hereinafter Appellate Body Report, *US-Gambling*]; Appellate Body Report, *Dominican Republic –Import and sale of Cigarettes*, ¶ 70, WT/DS302/AB/R (Apr. 25, 2005).

[9] Panel report, *China-Measures related to the exportation of various Raw Materials*, ¶ 7.515, WT/DS394/R (July 5, 2011) [hereinafter Panel report, *China-Raw Materials*].

A non-compliant trade measure may be justified if the Panel determines that the importance of the objective, through a weighing and balancing of the contribution of the measure and the trade restrictive impact are all assessed as necessary. This legal avenue and reasoning places the initial burden of proving the necessity of a non-conforming measure onto the responding party.

2.2 Assessing the Contribution of the Measure

As regards factor b), the subject of this paper, the Appellate Body Report in *Brazil–Retreaded Tyres*[10] stated that a measure can contribute to the stated objective in two different ways:

(i) it can bring about a material contribution to the achievement of its objective;
 or

(ii) it can be apt to produce a material contribution to the objective pursued, even if the contribution is not 'immediately observable'.

Thus, a panel may find that certain complex public health or environmental problems can be tackled only with a comprehensive policy comprising a multiplicity of interacting measures. Yet there must be evidence that the measure can bring about a material contribution to the Member's stated objective. Indeed, the Appellate Body went on to define a material contribution as one which needs to contribute in a significant or non-marginal way to the achievement of its objective. To assess the degree of necessity of a measure in achieving its objective has also been found to be: 'in a continuum, located significantly closer to the pole of "indispensable" than to the opposite pole of simply "making a contribution to."'[11] A measure could be found to contribute to the achievement of the objective "when there is a genuine relationship of ends and means between the objective pursued and the measure at issue."[12]

Adding to this relativist approach, the Appellate Body has also expressly recognized that "a risk may be evaluated either in quantitative or qualitative terms" and that a Panel is under no obligation to quantify the measure's contribution to the objective pursued. This was underlined in the *Bra-*

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[10] Appellate Body Report, *Brazil–Measures affecting imports of Retreaded Tyres*, ¶ 151, WT/DS332/AB/R (Dec. 3, 2007) [hereinafter Appellate Body Report, *Brazil–Retreaded Tyres*].
[11] Appellate Body Report, *Korea –Beef,* ¶ 161.
[12] Appellate Body Report, *Brazil–Retreaded Tyres*, ¶ 145.

zil–Retreaded Tyres dispute, when the Appellate Body reported that a direct statement was made to the effect that the contribution of the measure could be demonstrated both quantitatively and/or qualitatively:

> *"Such a demonstration can of course be made by resorting to evidence or data, pertaining to the past or the present, that establish that the import ban at issue makes a material contribution to the protection of public health or environmental objectives pursued. This is not, however, the only type of demonstration that could establish such a contribution…*
> *…[A] demonstration could consist of quantitative projections in the future, or qualitative reasoning based on a set of hypotheses that are tested and supported by sufficient evidence."*[13]

Brazil defended its objective of reducing exposure to the risks to human, animal, and plant life and health arising from the accumulation of waste tyres under paragraph (b) of Article XX of the GATT 1994 stating that Brazil's chosen level of protection is the "reduction of the risks of waste tyre accumulation to the maximum extent possible". The Panel then assessed whether the import ban (i) can contribute to reduction in the number of waste tyres generated in Brazil; and (ii) a reduction in the number of waste tyres can contribute to the reduction of the risks to human, animal, and plant life and health arising from waste tyres. The Panel examined the replacement of imported retreaded tyres with new tyres on Brazil's market and determined that all types of retreaded tyres have by definition a shorter lifespan than new tyres. Accordingly, an import ban on retreaded tyres may lead to a reduction in the total number of waste tyres because imported verified the link between the replacement of imported retreaded tyres with domestically retreaded tyres and a reduction in the number of waste tyres in Brazil. If retreaded tyres are manufactured in Brazil from tyres used in Brazil, the retreading of these used tyres contributes to the reduction of the accumulation of waste tyres in Brazil by "giving a second life to some used tyres, which otherwise would have become waste immediately after their first and only life."

The Panel chose to conduct a qualitative analysis of the contribution of the Import Ban to the achievement of its objective, which was within the bounds of the latitude it enjoys in choosing a

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[13] Appellate Body Report, *Brazil–Retreaded Tyres*, ¶ 151.

methodology for the analysis of the contribution. In the course of its reasoning, the Panel tested some key hypotheses, including that:

- imported retreaded tyres are replaced with new tyres and domestically retreaded tyres;
- some proportion of domestic used tyres are retreadable and are being retreaded;
- Brazil introduced a number of measures to facilitate the access of domestic retreaders to good-quality used tyres;
- more automotive inspections in Brazil lead to an increase in the number of retreadable used tyres; and
- Brazil has the production capacity to retread such tyres.

The Panel concluded that the prohibition on the importation of retreaded tyres is capable of making a contribution to the objective pursued by Brazil, in that it can lead to a reduction in the overall number of waste tyres generated in Brazil, which in turn can reduce the potential for exposure to the specific risks to human, animal, plant life and health that Brazil seeks to address. The Panel also agreed that Brazil has taken a series of measures to facilitate the access of domestic retreaders to good-quality used tyres, and that new tyres sold in Brazil are high-quality tyres that comply with international standards and have the potential to be retreaded.

Bown and Trachtman criticize the WTO jurisprudence in the *Brazil–Retreaded Tyres* dispute, for its failure to evaluate the types of concerns that an economic welfare analysis would provide.[14] The Panel should have estimated, in quantitative terms, the reduction of waste tyres that would result from the Import Ban, or the time horizon of such a reduction. Without examining any empirical data, nor estimations on magnitudes, on the contribution of the import ban to the objective perused, it is impossible to make a rational judgment of the utility of the Brazilian policies contested. They suggest that if the justification for the import ban was grounded on the argument that it was a second-best Brazilian policy designed to combat a large externality, then Brazil's failure to impose a ban on used-tyre imports weakens its effectiveness by eroding potential welfare gains through a reduction in equilibrium production (and consumption) of Brazilian retreaded tyres. Moreover, the

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[14] C. P. Bown, & J. P. Trachtman, *Brazil–Measures Affecting Imports of Retreaded Tyres: A Balancing Act*, 8(01) WORLD TRADE REV. 85–135 (2009).

MERCOSURs' exemption from the ban has the same impact as weakening the possible environmental externality benefit of the import ban.

Returning to the reasoning in the *China-Raw Materials* dispute, the export restrictions on various raw materials were defended under Article XX(b) as intended to make a material contribution to reduce health risks associated with pollution generated by the production of specific raw materials. The economic rationale put forward was that under normal economic conditions, export restrictions would reduce the demand for exports, which decreases domestic production and, in turn, the pollution associated with its production. Furthermore, China argued that, in the long term, high world market prices would provide an incentive to new producers to enter the market, consequently reduce the world prices to their initial level. China submitted supporting evidence using both regression analyses and simulation models. The Panel found that the fact that in the long run the trade-restrictive effects of a measure may vanish does not imply that the short-term costs associated with the measure are not highly restrictive. The Panel upheld the claimant's challenge that the health-friendly description of the export duties was a mere ex-post facto rationalization of measures that were not originally designed to protect health.

The Panel found that China's quantitative analysis was problematic on the various grounds.[15] First, the highly speculative estimations, and lack of adequate data used in the economic analysis. Second, the inaccurate specifications of the estimated regression models such as control variables, as consumption and production, which are affected by the very export restrictions being examined. The most significant criticism was also directed at the unreasonable resemblance between domestic supply and demand elasticities for all EPR products. China had failed to establish that production technologies for the raw materials and the degree with which firms in the downstream sector can substitute these raw materials with other inputs, similarly across products. For that, the Panel found the analysis insufficient to account for critical upstream-downstream interactions. The latter is particularly important since the impact of China's export restrictions on domestic prices is affected by China's dominant role as an exporter of raw materials. As China's prices have been consistently lower than the international prices over the years, preserving this gap clearly offers an advantage to the domestic downstream manufacturing sectors over foreign producers.

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[15] Panel Report, *China–Raw Materials*, ¶ 7.531-7.538.

China also built on past empirical evidence that corresponds with the "Environmental Kuznets Curve" (EKC) theory, which suggests that as economic development takes place, environmental degradation increases until a certain point, and then decreases with the rise in GDP per capita. The Panel stated that even assuming that export restrictions could help generate the required discovery externalities and growth in the metal industries, it cannot prove a causal linkage from economic growth to environmental quality.[16] Particularly it does not necessarily mean that imposition of export restrictions on EPR products will be translated into long-term economic growth, which in turn achieves environmental protection. The Panel concluded that the evidence submitted did not prove that the export restrictions made a material contribution to the protection of health. Regarding possible 'future contribution' of the policy objective, the Panel disagreed that these measures could increase national growth and welfare, and consequently raise the level of health protection. Subsequently, the Panel went on arguendo, to prove that in any event the measures could not pass the least-trade restrictive means test.

Charlier & Guillou examined the effects of an export quota on quantities, prices and price distortion, based on the *China-Raw Materials* dispute, using a model of a monopoly extracting a non-renewable resource and selling it on both the domestic and foreign markets.[17] The empirical results highlight the importance of demand elasticities, for each heterogenic product, as suggested by the Panel in the dispute. It provides estimations of import demand elasticity for each product concerned in the case (at the HS6 level). Moreover, they challenge the proposition that an export quota always favours conservation of natural resource, and that a higher foreign price necessarily follows this policy and inherently increases price distortion and therefore discrimination. Among the products concerned, two groups should be differentiated depending on China's export market power. When China is a significant exporter, there is no evident sign of the distortionary effect by the export quota. However, as a weak exporter, but a strong producer and consumer, there is evidence according to which China is imposing an inefficient quota.

Despite several differences, driven by the characteristics of the two dispute cases, and the quantitative evidence provided, the Panel has reached relatively similar conclusions in *China-Rare*

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[16] Panel Report, *China–Raw Materials*, ¶ 7.551-7.553.

[17] C. Charlier & S. Guillou, *Distortion effects of export quota policy: an analysis of the China-Raw Materials dispute*, 31 CHINA ECON. REV. 320–338 (2014).

Earths dispute. China justified export duties that violated Paragraph 11.3 of China's Accession Protocol to the WTO, by alleging that these duties were justifiable under the scope of Article XX(b)."[18] While the Panel admitted that it was provided with sufficient evidence to substantiate that the mining and production of rare earths caused grave harm to the environment, health of humans, animals and plants in China, it was not convinced by China's quantitative or qualitative arguments. Particularly, China failed to prove that the export duties were specifically designed to reduce the environmental pollution; make a material contribution to achieve pollution reduction; establish causal linkage between the duties and the objective perused; relate the actual environmental impacts of the export duties on rare earths with that of "reasonably available" measures.

China's arguments were supported by Prof. De Melo's economic report "Selected Economic Issues Regarding Export Quotas and Production Quotas".[19] These claims were confronted with an economic analysis of Prof. L. Alan Winters.[20] Both economic experts agreed that a binding production quota introduced in isolation is likely to reduce both exports and domestic consumption relative to the unrestricted trade situation, as both export and domestic prices would be driven up. However, the experts disagreed on the nature of the interaction between production quotas and export quotas that would be necessary to ensure that no "perverse signals" are sent by the export quotas.

The Panel rejected China's arguments while expressing concerns regarding the reliability of the data and methodology with respect to the gap between foreign and domestic prices, and found the position of the complainants more convincing, based on a supportive analysis by Prof. Grossman.[21] According to this, a tax levied on exports causes an increase in foreign markets prices, and a fall in price in the home market. The increase in domestic consumption would offset the fall in foreign consumption. The Panel concluded that the fall in China's foreign exports of rare earths would indeed be offset by the increase in domestic consumption of rare earths as to negate any possible pollution reduction effects of the challenged measures.[22] In the case above, the Panel was expected

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[18] Panel Report, *China–Measures relating to exportation of Rare Earths, Tungsten and Molybdenum*, ¶ 7.172, WT/DS431/R (Mar. 26, 2014) [hereinafter Panel Report, *China – Rare Earths*].

[19] *China – Rare Earths*, Exhibit CHN-157.

[20] *China – Rare Earths*, Exhibit JE-169.

[21] *China – Rare Earths*, Exhibit JE-164, "Export Duties as a Means to Address Environmental Externalities".

[22] Panel Report, *China–Rare Earths*, ¶ 7.178.

to determine which particular economic evidence and methodologies are more reliable and should therefore be trusted. In turn, this reaffirms the imperative role of a well-grounded quantitative analysis in complementing the legal arguments, in similar future disputes.

2.3 Assessing Less Trade Restrictive Alternative Measures

If the preliminary analysis under Article XX(b) on the contribution of the measure to the objective pursued yields an initial conclusion that the measure is necessary, the result must be confirmed by comparing the challenged measure with possible alternatives suggested by the complainants.[23] Further, that in order to qualify as an alternative, a measure must be not only less trade restrictive than the challenged policy measure, but should also preserve for the responding Member its right to achieve its desired level of protection with respect to the objective pursued.[24]

The mere existence of an alternative measure is not sufficient to prove that the disputed measure is not "necessary". Citing *US–Gambling*, the Appellate Body in *Brazil–Retreaded Tyres* confirmed that a proposed alternative must preserve a Members' "right to achieve its desired level of protection with respect to the objective pursued". If the respondent demonstrates that the measure proposed is not a genuine alternative, or is not 'reasonably available', the measure at issue is to be deemed necessary.[25] Moreover, such alternative cannot be "merely theoretical in nature, for instance, where the responding Member is not capable of taking it, or where the measure imposes an undue burden on that Member, such as prohibitive costs or substantial technical difficulties."[26]

In *Brazil-Retreaded Tyres,* the EU suggested two possible alternative measures or practices: (1) measures to reduce the number of waste tyres accumulating in Brazil; (2) measures or practices to improve the domestic management of waste tyres. The Panel rejected them as reasonably available alternatives to the Import Ban since: the proposed alternatives were already in place and have not achieved Brazil's chosen level of protection, or would carry their own risks and hazards. Yet,

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[23] The AB Reports for several disputes have confirmed that it rests upon the complaining Member to identify possible alternatives: *US–Gambling*; *Brazil–Retreaded Tyres*; *China–Measures affecting Trading Rights and Distribution Services for Certain Publications and Audiovisual Entertainment Products*, WT/DS363/AB/R (Dec. 21, 2009).

[24] Appellate Body Reports: *US–Gambling*, ¶ 309 and *Brazil–Retreaded Tyres*, ¶ 156.

[25] Appellate Body Reports: *Brazil–Retreaded Tyres*, ¶ 156; *US–Gambling*, ¶ 307; *Korea–Beef*, ¶ 166.

[26] Appellate Body Report, *US–Gambling,* ¶ 308.

certain "estimates would have been very useful and, undoubtedly, would have strengthened the foundation of the Panel's findings." Bown and Trachtman argue however, that the Panel/Appellate Body reached their conclusions using unsatisfactory statements, rather than pursuing the best available evidence.[27] The WTO thus ignored its mandate of identifying the existence of less treaty inconsistent or trade restrictive alternatives that would contribute equivalently to the achievement of the relevant goal.

Furthermore, in their welfare-economic analysis, Bown and Trachtman suggest examining the effects of two possible alternative measures.[28] The first-best policy measure involves a production subsidy on retreads of once-used Brazilian tyres, equal to the size of the environmental externality, which Brazil aims to correct. Such measure incentivizes retreading additional tyres that would not otherwise have been retreaded. The reason for that is the relatively low price received by producers, as the market was not compensating them for the external societal benefit associated with retreading. Their model indicates that though consumers do not benefit from a change in price, and the level of imports decreases, domestic producers will increase their manufacturing to the socially optimal level. Moreover, such measure is anticipated to contribute positively to Brazil's total welfare. The second-best policy measure was levying a tariff on imports of retreads. Similarly to the previous proposed measure, domestic producers are encouraged to retread more of the stock of once-used Brazilian tyres. Yet, consumers face a higher price, and consequently reduce their imports even more compared to the production subsidy. The authors suggest that such trade policy can be welfare improving to Brazil, when the externality gains are large and the by-product (consumption) distortion losses associated with the import tariff are small.

Both of the alternative policies are less restrictive than a full ban, and capable of achieving Brazil's goal to the same extent as an import ban. However, each may raise questions regarding their "reasonable availability". A production subsidy may potentially discriminate or impose a restriction on imported tyres, which violate Articles III and IX of GATT (respectively). Moreover, such measures may involve establishing a costly and often too administratively complex tax collection scheme that would later provide the exact production subsidy. An additional difficulty, involves verifying that the once-used tyres being retreaded, which are entitled to receive subsidy, were con-

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[27] *Supra*, note 14.

sumed in Brazil and not elsewhere while later imported to Brazil. Nevertheless, this economic analysis provides a theoretical framework, assessing potential alternative measures employed in similar disputes.

In the *EC-Asbestos* dispute, Canada argued that the Decree was an excessive measure in view of the fact that controlled use is a less trade-restrictive alternative that enables the French objective of protecting human health to be attained.[29] Neither the preamble to the TBT Agreement nor the precautionary principle can justify the measure taken by the French Government in breach of the obligations contained in the TBT Agreement. Moreover, Canada claimed that Frances' risk assessment is based on hypothetical data and therefore has no real factual relation to the situation actually prevailing in France, while often misleading to base it on data from exposure to amphiboles or mixed fibres, instead of to chrysotile fibres alone. The extrapolations from data based on high exposure levels and exposures to friable products greatly exaggerates the risk from low exposure levels to products where chrysotile is encapsulated in a hard matrix, specifically chrysotile-cement and friction products. The analysis of reasonably available alternatives included the question of whether controlled use of asbestos:

(a) is sufficiently effective in the light of France's health policy objectives and

(b) constitutes a reasonably available measure.

The Panel considered that the evidence tends to show that handling chrysotile-cement products constitutes a risk to health rather than the opposite. Accordingly, a decision-maker responsible for taking public health measures might reasonably conclude that the presence of chrysotile-cement products posed a risk because of the risks involved in working with those products. Accordingly, the Panel concluded that the EC has made a prima facie case for the existence of a health risk in connection with the use of chrysotile, in particular as regards lung cancer. Furthermore, it was noted that the levels of protection obtained by following international standards, whether it be the ISO standard or the WHO Convention, are lower than those established by France, including those applicable before the introduction of the Decree. Considering the high level of risk identified, France's objective, which the Panel could not question, justified the adoption of exposure ceilings lower than

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[29] Panel Report, *European Communities – Measures Affecting Asbestos and Asbestos – Containing Products*, ¶3.12, WT/DS135/R (September 18, 2000)..

those for which the international conventions provided. The Appellate Body report therefore found that controlled use is not a reasonably available alternative in all the other sectors in which workers may be exposed to chrysotile.

In the case of *China-raw materials*, the Panel acknowledged that the measures in place (export restrictions) are less restrictive in most of the EPR products than full "bans" would be.[30] However, the Panel rejected China's claims that the policy measures are not restrictive, since the effect of an export restrictions on the world market does not depend on the world availability of the raw natural resources needed to manufacture EPR products, but on a country's export market share in the EPR market. Economic evidence proves that China's share of global exports in some of these products is significant, hence even unassertive measures would have a substantial impact. The complainants suggested six available WTO-consistent less trade-restrictive alternative measures that could ensure reduction of pollution and protection of health. The Panel agreed to undertake an arguendo analysis of the measures, which consist: (i) investment in more environmentally friendly technologies; (ii) further encouragement and promotion of recycling of consumer goods; (iii) increasing environmental standards; (iv) investing in "infrastructure necessary to facilitate recycling scrap"; (v) stimulating greater local demand for scrap material without discouraging local supply; and (vi) introducing production restrictions or pollution controls on primary production.

China responded that these suggested measures are already in place in China, and export restrictions complement them in order to achieve a better environmental protection. The Panel stated that China has not been able to provide evidence that these measures are actually implemented, while simply showing guidelines or plans cannot substitute mandatory obligations. Secondly, China did not justify why the proposed alternatives, could not be sufficient to achieve the objective stated or stand-alone without additional export restrictions.[31] Based on the examination of the three factors determining whether the measures were "necessary" and the assessment of less trade restrictive alternative measures, the Panel found that China's claims for using the export restrictions were not sufficiently justified. China did not to appeal the Panel's decisions under Article XX(b).

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[30] Panel Report, *China–Raw Materials,* ¶7.558.
[31] Panel Report, *China–Raw Materials*, ¶ 7.590.

3. SPS Article 5.6

3.1 The Scope of Article 5.6

Article 5.6 of the SPS Agreement provides that:

"[W]hen establishing or maintaining sanitary or phytosanitary measures to achieve the ap-
propriate level of sanitary or phytosanitary protection, Members shall ensure that such
measures are not more trade-restrictive than required to achieve their adequate level of san-
itary or phytosanitary protection, taking into account technical and economic feasibility."

The footnote to this provision reads as follows:

"For purpose of paragraph 6 of Article 5, a measure is not more trade-restrictive than
required unless there is another measure, reasonably available taking into account tech-
nical and economic feasibility, that achieves the appropriate level of sanitary or phyto-
sanitary less restrictive to trade."

Article 5.6 adopts a least trade restrictive alternatives test where, like the same test under Ar-
ticle XX(b) of the GATT, the less trade restrictive alternatives are regarded as reasonably available
only when they are economically feasible and can accomplish the same levels of protection which
the measures invoked by defending parties can achieve. Marceau & Trachtman, however, identify a
significant difference, which unlike the assessment of necessity under Article XX of the GATT, the
evaluation under Article 5.6 of the SPS Agreement does not include consideration of the degree of
the measure's contribution to the end pursued.[32]

In *Australia-Salmon* and *Japan-Apples*, the Appellate Body found that all of the following
three factors have to be shown in order to establish a violation of Article 5.6:

1) There is at least one alternative, which is reasonably available, taking into account technical
    and economic feasibility;

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[32] G. Marceau & J. P. Trachtman, *Responding to National Concerns, in* THE OXFORD HANDBOOK OF IN-
TERNATIONAL TRADE LAW (D. Bethlehem, D. McRae, R. Neufeld, I. Van Damme eds., Oxford Uni-
versity Press 2009).

2) The alternatives can achieve the Member's appropriate level of sanitary or phytosanitary protection;

3) The alternative is significantly less restrictive to trade than the SPS measure in dispute.

In *Australia–Salmon*, the Appellate Body affirmed that determining the appropriate level of protection is the right of the Member concerned, and not of the WTO tribunals. However, determining the level of protection should be done before adopting the measure, with sufficient precision. Otherwise, the Panel may determine its level of protection on the basis of the measure itself. In this dispute, Australia expressed its level of protection as 'very conservative', but the Panel instead assessed it as 'zero-risk' on the basis that the measure itself was a total ban. Moreover, since Article 5.6 ignores balancing the contribution to a legitimate objective, the tribunal need not reject the use of a measure merely because it did not adequately contribute to its objective and is highly trade restrictive. In the absence of a reasonably available alternative, a measure will be considered as consistent with the provision.

Additionally, in Article 5.6, the complainant must raise a *prima facie* case that the measure infringes them before the burden switches to the respondent to provide a rebuttal. Under the general exceptions, the complainant only needs to propose a measure to activate the respondent's burden of proving that it is not reasonably available. As the subject matter of the SPS Agreement typically applies to measures designed to achieve protection of health, the complainant's burden will often require it to prove detailed technical matters demonstrating that its proposed alternative would achieve the respondent's level of protection.

As indicated, under the SPS Agreement, a non-compliant measure may be justified, not unlike Article XX(b) exception, in order to achieve a desired level of protection. The interpretation of the legal requirements of Article 5.6 SPS is similar to those under Article XX(b). The complainant must first demonstrate that there is a prima facie case that the measure infringes the relevant provision, before the burden switches to the respondent to provide a rebuttal. The complainant then needs to propose a reasonably available alternative measure.

3.2 Assessing Trade Restrictiveness of a Measure and Possible Alternatives

In *Australia-Salmon*, the contested measure imposed by Australia (certain heat treatment requirements) prohibits the importation of fresh, chilled or frozen salmon. The Panel stated that the possible alternatives, which would be compared with the import ban of the raw salmon concerned, were five measures, identified, in the Australian 1996 Final Report. Whereas, Canada noted four alternative options are significantly less trade restrictive, Australia argued that the feasibility of one measure may be reliant on the existence of another, therefore individual measures or sets of measures are not technically and economically feasible in practice.[33] Moreover, some of the options were clearly less trade-restrictive than the import ban/heat treatment requirement. While the Panel found that less trade-restrictive measures existed, and could have been used by Australia,[34] the Appellate Body reversed the ruling on grounds that the Panel did not evaluate or assess the alternative' measures relative effectiveness in reducing the overall disease risk. Furthermore, it had based its considerations on the heat-treatment requirement, and not on the import prohibition. Yet because of these insufficient factual findings, the Appellate Body found itself unable to conclude whether Australia had violated Article 5.6.

In *Australia-apples*, the Panel stated that the reasoning articulated in Australia's risk assessment, with respect to the likelihood of entry, establishment and spread of fire blight, including estimation of the value for the respective probabilities, does not rely on adequate scientific evidence and, accordingly, is not coherent and objective.[35] The Panel agreed with New Zealand's' assertions that the methodological flaws result in a situation where the risk assessment overestimates the overall probability of the entry, establishment and spread of fire blight in this dispute. Moreover, the importation of mature, symptomless apples, suggested by New Zealand, was an appropriate alternative for Australia's eight fire blight and four European canker measures, and that the inspection of a 600-unit sample from each import lot was an appropriate alternative for Australia's ALCM measure.

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[33] Panel Report, *Australia–Measures affecting importation of Salmon*, ¶ 4.276, WT/DS18/R (June 12, 1998) [hereinafter Panel Report, *Australia–Salmon*].

[34] Panel Report, *Australia–Salmon*, ¶ 7.146.

[35] Panel Report, *Australia – Measures Affecting the Importation of Apples From New Zealand*, ¶ 7.259, WT/DS367/R (August 9, 2010)..

In its appeal, Australia's submitted a *Final Import Risk Analysis Report for Apples from New Zealand* ("IRA"). This risk assessment was "semi-quantitative" in that, for each pest, it combined a quantitative assessment of the likelihood of entry, establishment and spread with a qualitative assessment of the likely associated potential biological and economic consequences. The combination of these probability assessments then yield an overall determination of "unrestricted risk", that is, the risk associated with the importation of apples from New Zealand in the absence of any risk management measures. The IRA Report, responded to New-Zealand's claims regarding the imposition of the SPS measures in the *Australia-Apples* case, although it did not allow a genuine assessment of the restrictiveness of the measure, or possible alternatives. Nevertheless, the Appellate Body reversed the Panel's findings of inconsistency in regard to the measures relating to these two pests.

An economic analysis which was undertaken by Yue and Beghin reaffirms New Zealand's claims. It estimates the tariff equivalent and trade effects when there is no trade flow of a commodity due to the presence of a quarantine non-tariff measure (i.e. imports ban).[36] Their solution yields demand functions influenced by prices (include transportation costs, tariffs and the tariff equivalent of the technical barriers) and a random component. This yields likelihood functions of consumption levels of the commodity in the countries involved and other countries that depend on prices in those countries. Their application suggests that the ad-valorem tariff equivalent of the ban by Australia on New-Zealand's apples is, on average, about 99% of the fob price inclusive of transportation costs.

In *Japan-Apples*, the 'Least Trade Restrictive Alternative' analysis under Article 5.6 of the SPS Agreement was seen to have been a relatively moderate one, as compared with that of Article XX (b) of the GATT. In this dispute, the Japanese varietal testing requirement was compared with "testing by product", as a less trade restrictive alternative. The Panel found that Japan acted inconsistently with Article. 5.6 since the measure was more trade-restrictive than required to achieve the appropriate level of SPS protection. It concluded that this alternative measure: (i) was reasonably available taking into account technical and economic feasibility; (ii) achieved Japan's appropriate level of SPS protection; and (iii) was significantly less restrictive to trade than the SPS measure at issue, confirming the 3-pronged test.

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[36] C. Yue & J. C. Beghin, *Tariff Equivalent and Forgone Trade Effects of Prohibitive Technical Barriers to Trade*, 91(4) AM. J. AGRIC. ECON. 930–941 (2009).

The Panel's ruling is reinforced by an econometric analysis of Calvin & Krissoff, who quantify the restrictiveness of the SPS measures that Japan imposed on apple imports from the US.[37] They measured the trade and welfare impacts of reducing trade barriers, building on a partial equilibrium (PE), two-equation framework that endogenously determines the SPS tariff-rate equivalent and the level of trade. Their estimates of ad-valorem equivalent of the Japanese technical measures, using the price wedge approach, are around 27%, hence significantly more critical than tariffs in restricting imports. They suggest that these measures serve mainly as a protectionist instrument for shielding domestic producers of Fuji apples.

A follow-up analysis, by Calvin et al, indicates the economic costs of Japans' SPS measures on US apples.[38] They estimate the transaction cost ($k = 33$) and SPS measures ($CPP = 15$) at cents per pounds. Using these results and the exporter's price ($Pus = 50$), the tariff equivalent of SPS is estimated to be approximately 18.1%. Honda uses similar methodology to that suggested by Yue and Beghin for Australia[39] and suggests that Japan's SPS measures impose a significantly higher restrictiveness on U.S. apples, which has an average effect over the entire period of 118.9%.[40] These results imply that other suggested methodologies for quantifying tariff equivalents of Japanese SPS on U.S. apple imports have been underestimated.

4. TBT Article 2.2

4.1 Application of Technical Regulations under Article 2.2

Article 2.2 of the TBT Agreement establishes:

> *"Members shall ensure that technical regulations are not prepared, adopted or applied with a view to or with the effect of creating unnecessary obstacles to international trade. For this purpose, technical regulations shall not be more trade-restrictive than necessary to fulfil a legitimate objective, taking account of the risks non-fulfilment*

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[37] L. Calvin & B. Krissoff, *Technical Barrier to Trade: A Case Study of Phytosanitary Barriers and U.S.-Japanese Apple Trade*, 23(2) J. AGRIC. & RESOURCE ECON. 351—366 (1998).
[38] L. Calvin, B. Krissoff, & W. Foster, *Measuring the Costs and Trade Effects of Phytosanitary Protocols: A U.S.-Japanese Apple Example*, 30(1) REV. AGRIC. ECON. 120—135 (2007).
[39] *Supra* note 36.
[40] K. Honda, *Tariff equivalent of Japanese sanitary and phytosanitary: Econometric estimation of protocol for US-Japanese apple trade*, 32(2) ECONOMICS BULLETIN ACCESSECON 1226-1237 (2012).

would create. Such legitimate objectives are, inter alia: national security requirements; the prevention of deceptive practices; protection of human health or safety, animal or plant life or health, or the environment. In assessing such risks, relevant elements of consideration are, inter alia: available scientific and technical information, related processing technology or intended end-uses of products."

The resemblance in much of the wordings to GATT general exceptions has resulted in Appellate Body jurisprudence on TBT Article 2.2 being closely aligned with Article XX(b). When determining if the challenged measure is more trade-restrictive than necessary to fulfil a legitimate objective under Article 2.2, the Appellate Body has established a test very similar to the necessity test under the general exceptions. First, the Panel is required to weigh and balance the trade-restrictiveness of the regulation with its contribution to the legitimate objective, and the risks that non-fulfilment creates.[41] Second, if the measure is found necessary, the Panel will consider whether there are any reasonably available less-trade restrictive alternatives, which could make an equal contribution to the objective[42] Accordingly, the Panel should take account of 'the nature of the risks at issue and the gravity of the consequences that would arise from non-fulfilment'[43].

The main differences between the two provisions are the following: First, the burden of proof to establish the violation of Article 2.2 of the TBT agreement lies with the complainant. This in in contrast to GATT Article XX, where the respondent bears the burden of establishing the justification for what else would be a violation.[44] Second, while Article 2.2 contains a non-exhaustive list of the 'legitimate objectives', the general exceptions contain only the base on which an exception can

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[41] Appellate Body Report, *US–Measures concerning the importation, marketing and sale of Tuna & Tuna Products*, ¶ 318, WT/DS381/AB/R (May 16, 2012) [hereinafter Appellate Body Report, *US–Tuna II (Mexico)*]; *see also* Appellate Body Reports, *US–Certain Country of Origin Labelling Requirements*, ¶ 374, WT/DS384/AB/R (June 29, 2012 and May 18, 2015) [hereinafter Appellate Body Reports, *US–COOL*].

[42] Appellate Body Report, *US–Tuna II (Mexico)*, ¶ 320; *see also* Appellate Body Reports, *US–COOL*, ¶ 376.

[43] Appellate Body Report, *US–Tuna II (Mexico)*, ¶ 321.

[44] Appellate Body Report, *EC–Measures prohibiting the importation and marketing of Seal Products*, ¶ 5.169, WT/DS400/AB/R (May 22, 2014); Appellate Body Report, *Korea–Beef*, ¶ 157.

be established.[45] Third, it is only in Article 2.2, that the risks of non-fulfilment of the relevant objective is required to be considered in determining whether a TBT measure is more trade-restrictive than necessary.

This section completes the proposition underpinning this article, that under the TBT Agreement, a non-compliant measure may be justified, not unlike the exception under Article XX(b) and Article 5.6 of the SPS Agreement. A very similar interpretation of the legal requirements has been explicitly followed by the DSB under Article XX(b). Indeed, the WTO DSB has opined that there are no significant differences between the tests developed under Art. XX(b) of the GATT 1994 and Art. 5.6 of the SPS Agreement, nor that any aspect of the Art. XX(b) jurisprudence relating to the interpretation of the term "necessary" would be inapplicable to Article. 2.2 of the TBT Agreement.[46]

4.2 Assessment of Trade Restrictiveness of a Measure

In the *US-Clove Cigarettes*, the Panel found a solid basis for justifying the imposition of the measure, as it makes a material contribution to the identified objective. This finding was supported by numerous of scientific and quantitative evidence, which were submitted by the respondent party.[47] Subsequently, the Panel decided to compare the measure with several less restrictive alternatives measures, suggested by Indonesia. Among these measures were: adopting provisions to limit cigarette companies from engaging in practices targeting youth and adopting various measures set out in the WHO Framework Convention on Tobacco Control aimed at preventing cigarette sales to minors.[48] Yet the Panel's assessment rested on pure legal analysis, without complementary economic evidence on the level of restrictiveness of the proposed measures, or on their success in achieving the objective perused. Based on this narrow legal focus, the Panel found that Indonesia failed to prove that its proposed alternative measures could reduce the relevant health risks to the same extent as the US measure.

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[45] Appellate Body Report, *US–Tuna II (Mexico)*, ¶ 313; Appellate Body Reports, *US–COOL*, ¶ 370.
[46] Panel Report, *US-Gasoline*, ¶ 6.20 (cited in Panel Report, *EC–Asbestos*, ¶ 8.169; Panel Report, *EC–Tariff Preferences*, ¶ 7.197; Panel Report, *Brazil–Retreaded Tyres*, ¶ 7.40).
[47] Panel Report, *US – Measures affecting the production and sale of Clove Cigarettes*, ¶ 7.402-7.414, WT/DS406/R (Sept. 2, 2011) [hereinafter Panel Report, *US – Clove Cigarettes*].
[48] Panel Report, *US – Clove Cigarettes*, ¶ 7.420.

In the *US-Certain Country of Origin Labelling* (COOL), the Panel ruled that the US did not meaningfully inform consumers about the countries of origin with respect of meat products. It asserted that the labels identifying multiple countries of origin could confuse or mislead, rather than inform, consumers. Moreover, the Panel stated that the COOL implementation is more trade restrictive than is necessary to fulfil its objective, and therefore violates Article 2.2 of the TBT agreement. The Panel indicated that the focus of an assessment of trade-restrictiveness should be the impact on competitive opportunities:

> [T]he scope of the term 'trade-restrictive' is broad ... [and] does not require the demonstration of any actual trade effects, as the focus is on the competitive opportunities available to imported products...[49] . [T]he COOL measure negatively affects imported livestock's conditions of competition in the US market in relation to domestic livestock by imposing higher segregation costs on imported livestock.[50]

The term 'competitive opportunities' is often used in contradistinction to trade effects; emphasising the importance of market access to potential imports. Nevertheless, the Panel declared that the COOL measure had 'brought about actual negative trade effects on imported livestock as shown by a significant and negative impact on import shares and prices'.[51] The US provided the Panel with an econometric study[52], prepared by the US Department of Agriculture (USDA), focusing on imports from the Canadian and Mexican fed and feeder cattle market. The study indicates that the price gap between Canada and US's livestock decreased subsequent to the implementation of the COOL. The estimators of the COOL measure on the import ratio of Canadian livestock were found to be negatively correlated, although not significantly far from zero. Furthermore, it showed that the US economic recession is the primary cause for the decline in Canada import shares.

The Panel also reviewed two econometric analyses, submitted by Canada, namely the 'Informa Study'[53] and the 'Sumner Econometric Study'. The 'Informa Study' focused on the how differ-

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[49] Panel Reports, *US–Certain Country of Origin Labelling Requirements*, ¶ 7.572, WT/DS384/R (Nov. 18, 2011 and Oct. 20, 2014) [hereinafter Panel Reports, *US–COOL*].

[50] Panel Reports, *US–COOL*, ¶ 7.574.

[51] Panel Reports, *US–COOL*, ¶ 7.759.

[52] *US–COOL*, Exhibits US-42 and 149.

[53] *US–COOL*, Exhibits CDA-64.

ent types of compliance and segregation costs, of the COOL measure, are allocated along the supply chains. It showed that these costs depend on a large number of variables, among them the production fragmentation, the stage of the supply chain, size of the firm, and others. The compliance costs increase as livestock and meat move downstream on the chain. The second analysis described an economic model simulation of the US livestock sector to illustrate how the differential implementation costs of the COOL measure are distributed among market participants through market forces. It emphasised the readiness of economic operators along the supply chain to pay for mixed origin beef and hog, along a comparison of the behaviour of consumers, prior and post the imposition of the COOL measure. The implementation of the COOL requirements, leads to a reduction of the willingness to pay by the operators along the supply chain for given quantities of Canadian cattle and hogs.

The Panel stated that it could not genuinely assess, the reliability and precision of the estimations in the studies proposed by both sides. Yet, Canada's reports were "sufficiently robust" to prove the causal impact of COOL in reducing competitive opportunities for Canadian exporters. It accepted that the segregation costs lead traders towards privileging US-origin livestock, consequently create a negative and significant impact on Canadian import shares and prices. The US challenged this two-step approach, arguing that the Panel went beyond the scope of Article 2.2, to make an "intrusive and far-ranging judgment" on whether COOL "is effective public policy." Instead it should have focused only on whether COOL is more trade-restrictive than necessary. Although upholding the Panel's ruling with regards the legitimacy of the measure's objective, the Appellate Body found the Panel's had incorrectly decided that a measure could be consistent with Article 2.2 only if it fulfilled its objective completely or exceeded some minimum level of fulfilment. It has ignored its own findings, which demonstrated that the COOL measure does contribute, at least to some extent, to achieving its objective. Although reversing the Panel's finding that COOL is inconsistent with Article 2.2, the Appellate Body was not able to determine whether COOL is more trade-restrictive than necessary to meet the TBT requirement that it be a legitimate objective. The Appellate Body did not complete its analysis, since it lacked the necessary evidentiary information. It should also be noted that with respect to the less trade-restrictive alternative measures, the Panel never reached the stage of comparing the COOL measure against less trade restrictive alternative measures, since the COOL measure "does not fulfil the identified objective within the meaning of

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Article 2.2, as "it fails to convey meaningful origin information to consumers", therefore violates Article 2.2 of the TBT agreement.

Pouliot & Sumner highlight that the relative sizes of the impacts of COOL on quantities and prices depend significantly on Canada's export supply elasticity.[54] Given the conditions on demand and supply in Canada, the export supply of fed cattle should be less elastic than the export supply for feeder cattle. Subsequently, the model predicts that a strong effect of COOL on price in the fed cattle market, and strong effect of COOL on import quantity ratios in the feeder cattle market. The empirical results show statistically significant effects of COOL that are consistent with the expectations from the theoretical model. In the fed cattle market, results show a significant widening of the basis from COOL while smaller and less significant effects on the ratio of imports to domestic use. In the market for feeder cattle, they found less significant results for the price, but significant reductions in the import ratios. Overall, the implementation of COOL had a significant differential effect on the cattle market in Canada versus the US domestic cattle market.

Twine & Rude assert the impact of the COOL measure from a slightly different angle.[55] The authors propose a multi-market partial equilibrium model in order to simulate the impact of several exogenous shocks, on the economic performance of Canadian and US beef cattle industries. These include: feed price escalation, mandatory COOL requirements, and economic recession. Their empirical results demonstrate that the impacts on the US industry are relatively small compared to those on the Canadian industry. Moreover, the COOL measure and feed price escalation, account for the largest negative impact on the Canadian cattle industry. These simulations reinforce the WTO tribunal's findings with respect to the trade restrictiveness of the COOL measure.

4.3 The Contribution of the Tuna-Dolphin Dispute

In many respects, the *US-Tuna II (Mexico)* dispute is a unique example. First, this case was the first time, in nearly 200 WTO rulings, that the Panel found a violation under Article 2.2 of the

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[54] S. Pouliot & D. A. Sumner, *Differential Impacts of Country of Origin Labeling: COOL Econometric Evidence from Cattle Markets*, WORKING PAPERS 148593, STRUCTURE AND PERFORMANCE OF AGRICULTURE AND AGRI-PRODUCTS INDUSTRY (2012).

[55] E. Twine & J. Rude, *Effects of Market and Policy Shocks on the Canadian and U.S. Cattle and Beef Industries*, Paper presented at the Agricultural and Applied Economics Association's Annual Meeting, Seattle (Aug. 12 – 14, 2012).

TBT agreement. More importantly, the dispute exemplifies the difficulties faced by the DSM when disputes involve contentious quantitative submissions in the form of existing qualitative studies. For after determining whether the US dolphin safe provisions fulfilled a legitimate objective, the Panel was also called upon to determine whether the contribution of provisions to the US objective (of ensuring that consumers are not misled about whether the tuna contained in tuna products was caught in a manner that adversely affects dolphins) are more trade-restrictive than necessary to fulfil such objective, taking account of the risks non-fulfilment would create.[56]

The only piece of evidence presented in these proceedings to ascertain what US consumers in fact understand the terms "dolphin-safe" to mean is an opinion poll submitted by Mexico.[57] This poll shows that 48 per cent of the 800 individuals surveyed believe that "dolphin safe" means that "no dolphins were killed or injured" while 12 per cent believe that it means that "dolphins were not encircled and then released to capture the tuna". The Panel found that in light of the poll, it is not clear that US consumers understand the term "dolphin-safe" to mean the same as what the US dolphin-safe provisions define it to mean.[58] The discrepancies between the meaning of this term under the measures and consumer perceptions may create confusion and undermine the ability of the measure to effectively ensure that consumers are not misled.

The Panel noted the numerous studies that suggest that various adverse impacts can arise from setting on dolphins, beyond observed mortalities,[59] but also other studies that question these conclusions. The Panel stated that further study would be required in order to draw overall conclusions, confirming that the information available in this respect is incomplete and that this issue warrants additional analysis.[60]

Our findings take into account the information, including scientific information concerning the effects of tuna fishing on dolphins that is available to us for the purposes of these proceedings. From these elements, it appears that a number of aspects of this is-

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[56] *US–Tuna II (Mexico)*, Mexico's first written submission, ¶ 205.
[57] *US–Tuna II (Mexico)*, Exhibit MEX-64.
[58] *US–Tuna II (Mexico)*, United States' response to Panel question No. 42, ¶ 108-09.
[59] *US–Tuna II (Mexico)*, Exhibit US-4, p. 24.
[60] *US–Tuna II (Mexico)*, Exhibit MEX-67, p. 9.

sue are not fully documented and that further research may be necessary in order to as-
certain the exact situation in various areas.[61]

Ultimately, the Appellate Body reversed these Panel findings, disagreeing that the measure at issue was more trade-restrictive than necessary to fulfil US legitimate objectives, thus inconsistent with Article 2.2. Instead, the Appellate Body determined that the alternative measure proposed by Mexico (AIDCP 'dolphin safe' labelling combined with the existing US standard) would contribute to both the consumer information objective and the dolphin protection objective, to a lesser degree than the measure at issue.

Mexico's failure to justify its arguments in front of the Appellate Body, was likely due to its lack of ability to provide any quantitative evidence to support its claims. Simply stating a hypothetical less trade restrictive alternative, without providing empirical support that it is reasonably available, or that it is less trade restrictive, was insufficient. Taking the complementary approach using an econometric analysis may have been found to be more beneficiary to support Mexico's argument. Such an analysis should have focused on the adverse effects of the labelling measure along with the US standard on the behaviour of consumers, and eventually proving that it could achieve a similar level of consumer information and dolphin protection as US's stated objective.

5. Conclusions

This paper has provided a comparison of the legal and economic assessments used in GATT Article XX(b), Article 5.6 of the SPS Agreement and Article 2.2 of the TBT Agreement. Particularly, it displays the selection of methodologies which were undertaken in various dispute settlements, to analyse the "necessity" of the selected measure at achieving the objective/ perused, evaluate the 'trade restrictiveness' which the policy measure imposes, as well as assess the availability of alternative less trade restrictive policy measures. Since despite the substantial importance and centrality of the term 'trade-restrictiveness' in DSM, its definition and exact scope still remain unclear, we aim to identify the arsenal of practices that the WTO tribunals use in determining its meaning and justified extent.

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[61] Panel report, *US-Tuna II (Mexico)*, ¶ 7.623.

The main conclusions are as follows: First, despite minor differences, in general, the legal assessments are noticeably similar. The same cannot be said regarding the application of quantitative assessments of the various measures, which fall under these provisions. Second, rarely any of the parties in the disputes support their arguments using empirical modelling and quantification of the trade restrictiveness of the chosen measures, nor a quantitative comparison to less trade restrictive alternative measures. Third, in the few cases where the parties do provide such evidence, it is often rejected by the tribunal, which explicitly express its concerns and lack of trust in these methodologies. Much of this reluctance is explained on the grounds of the reliability and accuracy of the data, the specifications and control variables included the regressions or the robustness of the findings. These justifications may explain the tribunals' rulings, however, the insufficient trust or lack of acquaintance with the recent economic progress, still remain at the heart of the underuse of economic assessments by the parties themselves.

Finally, the significant advancements in international trade theory as well as in analytical methodologies assessing the trade restrictiveness of policies, is of great benefit to WTO tribunals. It may reduce uncertainty and promote a more consistent approach regarding assessments required in GATT/WTO trade disputes. In the paper, we provide various examples of studies from the economic literature, which are directly related to the particular DS cases mentioned, and highlight the benefits of implementing quantitative methodologies. Such valuable experience in quantifying the extent to which a given policy measure or alternative measure would contribute to a given non-trade policy objective, may provide coherent guidelines to on-going and possibly future WTO disputes. Moreover, unless the Panel/Appellate Body are prepared to assess the key conceptual economic approach in their proceedings, they may potentially risk resulting in economic outcomes that ultimately undermine the original objectives of the WTO agreements.

The Trade-Enhancing Effect of Non-Tariff Measures on Virgin Olive Oil

Abstract

Over the last 15 years, the global trade of virgin olive oil (VOO) seems to face a stringent regulatory regime, mainly through the imposition of TBT and SPS measures. Such a development should have adversely impacted global levels of VOO trade. However, evidence shows that the world's imports of VOO have more than quadrupled in value since 2000. Alongside this trend, the share of VOO imports gradually shifts from traditional sources (mainly EU) to New World producing countries, such as Argentina, Australia, the USA, and Chile. By extracting data from hundreds of NTM regulations, as well as all possible registered bilateral trade flows between 2002 to 2014, this paper aims to empirically explore to what extent particular NTMs impact imports of VOO. The results indicate that while tariffs remain a stringent barrier, most NTMs have a positive impact on imports, rather than enhancing restrictiveness. The paper asserts that the majority of NTMs respond to consumers' demand for higher food safety standards and protection of human health, while increasing available information and transparency. That, in turn, leads to an expansion in the magnitude of imports of VOO products.

1. Introduction

The agreements on Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT) of the World Trade Organization (WTO) were designed to provide the member countries with the freedom to choose a particular measure that allows them to achieve legitimate policy objectives, such as the protection of human health and the environment. However, these instruments should be levied only to the extent necessary to achieve the desired purpose while the prohibitive effects on trade are kept to a minimum. Meanwhile, over the past two decades, the Dispute Settlement Body of the WTO reports a growing number of trade disputes, related either to SPS or TBT measures which created unnecessary trade barriers (WTO, 2012).

The influence of SPS and TBT measures on international market access are more complicated than those of traditional trade barriers, such as tariffs and countervailing duties. The pivotal role of SPS and TBT measures ranges from alleviating asymmetric information in the marketplace (i.e. labelling requirements) to mitigating risk in the consumption of particular products and enhancing the sustainability of the eco-system. Accordingly, SPS measures and TBTs are likely to impact both consumers' and producers' preferences and modify their decisions. Consequently, while NTMs may create unnecessary trade barriers and significantly impede market access for agricultural products from particular sources, it may also enhance consumers' demand via risk mitigation or quality assurance, and possibly serve as trade catalysts.

The paper aims to provide an empirical framework for examining the inclusive effects of a variety of SPS and TBT measures, collectively organized into seven subgroups, on the imports of a particular sector. To achieve this objective, the olive oil sector has been chosen as a case study. Notably, the paper refers to the subcategory of virgin olive oil (VOO), which despite being the highest quality of olive oil, accounts for over 85% of the total olive oil exports. This sector is of particular interest given the intensified regulation environment it operates in, as well as the dynamic developments that have occurred during the last three decades against the background of the surge in global consumption. Moreover, a special interest is attributed to the shift in the variety of production sources, after hundreds of years of absolute dominance of the Mediterranean basin countries (predominantly Spain, Italy, and Greece).

The significant growing demand for VOO, highlights the increasing popularity of the Mediterranean diet, for its highly beneficial nutritional and culinary properties due to the unique composition of fatty acids and antioxidants. Accumulated evidence demonstrates that demand for VOO has more than quadrupled since the new millennium, primarily in countries outside the EU. Furthermore, the consumption of VOO is expected to further increase significantly in near future. Additional notable trend is the shift of imports of VOO, from the traditional exporting countries to the 'New World' producing countries, such as Argentina, Australia, the USA, and Chile. This development which is clearly generated by the growing demand for affordable products, as well as the consumers' interest in diversified supply sources, creates another challenge for VOO producers.

The novelty of this paper arises from the detailed analysis of trade regulations and their impact on global trade flows of VOO. This type of analysis is especially useful for identifying which regulations (most) efficiently achieve a magnifying effect, in contrast to those which pose a restrictive barrier to trade. Moreover, it also allows to determine the extent to which these measures can serve as trade catalysts for the relevant stakeholders.

The main contribution of the paper is the empirical validation it provides to the trade-enhancing impact of a wide range of regulatory measures on VOO imports. It does so by building a panel data which consists of thousands of possible NTMs, affecting all possible bilateral trade flows between the years 2002 to 2014. The estimation results reveal that while tariffs remain a stringent barrier, most TBT and SPS measures are associated with a positive impact on imports rather than increasing restrictiveness. The paper asserts that while aiming to achieve better food safety, human and animal health, and protection of the environment, the majority of NTMs generate additional economic benefits. Through risk mitigation, quality assurance and increased traceability, as well as information and transparency, numerous regulatory measures virtually enhance consumer demand, resulting in an expansion in the demand for VOO imports.

The paper is comprised of five sections. Following the introduction, the second section portrays the characterization of the VOO sector and the policy measures which affect its trade across countries. The third section outlines the relevant literature review, which examine the relations between tariffs, NTMs, and olive oil trade. The fourth section presents the econometric methodology which was chosen to conduct the analysis, accompanied by a discussion of the results of the estimations,

and a comparison of the exports by EU producing countries to non-EU producing countries. The last section underlines the key findings which can be drawn from the research.

2. The Global Trade of Virgin Olive Oil

2.1 Background and Characteristics

Edible olive seems to have co-existed with humans for millennia, with its origins traced along the eastern Mediterranean coast, which is nowadays Turkey, Syria, Lebanon, Palestine, and Israel. After their introduction to Greece, Egypt, and western Turkey, olives continued to move westward into Italy, France, Spain, Portugal, Algeria, Tunisia, and Morocco. Since then, through the Roman Empire, olive planting and oil processing facilities have spread around the Mediterranean basin, which remain up to recent years, the main region of olive oil production and largest market of consumption.

Table 7: EU vs. Non-EU countries, Olive Oil Statistics

		2000		2008		2015	
		Volume	Share	Volume	Share	Volume	Share
EU	Production (1,000 tonnes)	1.879	79,1%	1.939	72,6%	1.435	58,4%
	Consumption (1,000 tonnes)	1.728	70,7%	1.866	67,7%	1.605	55%
	Exports, Virgin Olive Oil ($ Mil.)	1.293	84,8%	3.884	81,5%	4.730	78,6%
	Imports, Virgin Olive Oil ($ Mil.)	1.112	71,8%	3.284	66,3%	3.979	63,5%
	Per Capita Consumption (kg)			3,74		3,21	
Non-EU	Production (1,000 tonnes)	496	20,9%	730,5	27,4%	1.024	41,6%
	Consumption (1,000 tonnes)	714	29,3%	887	32,2%	1.312	45%
	Exports, Virgin Olive Oil ($ Mil.)	232	15,2%	884	18,5%	1.286	21,4%
	Imports, Virgin Olive Oil ($ Mil.)	436	28,2%	1.667	33,7%	2.286	36,5%
	Per Capita Consumption (kg)			0,15		0,21	

Source: WITS and the International Olive Council, Nov. 2016

The dominant producing countries of olive oil (OO) nowadays are Spain, Italy, and Greece, which account for more than half of the global production. Spain is also the leading exporter of VOO, with a share of 52% of the world's exports, followed by Italy, Portugal, and Greece. Spain's significant growth in production is a result of the vast plantations and investments made during the 1980s, thanks to the incentives for production, export, and storage provided within the EU Common Agricultural Policy. Trailing behind the EU are Tunisia, Turkey, Syria and Morocco, that gradually

gain a grip of the world's production of OO. Table 7 shows the gradual shift in output share from the EU to non-EU producing countries, which currently account for about 42% of the global volume produced.

In the last 20 years, several notable developments were associated with olive oil. The most significant development is the growing popularity of the Mediterranean diet, mainly due to its acknowledged nutritional properties, but also as a response to the growing threat caused by global obesity (also known as the 'silent killer'). Notably, the most valuable benefits are attributed to the quality of VOO. Coupled with improvements in cultivation and the use of oil-mill technologies, this has generated a substitution drift from generic olive oil towards VOO.

Table 8: Imports of Virgin Olive Oil by Main Importing Countries

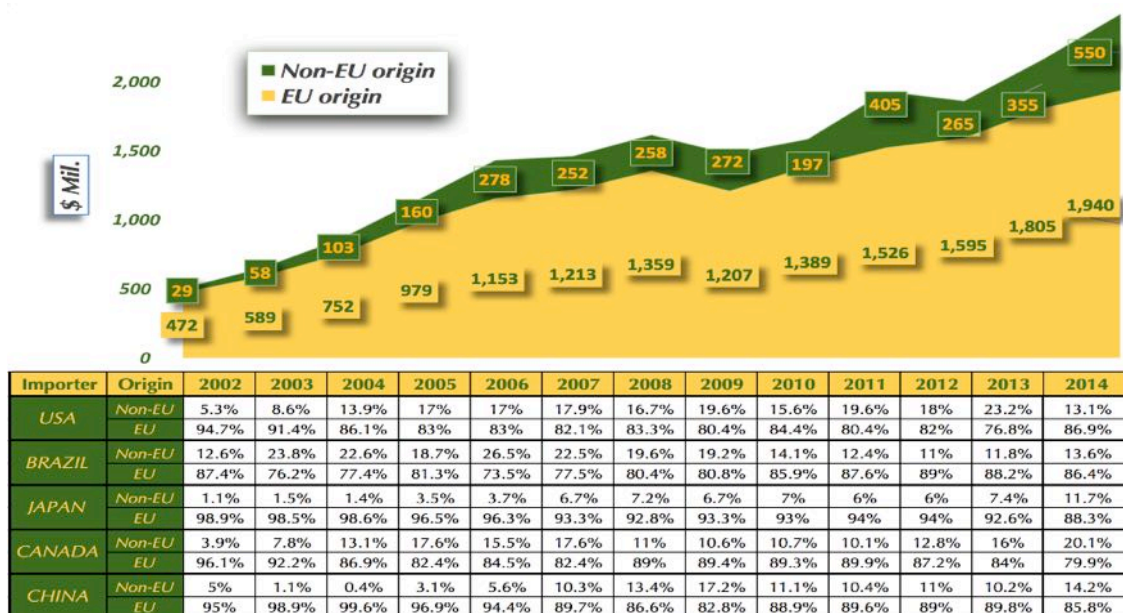|		2000		2008		2015		MFN Applied Tariff Rates
		$ Mil.	Share	$ Mil.	Share	$ Mil.	Share	
EU	Italy	928	46,4%	1.659	33,5%	1.876	29,9%	
	Spain	15	0,8%	194	3,9%	603	9,6%	
	France	194	9,7%	435	8,8%	448	7,1%	
	Germany	108	5,4%	272	5,5%	278	4,4%	
	Portugal	67	3,4%	174	3,5%	245	3,9%	
	United Kingdom	63	3,2%	201	4,1%	181	2,9%	
	Belgium	31	1,6%	71	1,4%	58	0,9%	
	Netherlands	16	0,8%	52	1,1%	54	0,9%	
	Total EU	**1.484**	**74,2%**	**3.284**	**66,3%**	**3.979**	**63,5%**	40%*
Non-EU	USA	263	13,1%	760	15,4%	926	14,8%	1.3%*
	Japan	60	3%	116	2,4%	236	3,8%	0%
	Brazil	17	0,9%	152	3,1%	224	3,6%	10%
	China	0	0%	41	0,8%	145	2,3%	10%
	Canada	37	1,8%	107	2,2%	133	2,1%	0%
	Russia	3	0,2%	44	0,9%	40	0,6%	5%
	Switzerland	30	1,5%	78	1,6%	79	1,3%	0%
	Australia	25	1,2%	55	1,1%	47	0,7%	0%
	S. Korea	4,5	0,2%	45	0,9%	48	0,8%	5%
	Total Non-EU	**515,7**	**25,8%**	**1.667,20**	**33,7%**	**2.286**	**36,5%**	

Source: UN Comtrade Dataset & World Integrated Trade Solution (WITS).
Notes: * Converted to tariff ad-valorem equivalents, using 2015 imports.

After thousands of years of pure dominance, the world is experiencing a remarkable growing demand for VOO, which is spreading beyond the Mediterranean region to non-traditional markets. In particular, countries such as the USA, Brazil, Japan, Canada, China have extensively increased their VOO consumption. Since the beginning of the millennium, while the total consumption of olive oil has increased up to 1.8-fold, the share of consumption of olive oil by non-EU countries has soared 4-fold to 45% of the world's consumption (IOC, 2016). The highest growth rate in consumption is recorded in Japan (1400%), and the biggest in terms of volume is the USA, which jumped from 88 to 308 thousand metric tons.

Obviously, the increase in demand for VOO is accompanied by a rise in imports to supply this consumption. The global imports of VOO, as reported in Table 8 account for USD 6.3 billion (2015). Excluding intra-EU trade, the rest of the worlds' imports of VOO accounts for 36.5% of the total imports. That represents a dramatic surge of over 500% since the beginning of the millennium. In 2015, the largest EU importers of VOO were Italy, Spain, France, and Germany, while outside the EU, the biggest importers are the USA with 14% of the global imports, followed by Japan, Brazil, China and Canada. Interestingly, the annual growth of VOO imports, in the non-EU countries, since the year 2000, is over 10%, with Brazil demonstrating the fastest annual growth rate of 22.9%, followed by Japan with 11.9%.

Figure 4: World imports of Virgin Olive Oil, By Origin, (Excl. Intra-EU Trade)

Importer	Origin	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
USA	Non-EU	5.3%	8.6%	13.9%	17%	17%	17.9%	16.7%	19.6%	15.6%	19.6%	18%	23.2%	13.1%
	EU	94.7%	91.4%	86.1%	83%	83%	82.1%	83.3%	80.4%	84.4%	80.4%	82%	76.8%	86.9%
BRAZIL	Non-EU	12.6%	23.8%	22.6%	18.7%	26.5%	22.5%	19.6%	19.2%	14.1%	12.4%	11%	11.8%	13.6%
	EU	87.4%	76.2%	77.4%	81.3%	73.5%	77.5%	80.4%	80.8%	85.9%	87.6%	89%	88.2%	86.4%
JAPAN	Non-EU	1.1%	1.5%	1.4%	3.5%	3.7%	6.7%	7.2%	6.7%	7%	6%	6%	7.4%	11.7%
	EU	98.9%	98.5%	98.6%	96.5%	96.3%	93.3%	92.8%	93.3%	93%	94%	94%	92.6%	88.3%
CANADA	Non-EU	3.9%	7.8%	13.1%	17.6%	15.5%	17.6%	11%	10.6%	10.7%	10.1%	12.8%	16%	20.1%
	EU	96.1%	92.2%	86.9%	82.4%	84.5%	82.4%	89%	89.4%	89.3%	89.9%	87.2%	84%	79.9%
CHINA	Non-EU	5%	1.1%	0.4%	3.1%	5.6%	10.3%	13.4%	17.2%	11.1%	10.4%	11%	10.2%	14.2%
	EU	95%	98.9%	99.6%	96.9%	94.4%	89.7%	86.6%	82.8%	88.9%	89.6%	89%	89.8%	85.8%

An additional trend is the gradual shift of VOO imports from traditional sources in the EU to 'New World' producing countries. Among these countries, the most noteworthy sources of VOO are Tunisia, Morocco, Syria, Turkey, and Algeria. Yet, growing demand is emerging from developed countries such as Argentina, Chile, USA, Australia, and others. By 2015, non-EU countries are responsible for approximately 40% of the world OO production. Moreover, the evidence presented in Figure 4 shows that between the years 2002 and 2014, excluding intra-EU trade, imports arriving from Non-EU exporters more than tripled their share in the global imports of VOO. Figure 4 displays the growth in the share of imports from non-EU sources in particular to countries such as the USA, Brazil, Japan, Canada and China. With the rise in the presence of non-EU producers on the international arena, these countries are beginning to exercise a more significant influence on designing trade policies.

2.2 Policy Measures Affecting the Trade of Virgin Olive Oil

With the exception of the EU, the global applied tariff rates on VOO are relatively low and range between 0 and 10%. 0% tariffs are applied on VOO imports entering Japan, Australia, Canada, Switzerland and others. While the USA imposes ad-valorem tariffs equivalent of 1.3%, the EU charge an equivalent tariff of approximately 40% (2015). Yet, only a negligible share of EU's imports is subject to full MFN rates, as the majority benefit from preferential trade agreements. Statistical evidence validates that while the average MFN tariff rates on VOO have declined from 9% in 2002 to 5.5% in 2015, the use of TBT and SPS measures affecting the VOO appear to be on the rise (Figure 5).

The regulatory landscape is filled with wide range of NTMs, which partly serve to protect domestic producers against foreign competition, but undeniably also act to improve the quality of VOO products entering local markets. Such measures are designed to protect human health, increase consumers' welfare, afford adequate information and increase risk assurance for consumers, as well as provide protection from counterfeit. Numerous examples of illegal products confiscated, after failing to follow national standards, were reported in recent years. To combat such endeavours, countries apply a broad range of regulations and procedures, among which labelling requirements,

standards and marketing order, as well as food safety regulation. While often these policy measures are grouped as SPS or TBT measures, the proposed research allows to differentiate between sub-groups of NTMs in order to examine the effective impact of each individual measure on VOO imports.

Figure 5: Evolution of NTMs & MFN Applied Tariffs on Virgin Olive Oil
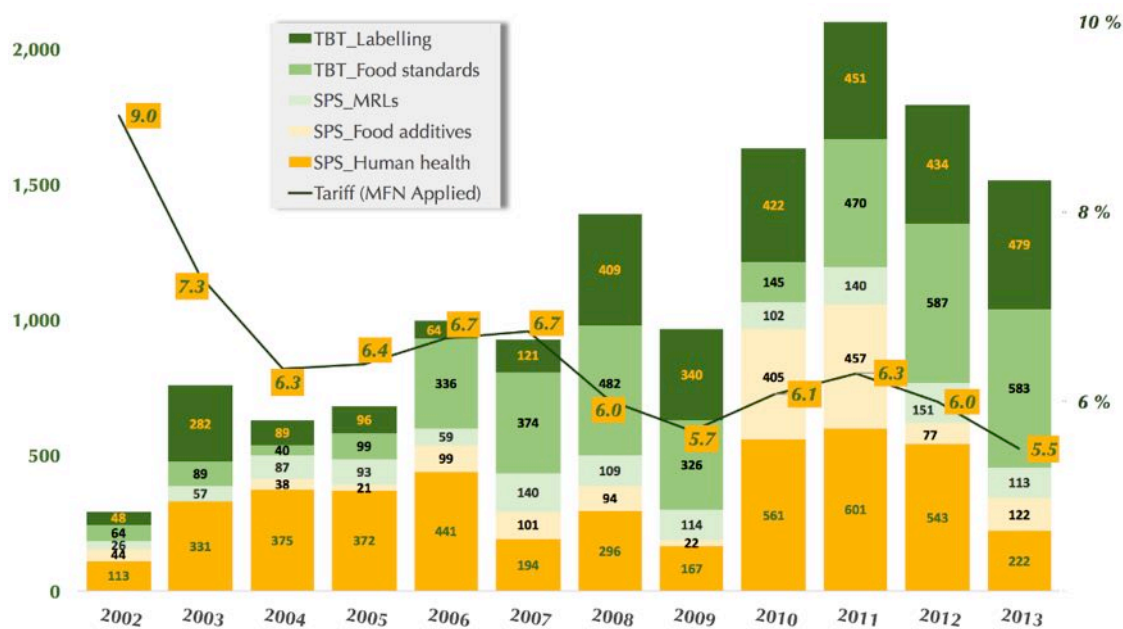
Source: Authors calculations based on data of the World Bank and WTO I-TIP.

The global minimum requirements for olive oil are covered by the Codex Alimentarius Standard for Olive Oils and Olive Pomace Oils. Also known as the "Food Code", it aims to develop science-based harmonized international food standards, to protect consumer health and promote fair practices, in the least trade-distorting manner. The Food Code covers composition and quality factors for various types of olive oil, including food additives, contaminants, labelling requirements, physical features and methods of analysis and sampling. Evidence show that not only that food safety standards imposed by developed countries are stringent compared to the Food Code, but also, these standards have become increasingly stricter over time.

For example, Maximum Residue Limits (MRLs) were introduced to control harmful damage caused due to the widespread dissemination of pesticides for improving agricultural productivity. In general, MRLs are determined by national regulatory agencies, whether on their own or based on

the Food Code. The European Regulation from 1991 and its amendments from 2015 classifies eight quality categories of olive oil to define which may be granted access to the EU market. Similarly, Australia and Japan have MRLs which are more stringent than the Codex MRLs, whereas other countries set their standards near or follow the exact Codex wordings.

Another example of a NTMs may be the labelling requirements, which were originally intended to provide better traceability information, but also inform more knowledgeable consumers regarding their preferences. Along with labelling requirements, there is a growing importance of organic and fair trade schemes, which resulted in the demand to follow organic certification requirements. For instance, for the olive oil to be marketed as organic-certified in the EU, it must contain the EUs organic logo, after complying with the EU regulation for organic farming and marketing.

3. Literature Review

An extensive literature on the effects of NTMs on import flows has evolved in the last two decades, primarily due to the proliferation in the use of trade-related regulatory measures. Supplementary conceivable explanations involve the global reduction of tariffs; the growing demand for transparency and reporting requirements on the application of NTMs by WTO; and the harmonization of regulations, as a result of PTAs signed and implemented by various countries. Lastly, the valuable advancement in estimation methodologies allow the quantification of trade impact of NTMs and provide a strong base for comparison across countries or within sectors.

The economic literature, however, provides an indecisive response regarding how and to what extent these policy regulations, affect trade in the myriad of agriculture or food products. Particularly, it is often uncertain whether these regulatory measures necessarily hamper trade, mainly through the associated compliance costs of stringent regulations. Alternatively, these measures may raise consumers' confidence in the safety associated with the product, while creating a positive feedback which. This may result in the expansion of imports of a particular product which has initially been subject to a stringent measure.

The ambiguous trade effect of NTMs evidently differs across sectors, and varies among countries, depending on the economic development level. Disdier et al. (2008), examine the impact of SPS and TBT on 30 disaggregated Agri-food products imported to OECD members and find a sig-

nificantly adverse effect on 10 industries. Yet, SPS and TBTs can have no impact (as found in 12 industries) or even a positive effect, as these measures carry information and provide confidence in the imported products. While OECD exporters are not significantly affected by SPS and TBTs in their exports to other OECD countries, developing and least developed countries' exports are negatively and significantly affected. Furthermore, EU imports seem to be more negatively influenced by tariffs and SPS and TBTs than imports of other OECD countries.

In the large share of surveyed literature, a trade-reducing impact of food safety standards on Agri-food products is observed. In particular, the heterogeneity of standards is associated with an adverse effect on trade. Winchester et al. (2012) validate the significant trade-restrictive effect of stringent MRLs for plant products in importing countries compared to exporting countries. Further, Chen et al. (2006) determine that in developing countries, the testing procedures and lengthy inspection times significantly reduce firms' propensity to export to developed countries, predominantly in agricultural firms. Moreover, the compliance costs associated with SPS measures tend to create a comparative disadvantage for the small and medium-sized firms. Fontagné et al. (2013) show that SPS compliance costs create market entry prohibition and increase the probability to exit the restricted market by 2%.

By contrast, several scholars acknowledge the trade-enhancing effects of NTMs due to their beneficial impact on public health, well-being, animal welfare, food safety and sustainable environment. Josling et al.(2004) find that in nations where consumer awareness to such features is valued, demand is stimulated for products under such policies. Another key channel through which NTMs may positively affect trade flows is the correction of market imperfections (Thilmany and Barrett, 1997). Moreover, as countries differ in their capacity to meet with foreign standards, some countries may enjoy a competitive advantage. Henson and Jaffee, (2008) show that exporters facing stricter food safety standards incur compliance costs which may be offset by benefits from the enhancement of food management capacity. Supplementing this, Swinnen and Vandemoortele (2011) acknowledge the trade-augmenting role of food standards, and Chevassus-Lozza et al. (2008), report positive trade effects of sanitary measures, despite some negative or insignificant impacts of phytosanitary and quality measures.

Xiong and Beghin (2014) highlight the gradually challenged 'standards-as-barriers' perception, by the 'two faces of standards' approach. Consequently, even if there is a cost involved in comply-

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ing with standards, the trade-enhancing effects may be larger. The effects of MRLs regulations imposed by high-income OECD countries jointly enhance the import demand and hinder foreign exporters' supply. Although the net effect is positive for most countries, it is smaller for developing countries. This implies that exporters from developing countries face greater difficulty than their competitors from developed countries when food safety standards exist in export markets.

In his review of the economic literature and surveys on the trade effects of international and national standards as well as regulations of various products, across countries, Swann (2010) provides valuable insights. First, compared to national standards and regulations, which tend to negatively impact imports, in most of the economic literature, international standards and regulations are found to have a positive effect on imports. With respect to data based on surveys, the effects of national standards on imports can be either positive or negative. Nevertheless, the effects of national regulations on domestic imports are mostly found to be negative.

Michalek et al. (2005) analyse the effects of three EU approaches for dealing with TBTs for the new member states (CEEC) and the Mediterranean countries. Their results suggest that the Harmonization Approach and the New Approach are likely to increase trade, while the Mutual Recognition approach (MR) tends to reduce trade. The effect of MR may seem surprising, since supportive studies find it the most efficient method to overcome TBTs. Their interpretation highlights the reverse direction of causation connection, i.e. that MR may be introduced in sectors when trade flows are relatively low but there are few TBTs, meaning little to be gained from a policy other than MR.

As increased cooperation among countries reduces regulation heterogeneity, importers may gain market share at the expense of domestic producers. Liu and Yue (2012) argue that the EU's adoption of the Hazard Analysis Critical Control Point (HACCP) standard was a catalyst for orange juice imports. It resulted in increased imports, reduced sales of domestic producers, and improved consumer welfare. By contrast, Anders and Caswell (2009) find a negative effect of a HACCP food safety standard on the overall seafood imports. However, a differentiation by exporting country shows negative effects for developing countries, but positive effects for developed countries.

Drogué and Federica (2012) finds that reducing the heterogeneity between MRLs has a trade-enhancing impact on apples and pears, however, the impact differs depending on the exporter. Nevertheless, regulatory harmonization where previously a country did not have a standard may imply new or higher costs for existing producers and an increase in the stringency. This was the case with

the harmonization of MRLs for aflatoxin in the EU in 2002, which meant that aflatoxin standards became more stringent in most countries (Xiong and Beghin 2012; Otsuki et al. 2001). According to the latter, the new EU regulation on aflatoxins will reduce trade flows by 63% compared to when the Food Code standards are followed.

In recent years, several attempts have been undertaken to study the effects of various regulatory policies on consumers' willingness to pay (WTP) for OO across and within countries. Labelling and Geographical Origin Certification seem to affect consumers' purchasing decisions. Menapace et al. (2011) underline that EU consumers have a greater WTP for Geographical Indication (GI) than non-GI labelled products. Dekhili et al. (2011) assert that 'official cues' are more important for consumers of non-producing countries, whereas consumers from producing countries choose OO based on origin and 'sensory cues' (e.g., colour and appearance). The Origin information and traceability as reported on the label is important as consumers are increasingly concerned about food safety (Krystallis and Ness, 2005). Higher value is also placed on quality assurances, such as MRLs, and 'Protected Designation of Origin' labels, which improve the signalling of credence to consumers (Combris et al.,2010).

Sandalidou et al. (2002) find that the 'Organic certification' of OO in Greece is positively perceived by consumers, irrespective of the continued unsatisfactory level of information. Gil and Sofer (2006) observed that information about the conventional product ("reference price") increased the perceived value of the Organic OO for Spanish consumers. Cicia et al. (2005) valued at one euro per bottle the attribute of Italian product origin (COOL) ascribed by Italian consumers. Dekhili and d'Hauteville (2009) highlight consumers' preference for traditionally known brands and private labels. By contrast, Kavallari et al. (2011) find that bulk olive oil is more likely to enter the German and the UK markets compared to similar packaged and branded products.

As seen in the review, the extensive and divergent studies which were reviewed reinforce the assertion that some regulatory measures are not necessarily protectionist, and at times actually boost imports. Yet, empirical validation regarding the impact of a wide range of regulatory measures on a particular agriculture sector is rare. The current research attempts to fill this gap by empirically studying the influence of various subgroups of SPS and food related TBT measures on the virgin olive oil sector. In particular, it encompasses a large dataset of national regulations in order to underpin further their trade-enhancing impact on imports of VOO during the years 2002-2014.

4. Econometric Methodology and Data

In the empirical econometric analysis, the determinants of imports of VOO are examined with respect to various explanatory variables. Among these variables, some are directly related to the olive oil sector, such as production, tariffs and NTMs which fall under the broad umbrella of the TBT and SPS practices, while others variables are standard in gravity modelling. The size of the sample which was developed for this purpose is comprised of approximately 2,600 observations, encompassing imports panel data of 160 importing countries, during the years 2002 to 2014.

The econometric methodology applied in this analysis is the following:

$$
\begin{aligned}
ln\,\text{IMPORTS}_{ijt} \\
= \alpha_{i,n}^1 ln\text{GDP}_{it} + \alpha_{i,n}^2 ln\text{PROD}_{jt} + \alpha_{i,n}^3 ln\text{GDPpc}_{it} + \alpha_{i,n}^4 ln\text{TARIFF}_{it} \\
+ \alpha_{i,n}^5 ln\text{DIST}_{ijt} + \alpha_{i,n}^6 ln\text{POP}_{ijt} + \alpha_{i,n}^7 \text{Comlang}_{ijt} + \alpha_{i,n}^8 \text{Contig}_{ijt} \\
+ \alpha_{i,n}^9 \text{Comcur}_{ijt} + \alpha_{i,n}^{10} \text{RTA} + \alpha_{i,n}^{11} \text{NTM}_{xijt} + \varepsilon_{i,n}
\end{aligned}
$$

For the purpose of this study, a log-linear transformation of the ordinary least squares (OLS) model has been employed. The dependent variable in all the specifications is *ln* IMPORTS *ijt*, which is the natural logarithm of the import values of VOO to country *i* from country *j* in a particular year *t*. From an empirical perspective, both the presence of zero flows and heteroskedasticity in the idiosyncratic error term are matters to take into consideration due to their possible effect on gravity-type estimations (Silva and Tenreyro, 2006). The solution to that has been to add an additional estimation using a Tobit model to correct for the presence of zero trade flows bias (Martin and Pham, 2008). Moreover, the paper assumes an additive error in specification and estimates the model using the Poisson pseudo-maximum likelihood estimator (PPML).

The econometric analysis is comprised of a vector of variables, which may account for control variables explaining the imports of VOO. The first control variable in the analysis is denoted as *ln*GDP*i,t* , which is the natural logarithm transformation of the Gross Domestic Product (GDP) of the importing country *i* in a particular year *t*. As the theory predicts, the correlation between imports of VOO and the variable is expected to be positive and significant, in line with the view that larger markets foster higher volumes of trade. The second major control variable is Production (denotes

*ln*PROD*j,ti)*, which represents the output of VOO, allowing to capture the exporting country's supply capacity. A positive coefficient for production of is expected, in line with the view that larger producers export higher volumes of VOO. The variable *ln*GDPpc*i,t* , represents the GDP per capita in the importing country *I*, and is likely to be positive since increasing income lead to higher demand for VOO.

The fourth control variable is denoted as *ln*(1+TARIFF*i,n*), which is a vector of the Most Favoured Nations (MFN) applied tariffs on VOO. Specifically, it provides the tariff rates on the 6-digit HS classification 150910. Data is provided for each of the importing country, depending on the source of import (i.e. a particular importing country may have dissimilar applied tariff rates to two exporting countries, depending on benefits granted by different trade agreements). As the theory predicts, the correlation between imports and tariffs is expected to be negative and significant, since the higher a tariff rate (i.e. higher costs on imports), the smaller the demand for VOO.

Several additional gravity variables were extracted from the CEPII database (Mayer and Zignano, 2011). 'Distance' is measured in km between the sample countries economic centres. Common language, currency and contiguous are dummy variables that take the value 1 when two countries share the same language, currency or are contiguous, correspondingly, and zero otherwise. In all cases, proximity among countries contributes to decreasing transaction costs and enhances imports. An additional dummy variable RTA takes the value 1 if a regional trade agreement exists between the importing and the exporting countries, to reflect the positive influence on imports of the recent proliferation of trade agreements in the last three decades. Therefore, except for distance, the coefficient signs are expected to be positive and significant.

As mentioned, the most significant set of variables is the NTMs, which were obtained following a careful analysis of hundreds of relevant regulations, extracted from I-TIP. The entire database provides information on over 25,000 measures, which were screened to identify only the particular regulations containing SPS and food related TBTs that affect trade in VOO. The regulations were allocated to four subgroups which fall under the scope of the TBT measures, and three subgroups which fall under SPS measures. Each dummy variable takes the value 1 if a particular policy measure imposed by an importing country *i* affects the exports of VOO from country *j*. It is important to note that these dummy variables indicate the mere existence of particular regulatory measures, over time, regardless the stringency level or (dis)similarity of these regulations among countries.

5. Estimation Results

5.1 Regression Results – Virgin Olive Oil

The results of the regression analysis for the entire sample of countries are presented in Table 9. The first two columns report OLS estimates in log form; however, the second column adds a list of dummy variables, which represent the impact of NTMs on the imports. The third column presents Tobit estimates, and the fourth column reports PPML estimates. Lastly, year fixed effects were added to all the specifications, to control for considerable seasonal fluctuations and climate sensitivity on olive cultivation, which may potentially bias the results.

While the estimated coefficients from the OLS and the Tobit models are relatively similar, most coefficients obtained from the PPML model differ from those obtained with the other model. The substantial advantage of the PPML model is that it allows us to deal with sample selection bias that may result from excluding zero observations. Although selection bias rarely affects the sign of the variable, it often influences the magnitude, statistical significance and economic interpretation of the marginal effects (Haq et al., 2013). In the rest of this subsection, unless specified otherwise, the results refer to the estimates from the PPML model. Notably, once the NTMs are introduced, the goodness-of-fit as measured by R-squared increase by a supplementary of 18% and 7.7% in the OLS and PPML specifications, respectively.

The estimation coefficients of 'TARIFF' are found to be negative and economically significant, however, the magnitude varies according to the specifications. While a relatively small impact of 1.6% is found in the basic OLS, adding the impact of NTMs increases its negative elasticity to 6.4% to 6.8% (OLS and the Tobit specification, respectively). Parameter estimates of GDP are statistically significant and have the expected positive sign. The results concerning VOO supply as captured by 'Prod' underline the substantial and positive contribution of olive oil production at the exporting country on imports of VOO. The estimates are statistically significant and range between 96% and 97% in the first two specifications, and 8% at the PPML model.

With respect to the gravity variables, the estimates are in line with previous studies (Disdier, et al., 2008 and Grant and Boys, 2012). The role of geographical distance is inversely related to imports of VOO; however, significantly larger when using OLS and Tobit estimators. The estimated elasticity is approx. between 0.77-0.79, whereas the PPML estimate is much lower (0.067). As seen

in most of the literature, socio-economic variables such as GDP per capita are main determinants of consumer's willingness to pay a premium for healthier olive oil (Gil and Soler, 2006). The difference in the size of the population between the importing country and the exporting country of VOO is found to influence positively and statistically significant. Lastly, the variables 'Comlang' and 'Contig' are statistically significant, at the 1% level, and positively impact imports of VOO as expected. Surprisingly, 'Comcur' is likely to negatively affect imports of VOO, and 'RTA' does not meaningfully affect such imports.

As the hypothesis suggests, the estimated coefficients of the Sanitary and Phytosanitary measures, if statistically significant, are found to be positive. The most predominant sub-category of NTM is the MRLs requirements with estimated coefficients which are statistically significant and positive. Generally, 'MRLs' enhance the import demand by reducing the potential risks caused by pests, and ensuring higher food safety, but it also expected to reduce export supply by imposing additional controlling costs. The net effect of MRLs as expected is stronger for the former. The effect of 'Human health' is found to be positive and statistically significant at 10% level of statistical significance, however, it affects VOO imports to a lesser extent compared to 'MRLs'. Analysing the trade effects of TBTs reveals that 'food standards' is the only sub-category that has a statistically significance and positive effect in all specifications. Interestingly, TBT measures that focus on labelling requirements were found insignificant in all the models.

Finally, it should be expressed that the estimations are to be interpreted with some caution, given that they reflect the underlying assumptions of the models, databases and the particular policy specifications which have been modelled, as detailed in the paper.

Table 9: Regression Results

	OLS (No NTMs)	OLS	Tobit	PPML
ln GDP	0.179*** (3.95)	0.177*** (3.99)	0.167*** (3.93)	0.017*** (4.12)
ln PROD	0.789*** (36.75)	0.969*** (49.83)	0.957*** (51.15)	0.080*** (47.86)
ln GDPpc	0.683*** (11.91)	0.726*** (11.13)	0.744*** (11.88)	0.055*** (9.16)
ln TARIFF	-0.016*** (-6.08)	0.068*** (-10.31)	-0.064*** (-9.98)	-0.006*** (-8.15)
ln DIST	-0.481*** (-6.88)	0.792*** (-14.82)	-0.768*** (-14.97)	-0.067*** (-13.83)
ln POP	0.506*** (12.27)	0.701*** (17.80)	0.700*** (18.53)	0.054*** (14.02)
Comlang	1.696*** (16.11)	1.147*** (10.27)	1.149*** (10.70)	0.097*** (8.54)
Contig	1.076*** (4.12)	1.511*** (8.20)	1.525*** (8.69)	0.105*** (7.89)
Comcur	-0.260* (-2.07)	-0.253* (-2.15)	-0.233* (-2.06)	-0.018 (-1.67)
RTA	-0.136 (-1.09)	0.051 (0.40)	0.02 (0.16)	0.007 (0.59)
SPS MRLs		0.390** (3.08)	0.374** (3.09)	0.040*** (3.69)
SPS Human Health		0.293** (2.61)	0.270* (2.51)	0.023* (2.55)
SPS Food Additives		-0.172 (-1.65)	-0.16 (-1.61)	-0.009 (-1.01)
TBT Food Standards		0.305*** (3.41)	0.313*** (3.65)	0.022** (3.02)
TBT Conformity Ass.		-0.21 (-0.43)	-0.276 (-0.59)	-0.01 (-0.24)
TBT Consumer Info.		0.15 (0.61)	0.148 (0.63)	0.021 (1.01)
TBT Label		0.005 (0.06)	0.007 (0.09)	-0.003 (-0.45)
R2	0.453	0.633		0.639
N	2,601	2,601	2,601	2,601

Notes: t statistics in parentheses. p-value (* p<0.05, ** p<0.01, *** p<0.001)

5.2 Regressions Results – Virgin Olive Oil, EU vs. Non-EU

This part of the paper disentangles the impact of various NTMs on imports of VOO, according to the major import sources. The two clusters are the EU exporting countries of VOO to Non-EU markets and other VOO manufacturers who export to EU markets. This exercise aims to examine whether "a retaliation effect" exist, that is to say, non-EU exporters may face tougher import regulation compared to the regulatory requirements imposed on EU exporters due to the growing presence of the former in VOO arena. Notice that the sample used for EU exporters excludes internal EU trade flows, to avoid the positive effect associated with regulatory homogeneity in the EU single market.

The results of the comparison are presented in Table 10. The estimations which proxy the supply side of the equation, are relatively similar in terms of magnitude and direction to the EU exporters, which is not surprising given that most VOO exporters are Europeans. The estimated coefficients of GDP were significantly trade-enhancing for non-EU exporters, yet meaningless for EU exporters. Nevertheless, the level of income per capita of the importing country is positive and likely to affect more significantly the EU exporters, compared to non-EU exporters. Concerning the geographical and supplementary gravity variables, the impact is fairly similar to the previous findings.

The results of the analysis, seem to reject the "retaliation effect" proposition, since both groups of exporters face a relatively similar adverse effect of tariff barriers. The coefficients found in the OLS model and the Tobit specification imply that a 1% tariff reduction is associated with 6-7% higher VOO imports. In terms of economic magnitudes, it means that an increase in tariffs from 1% to their mean level of 6.5% (a 550% increase) decreases VOO imports by 37%, which is a considerable impact.

More importantly, the coefficients of NTMs, despite the asymmetrically impact on exporters according their source, are found to effect VOO imports positively. In particular, EU exporters enjoy a significantly positive effect of MRLs requirements; mainly due to their capacity to meet stricter requirements in their neighbour EU markets. Similarly, SPS measures dealing with food additives are found to affect EU exporters positively, yet when imposed by the European Commission, they adversely affect non-EU exporters. TBT measures in the form of food standards are associated with 3.1% higher imports of VOO, yet insignificantly affect imports from EU producing countries.

Table 10: Regression Results, EU vs. Non-EU Exporters

	EU Exporters			Non-EU Exporters		
	OLS	Tobit	PPML	OLS	Tobit	PPML
ln GDP	0.027 (0.26)	0.058 (0.62)	0.008 (0.92)	0.337*** (4.64)	0.314*** (4.52)	0.033*** (4.73)
ln PROD	0.953*** (26.98)	0.927*** (27.77)	0.077*** (23.19)	0.683*** (13.58)	0.679*** (14.09)	0.065*** (13.94)
ln GDPpc	1.148*** (9.57)	1.119*** (10.00)	0.080*** (7.17)	0.233* (2.11)	0.261* (2.46)	0.02 (1.89)
ln TARIFF	0.067*** (-8.02)	0.061*** (-7.68)	-0.006*** (-6.05)	0.067*** (-5.45)	-0.064*** (-5.44)	0.007*** (-4.58)
ln DIST	0.621*** (-5.40)	0.592*** (-5.51)	-0.046*** (-4.64)	-0.495*** (-4.78)	-0.463*** (-4.65)	0.050*** (-4.89)
ln POP	0.837*** (8.84)	0.794*** (8.98)	0.057*** (6.16)	0.423*** (7.03)	0.436*** (7.57)	0.039*** (6.93)
Comlang	1.555*** (7.37)	1.494*** (7.61)	0.118*** (5.93)	1.169*** (6.81)	1.176*** (7.13)	0.112*** (6.65)
Contig	1.076* (2.08)	1.061* (2.21)	0.086** (2.71)	1.480*** (3.74)	1.527*** (4.05)	0.117** (2.90)
Comcur	-0.1 (-0.47)	-0.099 (-0.50)	-0.007 (-0.38)	-0.394 (-1.83)	-0.331 (-1.60)	-0.036 (-1.62)
RTA	0.373 (1.73)	0.374 (1.87)	0.032 (1.53)	0.22 (1.00)	0.16 (0.77)	0.023 (1.19)
SPS MRLs	0.688*** (3.51)	0.653*** (3.58)	0.048*** (3.41)	0.336 (1.71)	0.335 (1.79)	0.03 (1.80)
SPS Food Additives	0.348 -1.88	0.338 -1.95	0.029 -1.84	-0.525** (-2.68)	-0.483* (-2.58)	-0.042* (-2.39)
SPS Human Health	0.292 (1.55)	0.287 (1.63)	0.023 (1.49)	0.592** (2.66)	0.510* (2.39)	0.054* (2.44)
TBT Food Standards	0.005 (0.03)	0.028 (0.20)	-0.003 (-0.24)	0.420* (2.57)	0.433** (2.78)	0.035* (2.48)
TBT Consumer Info.	-0.153 (-0.45)	-0.065 (-0.21)	-0.013 (-0.40)	0.526 (1.34)	0.419 (1.12)	0.059* (1.97)
TBT Conformity Ass.	-0.505 (-0.81)	-0.646 (-1.11)	-0.028 (-0.49)	0.035 (0.04)	0.02 (0.03)	0.013 (0.23)
TBT Label	-0.054 (-0.36)	-0.012 (-0.09)	-0.012 (-0.97)	0.02 -0.14	0.05 -0.29	-0.005 (-0.33)
R2	0.722		0.694	0.403		0.417
N	669	669	669	976	976	976

Notes: t statistics in parentheses. p-value (* p<0.05, ** p<0.01, *** p<0.001)

6. Conclusions

The paper aims to examine, whether, and to what extent, NTMs can serve as trade boosters rather than create unnecessary trade barriers. To perform such analysis, the paper provides an empirical framework which incorporates all bilateral imports of virgin olive oil (VOO) during the period of 2002-2014. It examines a spectrum of possible determinants, which can explain the trade flows of VOO, while further investigating beyond the realm of the traditional trade policies. Predominantly, it focuses on the actual impact of a wide range of regulatory measures on the imports flow. This dataset of NTMs was extracted following a detailed screening process of all potential regulations affecting VOO. This provides an opportunity to identify which type of regulatory measure affects the level of bilateral trade the most. Moreover, it allows to differentiate which regulatory instruments could be associated with trade-enhancement, and which policy measures impede trade.

At the outset, the analysis highlights the restrictive role of tariffs on VOO imports. Further, it validates the positive impact of most of the gravity explanatory variables. As The results of this study validate the hypothesis of this paper, that while serving legitimate public policy objectives, the majority of NTMs actually do not necessarily impose restrictiveness on imports. The results highlight the statistically and economically significant support for the demand-enhancing effect of regulatory measures, and in particular of MRL requirements. Likewise, a significant positive contribution is associated with human health regulations and food standards. Furthermore, a differentiation by source of VOO exporters, uncovers the asymmetrical yet, positive impact of NTMs on VOO imports. EU countries are affected mainly by MRL regulations, while "New World" producing countries are positively affected by human health requirements and adversely affected by the EU's food additives regulations.

These findings have two policy implications. First, despite the extensive heterogeneity among countries regarding the implementation of various regulatory measures, in fact, the mere existence of regulations does not necessarily impede international trade in their cumulative effects. Second, the implementation of measures related to food safety, human health, information and transparency, may, in turn, actually expand the magnitude of trade amid countries.

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Appendix

Table 11: Variables and Sources

Variable	Definition	Source
IMPORTS	Bilateral Imports of Virgin Olive Oil ($), HS Classification 150910	The World Integrated Trade Solution (WITS), The World Bank
TARIFF	MFN applied tariffs, of Virgin Olive Oil, HS classification 150910	The World Integrated Trade Solution (WITS), The World Bank
NTMs	TBT / SPS Measures, By Subgroups, Dummy Variable	The Integrated Trade Intelligence Portal (I-TIP) World Trade Organization
PROD	Production VOO, Crops processed (1,000 tonnes)	Food and Agriculture Organization (FA-OSTAT)
CONS	Consumption of Olive Oil	International Olive Council (IOC)
GDP	Gross Domestic Product, Current prices (Bil. $)	International Monetary Fund (IMF)
GDPpc	Gross Domestic Product per capita, in current prices ($)	International Monetary Fund (IMF)
DIST. POP. Comlang Contig Comcur RTA	Distance between capitals (km). Population (mil.) Common Language, dummy. Countries are Contiguous, dummy. Common Currency, dummy. Regional Trade Agreement, dummy.	Centre d'Etudes Prospectives et d'Informations Internationales (CEPII)
D_EU	Dummy Variable 0=Non EU Member States. 1=EU Member State	The European Commission
Year FE	Fixed effects of years	
Exporter FE	Fixed effects of exporters	

Table 12: Statistical Description

Variables	Mean	Std. Dev.	Min	Max	Observations
IMPORTS	3,594	33,266	0	1,118,144	12,100
TARIFF	6.54	12.9	0	261	9,006
GDP	104,994	2,595,613	184	16,700,000	11,849
PRODUCTION	166	337.3	0	1,615	1,977
GDPpc	28,291	17,056	223.6	114,665	11,923
CONSUMPTION	251	261.3	0	848	7,722
SPS MRLs	0.1909	0.393	0	1	6,238
SPS Food Additives	0.2373	0.425	0	1	6,238
SPS Human Health	0.6759	0.468	0	1	6,238
TBT Food Standards	0.5763	0.494	0	1	6,238
TBT Consumer Info.	0.0348	0.183	0	1	6,238
TBT Conformity Ass.	0.0053	0.073	0	1	6,238
TBT Label	0.5186	0.45	0	1	6,238