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Abstract

In this paper, we examine the relevance of non-tariff measures (NTMs) at the 6-digit level of the Harmonised System over the period 2002-2011 by estimating ad valorem equivalents. We draw on information of NTMs notified to the WTO from the Integrated Trade Intelligence Portal (I-TIP), distinguishing various NTM types, such as technical barriers to trade and sanitary and phytosanitary measures. To assess whether NTMs facilitate or impede trade across countries we apply a gravity approach, which allows calculating implied ad valorem equivalents of NTMs for about 100 WTO member countries. Evidence of these AVEs is provided differentiated by NTM types, income groups, industries and product categories.

Keywords: non-tariff measures, trade barriers, ad valorem equivalent, gravity model, I-TIP

JEL classification: F13, F14

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1. Introduction

At least four developments have stimulated discussions on the use of non-tariff measures (NTMs) as trade policy tools. First, while global average tariff rates have decreased by about half since the mid-1990s, there is a general trend towards an increasing use of NTMs, provoking the question whether NTMs might be implemented as substitutes for tariffs (e.g. Moore and Zanardi, 2011; Aisbett and Pearson, 2012; Beverelli et al., 2014).

Second, particularly during the recent global economic and financial crisis, one observes an abrupt increase in the number of NTMs notified to the World Trade Organisation (WTO), as is shown in Section 2. Global trade expanded rapidly in the years before the crisis but has more or less stagnated in the years since 2011, after having picked up again after the 'great trade collapse' in 2009. The sluggish growth of world trade since then is spreading the fear of a rise of new protectionist schemes (e.g. Baldwin and Evenett, 2009; UNCTAD, 2010; Kee et al., 2013) that dampen investment activities and trade, thereby indirectly decelerating the economic recovery from the crisis.

Third, the number of trade agreements having been negotiated since the early 1990s – predominantly bilateral free trade agreements – has increased tremendously. Yet, not only their number but also the depth of their agendas has increased considerably (Dür et al., 2014) – shifting the focus away from tariffs to issues of investment, dispute settlement and non-tariff measures.

Finally, standard setting and non-tariff measures feature prominently in negotiations of and public discussion around the 'Big 3' megaregional deals: the Transatlantic Trade and Investment Partnership (TTIP) between the EU and the US, the Transpacific Partnership (TPP) centred around the US, and the Regional Comprehensive Economic Partnership (RCEP) including China (e.g. Egger et al., 2015; Berden and Francois, 2015). As the negotiating trading partners account for about 80% of world GDP, 75% of world trade and more than 60% of the world population[1], debates on global standard setting (e.g. Hamilton and Pelkmans, 2015), the political economy of trade policy (e.g. Moore and Zanardi, 2011) and the risk of politics undermining multilateralism (e.g. Winters, 2015) are spurred.

Yet, non-tariff *measures* need not be non-tariff *barriers*. The impact of NTMs on trade can be negative or positive. If NTMs increase fixed or variable costs along the production and supply chain, everything else equal, they result in higher prices and potentially in a fall in import demand. For some NTM types, such as quotas and prohibitions, the effect on trade is negative by design. However, for other NTM types, such as sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBTs), also a trade-promoting effect can be expected. In particular, it is widely agreed that in the presence of information asymmetries, the imposition of NTMs (e.g. labelling) can increase consumer trust, decrease transaction costs and promote trade. Furthermore, some NTM types bear the potential of increasing product quality, e.g. through a minimum quality standard, thereby positively affecting trade. Finally, the imposition of a new NTM might contribute to a regional harmonisation of NTMs, fostering trade relations. To summarise,

1 The World Bank, 'World Development Indicators': http://databank.worldbank.org/data/home.aspx, wiiw calculation.

'trade will increase or fall depending on whether the positive effect on demand is greater than the negative effect on supply' (WTO, 2012, p. 136).

Recently, a new research field has developed, trying to compare trade effects of NTMs with the impact of tariffs by computing ad valorem equivalents of non-tariff measures. Many studies focus on the trade effects for specific products, resulting from the imposition of a specific NTM for a group of countries (e.g. Rickard and Lei, 2011; Nimenya, 2012; Arita et al., 2015). A few studies cover a wide range of products and trading partners (e.g. Dean et al., 2009; Kee et al., 2009; Cadot and Gourdon, 2015). However, to the best of our knowledge, none of the latest studies allows for a differentiation of importer-specific effects across different NTM types.

NTMs differ greatly by their purpose and design. For example, measures targeting subsidised exports differ strongly from measures establishing maximum residue limits of pesticides on agricultural products. Likewise, the labelling requirement on the energy consumption level of manufactured goods cannot be directly compared to import quotas. Given that about 40% of all imported products targeted by NTMs in our sample are facing multiple NTM types, it seems to be particularly important to make a distinction between the trade effects of different NTM types. Depending on the economic structure of the NTM imposing country, we also expect the effects to differ by country. Goldberg and Pavcnik (2016) make the point that the inability to measure different forms of non-tariff barriers that are replacing traditional trade policy tools such as tariffs has contributed to the perception that trade policy does no longer matter.

This paper contributes to filling these gaps in the literature by using a rich data compilation of WTO notifications. The WTO provides comprehensive data on NTM notifications via the Integrated Trade Intelligence Portal (I-TIP). Ghodsi et al. (2016c) enhanced the value of this database for economic analysis by matching missing product codes to these notifications. Drawing on this information, this paper distinguishes between several categories of NTMs, with special attention given to the analysis of sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBTs), which account for more than 80% of all NTM notifications to the WTO. Furthermore, working with this unique dataset allows evaluating the trade effects of NTMs by means of an intensity measure, i.e. by counting how many NTMs a specific importing country imposed against a trading partner for each product at the 6-digit level of the Harmonised System (HS). Using this intensity measure, we estimate the impact of NTMs on imports to the NTM-imposing country by means of a gravity framework. Allowing for both import-promoting and import-impeding effects of NTMs, we calculate the ad valorem equivalent (AVE) of each NTM type for each imposing country at the 6-digit product level of the Harmonised System over a sample of 118 importers and 5,221 products for the period 2002-2011.

The remainder of this paper is structured as follows. Before delving into the literature and subsequent analysis, Section 2 describes the NTM types entering our analysis as well as their evolution over time. This shall give a better understanding of why effects of NTMs differ across studies depending on the types of NTMs analysed. Sections 3 gives a brief overview of the literature. Section 4 describes the data and methodology to estimate AVEs. Section 5 presents empirical results while section 6 discusses the robustness of the findings. The final section concludes.

2. The structure and evolution of non-tariff measures

To capture the effects of NTMs, we make use of a rich data compilation of NTM notifications provided by the WTO I-TIP covering 136 NTM imposing WTO members targeting 179 countries or territories. For our analysis, we employ count variables, i.e. the number of NTMs in force per importing country, exporting country, year and HS 6-digit product, for the following set of NTM types[2]:

(a) Sanitary and phytosanitary (SPS) measures aim at protecting human or animal life and include e.g. regulations on maximum residue limits of substances such as insecticides and pesticides, measures addressing the assessment of food safety regulations or labelling requirements. For example, a bilateral SPS measure of the EU entered into force in June 2015, suspending imports of dried beans from Nigeria due to pesticide residues at levels largely exceeding the reference dose established by the European Food Safety Authority.[3] However, one single notification may also apply to all trading partners, such as the SPS measure of the EU that entered into force in January 2015, defining import rules for ovine embryos to prevent transmissible spongiform encephalopathies.[4] SPS measures mainly target product groups of the agri-food sector, i.e. live animals, vegetables, prepared foodstuff and beverages.

(b) Technical barriers to trade (TBTs) are standards and regulations not covered by SPS measures, such as standards on technical specifications of products and quality requirements. An example is a TBT of the EU, in force since January 2016, that regulates the energy labelling of storage cabinets including those used for refrigeration, with the stated aim of pulling the market towards more environmentally friendly products by providing more information to end-users.[5] TBTs also apply to the agri-food sector, but largely to the manufacturing sector, especially to machinery and electrical equipment. As we are going to show below, the number of notified SPS measures and TBTs increased dramatically during the period under investigation.

(c) Antidumping measures (ADP), countervailing duties (CVD) and (special) safeguard ((S)SG) measures are counteracting measures. By definition, they are only temporarily implemented to counteract the negative effects resulting from increasing imports, associated with trade policies considered as unfair. ADP is the most prominent counteracting measure, aiming at combating (predatory) dumping practices that cause injury to the domestic industry of the importing country. Countervailing duties target subsidised exports. Safeguard measures apply for a specific product but for all exporters in order to facilitate the adjustment to the increased import influx for the

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2 A detailed classification of types of NTMs, including examples, is provided by UNCTAD (2013): http://unctad.org/en/PublicationsLibrary/ditctab20122_en.pdf

3 WTO Document: G/SPS/N/EU/131, 29 June 2015

4 WTO Document: G/SPS/N/EU/67, 4 March 2014

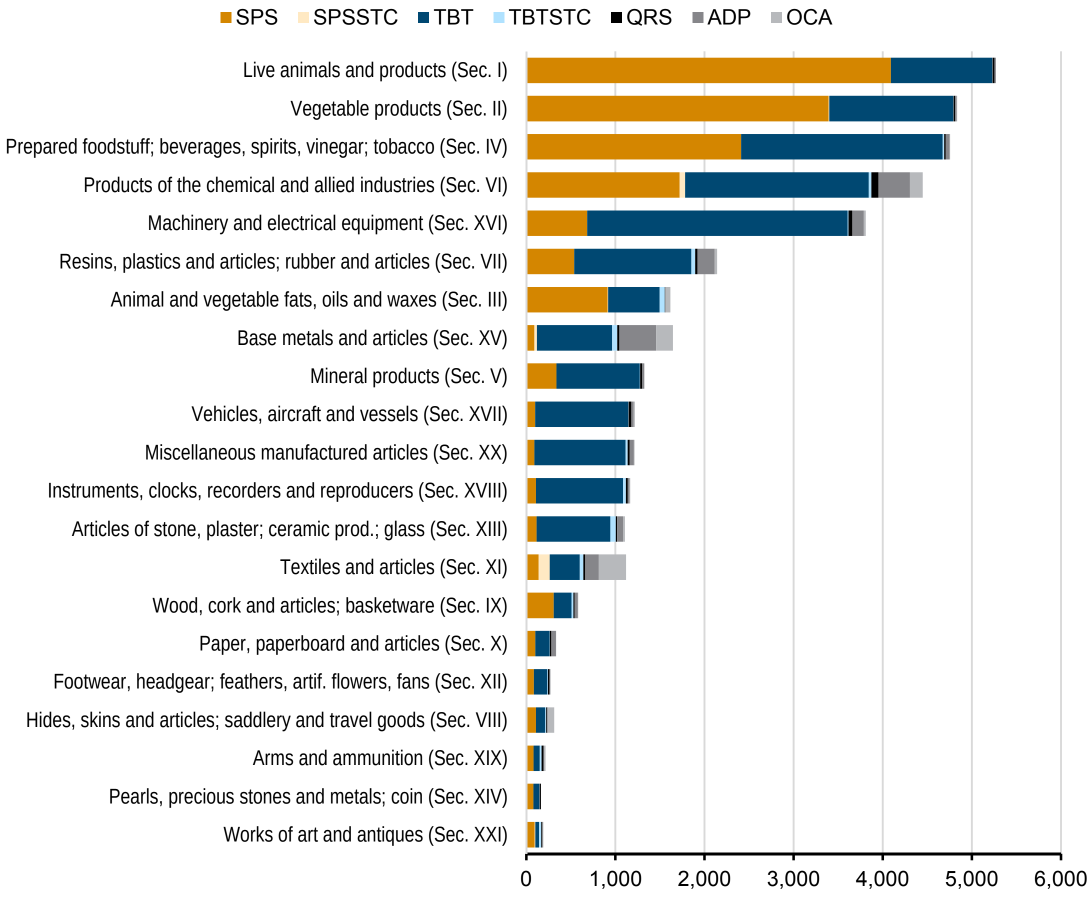
5 WTO Document: G/TBT/N/EU/178, 28 January 2014

importing country. In the following figures, we summarise countervailing duties and (special) safeguards under the category of *other counteracting measures* (OCA) due to their small number.

(d) The last group of NTMs consists of the traditional 'hard' trade policy tools of quantitative restrictions (QRS) such as licencing, quotas or prohibitions.

In addition, we look at specific trade concerns (STCs) raised by WTO members at the SPS and TBT committees. These committees serve as platforms to discuss SPS measures and TBTs employed by other WTO members. Questions usually relate to proposed measures notified to the WTO or to the implementation of existing measures. If the reporting of NTMs to the WTO were complete, then we would observe one SPS (or TBT) notification by the importing country for every STC relating to a SPS measure (or TBT) raised by an exporting country and discussed in the SPS (or TBT) committee. These SPS measures and TBTs could then be interpreted as the most stringent and probably most trade-impeding NTMs. However, reporting is not complete, meaning that we find specific trade concerns without matching measures reported by the importer, such that we include STCs as separate NTM categories in our empirical analysis.

Figure 1 / NTM stock in 2011, by NTM type and product group



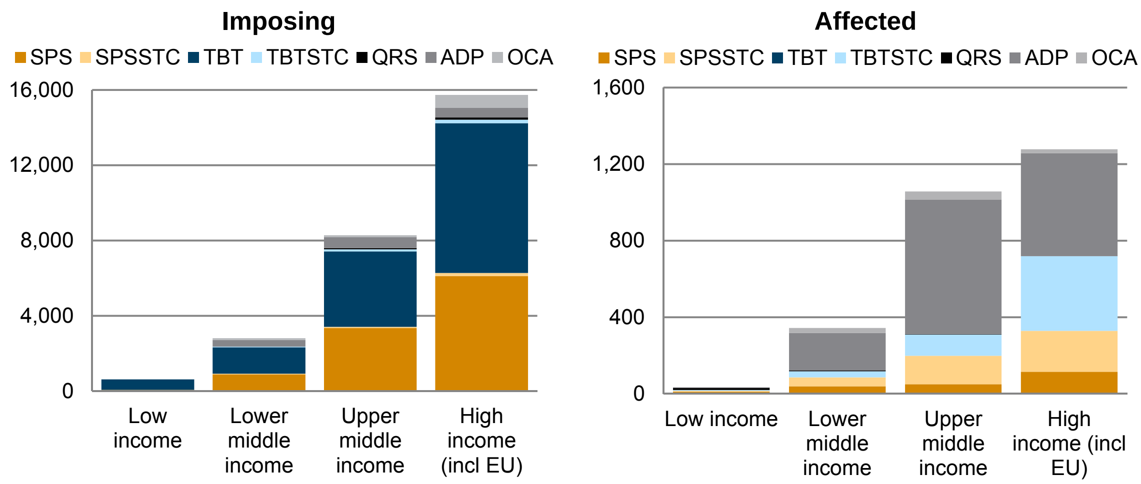
Source: WTO I-TIP; wiiw calculations.

Figure 1 shows the stock of notified NTMs in 2011 for each NTM type, split up by the 21 sections of the Harmonised System (Version 2002). The three product groups that faced the greatest number of total NTMs in 2011 (around 5000 each) belong to the agri-food sector. As expected, SPS measures play a dominant role for those. Other quantitative restrictions, though small in number, are as well mainly applied to agri-food products. Ranked fourth – after live animals, vegetable products and prepared foodstuff – we find products of chemical industries, followed by machinery and electronical equipment for which around 4000 NTMs, mainly TBTs, were notified.

Politically of great interest is also the question, whether richer or poorer countries are the main applicants of NTMs. Figure 2 therefore summarises the stock of NTMs for the year 2011 by income level of the imposing and the affected countries. Traditionally, developed countries were the primary users of NTMs, with emerging countries catching up. It is reasonable to expect developed countries to ask for higher standards for both domestically produced and imported products and therefore to employ a greater number of SPS measures and TBTs. Indeed, the left panel of Figure 2 shows that by far the greatest number of imposed NTMs is attributable to high income countries, accounting for 57.3% in comparison to 2.4% for low income countries. Calculating the average number of NTMs over all imported HS 6-digit products per country and plotting these figures against GDP per capita, we find a clear positive relationship for counteracting measures (ADP, SSG and CVD) in the manufacturing sector. By contrast, for the agri-food sector, this positive relationship is much more pronounced for SPS measures, TBTs, their corresponding specific trade concerns and antidumping. However, it has also to be kept in mind that the data presented are notifications to the WTO, which might be of greater risk to be incomplete for developing countries.

The numbers shown for affected countries in the right panel of in Figure 2 are much lower, as we excluded from the graph all NTMs which apply for all exporters, which substantially reduces the number of SPS measures and drops TBTs as well as safeguards from the picture. What is left are mainly antidumping measures and specific trade concerns, which are foremost addressing upper middle and high income countries.

Figure 2 / NTM stock in 2011, by NTM type and income of imposing and affected countries

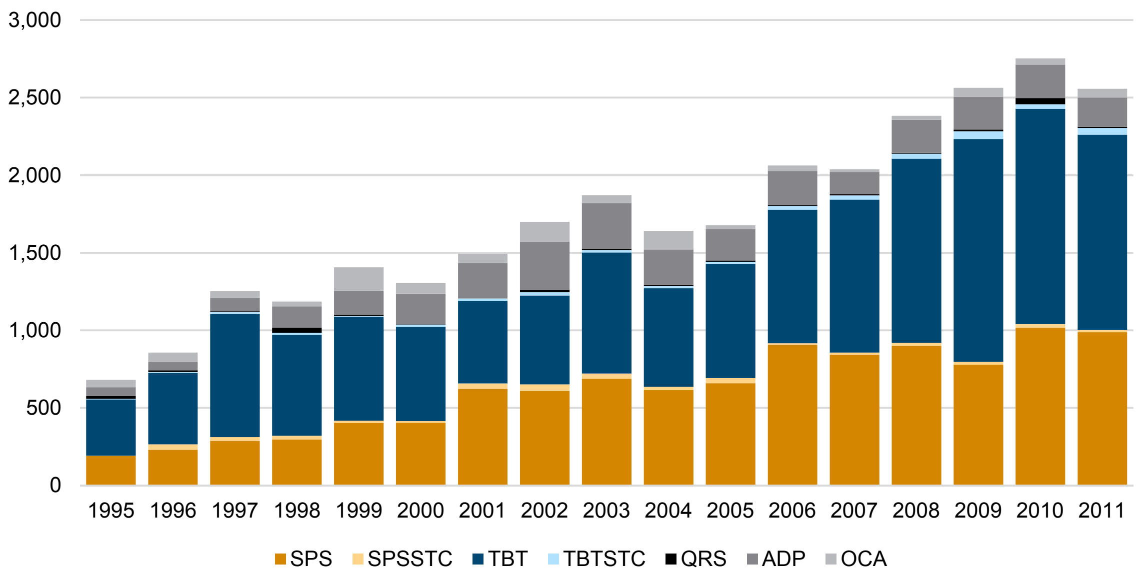


Source: WTO I-TIP; wiiw calculations.

Figure 3 illustrates the evolution of notifications over time, depicting the number of annual notifications for the period 1995 to 2011. There is a clear upward trend in the number of SPS measures and TBTs, which account for 39% and 47% of all NTM notifications (not including specific trade concerns) for our sample period (2002-2011), respectively. The number of annual ADP notifications, however, has been decreasing since peaking in 2002, when ADP notifications represented 19% of all NTMs imposed. Still, they form the third largest NTM group, with a share of 11% of all notifications between 2002 and 2011. The number of counteracting measures is showing three peaks in 1999, 2002 and again 2004, mainly driven by special safeguard measures. Yet, they account for less than 3% of all NTMs notified to the WTO during the period of our empirical investigation. Quantitative restrictions amount to even less, with a share of only 0.6% of NTMs notified. However, like TBTs and SPS measures, they usually address a big number of exporters, which significantly changes their magnitude when we consider our bilateral dataset.

The number of *bilateral product lines* targeted by an NTM more than quintupled between 2002 and 2011. While TBTs, SPS measures and QRS usually target a large number of exporters – if not all – counteracting measures are targeting specific products and (with the exception of safeguard measures) specific exporters, which reinforces the dominance of SPS measures and TBTs in the bilateral setting.

Figure 3 / Evolution of annual notified NTMs entering into force by NTM type



Source: WTO I-TIP; wiiw calculations

In order to evaluate the impact of NTMs, we consider a panel of bilateral import flows of WTO members from all their trading partners at the HS 6-digit product level for the period 2002 to 2011. Data availability reduces our country sample from 162 WTO members in 2016 to 135 countries, of which for the period under investigation (2002-2011) 118 countries reported to have at least one NTM in force. The result of our empirical investigation is a collection of ad valorem equivalents for about 100 countries.

3. Literature review

The enormous speed with which NTMs spread as trade policy instruments is reflected in the fast growing literature on their economic effects. Van Tongeren et al. (2009), Beghin et al. (2012) and Ghodsi (2015b), for example, applied a partial equilibrium framework for analysing the impact of NTMs, but also computable general equilibrium models have been recently used e.g. by Francois et al. (2011) for this purpose. In order to assess the impact of NTMs on international trade, often a gravity estimation approach is followed, e.g. by Essaji (2008), Disdier et al. (2008) and Ghodsi (2015a). Some authors have analysed the substitutability of tariffs with NTMs and other trade policy instruments (Moore and Zanardi, 2011; Aisbett and Pearson, 2013; and Ghodsi, 2016). However, NTMs are complex in nature cannot be easily compared with tariffs.

A way to contrast the effects of NTMs on trade with the impact of tariffs on trade but also to render the effects of different types of NTMs more comparable is to compute the ad valorem equivalents (AVEs) of NTMs, capturing the impact of non-tariff measures on prices. Dean et al. (2009), Kee et al. (2009), Beghin et al. (2014), Bratt (2014), or Cadot and Gourdon (2015) contributed to this branch of literature. Ferrantino (2006) offers a detailed description of methods frequently used to quantify the effects of NTMs on trade flows and prices by NTM type.

One method to calculate AVEs is to analyse the price wedge resulting from the implementation of NTMs, applied e.g. by Dean et al. (2009), Rickard and Lei (2011), Nimenya et al. (2012) or Cadot and Gourdon (2015). The amount of information necessary for this analysis restricts most of the papers to the analysis of very few – mainly agricultural – products for a small set of countries. The papers by Dean et al. (2009) and Cadot and Gourdon (2015) are rather rare exceptions. Another drawback of this method is that domestic prices in the absence of NTMs are not observable. Therefore, domestic prices affected by NTMs are often directly compared to international prices, neglecting the possible impact of differences in product quality. Furthermore, NTMs occur at different stages along the supply chain, which makes a comparison of different prices along the production and distribution chain (e.g. Cost, Insurance and Freight (CIF), Delivered Duty Paid (DDP)) for a single product necessary. In the case of prohibitive NTMs, no prices are observable at all.

The other branch of literature has been triggered by a contribution of Kee et al. (2009), who infer the AVEs of NTMs indirectly in a two-step approach. They assess the impact of NTMs on the imports with a gravity model. The results are then converted to AVEs using import demand elasticities, which are estimated beforehand. The main advantage of the gravity approach in comparison to the price wedge approach is that the former relies on trade data, which are more abundant at the disaggregated product level than price data. In addition, it can be used for broad panel analysis, i.e. for a big set of countries and products, with different NTMs evolving over time. Yet, the indirect approach has drawbacks too. Like the price gap method, this approach does not distinguish the quality of domestic from foreign goods, influencing the impact of NTMs. In addition, AVE calculations are based on import demand elasticities, which are themselves estimates. Acknowledging the advantages and drawbacks of either approach, we aim at contributing to the latter branch of literature.

Kee et al. (2009) find that the average AVE of all products affected by NTMs is 45%, and 32% when weighted by import values. Furthermore, they report a great variation of AVEs across products and countries, with highest AVEs found for agricultural products and for low income countries in Africa. Importantly, Kee et al. (2009) restricted their AVEs to be positive, i.e. by employing parameter restrictions they forced all NTMs to have only import-restricting effects comparable to tariffs. However, given market imperfections, NTMs can also serve to facilitate trade. Beghin et al. (2014) therefore, re-estimate the gravity approach proposed by Kee et al. (2009) for standard-like NTMs for the years 2001 to 2003, allowing for positive and negative values of AVEs of NTMs. In their analysis, 12% of all products at the HS 6-digit level were affected by technical regulations. Out of these, 39% exhibited negative AVEs – i.e. an import-facilitating effect. Bratt (2014) concludes, that overall, NTMs impede rather than facilitate trade, with a median AVE of 15.7%. However, 46.1% of all AVEs computed show a positive effect on trade. Furthermore, he finds that the effects of NTMs are primarily driven by the NTM imposing importing countries, where AVEs of NTMs are highest for low income countries for both sectors. In addition, Bratt (2014) highlights that NTMs targeting the food sector are more import restricting than NTMs in the manufacturing sector.

Previous calculations of AVEs of NTMs (Kee et al., 2009; Beghin et al., 2014 and Bratt, 2014) were conducted on cross sectional data due to lack of information on and variation of NTMs. Having a rich database on NTMs obtained from WTO I-TIP we are extending their approach to a panel analysis. Moreover, and maybe most importantly, previous calculations were not distinguishing NTM types whose diverse attributes by motives would bring various trade consequences. In this article, we differentiate major categories of NTMs, which can provide better insights on the implications of the use of different NTMs. In addition, the amount of applied NTMs was not considered in previous studies. Rather, the existence of NTMs was captured by employing dummy variables. Our analysis is based on the intensity of use of NTM types by counting the number of reported NTMs. Finally, we allow the effects of NTMs to differ by the NTM imposing, i.e. importing, country.

4. Data and methodology

Our approach is a three-step analysis, where first import demand elasticities are estimated. Second, a gravity model is used to estimate the impact of NTMs on import quantities. In the third and last step, this effect is transformed into a price effect – i.e. the AVEs – by means of previously computed import demand elasticities.

For the first step, we make use of import demand elasticities calculated by Ghodsi et al. (2016a).[6] In order to assess the impact of NTMs on import quantities in the second step we augment a fairly standard specification of the gravity equation by allowing for importer-specific effects of NTMs:

$$\ln(m_{ijht}) = \beta_{0h} + \beta_{1h}\ln(1+t_{ijht_{-1}}) + \sum_{n=1}^{N-1}\beta_{2h}^{n}NTM_{ijht_{-1}}^{n} + \sum_{i=1}^{I}\beta_{2ih}^{n'}\,\omega_i NTM_{ijht_{-1}}^{n'} + \beta_{3h}C_{ijt_{-1}} + \omega_{ijh} + \omega_{ht} + \mu_{ijht}, \quad (1)$$

$$\forall h;\ \forall n, n' \in \{ADP, CVD, SG, SSG, SPS, TBT, QRS; STC_{SPS}, STC_{TBT}\}\ where\ n' \neq n$$

m_{ijht} denotes the import quantities of product h to country i from partner country j at time t. We assess the effects of NTMs on import quantities estimating equation (1) for each product h at the HS 6-digit level. Therefore, β_{0h} represents product-specific fixed effects. $t_{ijht_{-1}}$ is the ad valorem tariff rate (using UNCTAD 1 methodology[7]) imposed by the importing country i against the import of product h from partner country j. The equation incorporates the coefficients capturing the impacts of tariffs (β_{1h}) and non-tariff measures (β_{2h}^{n}, $\beta_{2ih}^{n'}$) on imports, where $\beta_{2ih}^{n'}$ measures the importer-specific impact of one NTM type n' under consideration, while β_{2h}^{n} represents the effects of all other NTM types which we control for. It is the collection of all importer-specific coefficients $\beta_{2ih}^{n'}$ for all NTM types, which will eventually be transformed to importer-specific AVEs per NTM type. $NTM_{ijht_{-1}}^{n}$ and $NTM_{ijht_{-1}}^{n'}$ are count variables for the NTM types described earlier, i.e. they show the cumulative number of NTM regulations in force.[8] In order to obtain importer-specific AVEs of NTMs, we interact NTM variables with importer country dummies ω_i.

$C_{ijt_{-1}}$ captures time-varying country-pair characteristics and consists of classical gravity variables and factor endowments. Gravity variables that enter our regressions are dummy variables indicating whether they (i) are both EU members, (ii) are both members of the WTO, or (iii) are both members of a Preferential Trade Agreement (PTA). Following Baltagi et al. (2003) we additionally employ an index ranging from 0 to 0.5 depicting how different the trading partners are with respect to real GDP per capita, shown in equation (2). To account for the traditional market potential, we also include the sum of the trading partners' GDP at PPP in (3). Furthermore, we consider the distance between the trading partners with respect to three factor endowments relative to GDP in (4), namely labour *L*, capital stock *K*, and agricultural land area A_l.

6 Please consult the Appendix for a short description of the estimation procedure to derive import demand elasticities.

7 See: http://wits.worldbank.org/wits/wits/witshelp/Content/Data_Retrieval/P/Intro/C2.Ad_valorem_Equivalents.htm

8 The I-TIP database provides the date of withdrawal for ADP and CVD measures. For other types of NTMs this information is not available. For our analysis, we assume that they have not been withdrawn since.

$$y_{ijt} = \left(\frac{GDPpc_{it}^2}{(GDPpc_{it}+GDPpc_{jt})^2} + \frac{GDPpc_{jt}^2}{(GDPpc_{it}+GDPpc_{jt})^2}\right) - \frac{1}{2}, y_{ijt} \in (0, 0.5) \quad (2)$$

$$Y_{ijt} = \ln(GDP_{it} + GDP_{jt}) \quad (3)$$

$$f_{kijt} = ln\left(\frac{F_{kjt}}{GDP_{jt}}\right) - ln\left(\frac{F_{kit}}{GDP_{it}}\right), F_k \in \{L, K, A_l\} \quad (4)$$

Instead of employing time-invariant country-pair variables (e.g. indicating distance, whether countries are adjacent, share a common language, or exhibit a common colonial history) we make use of country-pair fixed effects ω_{ijh}. Finally, we include time fixed effects ω_{th} to abstract the effects of large-scale economic shocks that influence all trading partners, such as the global financial and economic crisis. Moreover, robust estimator clustering by country-pair-product is used to control for the shocks resulting in a heteroskedastic error term μ_{ijht}.

Explanatory variables are lagged by one period for two reasons: First, we expect that it takes time for demand to react to policy changes, which seems particularly reasonable for intermediate products. Second, some NTM types such as antidumping or countervailing duties are by nature counteractive, i.e. they only apply when imports are already strongly increasing. Therefore, not accounting for a lag would result in a strong endogeneity bias by measuring the import-increasing effect (e.g. associated with dumping or export subsidies) rather than the effect of the counteracting NTM. In general, if imports react to the imposition of NTMs, but also NTMs are imposed in response to changes in imports, we are facing an endogeneity problem. By lagging the policy variables by one period we expect the endogeneity bias to be substantially reduced.

We make use of the Poisson maximum likelihood estimator suggested by Santos Silva and Tenreyro (2006), which can be applied to import levels and is a robust approach in the presence of heteroscedasticity. Results obtained from a two-step Heckman procedure to account for the possibility that zero trade flows in our data are the result of firm's decisions not to export for reasons we do not observe are reported in Section 6.

In a final step, AVEs are obtained by differentiating our import equation (1) with respect to each NTM type. The impact of NTMs on import quantities can be decomposed, as shown in equation (5), into (i) the impact of prices on import quantities, i.e. import demand elasticities, estimated previously by Ghodsi et al. (2016a) and (ii) the impact of NTMs on prices, i.e. the AVEs of NTMs.

$$\frac{\partial \ln(m_{ih})}{\partial NTM_{ih}^n} = \frac{\partial \ln(m_{ih})}{\partial \ln(p_{ih})} \frac{\partial \ln(p_{ih})}{\partial NTM_{ih}^n} = \varepsilon_{ih} AVE_{ih}^n \quad (5)$$

p_{ih} are prices for product h imported to country i, and ε_{ih} is the import demand elasticity of country *i* for product *h*, which is assumed to be constant during the period of analysis. It is defined as the percentage change in the import quantity of a product due to an increase of its price by 1 %. In this paper we exclude Giffen goods, i.e. products, for which import demand increases as prices increase (implying $\varepsilon_{ih} > 0$). Solving for AVEs and rearranging terms leaves us with our desired AVEs per product and importing country as follows:

$$AVE_{ih}^{n'} = \frac{e^{\beta_{2ih}^{n'}} - 1}{\varepsilon_{ih}} \quad (6)$$

At the heart of our dataset are the NTM notifications to the WTO provided via the WTO I-TIP database, complemented by Ghodsi et al. (2016c) by imputing a large number of HS 6-digit product codes for two thirds of the notifications with missing HS codes (see description in Section 2). Import data were taken from the Commodity Trade Statistics Database (COMTRADE) and complemented by the Trade Analysis Information System (TRAINS) database. We consider ad valorem tariffs at the HS 6-digit level from TRAINS and the WTO Integrated Data Base (IDB) provided by the World Integrated Trade Solutions (WITS) platform. The data gathering on tariffs followed a three-step choice rule: Whenever available, preferential rates were considered. When this information was not given or not applicable, the most-favoured-nation tariff rates entered our set. Lastly, we used data on the effectively applied tariff rates. Data on factor endowments (labour force and capital stock) as well as GDP were retrieved from the Penn World Tables (PWT 8.0); see Feenstra et al. (2013 and 2015). The last update of the PWT 8.0 included data up to 2011, which constrained our analysis to the period 2002 to 2011. Information on agricultural land was taken from the World Development Indicators (WDI) database of the World Bank. CEPII provides data on commonly used gravity variables as mentioned above. Finally, we borrow a data compilation for Preferential Trade Agreements (PTAs) as reported by the WTO.

5. Empirical results

We considered two different samples for our analysis. The first sample includes all bilateral import flows of all countries covered by the WTO I-TIP database. The second sample excludes intra-EU trade flows. The reason is that we do observe the number of imposed NTMs per country, but not the degree of heterogeneity in terms of quality of NTMs. As we expect a higher degree of homogeneity of NTMs addressing imports across the EU, including intra-EU trade and therefore a higher number of similar NTMs would lead to a downward bias in our AVE estimation results.

Considering the full sample – 5,221 products at the HS 6-digit level and 118 importers – our investigation results in 616,078 importer-product combinations, for which in 259,721 cases, i.e. roughly 42%, at least one NTM applied between 2002 and 2011. Out of these, more than 60% were targeted by one NTM type. Another quarter of observations were subject to two NTM types, 8% to three NTM types and about 3% to four NTM types, respectively. We also find a small number of observations for which even five or six types applied. Observations being faced with six NTM types concern four HS sections, all belonging to the agri-food sector. In particular, these observations are associated with the EU and the US on the importer side. They are characterised by the use of counteracting NTMs, SPS measures and TBTs as notified by the imposing country to the WTO, as well as by specific trade concerns (STCs) raised against SPS measures and TBTs by the exporter, pointing towards the importance of these products for both the importing as well as exporting countries.

On average, each HS 6-digit product targeted by an NTM was imported by 58 importers, with a minimum of one importer, namely China, for product HS 860620 (insulated or refrigerated railway or tramway freight cars) and a maximum of 104 importers for product HS 040700 (birds' eggs in shell). Products targeted by NTMs and imported by at least 90 countries (i.e. corresponding to the 99th percentile) all belong to the agri-food sector, and to a great extend to two HS-chapters, namely HS 02 (meat and edible meat offal) and HS 07 (edible vegetables). Furthermore, countries in the sample targeted on average 3,542 imported products with NTMs out of approximately 5,200 products in the HS classification, ranging from 1 for a Cambodian TBT for chili sauce (HS 210390) to 5,114 products for the United States.[9]

Depending on the specification and after excluding potential outliers, we are able to provide AVE estimates for at least 30% and up to 47% of all importer-product pairs for which at least one NTM was in force and notified to the WTO. Extreme values and potential outliers were dealt with in two steps: First, we dropped the tails of the distribution, by defining the maximum (minimum) values as those values three times the interquartile distance (IQ) above (below) the third (first) quartile of the distribution, i.e. we specify the possible set of AVEs by the interval [Q1-3×IQ;Q3+3×IQ]. Second, we defined the lower bound for negative AVEs at -100%. The rationale behind it is that the domestic price of a product can only be reduced by a maximum of 100%.

9 Recall that the number of NTM notifications to the WTO reported in I-TIP is much lower, as some notifications target several HS 6-digit products or even entire HS groupings.

5.1. AVES BY TYPE OF NTM

Table 1 gives a first overview of our AVE results, reporting the mean and median computed over all importer-product combinations for each NTM type[10]. It is grouped into four parts. The left panel shows the results for the full sample, while the right panel reports the results when intra-EU trade flows are excluded prior to the estimation. The upper part shows summary statistics for all computed AVEs, while the lower part reports only *binding* AVE estimates for which the impact of NTMs on import quantities was statistically different form zero at the 10% level.

Table 1 / Simple average AVEs and tariffs over all importer-product pairs

	Full sample				Excluding intra-EU trade			
	NTM	*Mean*	*Median*	*Obs.*	*NTM*	*Mean*	*Median*	*Obs.*
All	ADP	14.0	23.5	6,031	ADP	13.3	23.4	5,947
	CVD	2.9	10.3	697	CV	5.5	15.0	692
	QRS	-2.0	0.0	3,922	QR	-0.8	0.3	3,782
	SG	4.5	3.4	91	SG	2.7	7.1	90
	SSG	0.5	5.3	154	SSG	9.1	16.3	76
	SPS	0.9	0.0	24,481	SPS	2.9	0.3	21,021
	STC_{SPS}	-5.2	1.1	3,658	STC_{SPS}	-6.2	-0.1	3,645
	TBT	2.7	0.8	54,298	TBT	4.1	2.1	49,356
	STC_{TBT}	8.9	16.6	12,112	STC_{TBT}	9.1	17.3	11,937
	Tariffs	3.4	1.4	74,617	Tariffs	5.0	3.1	68,532
	AVEs Total			105,444	AVEs Total			96,546
significant impact of NTMs on import quantities ($p < 0.1$)	ADP	20.8	44.0	4,198	ADP	19.4	43.7	4,133
	CVD	7.0	32.5	479	CV	9.9	34.6	467
	QRS	0.8	8.6	1,407	QR	2.5	11.9	1,380
	SG	21.5	46.7	38	SG	14.9	46.8	41
	SSG	14.2	28.4	58	SSG	18.9	34.6	44
	SPS	4.1	1.1	8,374	SPS	8.2	6.4	8,888
	STC_{SPS}	-4.7	19.1	2,267	STC_{SPS}	-5.9	15.8	2,242
	TBT	8.6	6.8	19,768	TBT	10.8	11.2	21,620
	STC_{TBT}	18.9	48.2	7,334	STC_{TBT}	19.0	48.5	7,179
	Tariffs	3.4	1.4	43,923	Tariffs	5.0	3.2	37,180
	AVEs Total			43,923	AVEs Total			45,994

Note: Results based on Poisson estimation and elasticity estimates significantly different from zero at the 10% level. Average tariffs computed over all observations with at least one non-zero AVE.

We can observe, first, that the total number of importer-product specific AVEs is reduced by about 8% if we exclude intra-EU trade. Yet, the number of AVEs, for which a significant effect of NTMs on import quantities was computed, increases by 5%, driven by TBTs (+9%) and SPS measures (+6%). This is the effect we would expect, given that a great portion of trade of each EU Member State concerns intra-EU trade for which the same NTMs apply (or are mutually recognised) and therefore should not affect intra-EU trade. Henceforth, we therefore focus on the analysis of AVEs excluding intra-EU trade. Second, our AVE results are dominated by TBTs, for which we could compute about as many importer-product specific AVEs as for all other NTMs taken together. Average AVEs for TBTs are found to be about one percentage point lower than average tariff rates, while binding AVEs for TBTs are found to be more than

10 A graph on the distribution of AVEs over NTM types can be found in the Appendix.

twice as large as average tariffs. Third, AVEs differ greatly between NTM types, with the highest average AVEs found for antidumping measures, followed – with some distance – by TBTs for which specific trade concerns were raised (STC_{TBT}) and safeguard measures. Fourth, overall AVEs show positive mean and median values, pointing towards an overall import-impeding effect of NTMs. It has to be kept in mind, though, that counteracting measures are designed to reduce imports. By contrast, SPS measures and TBTs might be (mis-)used as (discriminatory) trade policy tools but primarily aim at improving the quality of products, packaging or the information provided to consumers. Positive AVEs for SPS measures and TBTs therefore not only indicate import-restricting effects but in addition point towards possible quality-increasing effects of NTMs.

A split up in positive and negative AVEs reveals that we find 27% more positive AVEs than negative ones, i.e. the share of negative AVEs is roughly 45%. Restricting our view to only binding AVEs, the share of negative AVEs reduces to below 40%. This finding is in line with recent literature allowing for positive and negative AVEs. Beghin et al. (2014) and Bratt (2014), who amended the approach of Kee et al. (2009), find trade-facilitating effects for 39% and 46% of all product lines affected by NTMs, respectively.

In order to derive policy relevant implications we continue our analysis by exploring AVEs by importer, location and income as well as by product according to the Harmonised System (HS) and broad economic categories (BEC).

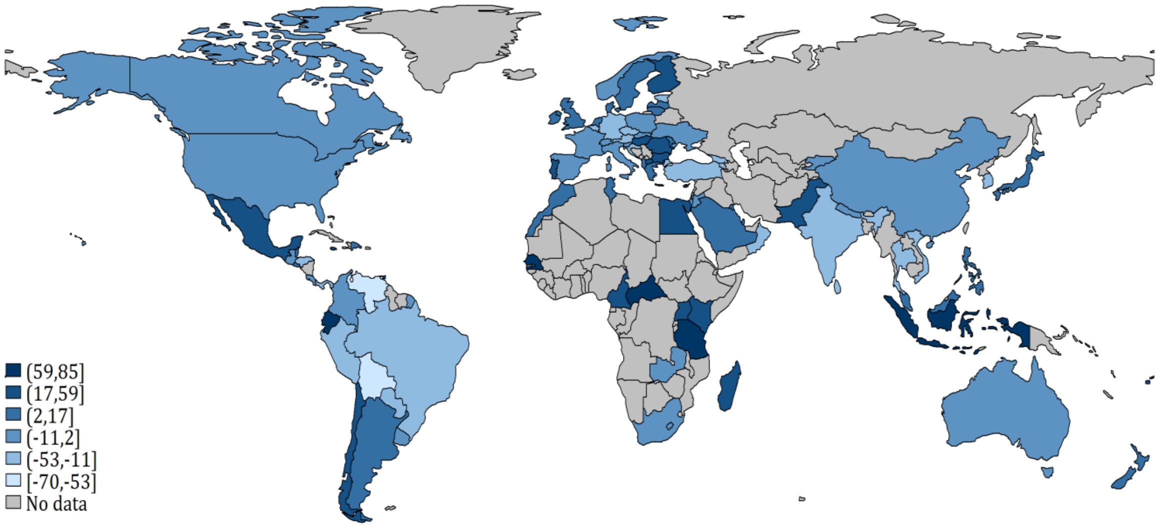
5.2. AVES BY IMPORTER

Different countries apply different types of NTMs. Even the same NTM type can have an import-promoting effect for one country and an import-impeding effect for another. On the one hand, the average AVE per NTM for one specific importer can be influenced by the purpose and quality of the NTM measure imposed. On the other hand, it is influenced by the structure of imports, i.e. the product mix and the trading partners: First, depending on the structure of the domestic industry, imports of a specific product can be substitutes or complements to domestic production, which influences the impact of NTMs. Second, not every country imports every product. For example, as we shall later show, our analysis reveals high AVEs for arms and ammunition. If some countries do not import arms and ammunition, their average AVEs are, ceteris paribus, lower than those of countries that do import arms and ammunition.

In the following, we often summarise AVEs for countervailing duties and (special) safeguards under the heading ‘other counteracting measures’ (OCA) as they are all measures reacting to a high import influx and – as reported Table 1 – are small in numbers. In addition, we aggregate AVEs for specific trade concerns on SPS measures and TBTs under the terms STC for reasons of readability.

As SPS measures and TBTs are the predominant NTMs in our data and form the heart of ongoing political discussions, specifically with respect to the formation of deep mega-regional trade agreements such as the Transatlantic Trade and Investment Partnership (TTIP) and the Trans-Pacific Partnership (TPP), we first restrict our attention to the analysis of AVEs computed for these measures. Figure 4 displays the import-weighted (i.w.) binding AVEs[11] for SPS measures and TBTs and their corresponding STCs (summed up to one figure) for 96 countries on a world map. It shows the limitations that data availability poses on our analysis, with countries for which we cannot report AVEs of SPS measures and TBTs dyed in grey. Many countries in Africa as well as in West and Central Asia are either not members of the WTO, or hold only observer status, such that we do not have information on NTMs imposed. In addition, there are WTO member states in the south and west of Africa – including big countries, such as Angola, Chad, Mauritania, Namibia, and Niger– for which we do not have information on their applied NTMs. For Russia, data on SPS measures and TBTs are only available from 2012 onwards, i.e. starting with the year of its accession to the WTO. Countries for which we were able to calculate AVEs for SPS measures and/or TBTs are coloured in blue, with darker shading indicating higher AVEs.

Figure 4 / Import-weighted binding AVEs of SPS measures, TBTs and STCs



Note: Based on Poisson estimation excluding intra-EU trade. Six colour shadings according to the boxplot method.

Trade-weighted AVEs result in 41 countries showing overall import-promoting and 55 countries with import-impeding effects of SPS measures and TBTs. However, if NTMs are indeed trade barriers they would naturally reduce imports. Consequently, using import values as weights for AVEs, we likely underestimate the import-impeding effects of the use of NTMs. When we calculate importer-specific AVEs by using the simple average over all products, 69 countries show import-impeding effects and only 28 countries are left showing overall trade-enhancing effects of SPS measures and TBTs.[12] Yet, imposing no weight on evaluated AVEs does not account for existing import structures of economies and overemphasises the importance of AVEs for certain products. The truth will lie somewhere in between.

Generating country rankings with and without import weights often yield similar results, but it need not necessarily be the case. Considering the sum of import-weighted binding AVEs for SPS measures, TBTs and corresponding STCs, as shown in Figure 4, we find the highest import restrictions for the

11 $i.w.mean\ AVE_{in} = \sum_h \frac{AVE_{ih}^{n} * Imports_{ih}}{Imports_i}, \forall\ i,n$ where $Imports_i$ constitutes imports of country *i* over all HS 6-digit products, for which at least one AVE could be computed. [Using total imports instead would imply that we wrongly assumed that NTMs for which we were not able to compute AVEs were ineffective, i.e. show AVEs equal to zero.]

12 Please see the Appendix for a full list of all importers and their simple average country-specific AVEs by NTM type.

Central African Republic, Ecuador and Indonesia. Romania, Bulgaria and Finland are the EU Member States that can be found within the top 20. Yet, the majority of EU members is found halfway down the list. We find the lowest average AVE for SPS measures, TBTs and their corresponding STCs for Bolivia, Barbados and Venezuela. Germany is ranked 5th after Turkey. Also Croatia[13], the Czech Republic and Estonia can be found among the top 20.

Table 2 / Binding AVEs by EU Member State – extra-EU trade

				Simple Averages			*Import-weighted Avg.*		
Rk.	*Importer*	*ISO2*	*Accession*	*SPS*	*TBT*	*STC*	*SPS*	*TBT*	*STC*
16	Austria	AT	1995	0.9	2.8	14.5	1.0	-8.1	-5.5
20	Belgium	BE	1958	0.3	3.4	11.3	-3.1	-3.8	-5.6
9	Bulgaria	BG	2007	7.3	11.9	19.4	-1.1	6.9	20.6
3	Cyprus	CY	2004	7.8	16.5	40.9	1.2	14.9	1.2
12	Czech Republic	CZ	2004	6.9	7.0	12.0	0.3	-0.1	-16.3
10	Denmark	DK	1973	1.6	8.2	26.3	0.9	5.9	8.5
17	Estonia	EE	2004	6.6	8.8	2.6	3.3	1.7	-18.2
6	Finland	FI	1995	6.8	14.5	26.7	1.2	12.0	10.4
25	France	FR	1958	-0.6	0.6	5.7	-0.4	-5.1	-2.7
27	Germany	DE	1958	-2.9	-1.4	-1.3	-1.7	-12.2	-19.3
4	Greece	EL	1981	9.3	11.4	42.5	0.7	5.4	7.0
7	Hungary	HU	2004	7.1	10.3	29.0	0.9	12.7	6.9
21	Ireland	IE	1973	3.1	8.2	3.2	0.9	2.7	7.4
14	Italy	IT	1958	1.0	4.5	15.8	0.4	3.0	-10.0
5	Latvia	LV	2004	9.6	12.0	31.3	0.2	2.5	2.5
8	Lithuania	LT	2004	8.7	12.1	21.6	1.5	2.6	2.0
13	Luxembourg	LU	1958	10.1	3.8	11.2	-1.2	-3.0	-7.5
1	Malta	MT	2004	9.5	16.4	59.0	0.9	2.2	19.2
23	Netherlands	NL	1958	-1.3	2.0	11.5	-0.8	-0.8	5.3
24	Poland	PL	2004	2.4	3.9	5.3	-1.2	-0.1	-4.5
26	Portugal	PT	1986	2.1	2.8	-0.3	-0.2	9.1	11.4
2	Romania	RO	2007	14.8	8.9	52.5	2.2	10.4	29.3
11	Slovakia	SK	2004	14.7	10.0	10.6	0.8	-2.2	-7.1
19	Slovenia	SI	2004	8.8	3.4	3.8	0.8	-1.5	-5.3
15	Spain	ES	1986	0.2	4.2	14.8	0.5	5.5	-4.9
22	Sweden	SE	1995	0.8	2.3	11.4	-0.6	-1.2	4.1
18	United Kingdom	UK	1973	4.6	5.1	6.7	2.0	2.8	8.6

Note: Excludes Croatia from the list, as the analysis refers to pre-Croatian accession to the EU. Results based on Poisson estimation excluding intra-EU trade. The ranking (Rk.) is based on simple averages over binding AVEs for SPS and TBT. i.w. refers to import-weighted averages.

In light of ongoing trade negotiations at the European level, it is worth exploring how heterogeneous EU members are with respect to NTMs. If we rank EU members from 1 to 27, with 1 indicating the highest AVEs and 27 representing the lowest AVEs, we find that the rankings are very similar when using simple averages over all products, or when computing simple averages only over products significantly affected by AVEs. In these two cases, the 'new' EU-12 Member States that acceded to the EU in 2004 and 2007

[13] Croatia does not feature as an EU member country within our analysis (as it acceded to the EU in 2013 while our analysis is restricted to 2011). Therefore, trade between Croatia and the EU is not excluded from our econometric analysis. In the run up to accession and specifically after signing the Stabilisation and Association Agreement in late 2001, Croatia's NTMs might have adapted to standards of the EU, which in 2012 was Croatia's main trading partner absorbing more than 60% of its exports.

appear more trade restrictive than the 'old' EU-15 Member States, with Malta, Romania and Cyprus representing the Top 3, while the Bottom 3 is formed by EU-15 Member States, namely Germany, Portugal and France. If we impose import weights, we still find Malta and Romania among the Top 5, but also Finland with relatively high AVEs for TBTs. At the end of the list, we again find Germany, this time followed by the Czech Republic and Estonia. When employing import weights, quite some EU-15 members drift towards the centre, e.g. Ireland and the UK, with Slovenia and Slovakia instead taking their place.

Why can AVEs among EU member countries differ? The reasons can be manifold. First, EU Member States indeed differ by the NTMs they employ. Looking at the number of notifications to the WTO in force by 31 May 2015, we find that the share of the sum of notifications of individual EU Member States in per cent of NTMs notified by the EU is close to 5% for SPS measures and 62% for TBTs. EU-12 countries account for 17% and 40%, respectively. There are no national NTMs notified for quantitative restrictions, antidumping and countervailing duties. However, there are more than eight times as many national safeguard measures in place, compared to safeguards notified by the EU. All these notifications by individual EU Member States are attributable to EU-12 members.

Second, countries differ by their economic structure and trade relations, i.e. by the product mix that they import and their trading partners, which can be driven among other reasons by historical ties, the integration in global value chains or heterogeneous preferences of consumers across the EU. In this paper, we are not going to unravel the Pandora box of intra-EU differences in AVEs. However, we will shed light on how AVEs differ by products, product groups and the use of products as intermediates, consumption goods or gross fixed capital goods in Section 5.3.

In order to evaluate the global impact of NTMs, we aggregate our country-based AVE results according to their regional affiliation as laid out in the list of economies provided by the World Bank[14], which comprises 215 countries. The share of each region, in terms of number of countries according to the World Bank's list, resembles the shares of our country sample composition – with the exception that we include a greater proportion of countries in Europe and Central Asia and fewer countries from Sub-Saharan Africa due to data limitations in our NTM data as previously mentioned. Our sample of 118 countries is composed of 39 countries in Europe and Central Asia, Canada and the United States in North America and 26 countries in Latin America and the Caribbean. Seventeen countries belong to the region East Asia and Pacific and another four –including India – to South Asia. From the Middle East and North Africa, our sample includes 12 countries and 18 countries from Sub-Saharan Africa. Out of 118 countries in total, we were able to compute binding importer-specific AVEs for 98 countries. Unfortunately, 8 out of the remaining 20 countries belong to Sub-Saharan Africa, reducing the region as reported in Table 3 to 10 countries. Keeping the over-representation of European and Central Asian economies and under-representation of Sub-Saharan African countries in mind, we continue to elaborate patterns of the effects of NTMs by region.

Let us refer to the upper panel of Table 3 as the *'product panel'*. It shows results if we calculate the simple average over all country-specific AVEs, which by themselves constitute simple averages over all traded HS 6-digit products per country. That is, within each country, every product has equal weight, independent from its actual economic importance. It might therefore be regarded as the upper bound of

[14] Please refer to Appendix 7 and Appendix 8 for the categorisation of our country sample according to the World Bank List of Economies (July 2015).

the import effects of NTMs per region. For SPS measures and TBTs, we find the highest AVEs for Sub-Saharan Africa, comparable with tariffs of 10.5% and 6.3%, respectively. It is followed by the regions Europe and Central Asia and East Asia and Pacific. The only region that experiences SPS measures and TBTs on average as trade promoting is North America. The Middle East and North Africa as well as Europe and Central Asia show high import-hampering AVEs for quantitative restrictions. Considering the sum of binding AVEs for SPS measures, TBTs and QRS, 7 (16) EU member countries feature among the Top 10 (Top 20).

Table 3 / Binding AVEs by region

	Region	*SPS*	*TBT*	*QRS*	*ADP*	*OCA*	*STC*
PRODUCT (s.a. over country-specific s.a. AVEs)	Europe & Central Asia	4.4	5.2	20.5	16.7	12.9	14.6
	North America	-0.3	-2.6	.	-2.8	7.0	-5.5
	Latin America & Caribbean	2.8	5.4	4.1	29.3	0.1	5.7
	East Asia & Pacific	3.7	5.6	7.3	3.3	18.4	-10.2
	South Asia	2.4	0.7	.	10.2	100.6	-39.2
	Middle East & North Africa	0.7	6.1	27.2	7.6	27.8	11.0
	Sub-Saharan Africa	10.5	6.3	.	4.5	64.6	44.0
COUNTRY (s.a. over country-specific w.a. AVEs)	Europe & Central Asia	1.1	-0.8	0.0	6.2	1.3	-0.1
	North America	-0.4	-1.5	.	1.8	-0.2	-8.1
	Latin America & Caribbean	-4.1	4.0	-0.3	3.2	-0.8	-0.3
	East Asia & Pacific	4.3	9.6	1.2	3.5	0.1	-5.0
	South Asia	-2.8	-4.3	.	-4.4	0.3	-12.0
	Middle East & North Africa	-2.7	11.2	3.7	2.3	-9.4	2.5
	Sub-Saharan Africa	27.3	34.8	.	-1.3	0.2	34.7
WORLD (iw.a. over country-specific w.a. AVEs)	Europe & Central Asia	0.3	-3.3	-0.6	3.5	-1.2	-3.6
	North America	-0.5	-3.3	.	1.8	0.2	-6.5
	Latin America & Caribbean	0.9	2.4	0.0	2.4	-0.5	18.7
	East Asia & Pacific	-2.0	5.1	-0.1	1.2	0.1	-3.5
	South Asia	-5.1	-8.0	.	-16.3	0.0	-11.7
	Middle East & North Africa	-0.4	11.4	0.1	1.3	-0.3	0.1
	Sub-Saharan Africa	-0.3	2.5	.	-1.1	0.2	1.1

Note: Results are based on Poisson estimation excluding intra-EU trade. s.a. and w.a. refer to simple and import-weighted averages, respectively.

One might wonder, why we also report negative AVEs for antidumping and other counteracting measures. We can think of three plausible explanations. The first reason is an econometric issue. It might be that using a one year lag is not sufficient to rule out that we are capturing the effect of predatory export policies (such as dumping or export subsidies) instead of the effect of the measures that aim to counteract these policies (such as antidumping and countervailing duties). The second reason is economic in nature. Counteracting measures target very specific products of very specific exporters. These measures might therefore substantially reduce imports from one destination but simultaneously enable other new exporters to enter the market. A third reason could be the quality adaption of the exporter as a response to the NTM. Some recent research (Ghodsi et al., 2016b) suggests that exporters tend to downgrade the quality of their products when facing antidumping measures to circumvent antidumping duties and thereby increase their exports.

Overall, regional AVE results on measures other than SPS and TBT need to be interpreted with greater caution: On the country level, we report binding AVEs of SPS measures and TBTs for 82 and 90 countries, respectively. Other measures are very much limited to North America, Europe and East Asia. We find binding AVEs for antidumping and other counteracting measures for 56 and 51 countries, respectively and in addition binding AVEs for QRS for 36 countries.

The second panel of Table 3 puts import weights on every product within each country, accounting for economic structures of each importer. Yet, the regional figure is the simple average over all importing countries, i.e. puts equal weight to each importing country. We therefore label this panel the *'country panel'*. In comparison to the *product panel*, we observe a shift towards import-promoting effects. Yet, the import-impeding effects of SPS measures and TBTs prevail for Sub-Saharan Africa as well as for the East Asia and Pacific region. Average AVEs for quantitative restrictions and counteracting measures are drastically scaled down, which is what we expect, given the very nature of these NTM types.

As countries within regions are of different sizes and economic powers, we calculated a third panel, which we refer to as the '*world panel*', in which we apply import weights for each country within a region. That is, more emphasis is given to global players within each region, such as Brazil in Latin America, South Africa in Sub-Saharan Africa, India in South Asia or China and Japan in East Asia, in order to better grasp the current impact of NTMs on a global scale. Even in this case, TBTs appear to be lowering imports in four out of seven world regions on average.

Although more than 50% of the total number of imposed NTMs is attributable to high income countries, as we have previously seen from the descriptive statistics on the WTO I-TIP data, Table 3 and Table 4 do not reveal that they are also the most trade-restrictive ones. According to the income group classification of the World Bank, our analysis includes 10 low income countries, 25 lower middle income countries, 30 upper middle income countries and 53 high income countries.

Table 4 / Binding AVEs by income level

	Income	*SPS*	*TBT*	*QRS*	*ADP*	*OCA*	*STC*
PRODUCT (s.a. over country-specific s.a. AVEs)	Low income	13.6	8.6	.	.	.	.
	Lower middle income	0.5	4.2	.	6.3	52.8	7.2
	Upper middle income	3.3	6.4	12.2	23.1	21.0	8.0
	High income	4.1	4.6	19.1	14.1	5.9	10.1
COUNTRY (s.a. over country-specific w.a. AVEs)	Low income	27.4	58.5	.	.	.	.
	Lower middle income	-5.9	7.2	.	-1.4	4.0	6.8
	Upper middle income	2.0	4.8	0.2	2.5	0.3	2.7
	High income	0.4	1.8	0.2	6.1	-1.0	-2.0
WORLD (w.a. over country-specific w.a. AVEs)	Low income	0.9	18.0	.	.	.	.
	Lower middle income	-3.8	-4.6	.	-13.1	0.3	-9.4
	Upper middle income	-3.0	0.1	0.1	1.2	0.1	2.3
	High income	0.1	-0.4	-0.3	2.5	-0.5	-4.2

Note: Results are based on Poisson estimation excluding intra-EU trade. s.a. and w.a. refer to simple and import-weighted averages, respectively.

Applying the income group classification of the World Bank, Table 4 shows that low income countries appear to have by far the most restrictive SPS measures and TBTs in place, while AVEs for other NTM types did not apply (or were not reported). By contrast, lower middle income countries show the lowest AVEs for SPS measures, and depending on the import weights also for TBTs, but the highest AVEs for other counteracting measures. Upper middle and high income countries indeed show lower AVEs for SPS measures and TBTs, but also apply a wider range of different trade policy instruments. Although many 'hard' NTMs such as quotas are phasing out due to the regulations of the WTO, quantitative restrictions still seem to be trade restrictive, particularly for upper middle income countries, while antidumping deserves special attention in high income countries.

Given its political importance, specifically with respect to multilateral negotiations, we illustrate the linkages between income and (the effect of) NTMs by plotting the number of SPS measures and TBTs imposed as well as their corresponding average AVEs against GDP per capita in purchasing power parities (PPP) in Figure 5. The upper panel summarises the number of NTMs per importer, calculated as the simple average over all imported HS 6-digit products, while the lower panel plots the simple average AVEs.

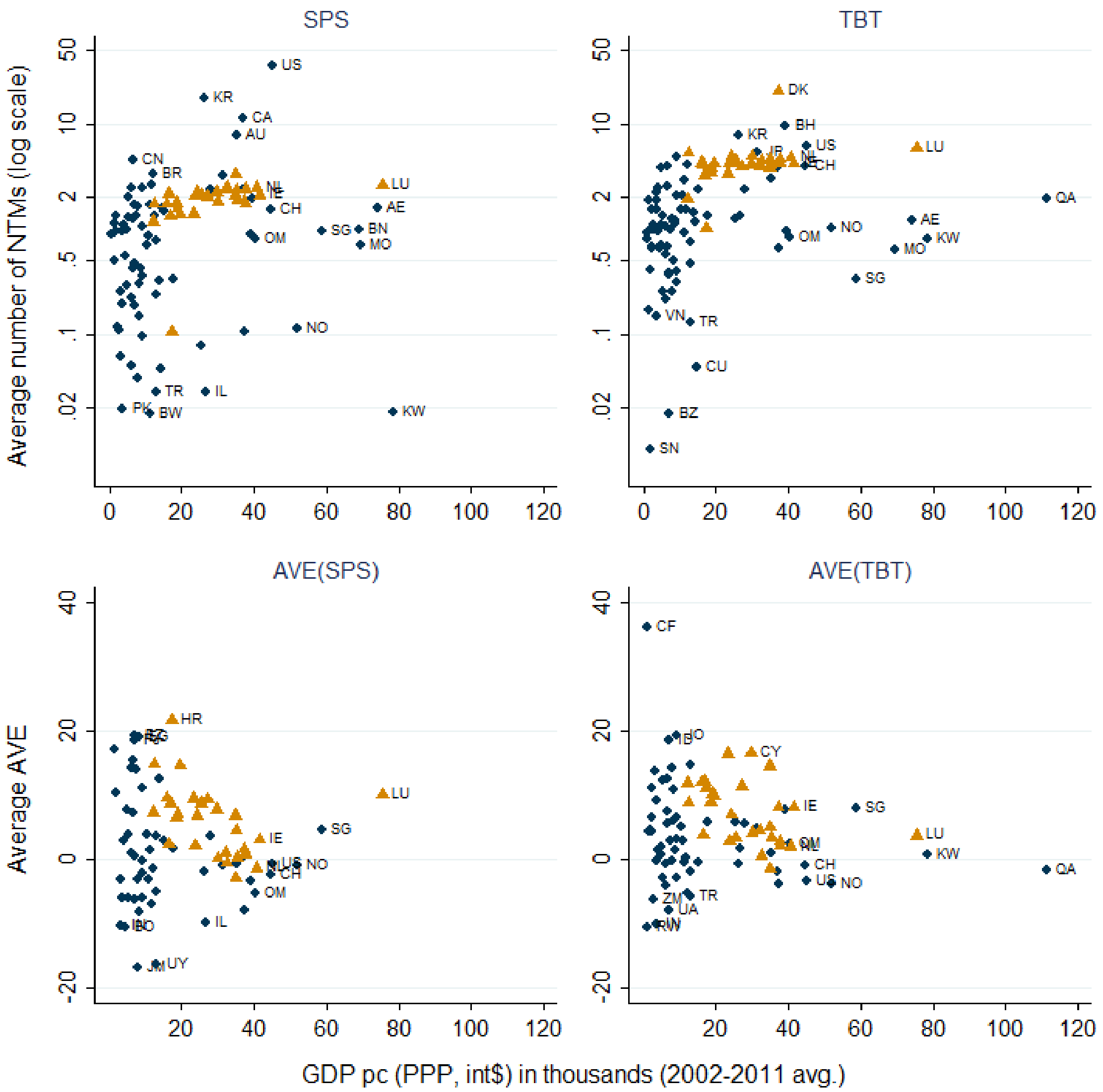
Looking at the average number of NTMs imposed on imported products, the impression is that it first increases with income and at some threshold starts to fall again. Note that we make use of log scaling in order to better see the dynamics among countries making little use of NTMs so far. This means that jumps from one horizontal line to the next, e.g. from Pakistan to Norway, or from Australia to the United States, indicate a quintupling of NTMs applying to imported products. For EU member countries (highlighted in orange), a clear tendency towards a higher number of NTMs for richer countries is observable. Extracting the number of notifications to the WTO of NTMs in force by 31 December 2015 (not broken down to country-product lines), we find for eight 'old' EU-15 Member States and one 'new' EU-12 country that no national NTM is notified in addition to those reported by the European Union. The share of NTMs issued by EU-12 states in total national SPS and TBT notifications is 17% and 40%, respectively. The lower number of NTMs for EU-12 countries can therefore be explained by (i) a higher number of national NTMs imposed by EU-15 members in addition to NTMs notified by the EU, (ii) the fact that a wide range of EU SPS measures and TBTs applied to EU-12 countries only from 2004 or 2007 onwards, respectively, and (iii) by the composition of products that are actually imported.

Turning to the lower panel of the graph, showing simple average AVEs by country, one might argue for a trend towards zero AVEs of NTMs. Poorer countries show a wide range of AVEs from strongly negative to strongly positive. Yet, with increasing income, the range of AVEs decreases. For EU members, we do observe a clear downward trend, yet, with most countries showing on average positive AVEs.

Summing up, we find that using simple averages over all products and excluding intra-EU trade, 62 countries show import-hampering effects of SPS measures, TBTs and corresponding STCs compared to 37 countries for which an import-promoting effect was computed. Focusing on binding AVEs increases the import-restricting effect, which is, however, scaled down to a great extent when employing import weights. The latter can either be the result of import-impeding NTMs imposed on products that are relatively unimportant for international trade or of the effectiveness of NTMs in reducing trade. We therefore argue for looking at simple as well as import-weighted averages of AVEs for broad cross-country comparisons and elaborating policy-relevant differences on a case-by-case basis.

In addition, we observe that richer countries employ a greater variety of NTM types and make more frequently use of these tools, while simultaneously we see diminishing AVEs along increasing incomes. The highest AVEs for SPS measures and TBTs are found among low income countries and are associated with Sub-Saharan Africa. However, the highest AVEs for quantitative restrictions and counteracting measures are found for high income and upper middle income countries, where quantitative restrictions feature prominently in the region Middle East and North Africa, while we should be alarmed about the use of antidumping in Europe and Central Asia.

Figure 5 / NTMs and binding AVEs of imported products for SPS and TBT over income



Note: Simple averages over HS 6-digit products. Excluding intra-EU trade. Labels are shown for countries forming the Top and Bottom 5% of the distribution and countries whose income over the period 2002-2011 on average exceeds 40,000 international Dollars at PPP p.c. EU members are shown in orange. Trinidad and Tobago with an average AVE(SPS) of 64.6 and Belize with an average AVE(TBT) of 49.9 were omitted from the graph.

5.3. AVES BY PRODUCT

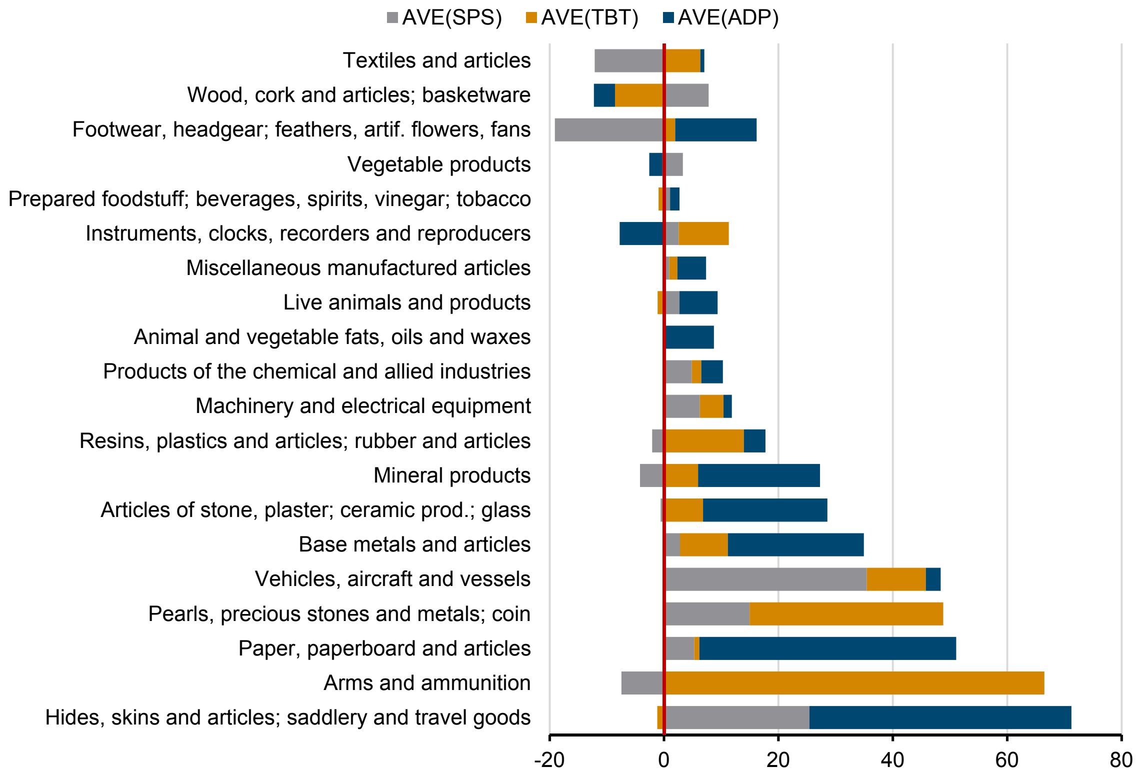
The question arises, which products are affected in which way. In this section, we therefore explore AVEs estimated for products at the HS 6-digit level, aggregated to 97 HS 2-digit groups and further to 21 HS sections. In addition, we make use of a correspondence table from HS to BEC constructed for the

World Input-Output Database (WIOD[15]) to explore patterns along the types of products with respect to their use as final consumption goods, intermediate goods or goods contributing to gross fixed capital formation.

A table with all import-weighted AVEs by NTM type and HS-2-digit product group can be found in the Appendix. The highest import-weighted binding AVEs for SPS measures are computed for aircraft and spacecraft (115, HS 88), works of art (71, HS 97) and musical instruments (49, HS 92), and the lowest for railway or tramway locomotives (-100, HS 86), cork and articles thereof (-57, HS 45), and wool (-27, HS 51). On the side of TBTs, arms and ammunition (67, HS 93) face the highest AVEs, followed by aircraft and spacecraft (63, HS 88) as well as printed books and newspapers (58, HS 49), while the lowest AVEs are found for prepared feathers (-80, HS 67), tin and articles thereof (-40.1, HS 80) and headgear (-30, HS 65).

Agricultural products appear neither among the products with the highest nor among those with the lowest AVEs. It can be noted however, that with the exception of tobacco, sugar, animal fats and edible vegetables, all agricultural products show on average positive AVEs for SPS measures. For TBTs we find positive effects for half of all agricultural product groups. Live animals face the highest AVEs computed for TBTs and quantitative restrictions. Sugar and dairy products are particularly affected by antidumping. The highest AVEs of specific trade concerns in the agri-food sector are found for tobacco and cereals.

Figure 6 / Simple average by section over country-specific import-weighted binding AVEs



Note: Results based on Poisson estimation excluding intra-EU trade.

[15] See www.wiod.org

Figure 6 shows our results for binding AVEs by HS section. We first apply import weights by section for each importer and then take the simple average over all importers. We opted for plotting the three most often applied NTM types. Figure 6 strongly points towards import-restricting effects of NTMs, especially for antidumping measures, showing that although notifications of SPS measures and TBTs dominated in our database, less frequently used and more traditional policy instruments still appear to be of great concern.

In order to observe the impact of AVEs along the production and supply chains, we further break down our product level results into the broad economic categories (BEC). We make use of a correspondence table from HS 6-digit products to three broad categories: (i) intermediate goods, (ii) final consumption goods, and (iii) goods contributing to gross fixed capital formation (GFCF). It was constructed from the UN Broad Economic Categories (BEC revision3) classification and their correspondence to broader groups as defined by the OECD. About 700 out of around 5000 products were reclassified for the WIOD project in order to account for the fact that they might qualify for several categories. Take the example from our sample of HS code 940540 comprising electric lamps and lighting fittings. Our correspondence table suggests a 50% use as intermediate product, a 25% use for final consumption and a 25% contribution to gross capital formation.

Table 5 reports our estimated binding AVEs per NTM type, split up by sector and the broad economic categories. Simple averages, as shown in the first part of the table, refer to the mean of AVEs over all products that (partly) belonged to one BEC category. Import-weighted (i.w.) means – on the importer level and the global level – were derived by multiplying imports by BEC weights and summing up over each BEC category. We thereby account for the average importance of specific HS 6-digit products within each product group over all countries in our sample and for their importance in global trade.

Table 5 / Binding AVEs by BEC/WIOD classification

Total	*BEC*	*SPS*	*TBT*	*QRS*	*ADP*	*OCA*	*STC*
PRODUCT	Intermediates	11.7	14.8	36.1	27.2	20.9	8.8
(s.a. over country-	Final Consumption	2.1	1.3	31.4	15.4	2.7	4.9
specific s.a. AVEs)	GFCF	31.9	20.8	64.2	34.2	53.6	25.5
COUNTRY	Intermediates	1.4	5.9	-0.2	5.3	0.2	-0.7
(s.a. over country-	Final Consumption	1.0	-1.9	-0.4	1.9	-0.2	-1.3
specific w.a. AVEs)	GFCF	10.8	12.6	1.7	1.5	1.9	2.0
WORLD	Intermediates	-3.6	2.1	-0.1	2.8	-0.5	-1.5
(w.a. over country-	Final Consumption	0.2	-4.9	-1.0	0.3	-0.4	-5.6
specific w.a. AVEs)	GFCF	2.8	1.0	0.8	0.9	0.6	0.6

Note: BEC = Broad Economic Categories; GFCF = Gross Fixed Capital Formation. Results based on Poisson estimation excluding intra-EU trade. s.a. and w.a. refer to simple and import-weighted averages, respectively.

What we learn from this calculation is that the highest AVEs for all types of NTMs are found for products contributing to gross fixed capital formation. Final consumption goods are facing high trade barriers in the form of quantitative restrictions and counteracting measures, but AVEs calculated for SPS measures and TBTs for final consumption goods are very low. Given the rising importance of global value chains, an in depth analysis of the restrictiveness of antidumping measures and TBTs for trade in intermediates is advisable.

6. Robustness of our findings

In the following we briefly discuss our findings with respect to different NTM samples and estimation procedures.

Our main specification concerned international trade excluding intra-EU trade flows. In addition, we repeated the regression analysis for the full sample, i.e. including intra-EU trade flows and therefore ignoring mutual recognition rules within the European common market. As an alternative to excluding intra-EU trade flows, we re-estimated AVEs by setting NTMs equal to zero if both the importing and the exporting country belonged to the EU.

As we look at trade flows at a very disaggregated level, our dataset contains a large number of zero trade flows. Due to the possibility that zero trade flows in our data are the result of firms' decisions not to export for reasons we do not observe we also discuss results obtained when following the Heckman two-stage estimation procedure.

6.1. THE NTM SAMPLE

We find that for all three specifications, mean and median AVEs show the same signs. Magnitudes, however, differ. While average AVEs computed for specific trade concerns on SPS measures and TBTs are very similar for all three samples, AVEs on SPS measures and TBTs themselves are found to be lowest for the full sample with a mean of 0.9% and 3.7% over all countries, respectively. Excluding intra-EU trade reduces the number of AVEs of SPS measures by 14% and for TBTs by 9%, resulting in average AVEs for SPS measures of 1.5% and for TBTs of 4.1%. If we alternatively assume zero NTMs for EU trading partners, results for TBTs remain more or less unchanged, while the average AVE of SPS measures increases significantly. The general observation that AVEs for antidumping measures are found to be highest holds throughout.

For all three samples under investigation, we find that only 42% to 48% of all NTMs have a significant impact on import quantities at the 10% level. Binding AVEs appear more trade impeding (or less trade promoting) for every NTM type.

The main messages formulated based on regional and income aggregates do not change much: Highest AVEs for counteracting measures are found for richer countries, particularly in Europe and Central Asia, while highest AVEs for SPS measures and TBTs were calculated for low income countries. Yet, despite showing lower AVEs for SPS measures and TBTs, we found the highest AVEs for specific trade concerns for lower middle income countries.

Table 6 / Average AVEs over importers resulting from different NTM samples

Full WTO sample		*SPS*	*TBT*	*QRS*	*ADP*	*OCA*	*STC*
All AVEs	Simple avg.	0.9	3.7	7.3	15.5	1.4	3.1
	i.w. avg.	-0.1	2.2	-0.9	1.7	-0.3	0.2
Binding AVEs	Simple avg.	1.5	4.8	8.8	17.4	12.1	10.6
	i.w. avg.	1.0	6.2	-1.2	4.0	-0.2	1.1

Excluding intra-EU trade		SPS	TBT	QRS	ADP	OCA	STC
All AVEs	Simple avg.	1.5	4.1	17.6	14.3	2.5	2.3
	i.w. avg.	-0.4	0.7	-1.0	1.7	-0.4	0.0
Binding AVEs	Simple avg.	3.5	5.2	18.0	15.7	15.5	9.3
	i.w. avg.	0.4	5.6	0.2	4.3	-0.1	0.2

Setting intra-EU NTMs to zero		SPS	TBT	QRS	ADP	OCA	STC
All AVEs	Simple avg.	6.8	4.6	17.5	15.0	3.9	2.6
	i.w. avg.	0.4	0.0	-0.9	1.5	-0.4	1.9
Binding AVEs	Simple avg.	6.1	5.5	16.4	15.7	14.3	9.0
	i.w. avg.	2.4	2.5	-1.0	3.6	-0.1	3.4

Note: Simple averages over importer-specific AVEs. Results based on Poisson estimations. i.w. avg. refers to import-weighted average.

6.2. HECKMAN RESULTS

In the first step of the Heckman two-stage estimation procedure, the selection equation (7) evaluates the probability of non-zero trade flows for specific country pairs. From this first step, the inverse Mills ratio (ϕ_{ijht}) is obtained, which enters the outcome equation (8) in the second step as an explanatory variable, which should solve the omitted variable bias in the presence of sample selection.

A main advantage of the Heckman selection procedure is that it allows for a data-generating process for zero and non-zero trade flows, while for the Poisson estimation it is assumed that all observations are drawn from the same distribution. Nonetheless, we decided to refer to the Poisson estimation as our preferred specification, as it deals well with heteroscedasticity and does not suffer from the incidental parameters problem. The latter means that as we are using a huge panel data set incorporating many fixed effects, probit models are more likely to render biased and inconsistent estimates, as they do not converge to their true value as the number of parameters (i.e. fixed effects) increases with sample size.

$$Prob[m_{ijht} > 0] = \alpha_{0h} + \alpha_{1h} \ln(1 + t_{ijht_{-1}}) + \sum_{n} \alpha_{2h}^{n} NTM_{ijht_{-1}}^{n} + \alpha_{3h} C_{ijt_{-1}} + \omega_{ht} + \epsilon_{ijht}, \quad (7)$$

$$\forall h;\ n \in \{ADP, CVD, SG, SSG, SPS, TBT, QRS; STC_{SPS}, STC_{TBT}\}$$

$$\ln(m_{ijht} | m_{ijht} > 0) = \beta_{0h} + \beta_{1h} \ln(1 + t_{ijht_{-1}}) + \sum_{n=1}^{N-1} \beta_{2h}^{n} NTM_{ijht_{-1}}^{n} + \sum_{i=1}^{I} \beta_{2ih}^{n'} \omega_i NTM_{ijht_{-1}}^{n'} + \beta_{3h} C_{ijt_{-1}} + \omega_{ijh} + \omega_{ht} + \phi_{ijht} + \mu_{ijht}, \quad (8)$$

$$\forall h;\ \forall n, n' \in \{ADP, CVD, SG, SSG, SPS, TBT, QRS; STC_{SPS}, STC_{TBT}\}\ where\ n' \neq n$$

In the first stage, we control for all NTM variables, while we allow for importer-specific effects of NTMs only in the second stage. Looking at simple averages over all AVEs we find first, that the only NTM type for which Heckman estimates are very close to the Poisson results are TBTs, which represent more than 50% of all AVE estimates. Second, AVEs for SPS measures are similar in magnitudes to AVEs of TBTs. However, while Poisson estimates indicated that TBTs appear slightly more trade restrictive, the reverse holds for the Heckman selection results. Third, we find counterintuitive signs for counteracting measures such as antidumping, countervailing duties, quantitative restrictions and safeguards, for which also the number of obtained AVEs is significantly lower. Table 7 reports average importer-specific AVEs per NTM type, i.e. the same weight is given to each single country in the sample.

Many conclusions on country-specific AVEs remain unchanged. Sub-Saharan Africa and the Middle East and North Africa show the highest AVEs for TBTs. Yet, while in the Poisson estimation Sub-Saharan Africa stood out with the highest AVEs for SPS measures, in the Heckman specification it is accompanied by South Asia. Although we lose many observations on counteracting measures with the Heckman procedure, yielding a greater proportion of negative AVEs, Europe and Central Asia still appear to have the most trade-impeding antidumping measures in place. Translating these results on income levels, the finding persists that low income countries show the highest AVEs for SPS measures and TBTs, while upper middle and high income countries show lower AVEs for these NTM types but in addition hamper trade with the use of quantitative restrictions and counteracting measures.

Table 7 / Average AVEs over importers resulting from Poisson and Heckman estimation

Poisson		SPS	TBT	QRS	ADP	OCA	STC
All AVEs	Simple avg.	1.5	4.1	17.6	14.3	2.5	2.3
	i.w. avg.	-0.4	0.7	-1.0	1.7	-0.4	0.0
Binding AVEs	Simple avg.	3.5	5.2	18.0	15.7	15.5	9.3
	i.w. avg.	0.4	5.6	0.2	4.3	-0.1	0.2

Heckman		SPS	TBT	QRS	ADP	OCA	STC
All AVEs	Simple avg.	4.3	2.3	7.5	-4.1	-5.6	-2.8
	i.w. avg.	0.6	1.7	-0.8	0.3	-2.4	-1.6
Binding AVEs	Simple avg.	4.7	3.4	9.1	5.1	-11.0	1.9
	i.w. avg.	4.2	7.4	-2.1	0.5	-4.6	-1.3

Note: Simple averages over importer-specific AVEs. i.w. avg. refers to the simple average over import-weighted AVEs per importing country. Results based on estimations excluding intra-EU trade.

7. Conclusion

In this paper we calculate ad valorem equivalents (AVE) for different types of non-tariff measures (NTMs) at the 6-digit product level of the Harmonised System for about 100 importing countries over the period 2002-2011. For this purpose, we make use of information on NTM notifications to the WTO provided via the WTO I-TIP database, enhanced by Ghodsi et al. (2016c) through matching of missing HS codes.

We contribute to the existing literature by distinguishing the effects of NTMs for several types of NTMs, with specific attention given to technical barriers to trade (TBTs) and sanitary and phytosanitary (SPS) measures. Working with this unique dataset allows evaluating the trade effects of NTMs by means of an intensity measure, i.e. by counting how many NTMs a specific importing country imposed against a trading partner for each product.

Recent literature has started to acknowledge that non-tariff measures need not necessarily be non-tariff barriers. Especially SPS measures and TBTs bear the potential to increase trade. Our analysis confirms that SPS measures and TBTs are found to both impede as well as promote trade, depending on the NTM imposing country and product under consideration.

While we find richer countries to apply more NTMs than poorer countries, we also observe smaller effects of NTMs for richer countries compared to poorer countries. At the product level, we cannot confirm findings of previous studies which indicated that especially trade in agri-food products is negatively affected by NTMs. Splitting up products according to their purpose of use we find the highest AVEs of NTMs for products contributing to gross fixed capital formation. Given the slowdown of global trade growth and the increasing importance of global value chains, a further in-depth analysis of the restrictiveness of antidumping measures and TBTs for trade in intermediates is advisable.

Finally, positive AVEs for SPS measures and TBTs might point towards the quality-increasing effects of these measures, as they aim at the protection of human, animal and plant life and at guaranteeing quality of packaging and information provided and therefore have implications which are reaching far beyond the impact on international trade.

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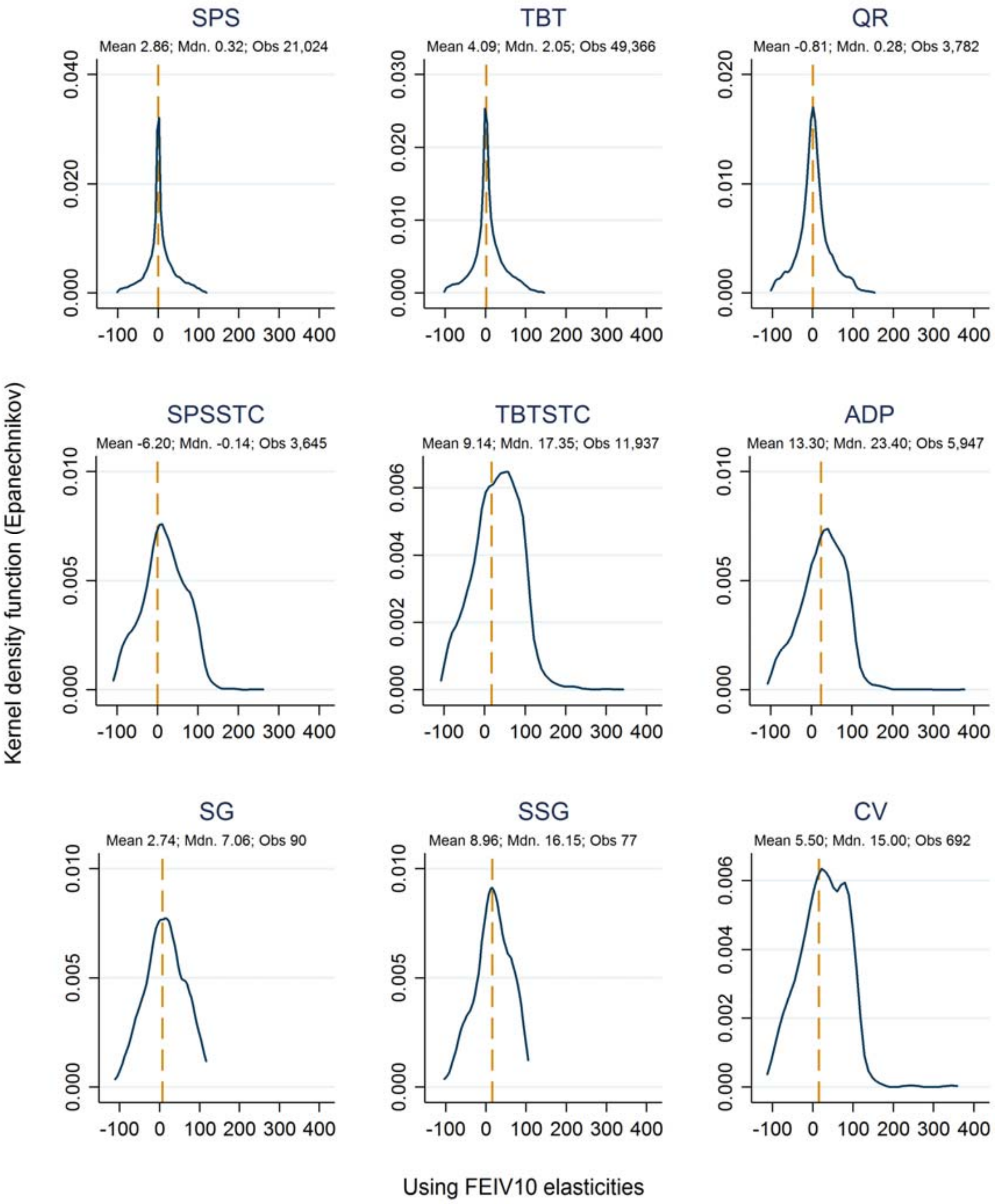
Appendix

Appendix 1 / Distribution of AVEs over importer-product pairs by NTM type



Note: The density plots display AVEs ϵ (-100, 400]; Summary statistics are computed over full distributions. Vertical lines indicate median values. Results based on Poisson estimation excluding intra-EU trade.

Appendix 2 / Binding AVEs of NTMs by importer and NTM type (simple averages)

Importer	*ISO2*	*SPS*	*TBT*	*QRS*	*ADP*	*OCA*	*STC*	*Tariff*
Albania	AL	14.0	2.9	.	.	.	27.6	3.8
Argentina	AR	3.0	4.6	.	29.0	.	5.9	7.4
Armenia	AM	-6.1	-2.8	.	.	.	-4.4	2.7
Australia	AU	-0.8	1.0	24.1	17.8	43.2	61.9	2.1
Austria	AT	0.9	2.8	8.0	11.6	9.4	14.5	3.5
Bahrain	BH	-3.4	7.6	.	.	.	32.4	5.2
Barbados	BB	12.5	.	.	.	.	.	7.6
Belgium	BE	0.3	3.4	-1.1	13.0	27.2	11.3	3.5
Belize	BZ	19.1	49.9	.	.	.	.	8.6
Bolivia	BO	-10.5	.	.	.	.	.	2.4
Brazil	BR	-1.5	-5.2	.	16.9	54.5	12.0	5.6
Bulgaria	BG	7.3	11.9	15.3	26.0	2.8	19.4	8.9
Cameroon	CM	.	11.0	.	.	.	.	11.0
Canada	CA	0.1	-1.9	.	-7.8	1.5	-5.5	5.1
Central African Republic	CF	.	36.0	.	.	.	.	7.9
Chile	CL	3.0	-0.5	.	-24.2	-27.2	-16.0	1.0
China	CN	15.3	7.5	.	14.5	77.5	-11.0	6.9
Colombia	CO	-2.0	-2.8	.	12.0	46.8	7.7	3.5
Costa Rica	CR	-3.1	3.0	0.1	43.1	-47.7	.	1.2
Croatia	HR	21.6	11.2	.	.	.	19.0	5.3
Cyprus	CY	7.8	16.5	25.8	15.5	65.7	40.9	4.5
Czech Republic	CZ	6.9	7.0	31.5	17.0	16.6	12.0	3.1
Denmark	DK	1.6	8.2	32.4	15.6	22.8	26.3	3.4
Dominican Republic	DO	-6.1	6.4	.	59.1	-29.2	.	2.9
Ecuador	EC	-8.3	6.1	.	160.1	85.0	.	3.3
Egypt, Arab Rep.	EG	19.1	10.7	.	21.2	.	.	12.8
El Salvador	SV	7.2	5.6	.	.	.	-57.6	0.9
Estonia	EE	6.6	8.8	28.8	15.7	-19.1	2.6	3.0
Fiji	FJ	18.6	.	.	.	.	.	11.5
Finland	FI	6.8	14.5	14.1	19.9	17.0	26.7	3.7
France	FR	-0.6	0.6	16.1	3.2	23.7	5.7	4.0
Georgia	GE	.	0.8	.	.	.	.	3.1
Germany	DE	-2.9	-1.4	0.3	12.0	-18.3	-1.3	3.9
Greece	EL	9.3	11.4	42.5	12.1	-18.8	42.5	3.3
Guatemala	GT	0.9	-0.8	.	.	.	70.6	0.9
Honduras	HN	2.9	1.6	.	10.8	.	.	0.7
Hungary	HU	7.1	10.3	8.5	20.5	-33.3	29.0	3.3
India	IN	-10.4	-10.1	.	-4.4	.	-39.2	12.6
Indonesia	ID	0.6	18.5	.	-10.5	10.6	.	5.1
Ireland	IE	3.1	8.2	12.2	15.5	-10.2	3.2	4.2
Israel	IL	-9.9	1.7	.	35.8	.	-8.3	5.0
Italy	IT	1.0	4.5	13.1	14.6	21.0	15.8	3.8
Jamaica	JM	-16.8	14.2	.	.	.	.	1.2
Japan	JP	-0.9	4.9	0.8	.	.	9.5	3.8
Jordan	JO	-0.2	19.2	.	-48.5	77.5	-43.5	12.7
Kenya	KE	.	6.4	.	.	.	.	15.7
Korea, Rep.	KR	-1.9	-0.6	-4.8	26.7	-28.0	-7.5	9.7
Kuwait	KW	.	0.7	.	.	.	.	3.7
Kyrgyz Republic	KG	.	4.4	.	.	-2.4	.	5.7
Latvia	LV	9.6	12.0	32.5	14.8	34.6	31.3	3.5
Lithuania	LT	8.7	12.1	33.7	22.0	22.3	21.6	3.6
Luxembourg	LU	10.1	3.8	4.7	24.9	3.5	11.2	3.8

(ctd.)

Appendix 2 / ctd.

Importer	*ISO2*	*SPS*	*TBT*	*QRS*	*ADP*	*OCA*	*STC*	*Tariff*
Macedonia, FYR	MK	11.2	3.0	.	.	.	.	3.9
Madagascar	MG	17.0	.	.	.	.	.	9.2
Malaysia	MY	1.7	5.9	.	-2.2	66.9	12.0	5.7
Malta	MT	9.5	16.4	27.2	22.1	38.1	59.0	4.7
Mexico	MX	3.6	14.7	.	-4.5	.	49.4	8.3
Moldova	MD	-3.1	13.7	.	.	.	21.4	2.6
Morocco	MA	3.9	12.3	.	.	95.5	.	24.1
Nepal	NP	10.3	.	.	.	.	.	12.3
Netherlands	NL	-1.3	2.0	30.8	12.3	3.9	11.5	4.0
New Zealand	NZ	3.7	5.6	.	14.4	-100.0	-100.0	3.8
Norway	NO	-1.0	-3.9	.	.	.	.	2.2
Oman	OM	-5.3	2.5	.	.	.	.	5.4
Pakistan	PK	.	-0.2	.	24.9	100.6	.	13.3
Panama	PA	-7.1	0.2	.	.	.	-10.0	3.9
Paraguay	PY	14.3	-4.1	.	.	.	.	2.2
Peru	PE	-3.0	-0.3	8.0	37.0	-81.8	28.6	2.2
Philippines	PH	7.8	2.0	.	.	58.2	.	1.3
Poland	PL	2.4	3.9	45.4	17.5	14.6	5.3	4.6
Portugal	PT	2.1	2.8	19.5	14.2	13.9	-0.3	4.1
Qatar	QA	.	-1.6	.	.	.	.	4.2
Romania	RO	14.8	8.9	32.0	36.4	21.2	52.5	2.3
Russian Federation	RU	.	.	-7.2	19.2	.	.	9.3
Rwanda	RW	.	-10.6	.	.	.	.	10.7
Saudi Arabia	SA	-8.0	-3.9	.	.	.	15.6	4.7
Senegal	SN	.	.	.	.	.	68.1	10.2
Singapore	SG	4.6	8.0	16.1	.	.	.	0.4
Slovakia	SK	14.7	10.0	29.3	25.7	3.5	10.6	2.9
Slovenia	SI	8.8	3.4	19.9	17.8	45.2	3.8	4.5
South Africa	ZA	4.0	5.1	.	4.5	64.6	19.8	9.0
Spain	ES	0.2	4.2	33.2	19.9	1.3	14.8	3.5
Sri Lanka	LK	7.3	12.5	.	.	.	.	12.7
Sweden	SE	0.8	2.3	33.8	16.0	-18.7	11.4	3.2
Switzerland	CH	-2.5	-1.0	.	.	.	.	4.1
Tanzania	TZ	.	4.6	.	.	.	.	19.3
Thailand	TH	1.5	-0.4	0.3	-37.5	.	-36.5	8.7
Trinidad and Tobago	TT	64.6	5.9	.	.	.	.	5.1
Tunisia	TN	.	1.5	.	.	-100.0	.	21.8
Turkey	TR	-5.0	-5.7	17.3	29.5	55.6	-15.8	6.7
Uganda	UG	.	4.2	.	.	.	.	9.3
Ukraine	UA	-6.2	-7.9	.	-4.5	54.3	-8.6	6.8
United Kingdom	UK	4.6	5.1	2.6	5.4	14.0	6.7	4.3
United States	US	-0.7	-3.3	.	2.2	12.5	-5.5	3.1
Uruguay	UY	-16.4	-1.9	.	.	.	.	1.1
Venezuela, RB	VE	.	.	.	-17.1	.	-33.4	3.6
Vietnam	VN	-6.0	9.1	.	.	.	.	5.0
Zambia	ZM	.	-6.1	.	.	.	.	4.4

Note: ave(OCA) is the sum of AVEs calculated for countervailing duties, safeguards and special safeguards; ave(STC) is the sum of AVEs calculated for specific trade concerns w.r.t. SPS measures and TBTs. Simple averages over HS 6-digit products. Average tariffs computed over the period 2002-2011 for products for which at least one AVE(NTM) could be evaluated.

Appendix 3 / Binding AVEs of NTMs by importer and NTM type (import-weighted averages)

Importer	*ISO3*	*SPS*	*TBT*	*QRS*	*ADP*	*OCA*	*STC*	*Tariff*
Albania	AL	17.2	-2.8	.	.	.	1.1	4.3
Argentina	AR	1.2	-0.7	.	15.3	.	6.3	7.8
Armenia	AM	-2.7	-6.4	.	.	.	-3.9	3.3
Australia	AU	-0.2	0.2	5.7	24.8	1.2	1.2	3.3
Austria	AT	1.0	-8.1	0.1	2.6	0.1	-5.5	3.7
Bahrain	BH	-2.1	38.2	.	.	.	8.7	7.6
Barbados	BB	-62.3	.	.	.	.	.	12.8
Belgium	BE	-3.1	-3.8	-10.6	3.4	0.9	-5.6	3.7
Belize	BZ	12.3	2.5	.	.	.	.	6.5
Bolivia	BO	-70.0	.	.	.	.	.	3.3
Brazil	BR	-5.1	-14.1	.	2.2	0.2	-0.3	3.6
Bulgaria	BG	-1.1	6.9	0.1	11.8	6.0	20.6	7.9
Cameroon	CM	.	50.3	.	.	.	.	7.2
Canada	CA	-0.4	0.9	.	1.7	-0.6	-10.3	4.7
Central African Republic	CF	.	85.4	.	.	.	.	5.3
Chile	CL	27.9	3.9	.	1.8	-8.1	0.5	0.8
China	CN	-5.4	3.1	.	1.0	0.2	-3.8	2.5
Colombia	CO	-0.5	-5.6	.	2.1	0.1	6.6	3.2
Costa Rica	CR	-1.7	-0.5	-2.0	0.5	-0.2	.	1.4
Croatia	HR	0.0	-29.3	.	.	.	4.2	6.6
Cyprus	CY	1.2	14.9	0.0	1.0	-30.6	1.2	3.1
Czech Republic	CZ	0.3	-0.1	1.9	2.9	0.9	-16.3	2.1
Denmark	DK	0.9	5.9	0.2	11.1	5.4	8.5	2.9
Dominican Republic	DO	-0.9	17.5	.	0.7	-1.9	.	2.7
Ecuador	EC	-0.5	71.1	.	2.3	9.0	.	2.7
Egypt, Arab Rep.	EG	4.1	27.8	.	4.0	.	.	3.1
El Salvador	SV	7.9	0.6	.	.	.	3.3	2.2
Estonia	EE	3.3	1.7	0.2	2.1	-0.8	-18.2	2.5
Fiji	FJ	48.2	.	.	.	.	.	13.9
Finland	FI	1.2	12.0	0.9	14.9	11.6	10.4	3.0
France	FR	-0.4	-5.1	5.0	1.6	-12.5	-2.7	3.4
Georgia	GE	.	-21.8	.	.	.	.	2.6
Germany	DE	-1.7	-12.2	0.5	0.1	-1.1	-19.3	3.1
Greece	EL	0.7	5.4	5.0	14.9	-0.3	7.0	2.3
Guatemala	GT	-8.5	10.0	.	.	.	0.1	1.3
Honduras	HN	-2.1	-11.2	.	0.9	.	.	1.0
Hungary	HU	0.9	12.7	5.3	14.8	12.2	6.9	2.0
India	IN	-5.2	-8.3	.	-16.9	.	-12.0	11.5
Indonesia	ID	0.0	68.5	.	-3.5	0.2	.	5.0
Ireland	IE	0.9	2.7	-1.2	3.6	-0.1	7.4	3.9
Israel	IL	-0.4	1.1	.	4.2	.	0.1	3.8
Italy	IT	0.4	3.0	-0.1	5.1	0.9	-10.0	2.8
Jamaica	JM	-0.2	28.0	.	.	.	.	0.9
Japan	JP	0.0	7.8	-1.0	.	.	-0.5	5.1
Jordan	JO	-6.8	14.3	.	-0.5	3.8	-15.6	12.8
Kenya	KE	.	23.0	.	.	.	.	16.9
Korea, Rep.	KR	-4.1	0.0	-1.3	1.1	-0.1	-9.1	7.1
Kuwait	KW	.	3.4	.	.	.	.	3.8
Kyrgyz Republic	KG	.	-9.0	.	.	3.8	.	5.7
Latvia	LV	0.2	2.5	6.5	41.1	39.9	2.5	2.1
Lithuania	LT	1.5	2.6	0.8	10.9	8.6	2.0	2.8
Luxembourg	LU	-1.2	-3.0	0.0	1.7	0.0	-7.5	3.6

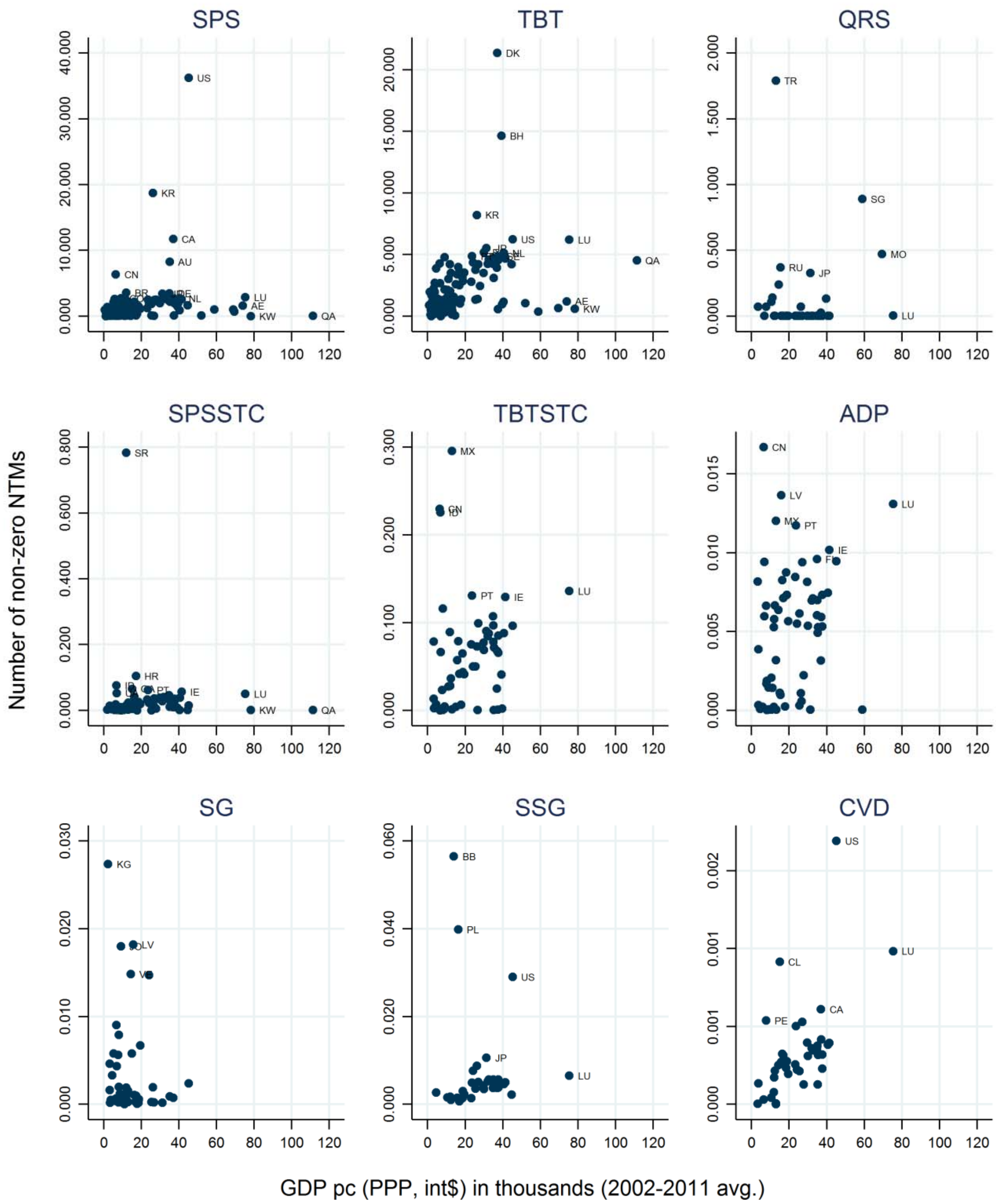
(ctd.)

Appendix 3 / ctd.

Importer	ISO2	SPS	TBT	QRS	ADP	OCA	STC	Tariff
Macedonia, FYR	MK	7.4	19.9	.	.	.	.	1.9
Madagascar	MG	55.1	.	.	.	.	.	13.3
Malaysia	MY	-0.2	6.1	.	0.6	0.0	-4.0	4.9
Malta	MT	0.9	2.2	3.7	1.6	-48.8	19.2	3.3
Mexico	MX	0.6	10.5	.	0.5	.	40.1	7.0
Moldova	MD	-1.0	9.9	.	.	.	-3.5	3.5
Morocco	MA	-6.7	17.1	.	.	7.4	.	8.1
Nepal	NP	-0.4	.	.	.	.	.	10.0
Netherlands	NL	-0.8	-0.8	0.3	5.1	-7.8	5.3	3.2
New Zealand	NZ	3.7	4.6	.	3.1	-0.6	-0.7	8.2
Norway	NO	10.9	-17.3	.	.	.	.	2.2
Oman	OM	-11.1	-13.5	.	.	.	.	3.4
Pakistan	PK	.	20.7	.	8.1	0.3	.	5.4
Panama	PA	-18.3	-0.3	.	.	.	-3.6	9.1
Paraguay	PY	0.0	-28.9	.	.	.	.	2.6
Peru	PE	-2.1	-12.6	1.4	15.6	-5.0	0.8	2.1
Philippines	PH	19.4	-4.0	.	.	0.0	.	1.3
Poland	PL	-1.2	-0.1	1.9	3.6	1.1	-4.5	3.5
Portugal	PT	-0.2	9.1	0.0	1.6	-0.1	11.4	5.2
Qatar	QA	.	9.7	.	.	.	.	3.8
Romania	RO	2.2	10.4	0.7	-0.7	-8.2	29.3	1.9
Russian Federation	RU	.	.	-23.0	0.2	.	.	8.3
Saudi Arabia	SA	0.3	9.2	.	.	.	0.2	4.5
Senegal	SN	.	.	.	.	.	68.1	5.2
Singapore	SG	5.3	29.9	2.3	.	.	.	.
Slovakia	SK	0.8	-2.2	0.3	3.5	0.0	-7.1	2.8
Slovenia	SI	0.8	-1.5	0.2	0.7	-6.9	-5.3	3.6
South Africa	ZA	-0.5	-0.2	.	-1.3	0.2	1.3	9.4
Spain	ES	0.5	5.5	0.1	9.2	1.1	-4.9	4.3
Sri Lanka	LK	-2.7	-25.2	.	.	.	.	15.5
Sweden	SE	-0.6	-1.2	2.6	5.2	1.7	4.1	2.4
Switzerland	CH	0.1	-7.5	.	.	.	.	2.8
Tanzania	TZ	.	63.8	.	.	.	.	22.7
Thailand	TH	-0.3	-14.2	0.3	-2.5	.	-18.5	9.7
Trinidad and Tobago	TT	37.4	9.1	.	.	.	.	9.7
Tunisia	TN	.	14.2	.	.	-0.2	.	8.6
Turkey	TR	-0.7	-20.0	0.6	5.6	0.3	-16.0	3.1
Uganda	UG	.	26.2	.	.	.	.	11.6
Ukraine	UA	-0.1	-4.0	.	-1.2	12.2	-4.3	4.7
United Kingdom	UK	2.0	2.8	0.8	2.5	1.0	8.6	4.2
United States	US	-0.5	-3.9	.	1.9	0.3	-5.9	3.1
Uruguay	UY	3.5	-7.3	.	.	.	.	0.9
Venezuela, RB	VE	.	.	.	-6.8	.	-56.6	1.6
Vietnam	VN	-15.2	3.5	.	.	.	.	5.0
Zambia	ZM	.	-5.1	.	.	.	.	0.8

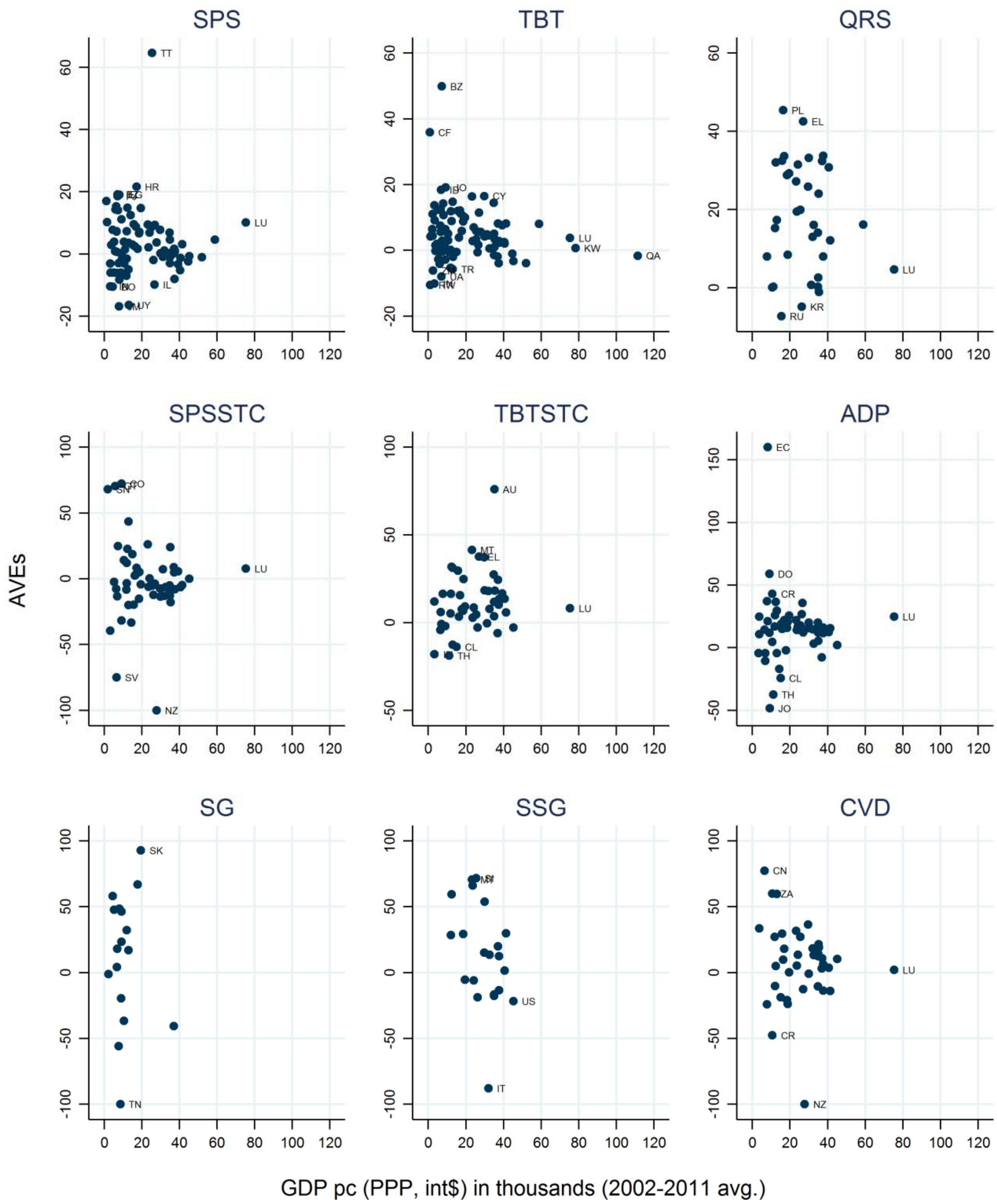
Note: ave(OCA) is the sum of AVEs calculated for countervailing duties, safeguards and special safeguards; ave(STC) is the sum of AVEs calculated for specific trade concerns w.r.t. SPS measures and TBTs. Import-weighted averages over HS 6-digit products. Average tariffs computed over the period 2002-2011 for products for which at least one AVE(NTM) could be evaluated.

Appendix 4 / Simple average NTMs over income by NTM type



Note: Excluding intra-EU trade. The agri-food sector is depicted in orange and the manufacturing sector in blue. NTMs by importer are computed as simple average over all traded products.

Appendix 5 / Simple average binding AVEs over income by NTM type



Note: Binding AVEs refer to estimates for which the impact of NTMs on import quantities was statistically different form zero at the 10% level. Results are based on Poisson estimation excluding intra-EU trade. AVEs by importer are computed as simple average over all traded products.

Appendix 6 / Binding AVEs of NTMs by HS-2-digit product group (import-weighted)

HS2	Product description	SPS	TBT	QRS	ADP	OCA	STC
1	Live animals.	9.3	19.9	28.9	.	.	6.8
2	Meat and edible meat offal.	1.8	-3.8	-6.6	-7.4	9.5	-1.7
3	Fish and crustaceans, molluscs […]	3.7	5.5	9.9	14.8	0.7	-7.3
4	Dairy produce; birds' eggs; […]	4.7	3.5	-12.8	28.5	1.6	0.5
5	Products of animal origin, […]	9.3	-2.8	-33.7	.	.	21.3
6	Live trees and other plants; […]	5.7	16.3	12.9	.	.	5.9
7	Edible vegetables and certain […]	-1.3	-0.7	-22.1	6.2	.	0.3
8	Edible fruit and nuts; peel […]	1.2	-2.6	7.6	0.6	.	4.7
9	Coffee, tea, mate and spices.	8.9	-3.1	5.2	7.8	.	6.9
10	Cereals.	8.6	10.5	23.4	-5.6	-3.0	51.4
11	Products of the milling industry; […]	1.7	5.8	-7.6	6.7	-5.8	6.5
12	Oil seeds and oleaginous fruits; […]	3.2	-1.6	-27.3	-3.8	-0.1	7.4
13	Lac; gums, resins and other […]	3.9	-14.1	1.9	.	-39.7	.
14	Vegetable plaiting materials; […]	16.9	12.8	-9.6	.	.	.
15	Animal or vegetable fats and […]	-0.2	0.0	-5.7	8.7	-9.9	-3.9
16	Preparations of meat, of fish […]	4.4	0.1	6.1	7.5	4.4	12.3
17	Sugars and sugar confectionery	-0.2	-1.1	13.5	22.0	-9.5	11.8
18	Cocoa and cocoa preparations.	6.5	5.1	.	7.5	-23.0	-10.6
19	Preparations of cereals, flour, […]	5.1	-3.6	.	0.9	-16.9	9.7
20	Preparations of vegetables, […]	1.1	-2.1	26.8	0.6	-10.0	-0.9
21	Miscellaneous edible preparations	-8.2	-2.7	.	-0.6	.	-12.0
22	Beverages, spirits and vinegar	0.6	0.4	-1.0	-3.9	4.6	7.0
23	Residues and waste from the […]	0.1	-6.6	.	2.1	-17.3	-7.4
24	Tobacco and manufactured tobacco […]	-1.7	12.2	-29.5	.	.	79.9
25	Salt; sulphur; earths and stone; […]	-0.5	8.0	4.6	-41.4	95.4	8.0
26	Ores, slag and ash.	-20.6	-4.6	11.8	1.0	.	59.0
27	Mineral fuels, mineral oils […]	-6.4	23.9	6.3	28.4	-0.9	-24.2
28	Inorganic chemicals; organic […]	-0.6	1.7	-4.9	-2.0	0.0	4.8
29	Organic chemicals.	0.1	5.4	9.6	7.0	21.7	4.2
30	Pharmaceutical products.	7.6	-3.5	15.0	34.1	.	-10.5
31	Fertilisers.	-11.7	-0.2	14.4	30.6	3.7	-56.6
32	Tanning or dyeing extracts; […]	-0.4	7.2	10.3	29.1	5.0	22.6
33	Essential oils and resinoids; […]	9.0	1.1	1.9	-9.2	.	5.8
34	Soap, organic surface-active […]	-5.5	-1.9	0.8	10.9	.	1.5
35	Albuminoidal substances; modified […]	15.7	0.1	12.9	16.7	-0.5	.
36	Explosives; pyrotechnic products; […]	-6.1	3.3	15.5	6.0	74.2	-7.5
37	Photographic or cinematographic […]	35.5	47.1	-14.3	46.5	.	.
38	Miscellaneous chemical product	8.3	-6.3	9.1	30.1	10.1	-7.2
39	Plastics and articles thereof	-4.6	4.6	1.7	9.1	5.8	2.8
40	Rubber and articles thereof	9.8	26.1	-35.3	14.0	36.2	-0.1
41	Raw hides and skins (other […]	44.9	22.5	53.7	96.3	.	.
42	Articles of leather; saddlery […]	-14.3	-24.8	-3.5	55.3	42.8	56.1
43	Furskins and artificial fur; […]	-14.8	21.0	-46.4	.	.	-53.7
44	Wood and articles of wood; […]	11.2	-8.6	20.1	-3.6	3.3	-25.3
45	Cork and articles of cork.	-57.3	.	23.0	-36.9	.	.
46	Manufactures of straw, of esparto […]	-13.2	.	.	.	.	.
47	Pulp of wood or of other fibrous […]	35.6	40.1	-13.2	.	.	.
48	Paper and paperboard; articles […]	1.3	1.4	48.1	46.4	53.9	100.6
49	Printed books, newspapers, […]	40.8	58.3	-16.9	-75.3	.	120.5

(ctd.)

Appendix 6 / ctd.

HS2	Product description	SPS	TBT	QRS	ADP	OCA	STC
50	Silk.	.	41.0	.	-100.0	.	-95.9
51	Wool, fine or coarse animal […]	-26.7	7.7	11.7	.	.	-10.5
52	Cotton,	-15.4	33.3	-4.1	23.1	-42.3	29.1
53	Other vegetable textile fibres; […]	-16.8	22.5	19.9	-100.0	.	-20.3
54	Man-made filaments.	14.3	15.1	-26.0	21.2	-15.3	-17.3
55	Man-made staple fibres.	18.1	28.4	-33.7	29.3	47.2	-14.2
56	Wadding, felt and nonwovens; […]	32.0	24.9	28.3	-21.5	.	47.7
57	Carpets and other textile floor […]	-1.2	17.0	41.4	.	.	80.9
58	Special woven fabrics; tufted […]	26.2	47.7	-34.9	9.2	.	-4.1
59	Impregnated, coated, covered […]	19.0	41.9	.	46.5	.	-44.9
60	Knitted or crocheted fabrics.	19.1	40.9	-1.1	56.8	.	31.7
61	Articles of apparel and clothing […]	21.0	-8.3	-26.8	4.1	.	-18.1
62	Articles of apparel and clothing […]	-1.0	-3.4	7.9	.	.	-2.6
63	Other made up textile articles; […]	-4.5	8.7	-18.1	-6.5	-13.2	4.6
64	Footwear, gaiters and the like; […]	0.0	18.9	-23.2	14.3	.	-23.9
65	Headgear and parts thereof	2.9	-30.3	29.7	.	.	114.9
66	Umbrellas, sun umbrellas, […]	-0.4	.	10.0	.	.	.
67	Prepared feathers and down […]	-18.8	-80.3	43.6	.	.	.
68	Articles of stone, plaster, […]	16.4	5.8	8.7	2.2	.	-6.3
69	Ceramic products.	-7.7	4.8	36.0	52.9	62.4	-7.1
70	Glass and glassware.	6.3	7.4	19.5	30.2	-100.0	-1.9
71	Natural or cultured pearls, […]	15.0	33.9	-16.7	.	.	18.6
72	Iron and steel.	5.3	3.4	7.0	35.6	-0.1	21.4
73	Articles of iron or steel.	0.9	11.3	16.5	17.7	-15.2	-24.1
74	Copper and articles thereof	-0.1	52.7	25.1	14.3	8.1	101.0
75	Nickel and articles thereof.	3.5	41.3	-33.4	.	.	-4.9
76	Aluminium and articles thereof	2.5	9.5	45.7	-3.1	42.0	9.9
78	Lead and articles thereof	7.1	-13.4	-20.0	.	.	56.0
79	Zinc and articles thereof.	4.6	-16.8	-30.2	11.5	.	.
80	Tin and articles thereof.	11.0	-40.1	9.0	.	.	.
81	Other base metals; cermets; […]	21.8	20.6	5.6	32.5	.	98.0
82	Tools, implements, cutlery, […]	21.9	15.5	3.9	12.0	.	-11.3
83	Miscellaneous articles of base […]	37.1	-7.8	-11.6	47.2	-43.9	68.3
84	Nuclear reactors, boilers, […]	8.4	5.5	1.0	2.3	2.3	15.9
85	Electrical machinery and equipment […]	16.3	8.6	10.0	-0.8	2.6	7.0
86	Railway or tramway locomotives, […]	-100.0	19.6	74.6	.	.	.
87	Vehicles other than railway […]	27.0	5.5	8.2	3.4	0.0	-6.5
88	Aircraft, spacecraft, and parts […]	114.8	63.3	.	.	.	.
89	Ships, boats and floating structures	.	45.6	.	.	.	.
90	Optical, photographic, […]	2.5	3.4	-15.3	-8.1	.	-12.9
91	Clocks and watches and parts […]	11.4	10.0	22.7	.	.	-100.0
92	Musical instruments; parts […]	49.1	21.0	-7.1	.	.	26.7
93	Arms and ammunition; parts […]	-7.5	66.5	45.5	.	.	.
94	Furniture; bedding, mattresses, […]	-25.2	0.6	-6.9	12.7	.	-5.8
95	Toys, games and sports requisites; […]	-19.5	4.3	-7.7	5.9	.	12.5
96	Miscellaneous manufactured […]	31.7	3.0	5.8	3.5	.	6.1
97	Works of art, collectors' pieces […]	71.3	.	.	.	.	.

Note: Binding AVEs refer to estimates for which the impact of NTMs on import quantities was statistically different from zero at the 10% level. Results are based on Poisson estimation excluding intra-EU trade. Import-weighted averages computed over HS 6-digit products by importer.

Appendix 7 / Country sample by region

Europe & Central Asia	*North America*	*Latin America & Caribbean*	*East Asia & Pacific*	*South Asia*	*Middle East & North Africa*	*Sub-Saharan Africa*
Albania	Canada	Argentina	Australia	India	Bahrain	Benin
Armenia	United States	Barbados	Brunei	Nepal	Egypt	Botswana
Austria		Belize	Cambodia	Pakistan	Israel	Cameroon
Belgium		Bolivia	China	Sri Lanka	Jordan	Central African Rep.
Bulgaria		Brazil	Fiji		Kuwait	Gabon
Croatia		Chile	Hong Kong		Malta	Gambia
Cyprus		Colombia	Indonesia		Morocco	Ghana
Czech Rep.		Costa Rica	Japan		Oman	Kenya
Denmark		Cuba	Macau		Qatar	Madagascar
Estonia		Dominican Rep.	Malaysia		Saudi Arabia	Malawi
Finland		Ecuador	Mongolia		Tunisia	Mauritius
France		El Salvador	New Zealand		United Arab Emirates	Nigeria
Georgia		Guatemala	Philippines			Rwanda
Germany		Guyana	Singapore			Senegal
Greece		Honduras	South Korea			South Africa
Hungary		Jamaica	Thailand			Tanzania
Iceland		Mexico	Vietnam			Uganda
Ireland		Nicaragua				Zambia
Italy		Panama				
Kyrgyz Rep.		Paraguay				
Latvia		Peru				
Lithuania		Saint Vincent and the Grenadines				
Luxembourg		Suriname				
Macedonia		Trinidad and Tobago				
Moldova		Uruguay				
Netherlands		Venezuela				
Norway						
Poland						
Portugal						
Romania						
Russia						
Slovakia						
Slovenia						
Spain						
Sweden						
Switzerland						
Turkey						
Ukraine						
United Kingdom						

Note: Classification according to the World Bank list of economies (July 2015).

Appendix 8 / Country sample by income group

Low income	Lower middle income	Upper middle income	High income
Benin	Armenia	Albania	Argentina
Cambodia	Bolivia	Belize	Australia
Central African Rep.	Cameroon	Botswana	Austria
Gambia	Egypt	Brazil	Bahrain
Madagascar	El Salvador	Bulgaria	Barbados
Malawi	Georgia	China	Belgium
Nepal	Ghana	Colombia	Brunei
Rwanda	Guatemala	Costa Rica	Canada
Tanzania	Guyana	Cuba	Chile
Uganda	Honduras	Dominican Rep.	Croatia
	India	Ecuador	Cyprus
	Indonesia	Fiji	Czech Rep.
	Kenya	Gabon	Denmark
	Kyrgyz Rep.	Jamaica	Estonia
	Moldova	Jordan	Finland
	Morocco	Macedonia	France
	Nicaragua	Malaysia	Germany
	Nigeria	Mauritius	Greece
	Pakistan	Mexico	Hong Kong
	Philippines	Mongolia	Hungary
	Senegal	Panama	Iceland
	Sri Lanka	Paraguay	Ireland
	Ukraine	Peru	Israel
	Vietnam	Romania	Italy
	Zambia	Saint Vincent and the Grenadines	Japan
		South Africa	Kuwait
		Suriname	Latvia
		Thailand	Lithuania
		Tunisia	Luxembourg
		Turkey	Macau
			Malta
			Netherlands
			New Zealand
			Norway
			Oman
			Poland
			Portugal
			Qatar
			Russia
			Saudi Arabia
			Singapore
			Slovakia
			Slovenia
			South Korea
			Spain
			Sweden
			Switzerland
			Trinidad and Tobago
			United Arab Emirates
			United Kingdom
			United States
			Uruguay
			Venezuela

Note: Classification according to the World Bank list of economies (July 2015).

Appendix 9 / Description of HS sections

Sections	*HS 2-digit (rev.2002)*	*Product group description*
I	HS 01-05	Live animals and products
II	HS 06-14	Vegetable products
III	HS 15-15	Animal and vegetable fats, oils and waxes
IV	HS 16-24	Prepared foodstuff; beverages, spirits, vinegar; tobacco
V	HS 25-27	Mineral products
VI	HS 28-38	Products of the chemical and allied industries
VII	HS 39-40	Resins, plastics and articles; rubber and articles
VIII	HS 41-43	Hides, skins and articles; saddlery and travel goods
IX	HS 44-46	Wood, cork and articles; basketware
X	HS 47-49	Paper, paperboard and articles
XI	HS 50-63	Textiles and articles
XII	HS 64-67	Footwear, headgear; feathers, artif. flowers, fans
XIII	HS 68-70	Articles of stone, plaster; ceramic prod.; glass
XIV	HS 71-71	Pearls, precious stones and metals; coin
XV	HS 72-83	Base metals and articles
XVI	HS 84-85	Machinery and electrical equipment
XVII	HS 86-89	Vehicles, aircraft and vessels
XVIII	HS 90-92	Instruments, clocks, recorders and reproducers
XIX	HS 93-93	Arms and ammunition
XX	HS 94-96	Miscellaneous manufactured articles
XXI	HS 97-97	Works of art and antiques

For details see: http://unstats.un.org/unsd/tradekb/Knowledgebase/HS-Classification-by-Section

Appendix 10 / Procedure for the estimation of import demand elasticities

The procedure for estimating import demand elasticities – i.e. the change in the import quantity of a specific product (in %) due to an increase its price (by 1%) – follows the approach published by Kee et al. (2008). Results of an update and extension of their work, which were used in this paper, are forthcoming in Ghodsi et al. (2016a).

This section only briefly summarises key elements of their approach. The theoretical model is based on Kohli's (1991) GDP function approach. It makes use of a semi-flexible translog GDP function $G^t(p^t, v^t)$ to estimate import demand elasticities with data on prices $p^t$and factor endowments v^t. Starting from a fully flexible translog functional form of the GDP function with respect to goods prices and factor endowments and employing restrictions such that the GDP function satisfies homogeneity and symmetry properties, the derivative of $\ln G^t(p^t, v^t)$ with respect to the price of good n gives the equilibrium share of good n in GDP at period t:

$$s_n^t(p^t, v^t) \equiv \frac{p_n^t q_n^t(p^t,v^t)}{G^t(p^t,v^t)} \qquad \text{(A1)}$$

where s_n^t is the share of good n in GDP (with negative values assigned to imports, and positive values associated with output and exports). Kee et al. (2008) show that under the consideration of the translog parameters of the GDP function, the derivative of s_n^t with respect to prices p_n^t is given as

$$\frac{\partial s_n^t}{\partial p_n^t} \equiv \frac{q_n^t}{G^t} + p_n^t \frac{\frac{\partial q_n^t}{\partial p_n^t}}{G^t} - \frac{q_n^t p_n^t}{(G^t)^2}\frac{\partial G^t}{\partial p_n^t} = a_{nn}^t \frac{1}{p_n^t} \qquad \text{(A2)}$$

where a_{nn}^t is a translog parameter stemming from the semi-flexible GDP function that captures the change in the share of good n in GDP (which by construction is negative for imported products) when the price of good n increases by 1 %. The multiplication of both sides with p_n^t and remembering that, (1) $\frac{\partial G^t}{\partial p_n^t} = q_n^t$, (2) $\partial s_n^t \equiv q_n^t p_n^t / G^t$ and (3) $\varepsilon_{nn}^t \equiv \frac{\partial q_n^t(p^t,v^t)}{\partial p_n^t}\frac{p_n^t}{q_n^t}$ results in $s_n^t + s_n^t \varepsilon_{nn}^t - (s_n^t)^2 = a_{nn}^t$, which after rearranging terms gives the result for the import demand elasticity of imported good n:

$$\varepsilon_{nn}^t \equiv \frac{\partial q_n^t(p^t,v^t)}{\partial p_n^t}\frac{p_n^t}{q_n^t} = \frac{a_{nn}^t}{s_n^t} + s_n^t - 1 \leq 0, \forall s_n^t < 0 \qquad \text{(A3)}$$

If the share of imports in GDP does not change due to changes in import prices ($a_{nn}^t = 0$), then the implied import demand is unitary elastic, meaning that an increase of the price p_n^t by 1 % induces a proportional decrease in quantities q_n^t such that the share in GDP, s_n^t, remains constant. If $a_{nn}^t > 0$, the share of the imported good n in GDP decreases (i.e. s_n^t becomes less negative), implying that demand is elastic, such that an increase in the price reduces quantities more than proportional. Finally, if $a_{nn}^t < 0$, the share of imported good n in GDP increases (i.e. s_n^t becomes more negative) import demand must be inelastic, as quantities respond less than proportionately to a change in prices. Thus, for small shares it holds:

$$\varepsilon_{nn}^t \begin{cases} < -1 \text{ if } a_{nn}^t > 0 \\ = -1 \text{ if } a_{nn}^t = 0 \\ > -1 \text{ if } a_{nn}^t < 0 \end{cases} \qquad \text{(A4)}$$

Empirically, this strategy is implemented by using a parameterisation from a fully flexible to a semi-flexible translog function and by restricting all translog parameters to be time invariant in order to handle the large number of goods at the HS 6-digit level. The resulting share equation is

$$s_n^t(p^t, v^t) = a_{0n} + a_{nn} \ln \frac{p_n^t}{\overline{p_k^t}} + c_{nm} \ln v_m^t \quad \text{(A5)}$$

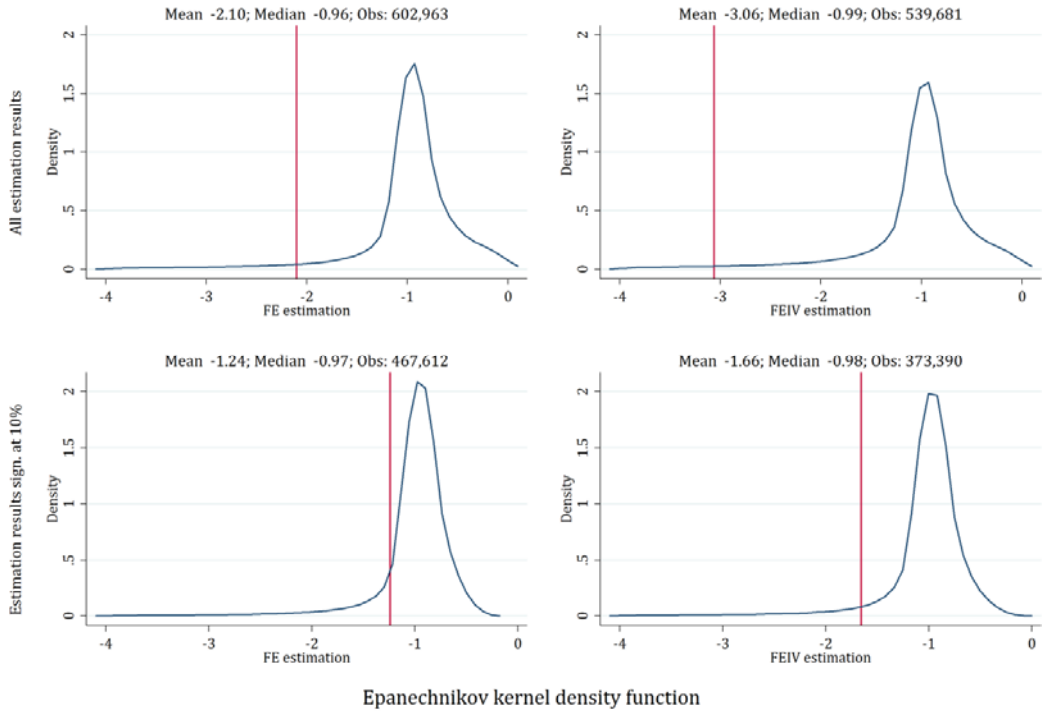
where p_n^t is measured using unit values and $\overline{p_k^t}$ is a weighted average of the log prices of all non- n goods, which is approximated with the observed Tornqvist price index of all non- n goods. c_{nm} is the translog parameter associated with factor endowment v_m^t. Equation A5 is pooled across countries and years, allowing for country and year fixed effects.

In order to reduce the bias due to endogeneity or measurement errors, we further instrument unit values using the simple averages of the unit values of the rest of the world in addition to the trade-weighted average distance of the importing country to all exporting countries of good n.

We dealt with extreme values and potential outliers in three steps: First, we dropped the tails of the distribution (0.5% of either side). Second, we dropped elasticities greater than zero, i.e. we abstained from analysing goods for which demand increases with higher prices. Finally, we set the minimum elasticity level at -100, as any price increase cannot decrease quantities by more than 100%.

The density plots in Elasticity Figure 1 show the distribution of elasticities over all country-product pairs, where the left panel corresponds to the fixed effects estimation, while the right panel shows fixed effects estimation results when instruments for unit values are implemented. The upper part reports all elasticity estimation results, while the lower part presents only elasticities significantly different from zero[16]. Import-weighted averages (not shown) point towards higher elasticities (closer to -1) for the manufacturing sector and lower elasticities (closer to 0) for the agri-food sector, especially for richer countries, including members of the EU.

Appendix Figure 1 / Import demand elasticity estimates over importer-product pairs



Note: FE refers to fixed effects estimation. FEIV refers to fixed-effects estimation with instrumental variables.

16 where $s.e.(\varepsilon_{nn}) = |s.e.(a_{nn})/s_n|$

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