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Non-tariff measures and competitiveness *

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Abstract

In this paper, we explore how tariff and standard-like Non-Tariff Measures (NTMs) introduced by the EU are related with market conditions in domestic EU markets. While Tariffs work as a pure tax on import, standard-like NTMs potentially affect costs of both domestic firms and foreign exporters. NTMs may not necessarily work as protectionist measures and even induce pro-competitive effects in the domestic market in the longer term, especially if we allow for firms mobility. The impact could be different for large and small firms. We extend the model by Melitz and Ottaviano (2008) to include Non-Tariff barriers. We derive some testable implications relating Non-Tariff barriers to the number of firms selling in the domestic market and average efficiency. The link between NTMs and domestic market conditions depends on whether they involve new standards and technical specifications imposed on both domestic and foreign firms, or, rather, the extension to foreign firms of standards and technical specifications already adopted by domestic firms. In the first case, there is a decline in the number of firms and in average productivity; in the second case, NTMs induce pro-competitive effects: an increase in the number of firms and of average productivity. We then take the model to the data for a group of European countries and manufacturing industries. We combine Compnet data for 15 EU countries in 2001-2012, providing information on firms performance at the industry level and by size class, with the STC WTO-I-TIP database, with information on Specific Trade Concerns raised at the WTO on NTMs and with the Trains database with information on Tariffs. The NTMs that we consider have similar effects as in the second NTMs case in the theoretical model; the results for Tariff are in the same direction, albeit of a larger magnitude. These results are consistent with a theoretical framework allowing for firms mobility in the longer term.

JEL Classification: F13, F14

Keywords: Tariffs, Non-tariff Measures, Heterogeneous firms, International Trade, EU.

1 Introduction

Standard-like Non-Tariff Measure (NTMs) are generally analysed with respect to their impact on trade, in particular due to possible protectionist effects. In this paper, we take instead the perspective of domestic producers and look at the effects of NTMs on market conditions in the domestic economy of the country imposing them and on exporters. We do this in theory and then for a sample of European countries and industries, analysed between 2002 and 2015.

From the perspective of domestic firms there is a crucial difference between tariffs and NTMs. Tariffs work as a pure tax on import, and induce a cost wedge between domestic and foreign exporters. NTMs may potentially affect the costs of both domestic firms and foreign exporters. In other words, domestic firms must adopt the same standards and technical requirements of foreign firms. Consequently, the cost of NTMs is levelled for both domestic and foreign exporters. As discussed in the literature reviewed in the next section, there are two different scenarios that should be considered. In the first, the standard or the technical requirement is new for domestic as for foreign firms, they all have to adopt it from scratch. The second scenario, refers to standards already adopted by domestic firms that are extended to foreign exporters. Even though this measure only imposes a cost on foreign exporters, it is not necessarily discriminatory, as it forces foreign exporters to level their production conditions to those of domestic firms. Still, it may rebalance the competitive advantage and discourage foreign exports, similarly to tariffs.

In what follows we develop a theoretical framework to analyze these three different options, (i) the introduction of a tariff, (ii) the adoption of a new NTM by domestic firms and foreign exporters, (iii) the extension of an already domestically adopted NTM to foreign exporters. We work within the framework of the model by Melitz and Ottaviano (2008), Section 3. We derive some testable implications relating Non-Tariff barriers to the number of firms selling in the domestic market and average efficiency.

The theoretical analysis envisages a long-term framework; therefore, it also allows for firms mobility between the two hypothetical identical countries analysed, country A (domestic) and country B (foreign). Trade barriers jumping is frequently observed in large markets like the European Union - think at Japanese automobile producers in the UK. Though this is more likely with tariffs, it may occuralso with NTMs, because of specialization and of the gains from avoiding two different technical standards on the same production line.

We identify the following results for domestic firms. The introduction of a new unilateral NTM on both domestic and foreign firms, reduces the number of firms producing in the domestic market and average productivity. This is a long-term result. In the short term (not analysed) the increased cost of producing at home implies that the number of domestic firms declines, as the least efficient ones exit. There might be fewer foreign exporters also. In the longer term, the number of firms based in A will decline further because of mobility. Producing in B is now more convenient, as the standard is not imposed on domestic sales there. The firms that will move to B will be the most efficient ones (which can afford the cost of relocation). The combined effect of the exit of domestic firms and possibly of the decline of foreign exports from B , will increase the market share of the remaining domestic firms and hence raise the minimum cost cut off. These counterbalancing effects introduce ambiguity, and will in the end generate a decline in average productivity in the EU (or in country A), with smaller less productive firms re-entering the market, accompanied by a decline in the share of exporters from A to B.

The introduction of a unilateral NTM affecting only foreign firms (as domestic ones have already introduced it) has opposite effects. Here, the number of domestic firms increases. Also, as the relative cost of exporters from B to A is now higher, productive capacity will be relocated accordingly. As generally, the most efficient firms are the ones making the move, the average productivity will increase in the domestic market A. The second case (NTM only on foreigners) gives identical theoretical predictions as the inclusion of a tariff, though likely of lower magnitude.

Note that these long-term outcomes partly contradict short term expected effects, namely with no relocation of production between counties. In the first case, the introduction of the NTMs by both domestic and foreign firms should have procompetitive short-term effects, leading to exit of the least efficient domestic firms and consequently to an increase in average productivity. In the second case the NTM works as a sort of protectionist measure, with anticompetitive effects: entry of least productive domestic firms and decline of average productivity. It is only the longer term relocation of firms that reverts these two results. In the end we have less firms, but lower average productivity in the first case, and more firms, but higher average productivity in the second case.

We then take the model to the data for a group of European countries and manufacturing industries. We combine CompNet data for 16 EU countries in 2002-2012, providing information on firms' performance at the industry level and by size class, with the STC WTO-I-TIP database, providing information on Specific Trade Concerns (STC) raised at the WTO on NTMs, and with the TRAINS database providing information on Tariffs. The empirical analysis exploits cross-industry and cross-country heterogeneity in trade barriers (see section 3). Even though both NTMs concerns raised by foreign trade partners and tariffs are the same for all EU countries, their different trade structures make them differently affected by NTMs and tariffs.

In the empirical analysis (Sections 4, 5, 6 and 7), we employ two measures of NTM protection built by using data on STC raised to Technical Barriers to Trade (TBT) committee. Therefore, we consider those TBT that are perceived as trade barriers. We investigate the effects of these TBT protection measures and of tariffs on market conditions of the country imposing the measure, in terms of number of firms and average productivity; we investigate whether and to what extent these effects are heterogeneous across firms, and therefore also affect the firms' efficiency distribution.

Most of our empirical results confirm broadly the theoretical predictions. As for TBT we find results consistent with the second model of NTMS, those regarding only foreign producers. Here, the number of firms increases, especially large firms and also average efficiency increases.

2 Related Literature

A recent stream of literature investigates the role of standard-like NTMs, also called technical measures, namely, Sanitary and Phytosanitary Standards (SPS) and Technical Barriers to trade (TBT) [1], with respect to trade flows and welfare.

Standard-like NTMs are not introduced with a protectionist aim, at least not explicitly. Their scope is to increase the quality of goods and/or reduce informational asymmetries (Gourdon, 2014). Nonetheless, these measures could also hide the aim to build a barrier to trade. Moreover, even if welfare enhancing, restricting trade might be a side outcome, because costs of compliance might be different across countries, in particular developed and developing countries (Disdier et al., 2008; Marette and Beghin, 2010), and also within countries across heterogeneous firms (Fontagné et al., 2015).

Because of the potential trade reducing effects of standard-like NTMs, since 1995, the WTO

[1] SPS are measures affecting areas such as restriction for substances, restriction for non eligible countries' hygienic requirements, or other measures for preventing dissemination of diseases; all conformity assessment measures related to food safety, such as certification, testing and inspection, and quarantine; TBT are measure such as labelling, marking, packaging, restriction to avoid contamination or other measures protecting the environment, standards on technical specifications and quality requirements (Gourdon, 2014)

agreements on standards require members to notify information on their imposed measures for transparency. Then a Specific Trade Concern can be activated, when a member (ore more than one) raises a concern to the WTO according to which a specific measure is perceived as a barrier to exporting in the country imposing the measure.

For the fact that they are not introduced with protectionist aims, this per se' opening room for ambiguities and controversial assessments, standard-like NTMs differ intrinsically from traditional trade barriers (Non-technical measures and tariffs)[2] in their economic implications along several dimensions, by working as potential supply and demand shifters (Beghin et al., 2015b; Fugazza, 2013). When standard-like NTMs imply a cost, e.g. to adapt the production process, to buy higher quality intermediate goods and inputs, to comply with the standard, typically both domestic and foreign firms bear this cost, while traditional barriers affect foreign firms only. But it could also be the case that domestic firms already met the standard in the country introducing the technical measure, which would in this case have potentially discriminatory effects with respect to foreign firms. On the other hand, in a world of heterogeneous firms, better foreign suppliers might satisfy the standard at a lower cost than domestic ones or vice-versa (Beghin et al., 2015b; Marette and Beghin, 2010). In general, the effects on trade depend on the relative cost of compliance across countries.

Standard-like NTMs can work as supply shifter by increasing the quality of the good or input, but also by solving technical incompatibilities and/or easing trust in buyer-supplier relationships (Jouanjean, 2012), this increasing matching opportunities. Depending on the measure and on the characteristics of the industry involved, they can help solving information asymmetries, reducing transaction costs in buyer-supplier relationships along the global value chain. They can also increase costs, marginal of fixed, of compliance and/or they shift these costs from buyer to suppliers with potential advantages for large suppliers (Beghin et al., 2015b). The extent of the supply shift will depend on the measure and the industry involved, but also on the size and geographical location of the firm. According to Beghin et al. (2015b) the effect of standard-like NTMs along the global supply chain is country, sector and standard specific, in some cases favouring large suppliers, in some others small firms.

They can also work as (final) demand shifter (Sturm, 2006; Tian, 2003), increasing the willingness to pay of consumers by increasing or certifying the quality or safety of the good

[2]Non-technical measures are the subset of measures under categories from D to P in the Unctad classification of NTMs (Gourdon, 2014).

(Disdier and Marette, 2010), solving information issues (Liu and Yue, 2009; Xiong and Beghin, 2014). Again, small firms and/or firms located in the South may benefit more than large firms from complying with the standard.

In general, the protectionist effects of standard type NTMs are ambiguous both because of heterogeneity across foreign and domestic producers (Marette and Beghin, 2010), and because they can be instrumental to overcome market failures and reduce negative externalities (Beghin et al., 2015a). The evidence on the effects of standard-like NTMs on trade flows is actually mixed, the results showing both trade enhancing and trade restrictive consequences depending on the country pairs, on the sector and on the measure considered (Beghin et al., 2015a; Cadot and Gourdon, 2016; Carrere, 2011).

The introduction of a standard measure can generate contrasting effects on firms' domestic and international activities. Moreover, since these effects are likely to be heterogeneous across firms of different size and productivity, the standard-like NTMs will also affect competition in the domestic market, with consequences on efficiency, prices and varieties availability.

Our work is related to three main stream of literature. The first one is the group of contributions assessing the potential protectionist effect of standard-like NTMs, by analyzing the relationship between NTMs and trade flows (Anders and Caswell, 2007; Disdier et al., 2008; Kee et al., 2009; Wilson and Otsuki, 2004; Xiong and Beghin, 2014).[3] The firm level evidence looking at firms' exporting margins is usually focused on the effects of standard-like NTMs in destination markets on firms' exporting activities. Fontagné et al. (2015), using French custom data and STC on SPS show that both small firms and, to a lesser extent, large firms are negatively affected by NTMs measure in the destination markets (both along the extensive and the intensive margin). The literature looking at the effects of standard-like NTMs in developing countries reach also mixed results, some of them showing an export enhancing effect for the firms, in particular large exporters, bearing the cost to met the standard (Chen et al., 2008; Henson et al., 2011; Martincus et al., 2010; Otsuki, 2011), others finding a negative effect for firms' exporting activities (Schuster and Maertens, 2015). Cadot and Gourdon (2016) looks instead at the effects of NTMs on the price of imported goods and the role of regional trade agreements as mediating factors in the relationship between NTMs and prices.

A second group of contributions indirectly related to our work investigates the effects of

[3]For a comprehensive review on approaches and computation of NTMs see Beghin et al. (2015b) and Carrere (2011).

standard-like NTMs on the labour market in the country imposing the standards (Leonardi and Meschi, 2017) or in the country specialized in exporting a good on which a standard has been imposed by trade partners (Colen et al., 2012).

Our work is also related to the heterogeneous firms' stream of literature, where the effects of variations in trade policy on firms and productivity depend on the type of trade costs affected and theoretical setup. In the standard CES model with heterogeneous firms (Melitz, 2003), an (symmetric) increase in the iceberg trade costs or fixed costs generate a similar outcome: an increase in the number of domestic producers and a reduction in the aggregate productivity. However empirical evidence suggests that changes in trade costs have heterogenous effects across firms with different size. For example, Nataraj (2011) finds that trade liberalization in India increased the average productivity of the firms at the top of the distribution. [4]

The removal of standard assumptions, such as CES, generates additional insights. Introducing heterogeneous demand elasticities, Spearot (2013) shows that imported varieties with high elasticity are the most harmed by an increase in tariff while low elasticity varieties not. [5] Using indirectly additive preferences, Bertoletti et al. (2017) provide evidence that small firms are more harmed by an increase in the iceberg trade cost, compared to large firms.

Heterogeneity arises also from different trade costs (additive or multiplicative). Irarrazabal et al. (2015) provide evidence that the introduction of an additive import tariff is more harmful (in term of welfare and trade) than the corresponding multiplicative tariff.

In general, assumptions on consumers preferences and the characteristics of trade costs are crucial to define the effects of changes in the trade policy.

3 Theoretical Model: Non tariff Measures: Regulatory Standards

3.1 Closed Economy

We use the model in Melitz and Ottaviano (2008).(henceforth M-O). The closed economy is characterized by a continuum of firms, each one producing a single variety of a product, with cost function $C(q) = cq$, where c is specific to each firm, and results after a firm has decided to

[4]Mion and Zhu (2013) show that an increase in the import competition from China in WTO did not reduce the survival probability of Belgian firms.

[5]Similarly to our model, Spearot (2013) assumes that consumer preferences are quasi-linear as in Melitz and Ottaviano (2008).

enter the market, from a random draw by Nature. Firms with too high a cost, in a sense to be specified later, will have to exit after entry. The demand function to each firm is derived by a quasi-linear utility function $U = q_0 + \alpha \int q_i di - \frac{\gamma}{2} \int (q_i)^2 - \frac{\eta}{2} \left(\int q_i di \right)^2$, where all the integrals are defined over the space of available varieties, q_0 is a *numeraire* good, q_i is quantity of variety of a differentiated good with index i, while γ measures the degree of product differentiation among varieties. The inverse demand function is of the form $p_i = \alpha - \gamma q_i - \eta Q^c$, where $Q^c = \int q_i di$. The maximum price $p^{\max}$ is a function of the utility function parameters and of the size of the country - if in autarky - and of the two countries under free trade. The resulting per-firm profit function in a closed economy is $\pi(c) = (L/4\gamma)(c_D - c)^2$ where L is the population size and $c_D = p^{\max}$ is the cut-off cost for surviving firms. Entrants discover their marginal cost after entry, as a draw by Nature from a distribution G(c), which is common knowledge to all firms. The support of c is $[0, M]$, the distribution is assumed to be Pareto, namely $G(c) = (c/M)^k$ over $[0, M]$.Let $w \equiv c_D$ be the cut-off cost, then under the assumption of a Pareto distribution , and letting $\omega(L) = \frac{kL}{4\gamma M^k}$ the expected profit from entry is a linear transformation of

$$I(c, w) \equiv \int_0^w (c - w)^2 c^{k-1} dc, \tag{1}$$

Then, expected profit is

$$E(\pi) = \omega(L) \int_0^w (w - c)^2 c^{k-1} dc \tag{2}$$

A firm has to pay an entry cost f to enter the market and this cost is sunk after entry. Ex-ante entry is profitable only if expected profit is non-negative and in the long run entry shall occur till the expected profit from entry is zero, or till $E(\pi) = f$. Let $E(\pi) = f$, then (2) provides a solution for the cutoff cost:

$$\left(c_D^0\right)^{k+2} \equiv 2(f/L)M^k \gamma(k + 2)(k + 1). \tag{3}$$

If a standard leads to a marginal cost increase equal to s the support of the cost distribution is translated from c to $q \in [s, M + s]$ where $q = c + s$. The cut-off now must satisfy $q = p^{\max}$; or $c_D + s = p^{\max}$. The distribution is $G(q) = ((q - s)/M)^k$. The zero profit condition before entry becomes:

$$E(\pi|s) = \omega(L)\int_s^z (z-q)^2(q-s)^{k-1}dc = \frac{L}{2\gamma M^k}\frac{(z-s)^{k+2}}{(k+2)\,(k+1)}. \tag{4}$$

Since z is the cutoff in the shifted support then $c_D^{'} = z - s$ is the cut-off in terms of the base (or "identity") variable c. Inspection of (4) reveals that setting $E(\pi|s) = f$ implies a solution such that $z - s = c_D$, where c_D is the original value. Hence the new cost cutoff is equal to the original one[6] plus s. The after-entry profit however is reduced for each firm. This makes entry less attractive ex-ante, leading to a reduction of the number of entrants in the industry. The lower number of entrants allows $p^{\max}$ (and hence the cutoff cost) to increase. Average price is increased so that a lower quantity of the differentiated good is bought at equilibrium - while consumer will buy more of the numeraire good. The number of firms operating in the industry will decrease, as from Equation 16 in M-O, namely $N_s^0 = 2(k+1)(\gamma/\eta)\frac{(\alpha - c_D)}{c_D}$, due to an increase in the cutoff from c_D to $c_D + s$.

It is important to consider here that we are not allowing the standard to increase α , namely the utility of the differentiated good. In that case the result on the cut-off and on the numeraire would be ambiguous.

3.2 Open Economy.

In an open economy the introduction of a standard will raise costs for the home firms but it will also increase costs to foreign exporters. Country A, where the standard is introduced, will be less attractive as a location for production, but country B now is also affected because exports to A from B are more expensive than before the standard. Therefore the question is whether the increase in the cut-off cost for the home country hurts production and efficiency in A or B, and what are the effects on trade flows. The answer will clearly depend also on the effect of the standard on the cutoff cost of country B. Let c_X^A represent the cutoff cost for the firms based in A exporting to B. Due to export costs of the iceberg form a unit exported arrives in country B with weight less than 1 hence the cost of a unit carried to country B from A is $\tau_{B.}c$ where $\tau_B > 1$(respectively τ_A for exports in the reverse direction). One can interpret the $\tau' s$ as incorporating tariff and transportation costs. To survive in country B an exporter from A must have cost at most equal to $c_X^A \equiv c_D^B/\tau^B$ (symmetrically $c_X^B \equiv c_D^A/\tau^A$). Letting $\lambda = \frac{k}{4\gamma M^k}$. The zero expected profit condition before entry is:

[6]The integral in (4) is also equal to $\omega(L)\int_0^{z-s}(z-s-c)^2(c)^{k-1}dc$

$$L^A \int_0^{c_D^A} \left(c_D^A - c\right)^2 c^{k-1} dc + L^B \left(\tau_B\right)^2 \int_0^{c_X^A} \left(c_X^A - c\right)^2 c^{k-1} dc = f/\lambda, \tag{5}$$

or,

$$L_A \left(c_D^A\right)^{k+2} + L_B \left(\tau_B\right)^2 \left(c_X^A\right)^{k+2} = \gamma\phi \tag{6}$$

where $\phi = 2(k+1)(k+2)M^k f$. Then, using the equalities $c_X^i = c_D^J/\tau^J$ and letting $\rho_i = 1/\tau_i$ for $i = A, B$ one obtains a system of two equations in two unknowns:

$$\begin{aligned} L_A \left(c_D^A\right)^{k+2} + L_B \rho_B \left(c_D^B\right)^{k+2} &= \gamma\phi \\ L_B \left(c_D^B\right)^{k+2} + L_A \rho_A \left(c_D^A\right)^{k+2} &= \gamma\phi \end{aligned}$$

whence the solutions c_D^{A0} and c_D^{A0} satisfy:

$$\left(c_D^{A0}\right)^{k+2} = \frac{\gamma\phi}{L_A} \frac{1-\rho_B}{1-\rho_A\rho_B} \text{ and } \left(c_D^{B0}\right)^{k+2} = \frac{\gamma\phi}{L_B} \frac{1-\rho_A}{1-\rho_A\rho_B}.$$

3.3 Marginal-cost-increasing standard

Let c in $[0, M]$ define the *identity* cost for firm c. Firms with identity cost $c > z - s$ will exit after entry, where z is the cut-off under the support shift ($z = c_D + s$). Let $u_j = c_D^j - s$ for $j = A, B$ and $w_j = c_X^j - s$. Let $h = \left(\frac{k}{4\gamma M^k}\right)^{-1} f$, then the zero expected profit conditions[7] write as:

$$\begin{aligned} L^A \left(c_D^A - s\right)^{k+2} + L^B \left(\tau_B\right)^{-k} \left(c_D^B - s\right)^{k+2} &= \gamma\phi \qquad \text{(a)} \\ L^B \left(c_D^B\right)^{k+2} + L^A \left(\tau_A\right)^{-k} \left(c_D^A - s\right)^{k+2} &= \gamma\phi \qquad \text{(b)} \end{aligned}$$

where $c_X^A - s = \dfrac{c_D^B}{\tau_B} - s$ and $c_X^B - s = \dfrac{c_D^A}{\tau_A} - s$.

Although an analytical solution is hard to find due to the term $\left(c_D^B\right)^{k+2}$ in the second equation we can state:

[7] In terms of the integrals like in (1) they are:

$$\begin{aligned} L^A I(c, u_A) + L^B \left(\tau_B\right)^2 I(c, w_B) &= h \quad \text{(A)} \\ L^B I(c, u_B) + L^A \left(\tau_A\right)^2 I(c, w_A) &= h \quad \text{(B)} \end{aligned}$$

RESULT 1: *An increase from zero to $s > 0$ of marginal cost due to a standard in the home country raises the cutoff cost $c_D^A - s$ defining the identity of firms that makes zero profits after entry in Home. It raises the domestic effective cut off cost z by an amount larger than s. It decreases the cutoff cost in the foreign country, and it also decreases the cut off for exporters in B.*

In Home the competitive pressure decreases leading to a lower number of entrants and of surviving firms, and to a lower average productivity. The average price in country A (home) increases[8]. Furthermore,

RESULT 2: *The proportion of exporters from the home country decreases.*

PROOF: The ratio $G(c_X^A - s)/G(c_D^A - s)$, namely the proportion of exporters in the Home country is the ratio $\left(\left(c_D^B/\tau_B\right) - s\right)^k / \left(c_D^A - s\right)^k$. The effect of an increase in s on the numerator is negative while that on the denominator is positive. Q.E.D.

By the same token, the proportion of exporters in the foreign country increases. The number of firms selling in country A, N^A, decreases since it is given by $N^A = \frac{2(k+1)\gamma}{\eta}\frac{a-z}{z}$. By the same token, N^B increases. The number of entrants in country A also decreases. It is given by:

$$N_E^A = \frac{M^k}{1-\rho^A\rho^B}\left[\frac{N^A}{\left(c_D^A - s\right)^k} - \rho^A\frac{N^B}{\left(c_D^B\right)^k}\right],$$

and hence it decreases since the first ratio in square brackets decreases and the second increases. Finally, the number of firms located in A that survive, $G(c_D^A - s)N_E^A$ decreases. Therefore we can state:

Proposition 1 (summary for effects of a standard in Home): *A standard that raises marginal costs - and does not raise the utility of the good - has the following long run effects: the profitability of locating in the home country vis-a-vis the foreign country decreases, hence the number of entrants in the home country decreases. The maximum price at which the good is sold increases and hence so does the cutoff cost for a firm located in A. The number of firms selling in A decreases, the number of firms located in A decreases, and so does the proportion of exporting home firms. The average marginal cost increases. The support of the distribution of costs is wider. The average price increases.*

[8] It is given by $\tilde{p}_A = \frac{2k+1}{2k+2}(c_D^A + s)$.

3.4 Tariff

A marginal cost increasing standard imposed by country H is different from a tariff because a tariff, t, is paid only by the foreign firms. The profit of the foreign exporter is changed to $\pi_X^B(c,t) = (L^A/4\gamma)(\tau_A)^2 (c_D^A - t - c)^2$.

Setting $\tau_A = 1$ be the original iceberg cost for A, to simplify, the new iceberg cost τ'_A such that delivered cost $\tau'_A c = c + t$; then $\tau'_A = \frac{t}{c} + 1$ varies inversely with c. This is a slight modification with respect to M-O, who only consider direct changes in τ_B , however this has no consequence on the main results.

Only firms in B with costs $c < c_D^A - t$ can export to A hence the population of foreign exporters is, regarding their identity cost, more efficient than before the tariff, but the tariff offsets this cost advantage and their average price increases. The cut-off costs are given by the solutions to:

$$L^A \left(c_D^A\right)^{k+2} + L^B (\tau_B)^{-k} \left(c_D^B\right)^{k+2} = h \quad \text{(At)}$$

$$L^B \left(c_D^B\right)^{k+2} + L^A (\tau_A)^{-k} \left(c_D^A - t\right)^{k+2} = h. \quad \text{(Bt)}$$

It is straightforward to show that:

RESULT 4: *The cutoff cost for the home country decreases after a per-unit tariff is unilaterally introduced by the same country.*

An increase in the tariff is equivalent to a decrease in ρ_A. The cut off costs c_D^A is *decreased* since ρ_A is decreased. By contrast the cut off costs c_D^B is increased. Then we can follow M-O on this account. The number of entrants in A increases, while in B decreases.

The number of sellers in country home (A) increases and in B decreases.

RESULT 4 : *The proportion of exporters from A to B* $G(c_X^A)/G(c_D^A) = G(c_D^B/\tau_B)/G(c_D^A)$ *increases.*

The number of sellers in country A may increase or decrease: $N^A = G(c_D^A)N_E^A + G(c_X^B)N_E^B$ is a sum of two terms with size depending upon, among other things, the size of the two countries. For the same reason, since the imported products in A will be sold at a higher price than before the tariff, the net effect on average price of goods sold at home is ambiguous.

Proposition 2 (summary for effects of a tariff in Home): *A unit tariff has the following long-run* *effects in home: the profitability of locating in the home country vis-a-vis the foreign country increases (protectionist effect), hence the number of entrants in the home country increases. The maximum price at which the good is sold decreases and hence so does the cutoff cost for a firm located in A. The number of firms selling in A increases, the number of firms located in A increases, and so does the proportion of exporting home firms. The average marginal cost decreases. The support of the distribution of costs is narrower.*

3.5 Standards that "follow" already adopted practices

If regulators impose standards that are already largely adopted by the home firms, the cost increase will be felt only by a portion of the home firms, but by all the foreign firms. An extreme situation is one where all the home firms have already adopted the standard before it becomes mandatory. This is also the easiest situation to analyze.

If there is no cost increase in home, then equation (a) above is unchanged while that for the foreign country becomes:

$$(B') \qquad L^B \left(c_D^B\right)^{k+2} = h - L^A \left(\tau_A\right)^{-k} \left(c_D^A - \tau_A s\right)^{k+2}.$$

This can be used to rewrite (a) as:

$$L^A \left(c_D^A\right)^{k+2} + \left(\tau_B\right)^{-k} \left[h - L^A \left(\tau_A\right)^{-k} \left(c_D^A - \tau_A s\right)^{k+2}\right] = h.$$

By differentiating this equation one obtains:

$$\frac{dc_D^A}{ds} \left[\left(c_D^A\right)^{k+1} - \left(\tau_A \tau_B\right)^{-k} \left(c_D^A - \tau_A s\right)^{k+1}\right] = -\left(\tau_A \tau_B\right)^{-k} \left(c_D^A - \tau_A s\right)^{k+1},$$

hence $\left(dc_D^A/ds\right) < 0$, where the sign follows from the positive sign of the term in square brackets. Furthermore one can show[9] that $\left(dc_D^A/ds\right) > 0$, so that all the results concerning the effect of a standard are reversed if compared with the case of a marginal cost increasing standard of Proposition 1.

Hence the asymmetry in the impact of a standard, when it only affects the foreign firms, reverses the sign of the effect on the cutoffs for the home and foreign country. All the perfor-

[9] Write $L^B \left(c_D^B\right)^{k+2} - h = -L^A \left(\tau_A\right)^{-k} \left(c_D^A - \tau_A s\right)^{k+2}$. Then differentiate to get the result, given that $\frac{dc_D^A}{ds} < 0$ has benn proven already.

mance indicators will vary in the same direction as for a tariff and opposite to the change of a standard that involves an increase in marginal cost equal at home as abroad. Furthermore one can infer what follows: let s^i, for $i = A, B$, denote the marginal cost increase implied by the standard in country i; imagine that $\Delta s \equiv s^B - s^A \geq 0$, then for Δs larger than some threshold value, the results would be in the same direction as those of a tariff as in Proposition 2. While, for $s^A = s^B$ and by continuity for Δs smaller than the threshold value, the results would be those of Proposition 1. One can also speculate that the intensity of the changes will be small for small values of Δs in a neighbourhood of the threshold value.

Summing up, if there is a substantial difference in the cost burden implied by the standard in favour of the home country firms,the changes in the number of firms, productivity, and fraction of exporters will be in line with those of a tariff. The results will be reversed only for standards leading to cost increases that are close enough across countries.

4 Data

We combine three major data sources. First, we use a database on specific trade concerns (STC) raised to TBT at WTO. Second, we consider the average applied tariff using the database from TRAINS. Finally, we retrieve information on market condition using CompNet, a recent database on aggregate statistics computed from firm-level data.

4.1 Non Tariff and Tariff Barriers

The first data source is the STC database on the Non Tariff Measure (NTM) notifications to the WTO from the Integrated Trade Intelligence Portal (I-TIP). It includes relevant information from TBT committee (Ghodsi et al., 2015). [10] This committee provides a platform to WTO members to settle issues related to regulation on product standards, in order to avoid discriminatory practices that create unnecessary obstacles to trade. TBT standards have to be notified to WTO and are applied to both domestically produced and imported goods. Notifications apply to existing or in the pipeline norms. If a TBT measure create " an unnecessary obstacles to trade", one ore more WTO member states may raise a concern to the committees in order

[10] TBT product requirements established by governments with the objective to protect human health and safety, environment, or quality. The STC database on the Non Tariff Measure (NTM) includes also information from SPS committee: SPS measures aims at ensuring food safety, and preventing the spread diseases among animals and plants. Since SPS mainly regards a few sectors, i.e. Food (10), Wood (16) and Chemical (20), we conduct our analysis by focusing on TBT measures only.

to ask the removal of the measure. Therefore, when a specific TBT measure is perceived as an obstacle to trade, a concern is raised (see Section A for more details).

The STC database records both countries that raise the concerns, [11] the country which imposes the standard, and the product covered by the measure. The STC database reports information at HS 6-digit level so we use products and HS 6-digit as synonymous. Finally, the STC database includes the year in which the concern has been raised and whether it has been resolved. [12] Therefore, when a country raise a concern over a measure/standard, it suggests that this specific measure is perceived as an effective barrier to trade. Therefore, a product is protected by a NTM if a concern has been raised and not resolved: in that case we consider a specific good covered by a NTM (see Section 4.3).

Another potential source on non-tariff trade measure is TRAINS database. However this source has two main drawbacks. First, NTMs from TRAINS are not updated since 2001 so that this source is not compatible with CompNet (see section 4.2). Second, TRAINS records NTM (only a part of them) without mentioning if a specific regulation is as a barrier to trade or not: such information is retrieved through a survey on exporters perceptions of obstacles to foreign-market access. Therefore, we prefer to use WTO STC database.

The STC database is merged with tariff data from TRAINS database. The tariff dataset includes information on the effectively applied tariff (AHS) at HS-6 digit level for each year and country pairs. [13] Finally, we merge STC and tariff data using HS-6 digit classification. To be consistent with our empirical analysis, we consider European Union (in STC and tariff data) as the importing country which imposes a tariff or set a TBT measure.

4.2 CompNet

Under the coordination of the European Central Bank, 17 national central banks [14] have produced a set of harmonized and comparable sector-year level indicators based on national firm-

[11] In addition, STC database includes "anonymous " NTM concerns for which the country raising the concern is unknown (while the imposing country is known).

[12] In most of the cases concerns are closed with a gentlemen agreement between parts (Fontagné et al., 2015). As a rule of thumb, we consider closed a concern after two years. Results are unaffected if we use a period of three years.

[13] The effectively applied tariff is defined as the lowest available tariff. If a preferential tariff exists, it will be used as the effectively applied tariff. Otherwise, the Most Favourite Nation tariff will be used. We use weighted tariff at 6-digit level, namely the average of tariffs weighted by their corresponding trade value across 8-digit products.

[14] Austria, Belgium, Croatia, Estonia, Finland, France, Germany, Hungary, Italy, Malta, Lithuania, Poland, Portugal, Romania, Slovakia, Slovenia, and Spain. We are going to use in the current analysis the fourth release.

level samples (Lopez-Garcia and di Mauro, 2014).[15] For each triple NACE rev.2 2-digit sector, country, and year, the indicators available are, among the others, number of firms, number of exporting firms as well as other information such as average labor productivity or employment level.

CompNet comprises two different samples. The *"full sample"* is produced from countries' samples based on firms with at least one employee and covers the period 1995-2012, while the *"20E sample"* is restricted to firms with at least 20 employees and covers the period 1995-2012.[16] However, the *"20E sample"* ensures a relatively higher degree of representativeness because the *"full sample"* in some cases do not cover smaller firms (those with less than 10 employees in Poland, less than 20 employees in Slovakia, less than 750,000 euros of turnover in France), and in the other cases tend to be biased towards medium and large firms (such a bias is severe for Austria and Germany). To improve representativeness and homogeneity across countries, the *"20E sample"* has been enriched by a weighting scheme based on the total number of firms by country-year-sector-size class taken from Eurostat Structural Business Statistics (SBS). Thus, *"20E sample"* is the most appropriate database for cross-country analysis.

4.3 Protection Index

In order to merge STC-Tariff database with CompNet, we need to construct indicators of protection with both tariff and non tariff measures which are defined at country, sector (Nace rev2 2-digit), and year level. The computation of a protection index raises two issues. First, CompNet data are disaggregated by country and sector level while trade protection, in particular for NTM, is defined at product and European Union level. [17] Second, HS nomenclature has to be aggregated at Nace Rev.2-2 digit.

To harmonize nomenclatures, we use correspondence tables from the World Integrated Trade Solutions (WITS) and RAMON-Eurostat databases. In order to identify HS-6 digit products within each Nace rev.2-2 digit, we proceed as follows. First we consider HS 2002 revision for STC and tariff database. [18] Second, we use correspondence between HS2002 and HS2007,

[15]The unit of analysis is the firm. Self-employed (physical persons with economic activity) are generally not included.

[16]Both samples are slightly unbalanced: for example, Portugal data begin in 2006, while Belgian ones end in 2011.

[17]Some of the concerns in the STC database are registered as imposed by a specific EU country. We do not use this piece of information. It accounts for the xxx% of concerns against EU,in the period of analysis.

[18]In particular, HS2002 allows us to have the largest set of information for the period 2002-2012 (CompNet) both in terms of tariff, STC, and imports from a unique datasource

and between HS2007 and CPA2008. Once we have the correspondence between HS2002 and CPA2008, we could aggregate all HS2002-6 digit within the first two digits of CPA2008: the first two digit of CPA 2008 corresponds to NACE rev. 2-2 digit.

In order to compute the degree of protection (due to tariff or TBT) for each CompNet country c and sector s, we first define the average tariff imposed to extra-EU exporters for each CompNet country c, as follows

$$T_{js}^{c} = \sum_{p(s)=1}^{P(s)} t_{jp}^{EU} \frac{import_{jp}^{c2000}}{import_{js}^{c2000}} \quad \forall\, j \,\in\, s \tag{7}$$

In Eq. 7, j is the exporting country, e.g., China, s is the NACE rev2-2 digit sector, p is the product (HS-6 digit) that belongs to the NACE rev2, c is a CompNet country, and t_{jp}^{EU} is the tariff imposed by EU to product p from country j or the STC raised by country j against EU for a product p. Notice that, with TBT, the term t_{jp}^{EU} takes value of one if a concern has been raised by country j versus the EU in product p, otherwise it is zero.

The EU protection measure (t_{jp}^{EU}) is apportioned across CompNet countries using specific weights which consider if a tariff (or TBT) in product p from origin j can be relevant for country c. Using the import share, we measure if a good p accounts for a large quota of imports from origin j in sector s; the second term in the r.h.s. of Eq. 7 is defined by $import_{jp}^{c2000}$ and $import_{js}^{c2000}$ which are the imports of product p in country c from j and the total imports in sector s from j, respectively. Weights are constant over time and refer to year 2000 in order to minimize endogeneity concerns arising from reverse causality. [19]

Finally, we compute the average protection (due to tariff or TBT) for CompNet country c in sector s as

$$ProtectionIndex_{cs} = \sum_{j=1}^{J} T_{js}^{c} \frac{import_{js}^{c2000}}{import_{tot,s}^{c2000}}. \tag{8}$$

Similarly to Eq. 7, $ProtectionIndex_{s}^{c}$ is computed using as weights the relative share of imports from origin j to total imports, for a given sector s. In the empirical analysis (see Section 5), we $ProtectionIndex_{s}^{c}$ to measure both protection raising from Tariff and TBT. [20]

[19]Imports data are from BACI database. Imports are collected at HS 6-digit level. We use the same aggregation procedure for trade data (HS 2002, HS 2007, CPA 2008, and NACE rev.2)

[20]Notice that TBT protection index can be written as

$$TBT_{cs} = \sum_{j=1}^{J} \sum_{p(s)=1}^{P(s)} TBT_{jp}^{EU} \frac{import_{jp}^{c2000}}{import_{tot,s}^{c2000}} \tag{9}$$

We define an alternative measure for the degree of protection originated by TBT using the share of protected products within NACE 2-digit sectors. First, we compute, for each sector s, the share of products p sourced by country of origin j under TBT concern.

$$share_{sj} = \frac{1}{N.Products(s)} \sum_{p(s)=1}^{P(s)} TBT_{jp}^{EU} \tag{10}$$

Therefore, variable *share* includes the sum of all TBT concerns raised by country j over all products p which belong to sector s. The denominator of Eq. 10 is the number of products in sector s. In order to redistribute TBT across EU countries, we define TBT protection index ($TBT(share)$) as follows,

$$TBT(share)_{cs} = \sum_{j=1}^{J} share_{sj} \frac{import_{js}^{c2000}}{import_{tot,s}^{c2000}} \tag{11}$$

where the weight measure the share of imports from country j in sector s for a CompNet country c (in 2000). [21]

4.4 Descriptive Statistics

In the period of analysis (2002-2012), 19,245 concerns were raised against European Union (almost the 15% of total concerns raised at WTO committees); most of them are TBT concerns (11,864). [22] Using these information and TRAINS data , we compute three indices to measure the average trade protection through tariff and TBT (see Section 4.3)

combining Eq. 7 and Eq. 8. It is straightforward to observe that Eq. 9 ranges from 0 to 1. If zero, none of the products p are recorded with a concern. If one, all the products p are under concerns.

[21] As Eq. 9, we can write $TBT(share)_s^c$ combining Eq. 10 and Eq. 12

$$TBT(share)_{cs} = \frac{1}{N.Products(s)} \sum_{j=1}^{J} \sum_{p(s)=1}^{P(s)} TBT_{jp}^{EU} \frac{import_{js}^{c2000}}{import_{tot,s}^{c2000}}. \tag{12}$$

[22] These numbers refers to all the concerns (agriculture and manufacturing) including those concerns for whom we have not information on the complaining country

The protection index is usually higher for tariff than for TBT, mainly for two reasons (see Table 1). First, most of the products within a NACE sector are not subject to concerns[23]. For each product, more than a country can raise a concern or none of the products are under concern. On average, 1000 concerns (485 TBT) are raised every year against the European Union, with a peak in 2008 and 2009 (1600 in both years) and none in 2005 and 2007.Consider that there are more than 5 thousands products (within 6 digit classification) so that in most of the cases TBT (Eq. 8) takes value of zero. Sector such as Food (10), Beverages (11), Chemicals (20), Motor Vehicles (29), and Other Manufacturing (32) are the most protected from TBT.

Table 1: Sector average protection ‡

Sector	Nace rev.2 code	Tariff	TBT	TBT(share)
Food	10	1.7134	0.0067	0.0036
Beverages	11	1.1666	0.0080	0.0030
Tobacco	12	0.1643	0.0000	0.0000
Textile	13	3.7671	0.0026	0.0005
Wearing Apparel	14	6.6400	0.0000	0.0000
Leather	15	3.3266	0.0000	0.0000
Wood	16	0.6771	0.0000	0.0000
Paper	17	0.0730	0.0000	0.0000
Printing	18	0.5031	0.0104	0.0104
Coke/Petroleum	19	0.0968	0.0000	0.0000
Chemicals	20	2.2779	0.0093	0.0031
Pharmaceuticals	21	0.1712	0.0045	0.0037
Rubber/Plastic	22	1.7368	0.0033	0.0003
Non Metallic Minerals	23	2.2155	0.0007	0.0003
Basic Metals	24	1.3236	0.0000	0.0000
Fabricated Metals	25	1.6052	0.0005	0.0024
Computer/Electronics	26	1.0203	0.0038	0.0007
Electrical Equipment	27	1.0183	0.0016	0.0028
Machinery	28	0.8103	0.0120	0.0103
Motor Veichles	29	4.8104	0.0202	0.0123
Other Transport	30	1.6176	0.0005	0.0003
Furniture	31	0.1179	0.0000	0.0000
Other Manufacturing	32	0.9354	0.0292	0.0223
Total		1.6430	0.0049	0.0033

‡ Source: Our calculation from TRAINS and STC database. Tariff and TBT computed as in Eq.7 and Eq.8. TBT(share) computed as in Eq.12

Figure 2 shows how the average trade protection for CompNet countries has evolved over time. In particular, TBT protection has risen during the period 2008-2012. [24] In that years EU introduced several new regulations and standards which have been notified to the WTO committees. In December 2006, EU introduced the new regulation on chemicals products and

[23]Notice that goods under concerns are a sub-sample of products for whom a TBT notification exists. Notifications are a sub-sample of all existing products.

[24]Similar patterns have been observed by Fontagné et al. (2015).

created the European Chemicals Agency [25], while the "Classification, Labelling and Packaging" regulation (CLP), to harmonize European system of labelling for chemicals products, has been declared in December 2008. [26] These new regulations aim to protect human health and environment through a more detailed analysis of chemicals substances used in all types of products (not only pure chemicals products). In light of these objectives, the regulation has been notified to WTO and trade partners can raise concerns against EU standards. In 2008, 1029 concerns were raised against EU in chemical sector. [27] Similarly, in 2007 and 2008 it has been introduced new regulations in food and wine labelling in particular for organic products [28] We may observe a similar pattern for the TBT share (see Figure 3).

Tariff protection is more constant over time with the exclusion of a small peak in 2007 mainly due to Textile and Wearing Apparel sector. [29] For example, between 2006 and 2007, the average tariff from China in cotton sector (HS -50) has increased by 15% (then 2008, the short term measures for trade in textiles, due to China entry in WTO has expired).

Finally, we can observe that there exists a certain degree of heterogeneity in term of protection across countries. Even if trade policy is common across European countries, the degree of protection varies across countries for our computed indices (see Table 3). Most protected countries by tariff (according to our index) seem Germany, France and Portugal. Conversely TBT seems to protect especially Belgium, Italy and France. Therefore, our protection index show some variability across CompNet countries (see Figure 1, Figure 2 , and Figure 4 in the appendix).

Finally, Table 4 reports CompNet descriptive statistics and in particular the number of firms and the average productivity within countries. Number of firms is the total number of firms, with whom CompNet statistics have been computed. Given that we use the *"20E sample"* (see Section 4.2), number of firms is not informative of the whole population of firms, but only for the sub-sample with more than 20 employees.

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[25] See Regulation (EC) No 1907/2006, which defined the "Registration, Evaluation, Authorisation and Restriction of Chemicals" (REACH), established a European Chemicals Agency.

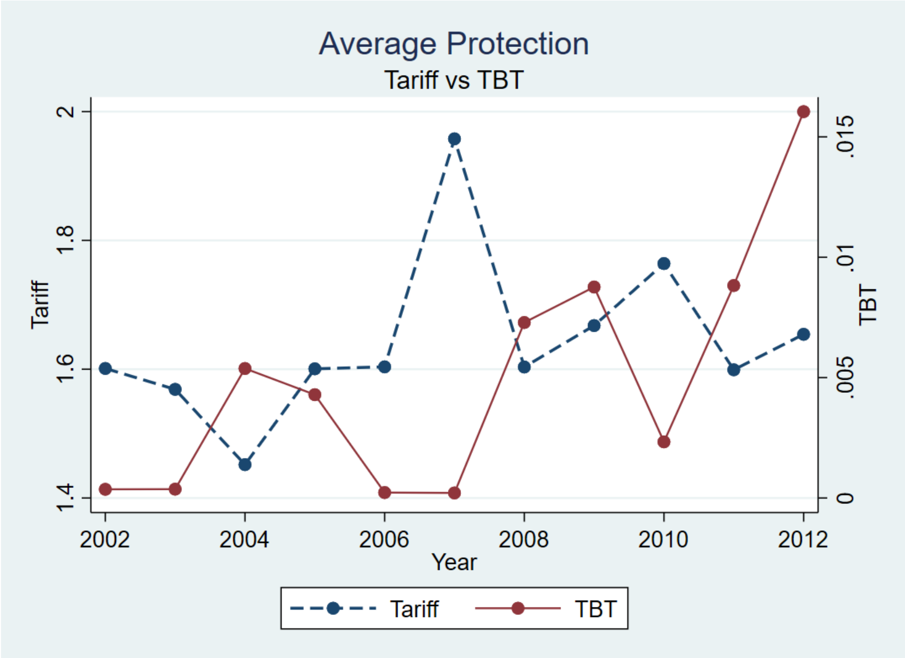
[26] See Regulation (EC) No 1272/2008.

[27] Notice that more than 30 times concerns have been raised against the only REACH regulation. Usually EU revises regularly its regulation (also as consequence of concerns). New concerns are often related to new revisions of regulation.

[28] Council Regulation (EC) No 834/2007 and No 1235/2008. 650 concerns were raised in 2009 in food sector.

[29] Given the definition of protection index in Eq. 7 and Eq. 8, tariff is a weighted mean of a percent tariff. So it moves (on average) from 1.6% to 1.9%.

Table 2: Average protection from tariff and TBT (2002-2012)‡



Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
TBT	0.0004	0.0004	0.0054	0.0043	0.0002	0.0002	0.0073	0.0088	0.0023	0.0088	0.0160
Tariff	1.6012	1.5688	1.4518	1.6007	1.6037	1.9578	1.6035	1.6678	1.7641	1.5991	1.6542

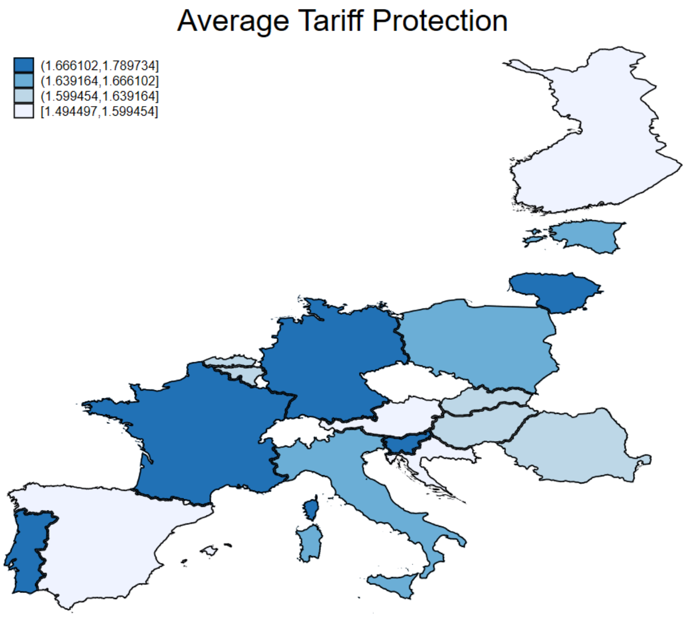
‡ Source: WITS and STC database. Tariff and TBT computed as in Eq. 7 and Eq. 8. Simple average across countries and sectors.

Table 3: Country average protection ‡

Country	Tariff	TBT	TBT(share)
Austria	1.5995	0.0039	0.0034
Belgium	1.6378	0.0072	0.0030
Croatia	1.5591	0.0043	0.0029
Estonia	1.6661	0.0055	0.0030
Finland	1.4945	0.0045	0.0030
France	1.7897	0.0058	0.0037
Germany	1.6819	0.0031	0.0032
Hungary	1.6096	0.0059	0.0040
Italy	1.6553	0.0061	0.0029
Lithuania	1.6912	0.0050	0.0035
Poland	1.6405	0.0052	0.0034
Portugal	1.7012	0.0040	0.0035
Romania	1.6316	0.0043	0.0027
Slovakia	1.6325	0.0037	0.0035
Slovenia	1.7035	0.0051	0.0039
Spain	1.5933	0.0051	0.0034
Total	1.6430	0.0049	0.0033

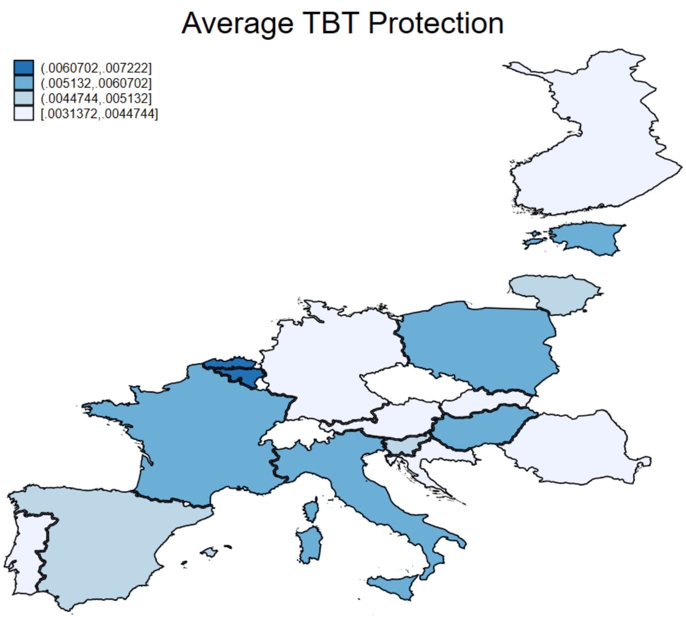
‡ Source: Our calculation from TRAINS and STC database. Tariff and TBT computed as in Eq.7 and Eq.8. TBT(share) computed as in Eq.12

Figure 1: Average country protection (Tariff)



Source: WITS and STC database.

Figure 2: Average country protection (TBT)



Source: WITS and STC database.

5 Empirical strategy

By using the STC data on TBT for NTM protection measures as described in Section 4.3, we investigate the relationship between NTMs and tariffs and market conditions in the EU coun-

Table 4: Descriptive Statistics - CompNet[‡]

Country	Stat	Firms	Labor Productivity
Austria	Mean	54.90	89.73
	St.Dev	46.24	43.26
Belgium	Mean	160.30	64.29
	St.Dev	154.80	31.23
Croatia	Mean	80.32	12.92
	St.Dev	74.59	8.17
Estonia	Mean	48.81	12.83
	St.Dev	45.96	7.32
Finland	Mean	102.02	64.64
	St.Dev	97.18	40.72
France	Mean	856.42	66.88
	St.Dev	789.96	25.88
Germany	Mean	634.36	97.76
	St.Dev	614.14	36.55
Hungary	Mean	216.25	7.51
	St.Dev	200.19	6.63
Italy	Mean	1285.81	39.37
	St.Dev	1068.81	17.16
Lithuania	Mean	88.77	9.01
	St.Dev	92.46	4.63
Poland	Mean	482.45	15.24
	St.Dev	479.24	13.56
Portugal	Mean	319.05	22.96
	St.Dev	310.55	11.31
Romania	Mean	431.50	5.22
	St.Dev	438.29	3.39
Slovakia	Mean	90.67	11.11
	St.Dev	74.16	6.99
Slovenia	Mean	53.04	13.10
	St.Dev	39.76	7.54
Spain	Mean	579.62	35.13
	St.Dev	502.28	11.36
Total	Mean	363.37	37.59
	St.Dev	577.23	38.15

[‡] Source: Our calculation from CompNet, sample 20E. Sector-Year averages. Labor Productivity: value added per worker.

tries imposing the measures. In particular, we consider the relationship between these measures and the total number of firms selling in the domestic markets and the average productivity. According to the theoretical model developed in Section 3, we expect the (unilateral) introduction of a tariff to be positively associated with the number of domestic firms and higher average productivity. As for NTMs, the theory predicts that the relationship between NTMs and market conditions depends on whether the standard is being introduced for the first time for both domestic and foreign firms, or rather, it is the extension to foreign firms of a measure already adopted by domestic ones. In particular, in the baseline case, where the (unilateral) introduction of the NTM implies an increase in the marginal cost for all firms, we expect a lower number of domestic firms, a lower share of exporters and lower average productivity, i.e. a worsening of market conditions in the country-sector imposing the measure.

When, instead, a country introduces a standard, which has already been adopted by a large number of domestic firms, the NTM works 'like' a tariff, since it represents a new cost only for foreign exporters to the country imposing the tariff. In this case, as for tariffs, we therefore should observe a positive relationship between NTMs, the number of firms and the average efficiency. We will also look at whether these effects are different along the firm size and productivity distribution.

We investigate these relationships considering empirical models in which tariffs and NTM measures are considered separately and then a model in which they are included together. [30] We therefore start by estimating the following equations:

$$\mathsf{Y}_{\mathsf{cst}} = a_0 + a_1 \mathsf{tariff}_{\mathsf{cst}} + a_2 \mathsf{X}_{\mathsf{cst}} + u_c + u_s + u_t + \epsilon_{cst} \tag{13}$$

$$\mathsf{Y}_{\mathsf{cst}} = a_0 + a_1 \mathsf{NTM}_{\mathsf{cst}} + a_2 \mathsf{X}_{\mathsf{cst}} + u_c + u_s + u_t + \epsilon_{cst} \tag{14}$$

$$\mathsf{Y}_{\mathsf{cst}} = a_0 + a_1 \mathsf{tariff}_{\mathsf{cst}} + a_2 \mathsf{NTM}_{\mathsf{cst}} + a_3 \mathsf{X}_{\mathsf{cst}} + u_c + u_s + u_t + \epsilon_{cst} \tag{15}$$

where Y_{cst}, the dependent variables, are alternatively, the number of domestic firms or the average labour productivity of country c in sector s at time t; $tariff_{cst}$ is the tariff barrier imposed by country c in sector s at time t as in equation 7 and NTM_{cst} are indicators of NTMs barriers, STC on TBT, alternatively, as in equation 7 and equation 10; X_{cst} is a vector of other potential control variables; in particular, we include in all specifications the imports from EU27. u_c, u_s and u_t are country, sector and year fixed effects, respectively, and ϵ_{cst} an error term. The inclusion of country fixed effects allow us to control for all the unobservable country-specific persistent characteristics which might simultaneously affect the industrial structure, i.e. number of firms, the share of exporters, efficiency, and the level of barriers, like quality of institutions, cultural inheritance and attitude towards competitiveness, geographical characteristics and resource endowments. The inclusion of sector fixed effects is useful in a framework where both

[30] Otherwise we would clearly have an omitted variable problem since there might be several cases in which sectors at the two-digit level, which is what we consider, might be protected simultaneously by a tariff and a NTM, a case that cannot have a theoretical counterpart.

the dependent and the explanatory variables are strongly related to both the demand side and the supply side industry characteristics; while year fixed effects allow us to control for both the EU business cycle and those macroeconomic events that might have happened in the period considered affecting simultaneously all EU countries. In all specifications both the dependent variable and the explanatory variables are in logarithm, and therefore the estimated coefficients can be interpreted as elasticities. We cluster standard errors at the country level and year to account for serial autocorrelation.

As a second step, we investigate whether the effects of barriers might be heterogeneous depending on firms' size. We therefore investigate the previous relationships by interacting the barriers, both NTMs and tariffs, with a categorical variable obtained by splitting firms into three different classes on the basis of the employment.

We estimate the following equations:

$$\mathsf{Y_{cst}} = a_0 + a_1 \mathsf{szclass_{cst}} + a_2 \mathsf{tariff_{cst}} + a_3 \mathsf{szclass_{cst}} * \mathsf{tariff_{cst}} + a_4 \mathsf{X_{cst}} + u_c + u_s + u_t + \epsilon_{cst} \quad (16)$$

$$\mathsf{Y_{cst}} = a_0 + a_1 \mathsf{szclass_{cst}} + a_2 \mathsf{NTM_{cst}} + a_3 \mathsf{szclass_{cst}} * \mathsf{NTM_{cst}} + a_4 \mathsf{X_{cst}} + u_c + u_s + u_t + \epsilon_{cst} \quad (17)$$

$$\begin{aligned} \mathsf{Y_{cst}} = a_0 &+ a_1 \mathsf{szclass_{cst}} + a_2 \mathsf{tariff_{cst}} + a_3 \mathsf{szclass_{cst}} * \mathsf{tariff_{cst}} + a_4 \mathsf{NTM_{cst}} \\ &+ a_5 \mathsf{szclass_{cst}} * \mathsf{NTM_{cst}} + a_6 \mathsf{X_{cst}} + u_c + u_s + u_t + \epsilon_{cst} \end{aligned} \quad (18)$$

where $szclass_{cst}$ is the categorical variable built by splitting firms in three groups on the basis of their employment, namely: szclass1 (10-49), szclass2 (50-249), szclass3 (>249). The excluded group is szclass1, i.e. smaller firms.

Table 5: tariffs, NTMs and number of domestic firms‡

	(1)	(2)	(3)	(4)	(5)
Tariff (ln)	0.017***		0.017***		0.017***
	(0.002)		(0.002)		(0.002)
TBTsh(ln)				0.004***	0.004***
				(0.000)	(0.000)
TBT(ln)		0.001***	0.001***		
		(0.000)	(0.000)		
Observations	2,963	2,964	2,963	2,964	2,963
R-squared	0.887	0.888	0.887	0.888	0.888

‡ Dependent variable: number of domestic firms. All models include fixed effects at the country, sector and year level and control for the level of import from EU27 (coefficients not reported). Standard errors (in parenthesis) clustered at the country and year level. Sectors with $nfirms < 10$ are excluded. Significance level: *0.10>p-value ** 0.05>p-value*** 0.01>p-value.

6 Results

6.1 Tariffs, NTMs and the number of domestic firms

Table 5, where the dependent variable is the the number of domestic firms in logarithm, shows the estimates of the models in Eq. (13) (column 1), in Eq. (14) (column 2 and 4,), and in Eq. (15) (in column 3 and 5). The results show a positive association, statistically significant at the 1% level, between the tariff and the number of domestic firms in all the specifications, in line with what expected. In particular, an increase of 1% in the tariff is associated with an increase of 0.017% in the number of firms. These results are in line with the implication of the theoretical model, where firms relocate production in the country protected by the tariff.

Turning the attention to the NTM, we see that the coefficients of both the TBT protection indexes, i.e. TBT and TBT-share are in line with those of the tariff, the results showing a positive and significant (at 1%) relationship with the number of domestic firms, the TBT-share showing a larger elasticity (0.004%) with respect to the TBT (0.001%). Both the coefficients are nevertheless of a smaller magnitude with respect to those of the tariff. This is also in line with what predicted by the theory. These results suggest that the NTM measures behave in line with the second case (3.5) that we consider in the theoretical model, where the majority of domestic firms have already borne the cost of the standard.

Table 6 reports the results on the association between NTMs and the number of firms when taking into account the firm size class. As before, column 1 shows the results of the estimates of the model in Eq. 16, columns 2 and 4 those of the model in Eq. 17, while estimations of the model in Eq. 18 are reported in columns 3 and 5. In all models, i.e. both when considered alone (column 1) and when included with either TBT (column 3) or with TBT-share (column 5), the inclusion of a tariff is positively and significantly related (at 1%) with the number of firms in the medium size class, while is not related with neither the number of small nor largest firms. In particular, an increase of 1% in the tariff corresponds to an increase of 0.038% in the number of medium-size firms in all the models.

Columns 2 and 3 show results for the TBT measure. Interestingly enough, we see that TBT are negatively and significantly (at 5%) related with the number of small firms, while they are positively and significantly related (at 5%) with the number of largest firms. In particular, an increase of 1% in the TBT measure corresponds to a decrease of 0.012% in the number of small firms and to an increase of 0.022% in the number of large firms. Results are confirmed, also in the magnitude of the coefficients, when the second index of NTM protection is considered, i.e. TBT-share, as in column 3 and 4.

It is worth noting that the heterogeneity across size classes of the relationship of both NTM and tariffs with the number of firms, showing opposite signs depending on whether small or large firms are considered, helps explain the small magnitude of the coefficients in the results reported in Table 5 when size heterogeneity is not taken into account. Results by size class show that all these measures are associated with the number of firms in the country imposing the measure, but since these associations go in opposite directions in the different size classes, they partially offset when the class dimension is not considered.

6.2 Tariffs and NTMs: implications for efficiency

In this Section we turn the attention to the average efficiency, proxied by the labour productivity. Results are reported in (Table 7), where we see that the average productivity is positively and significantly associated with both the NTM measures as expected from our theoretical model. An increase of 1% in the TBT-share measure is associated with an increase of 0.006% in the average productivity (statistically significant at 1%). This result is confirmed when looking at the other measure, the TBT index, even if the magnitude of the coefficient and the level of statistical significance are lower. In the previous analysis, by looking at the number of firms, TBT measures seemed to behave as measures which are not new for domestic firms, the second case in the theoretical framework (see Section 3.5). Therefore we expect them to increase the competition at the aggregate level showing a positive association with the average

Table 6: Tariffs, NTMs and the number of firms by size class‡

	(1)	(2)	(3)	(4)	(5)
szclass2	-0.195**	-0.058	-0.067	-0.067	-0.077
	(0.084)	(0.076)	(0.072)	(0.083)	(0.079)
szclass3	-1.451***	-1.030***	-1.028***	-1.039***	-1.036***
	(0.199)	(0.170)	(0.172)	(0.169)	(0.171)
TBTsh(ln)				-0.012**	-0.011**
				(0.004)	(0.004)
Tariff (ln)	0.013		0.015		0.015
	(0.009)		(0.009)		(0.010)
szclass2XTBTsh				0.011**	0.010**
				(0.003)	(0.004)
szclass3XTBTsh				0.035**	0.035**
				(0.012)	(0.012)
szclass2Xtariff	0.025*		0.023*		0.023*
	(0.012)		(0.012)		(0.012)
TBT(ln)		-0.012***	-0.012**		
		(0.003)	(0.004)		
szclass2XTBT		0.011***	0.010**		
		(0.003)	(0.004)		
szclass3XTBT		0.035**	0.035**		
		(0.012)	(0.012)		
szclass3Xtariff	-0.001		-0.007		-0.008
	(0.028)		(0.029)		(0.029)
Tariff + szclass2XTariff	0.038***		0.038***		0.038**
	(0.011)		(0.011)		(0.011)
Tariff+ szclass3XTariff	0.011		0.008		0.007
	(0.020)		(0.020)		(0.020)
TBT + szclass2XTBT		-0.001	-0.001		
		(0.001)	(0.002)		
TBT + szclass3XTBT		0.022**	0.022**		
		(0.009)	(0.008)		
TBTsh + szclass2XTBTsh				-0.000	-0.001
				(0.001)	(0.002)
TBTsh + szclass3XTBTsh				0.023**	0.023**
				(0.007)	(0.007)
Observations	5,282	5,282	5,282	5,282	5,282
R-squared	0.789	0.790	0.790	0.790	0.790

‡ Dependent variable: number of domestic firms. AAll models include fixed effects at the country, sector and year level and control for the level of import from EU27 (coefficients not reported). Standard errors (in parenthesis) clustered at the country and year level. Sectors with $nfirms < 10$ are excluded. Significance level: *0.10>p-value ** 0.05>p-value*** 0.01>p-value.

efficiency. This being also in line with the results shown in the analysis by size classes, where TBT is positively related with large (more efficient) firms and negatively related with small (less efficient) firms. In contrast with what predicted by our model in the long run, the tariff is negatively associated with the average efficiency (at 10% level).[31] The low effect on productivity can be explained by the indicator we use. Labor productivity (i.e., value added per worker) or TFP include both pure technical efficiency and firm market power (see among others De Loecker et al. (2016); Forlani et al. (2016)). The former is a key variable of our model (efficiency is the inverse of marginal cost c), while the latter measures the firm ability to charge a higher price for a given demand. Therefore, trade liberalization (as a reduction in tariff) may generate an increase in the average technical efficiency but, on the other hand, tariff reduction shrinks domestic firms mark-up due to increased competition (pro-competitive effect). Given that our productivity measures include both terms, the net effect could cancel out.

Table 7: tariffs, NTMs and the average efficiency[‡]

	(1)	(2)	(3)	(4)	(5)
Tariff (ln)	-0.019*		-0.019*		-0.019*
	(0.010)		(0.010)		(0.010)
TBTsh(ln)				0.006***	0.006***
				(0.001)	(0.001)
TBT(ln)		0.003*	0.003*		
		(0.002)	(0.002)		
Observations	2,961	2,962	2,961	2,962	2,961
R-squared	0.881	0.880	0.881	0.881	0.881

‡ Dependent variable: average labour productivity. All models include fixed effects at the country, sector and year level and control for the level of import from EU27 (coefficients not reported). Standard errors (in parenthesis) clustered at the country and year level. Significance level: *0.10>p-value ** 0.05>p-value*** 0.01>p-value.

7 Robustness

The empirical model in Section 5 may suffer from endogeneity issues. In particular, the number of firms may affect EU decisions on trade policy, i.e. on tariffs and NTM measures, or some unobserved characteristics may determine both the market outcome, the number of firms or the average efficiency, and the adoption of protectionist measures. Omitted variable bias should be reduced due to different levels of aggregation. Tariffs and NTM set at the HS6 level for

[31] It is worth noting that in the robustness check that we carry out the relationship is not statistically significant, see Section 7.

the whole EU are not likely to be affected by country-level lobbying unless some sectors are dominated by only a few firms in a few countries. In this case, it is necessary to control for firms' distribution at the sectoral level, which in our strategy is captured by sector fixed effect. Still, the empirical model in Section 5 may suffer from endogeneity issues if the tariff or the NTM measure is related to omitted variables at country-year or sector-year level. As a robustness check we also estimate the same equations as in 13, 14 and 15 by including country-year and sector fixed effects, allowing us to capture all those observable and unobservable factors varying at the country-year level, like for instance gdp per capita, population, openness or country asymmetric business cycle. Results are shown in Table 8 and Table 10 in the Appendix D, for the number of firms and average efficiency, respectively. All results of the baseline specification are confirmed and the magnitude of the coefficient is very similar. The only exception is the relationship between the tariff and the average efficiency which is still negative but is not statistically significant anymore.

As a further check we estimate the same equations as in 13, 14 and 15 by including country-year and sector-year fixed effects. This should allow us to capture observable and unobservable factors, common across EU countries, varying at the sector-year level, like for instance some sector specific consequences of the financial crisis, or the housing bubble. Results for this second check are reported in Table 9 and Table 11 in the Appendix D, for the number of firms and average efficiency, respectively. As for the number of firms, the results of the baseline are confirmed for both the tariff and the TBT-share measure of protection, with coefficient of a larger magnitude, in particular in the case of the tariff. By contrast, the significance of the other NTM measure, the TBT index, does not survive. The same applies to the relationship between protection and average efficiency. Again, as in the previous check, the negative relationship between the tariff and the efficiency is not statistically significant anymore, but in this check also the TBT index does not survive.

8 Conclusions

In this paper we investigate, both theoretically and empirically, the relationship between tariff and standard-like Non-Tariff Measures (NTMs) imposed by the EU and market conditions in domestic EU markets, in terms of number of firms and average productivity. We also explore whether and to what extent these effects are heterogeneous across firms, and therefore also affect firms' distribution. We develop a theoretical framework to analyze (i) the introduction of a tariff, (ii) the adoption of a new NTM by domestic firms and foreign exporters, (iii) the extension of an already domestically adopted NTM to foreign exporters. We work within the framework of the model by Melitz and Ottaviano (2008), Section 3. We derive some testable implications relating Non-Tariff barriers to the number of firms selling in the domestic market and average efficiency. We take the model to the data for a group of European countries and manufacturing industries. We combine CompNet data for 16 EU countries in 2002-2012, providing information on firms' performance at the industry level and by size class, with the STC WTO-I-TIP database, providing information on Specific Trade Concerns (STC) raised at the WTO on NTMs, in particular on Technical Barriers to Trade (TBT), and with the TRAINS database providing information on Tariffs. Results are in line with the implication of the theoretical model, where firms relocate production in the country protected by the tariff. As for TBT we find results consistent with the second model of NTMs, those regarding only foreign producers, where the majority of domestic firms have already borne the cost of the standard. Here, the number of firms increases, especially large firms and also average efficiency increases. Our results also show that the relationship of both NTMs and tariffs with the number of firms is heterogeneous across size classes.

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A Technical Barries to Trade (TBT)

In order to guarantee the production and consumption of "safe" products without creating unnecessary barriers to trade, WTO countries defined a set of rules under which regulate Technical Barries to Trade (TBT).

TBT agreement aims at regulating technical standards or products requirements which are imposed by states with the objective of protecting human health or environment. However, the existence of many standards may make difficult the actives of exporting firms. TBT agreement aims to facilitate trade and to solve countries dispute on production standards. On the one hand, TBT agreement recognizes countries rights to adopt the standards they consider appropriate. On the other hand, the TBT agreement try to simplify exporting activities across the multitude of regulations. It is achieved in different ways. First, TBT agreement encourages countries to use international standards in order to uniform regulation. Second, countries should notify to a specific committee, TBT committee, the existing and future regulations on products standards. [32] According to the agreement, standards have to be fair and equitable[33], and any discriminatory practices between domestic produced and foreign good is discouraged.

Usually in response to notifications, countries may use the TBT Committee to discuss specific trade concerns (STCs) related to regulations or procedures of other countries that affect trade. Raised concerns are related to regulations that may be beyond the purpose of public safety and impose a discrimination between domestic and foreign producers. Concerns may be raised on both existing and forthcoming regulation (both should be notified to WTO).

Differently from TBT, **SPS agreement** aims to protect the safety of food and to prevent the spread of diseases among animals and plants. Morevoer, SPS measures cannot be used as protection for domestic producers. In particular such regulation cannot be used to discriminate between countries with similar prevailing conditions. In order to export, it is necessary to demonstrate that the exporting country achieve the same level of protection as in the importing country. Similarly to TBT, governments have to provide in advance notification on

[32] Transparency is a fundamental point of TBT agreement. Notification, with establishment of enquiry points, and publication requirements are the three key points.

[33] It is encouraged also the recognition of other countries' assessment procedures.

new or changed sanitary and phyto-sanitary regulations to SPS committee. As for TBT, WTO members can raise concerns on SPS to the SPS committee.

B Proofs Section3

Proof of Result 1. Substitute for $\left(c_D^A - s\right)^{k+2}$ from the (a) to get

$$L^B\left(c_D^B\right)^{k+2} = h - (\tau_A)^{-k}\left[h - L_B(\tau_B)^{-k}\left(c_D^B - s\right)^{k+2}\right]. \tag{19}$$

Whence, by differentiating,

$$dc_D^B/ds = -\beta/(\alpha-\beta) < 0. \tag{20}$$

where $\beta = (\tau_A^k\tau_B)^{-k}(c_D^B - s)^{k+1}$ and $\alpha = \left(c_D^B\right)^{k+1}$. Hence c_D^B decreases. Then, rewrite (A) as $\left(c_D^A - s\right)^{k+2} = \left(h/L^A\right) - \left(L_B/L^A\right)(\tau_B)^{-k}\left(c_D^B - s\right)^{k+2}$, so that:

$$c_D^A = s + (1/L^A)^{\frac{1}{k+1}}\left(h - L_B(\tau_B)^{-k}\left(c_D^B - s\right)^{k+2}\right)^{\frac{1}{k+1}}.$$

It is then easy to show that $dc_D^A/ds > 1$.Hence $c_D^A - s$, the *identity* cut off cost increases with s. Q.E.D.

Proof of Result 3. From (Bt) one has $L^B\left(c_D^B\right)^{k+2} = h - L^A(\tau_A)^{-k}\left(c_D^A - t\right)^{k+2}$, then (At) rewrites as

$$L^A\left(c_D^A\right)^{k+2} + (\tau_B)^{-k}\left[h - L^A(\tau_A)^{-k}\left(c_D^A - t\right)^{k+2}\right] = h$$

so that $\left[\left(c_D^A\right)^{k+1} - (\tau_B\tau_A)^{-k}\left(c_D^A - t\right)^{k+1}\right]dc_D^A + \left[(\tau_B\tau_A)^{-k}\left(c_D^A - t\right)^{k+1}\right]dt = 0.$

And $\dfrac{dc_D^A}{dt} = -\dfrac{(\tau_B\tau_A)^{-k}\left(c_D^A - t\right)^{k+1}}{\left(c_D^A\right)^{k+1} - (\tau_B\tau_A)^{-k}\left(c_D^A - t\right)^{k+1}} < 0$ since the denominator is positive. Q.E.D.

Proof of Result 4. An increase in the tariff is equivalent to a decrease in ρ_A hence look at $sign[-\frac{d}{dt}(G(c_D^B/\tau_B)]$ as equivalent to $sign[-\frac{d}{d\rho_A}(G(c_D^B/\tau_B)] = sign\left[-\frac{d}{d\rho_A}(c_D^B)\right] = (+)$ while $sign[-\frac{d}{d\rho_A}(G(c_D^A)] = (-)$ hence the numerator in $G(c_D^B/\tau_B)/G(c_D^A)$ increases while the denominator decreases. Q.E.D.

Proof of Lemma 2. From (BBb) one obtains (before the standard)

$$L^B(c_D^B)^{k+2}\left[\frac{3}{k+3}\left(1 - (\tau_A\tau_B)^{-k}\right)\right] = \gamma\phi(1 - \tau_A^{-k}). \tag{B0}$$

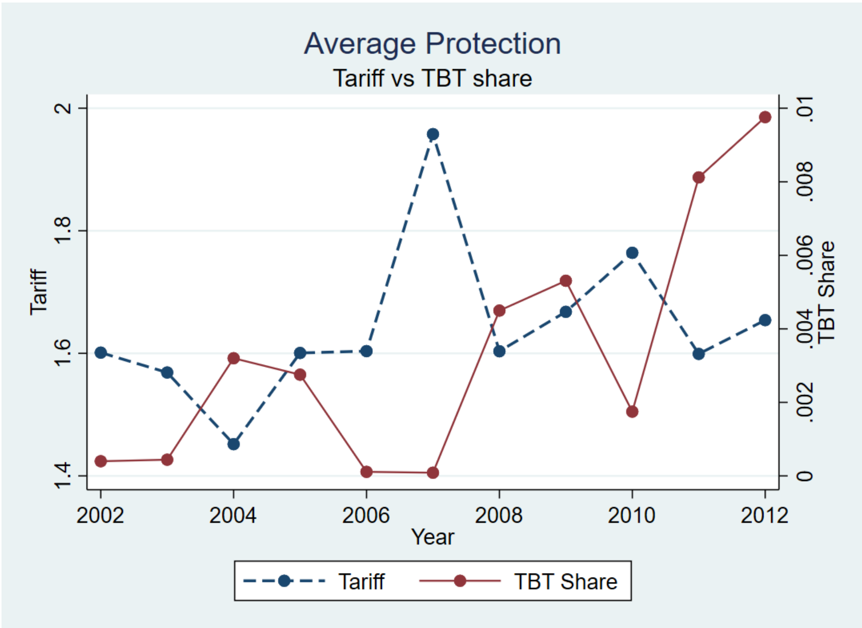
and from (BBa) one obtains (after the standard)

$$L^B (c_{D1}^B)^{k+2} \left[\frac{3}{k+3} \left(1 - \frac{k+3}{3} (\tau_A \tau_B)^{-k} \right) \right] = \gamma \phi (1 - \tau_A^{-k}). \qquad \text{(Ba).}$$

Hence $c_{D1}^B \geq c_D^B$ if $1 - \frac{k+3}{3} (\tau_A \tau_B)^{-k} \leq 1 - (\tau_A \tau_B)^{-k}$, which is true given $(k+3)/3 > 1$. Q.E.D.

C NTM - Share of protected goods

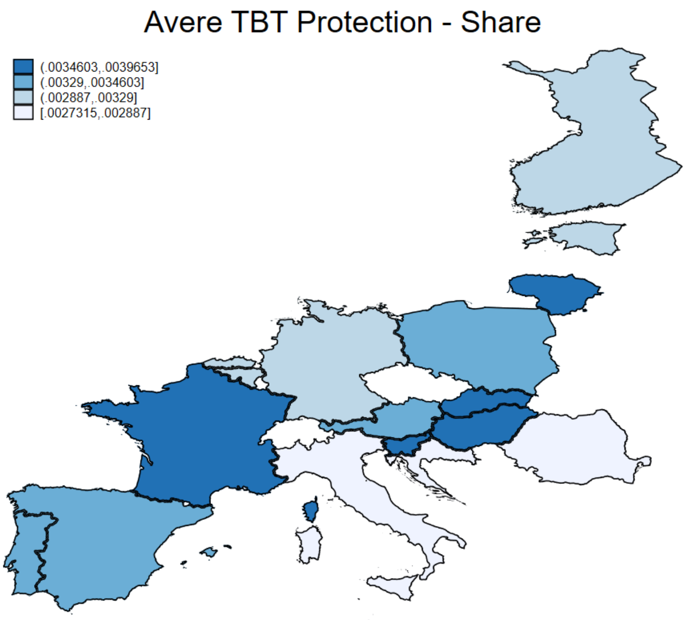
Figure 3: Average protection from tariff and NTM



Source: WITS and STC database. Tariff is computed as in Eq. 7 and Eq. 8. NTM is computed using Eq. 10 and Eq. 12

D Additional Tables

Figure 4: Average country protection (TBT-share)



Source: WITS and STC database.

Table 8: tariffs, NTMs and number of domestic firms‡

	(1)	(2)	(3)	(4)	(5)
Tariff (ln)	0.018***		0.018***		0.018***
	(0.001)		(0.001)		(0.001)
TBTsh(ln)				0.003***	0.003***
				(0.000)	(0.000)
TBT(ln)		0.001***	0.001***		
		(0.000)	(0.000)		
Observations	2,963	2,964	2,963	2,964	2,963
R-squared	0.891	0.892	0.891	0.892	0.892

‡ Dependent variable: number of domestic firms. All models include fixed effects at the country by year and sector level and control for the level of import from EU27. Standard errors (in parenthesis) clustered at the country and year level. Significance level: *0.10>p-value ** 0.05>p-value*** 0.01>p-value.

Table 9: tariffs, NTMs and number of domestic firms[‡]

	(1)	(2)	(3)	(4)	(5)
Tariff (ln)	0.028***		0.028***		0.028***
	(0.001)		(0.004)		(0.001)
TBTsh(ln)				0.007***	0.006***
				(0.002)	(0.002)
TBT(ln)		-0.008	-0.008		
		(0.005)	(0.006)		
Observations	2,963	2,964	2,963	2,964	2,963
R-squared	0.893	0.893	0.893	0.893	0.893

‡ Dependent variable: number of domestic firms. All models include fixed effects at the country by year and sector by year level and control for the level of import from EU27. Standard errors (in parenthesis) clustered at the country and year level. Significance level: *0.10>p-value ** 0.05>p-value*** 0.01>p-value.

Table 10: tariffs, NTMs and the average efficiency[‡]

	(1)	(2)	(3)	(4)	(5)
Tariff (ln)	-0.016		-0.016		-0.017
	(0.011)		(0.011)		(0.010)
TBTsh(ln)				0.006***	0.006***
				(0.001)	(0.001)
TBT(ln)		0.003*	0.003*		
		(0.002)	(0.002)		
Observations	2,961	2,962	2,961	2,962	2,961
R-squared	0.885	0.885	0.885	0.885	0.886

‡ Dependent variable: average labour productivity. All models include fixed effects at the country by year and sector level and control for the level of import from EU27. Standard errors (in parenthesis) clustered at the country and year level. Significance level: *0.10>p-value ** 0.05>p-value*** 0.01>p-value.

Table 11: tariffs, NTMs and the average efficiency[‡]

	(1)	(2)	(3)	(4)	(5)
Tariff (ln)	-0.012		-0.012		-0.013
	(0.013)		(0.013)		(0.012)
TBTsh(ln)				0.021**	0.021**
				(0.007)	(0.007)
TBT(ln)		-0.005	-0.005		
		(0.007)	(0.007)		
Observations	2,961	2,962	2,961	2,962	2,961
R-squared	0.889	0.888	0.889	0.889	0.889

‡ Dependent variable: average labour productivity. All models include fixed effects at the country by year and sector by year level and control for the level of import from EU27. Standard errors (in parenthesis) clustered at the country and year level. Significance level: *0.10>p-value ** 0.05>p-value*** 0.01>p-value.