Staff Working Paper ERSD-2014-18 **Date: 29 October 2014**

World Trade Organization
Economic Research and Statistics Division

Trade Policy Substitution:

Theory and Evidence from Specific Trade Concerns

Cosimo Beverelli
(Economic Research Division, WTO)

Mauro Boffa
(GSEM, University of Geneva)

Alexander Keck
(Economic Research Division, WTO)

Manuscript date: 29 October 2014

Trade Policy Substitution:

Theory and Evidence from Specific Trade Concerns*

Cosimo Beverelli‖ Mauro Bo a ·—· Alexander Keck«

Abstract

We investigate to what extent the probability that a Specific Trade Concern (STC) is raised in the WTO against a Member in a given sector is affected by past reductions in applied tariffs. Employing an identification strategy based on `new measures', we find evidence of a substitution of non-tariff measures for tariffs both in the sample of TBT and in the sample of SPS concerns. While in the SPS sample this result holds both among developed and developing economies, in the TBT sample such `trade policy substitution' only occurs when the country maintaining the measure at issue is economically developed. These results are consistent with our theoretical model, which predicts policy substitution between tariffs and standards in economies where meeting such standards is relatively less costly and in sectors where meeting such standards is relatively more important from the perspective of producers.

Keywords: Import, International Trade Agreements, Non Tariff, Tariff, WTO

JEL Classification: F13, F14, F15

---

* This is a working paper, and hence it represents research in progress. The opinions expressed in this paper should be attributed to its authors. They are not meant to represent the positions or opinions of the WTO and its Members and are without prejudice to Members' rights and obligations under the WTO. Any errors are attributable to the authors. Without implicating them, we thank Marc Bacchetta, Marcelo Olarreaga, Lorenzo Rotunno and participants at the Fifth Research Workshop on International Trade (Villars, 6-7 February 2014) and at the Trade Agreements Workshop (KU Leuven, 14-15 March 2014) for valuable comments and suggestions.

‖ Economic Research Division, World Trade Organization. Rue de Lausanne 154, CH-1211, Geneva, Switzerland. E-mail: cosimo.beverelli@wto.org (corresponding author); alexander.keck@wto.org.

·—· GSEM, University of Geneva. Bd. du Pont d'Arve 40, CH-1211 Geneva, Switzerland. E-mail: mauro.bo a@unige.ch.

1 Introduction

Through successive waves of liberalization, tari s have steadily dropped over the years both in industrial and developing countries (WTO, 2007; Milner, 2013; Bown, 2014). Having constrained this traditional instrument of import protection, countries may be inclined to pursue trade policy objectives through non-tari measures (NTMs). Unlike tari s, such measures may have a dual purpose: NTMs may be designed or administered in ways that intentionally restrict trade even if their declared purpose is to serve a public policy goal (WTO, 2012). For example, a technical product requirement may be introduced to prevent the importation and marketing of products considered unsafe for consumption, but it may also be targeted at undoing some of the impact of opening up to trade on the domestic industry. The use of NTMs to replace, at least in part, former levels of tari protection can be de ned as `trade policy substitution'.

We develop a model that can explain the occurrence of policy substitution when tari s come down, but also allows for the possibility of policy complementarity, whereby NTMs would be positively correlated with tari s. In the baseline version of the model, NTMs such as product standards unambiguously increase the rm's marginal production costs. Whether a domestic rm prefers standards to be tightened or loosened after tari reductions depends on the cost advantage in meeting the standardvis-a-vis foreign producers. Policy substitution, i.e. the tightening of standards, is likely to occur when domestic rms nd it relatively less costly to meet the standard than foreign rms, and vice versa for the case of policy complementarity. At the aggregate level, therefore, policy substitution is expected to occur in more advanced economies (where meeting product standards is relatively less costly) and policy complementarity in less advanced economies (where meeting product standards is relatively more costly).

When we relax the assumption that product standards only represent a cost for the rms adopting them, and allow for the possibility that rms' productivity may increase with the standard, results depend on the net cost advantage, i.e. the relative cost-bene t of domestic versus foreign rms in meeting the standard. Under this scenario, policy substitution can result in all cases in which the bene ts related to adopting the standard are high enough to warrant the costs. At the aggregate level, therefore, policy substitution is expected to occur in sectors where product standards are relatively more important.

In the empirical application of our model, we seek to determine to what extent the probability of applying

NTMs is related to tari reductions. To measure NTMs, we use the information embedded in Speci c Trade Concerns (STCs) raised in two WTO committees { the Committee on Technical Barriers to Trade (TBT) and the Committee on Sanitary and Phytosanitary Measures (SPS)[1]. STCs may be brought by any WTO member considering to be negatively a ected by an SPS/TBT measure imposed by a WTO trading partner. They are `soft law' mechanisms to deal with NTMs, as they are based on diplomatic relations, rather than adjudication.

Unlike other data on NTMs that has been used to address the question of trade policy substitution and that may include trade-enhancing policies { such as frequency counts of product standards { STCs identify actual trade restrictions in speci c sectors. Moreover, they refer to measures of general application { as opposed to bilateral measures such as anti-dumping investigations.

To address the issue of causality, we employ an identi cation strategy based on pre-determined (lagged) cuts in sectoral applied tari s and on the exclusive use of STCs relating to `new measures'. The intuition is that if a new TBT or SPS measure is introduced after a tari is liberalized, it is less likely (indeed, quite unlikely) to a ect tari liberalization itself compared to a pre-existing measure. To address the issues of confounding biases and of nuisance parameters, we control for a multitude of factors that are likely to a ect the use of NTMs and add country-sector xed e ects with year dummies in a conditional logit speci cation.

Our contribution to the literature is fourfold. First, we build a simple model of trade policy substitution that lends itself to empirical testing with existing data. Second, we examine the empirical evidence of trade policy

The paper is structured as follows. In Section 2 we give an overview of the existing theoretical and empirical literature on trade policy substitution, identify shortcomings in the methodologies and data employed and

measure for di erent levels of another. In his model, a standard is justi ed by the existence of a negative consumption externality and increases costs more for the foreign than for the domestic rm. For the speci c set-up of an international Cournot duopoly, Essaji (2010) highlights that the standard will be tightened following tari liberalization if this increases the government's payo s at lower levels of tari protection. Whether this is the case depends on the government's objective function. If the government only cares about consumer surplus and pro ts of domestic rms, it will respond to tari cuts by relaxing the standard (policy complementarity). Conversely, the standard will be increased if the government is also concerned with tari revenue and with the negative consumption externality (policy substitution). [4] Essaji's model underscores the fact that the proliferation of NTMs after tari liberalization may re ect a growing awareness of consumption externalities. However, the model also entails the counterintuitive result that \a government that is overwhelmingly protectionist, i.e., only concerned with the Domestic rm's pro ts, will be motivated to lower standards [...] in the wake of tari reduction" (Essaji, 2010, p. 14). This result is at odds with the considerable body of literature that has studied the use of standards for purely protectionist reasons (see for instance Fischer and Serra, 2000; Sturm, 2006; Abel-Koch, 2013).

As noted in Section 1, the apparent substitution of NTMs for tari s may indeed be motivated by an increased demand for regulation, as more potentially unsafe products become available, but it may also re ect a form of protection that is not openly discriminatory. The theoretical model we present shows how the importance of these considerations may vary across countries and sectors. Across countries, we expect trade policy substitution to prevail in advanced economies, relative to less advanced ones. Although we use a di erent approach (based on relative cost considerations), this prediction is similar to the one formulated by Bagwell and Staiger (2014). They argue that a degree of trade policy substitution in developed countries may be attributed to `globalization fatigue' { the fact that existing tari s were globally e cient when they were

countries. If this is true, ceteris paribus, we would expect the probability of trade policy substitution to be higher in developed compared to developing countries, following episodes of tari reductions.

de ciencies, such as inconsistent data collection across years, use of coverage/frequency ratios as a measure of trade protection or, where AVEs are calculated, potentially misleading estimates of their stringency.[5] Another strand of the empirical literature analyzes possible substitution e ects between tari s and a particular class of restrictive NTMs { anti-dumping (AD) measures. Evaluating data for 24 countries (17 developing and 7 developed countries) during the period from 1996 to 2003, Feinberg and Reynolds (2007) nd that reductions in bound tari s in the context of the Uruguay Round have a small positive e ect on AD. When only considering AD activities by developing countries, Feinberg and Reynolds (2007) nd a much larger positive e ect of lower tari bindings both for the likelihood of using AD and for the number of AD petitions led by a country. It is not clear, however, to what extent this result provides evidence of policy substitution. The authors focus on reductions in bound tari s, which in many instances, notably for developing countries, did not lead to actual reductions in Most-Favoured Nation (MFN) applied rates, but only to a narrowing of the `water' in the tari . Moreover, to their own surprise, Feinberg and Reynolds (2007) nd that tari commitments by developed countries, even though `biting' into applied rates, are associated with less frequent AD activity.[6] The authors conjecture that this result may re ect a move towards alternative means of protection, such as TBT and SPS measures, i.e. policy substitution proper. It may also be due to a host of other omitted variables, such as an increased orientation towards services and FDI in these countries, that would reduce their interest in AD (Feinberg and Reynolds, 2007). Given these limitations, Moore and Zanardi (2011) conduct a similar study, focusing on applied rather than bound rates and controlling for additional factors that may a ect AD initiations. Examining tari cuts and AD initiations in 35 countries (29 developing and 6 developed) over the period from 1991 to 2002, the authors also dispose of a larger set of importing and exporting countries, a longer time span, more disaggregated sectoral information and a more complete AD database. Overall, Moore and Zanardi (2011) nd that reductions in applied rates do not lead to a higher probability of AD petitions. But for a small group of developing countries that have become heavy users of AD, they obtain a statistically signi cant impact of trade liberalization on the probability of AD lings. For

[5] For an extensive overview of available sources of information on NTMs and an in-depth discussion of the challenges faced in using the data in trade analysis, see WTO (2012). For an illustration of the pitfalls in AVE estimations of di erent kinds of NTMs see, speci cally, the case studies provided in Whalley (2005). Beghin et al. (2014) estimate that almost 40% of the product lines a ected by NTMs according to the NTM global database (Kee et al., 2009) are actually subject to trade-facilitating measures.

[6] Applying the same methodology as Feinberg and Reynolds (2007), speci cally to AD investigations by the EU at a more disaggregate product level, Ketterer (2014) nds, however, a small positive impact of bound tari concessions on AD.

this sub-sample, a one standard deviation increase in tari liberalization is related to a 25 per cent higher probability of AD. Bown and Tovar (2011) obtain similar results for trade reforms undertaken by India in the 1990s. According to the authors, in India the probability of launching a trade remedy investigation is 50 per cent higher for a one standard deviation increase in trade liberalization.

From this literature, it is di cult to draw a general conclusion as to the occurence of trade policy substitution. At most, the existing literature has established, for a limited number of cases, the increased use of AD { a bilateral, time-bound and transaction-based measure in excess of MFN tari s { when the general level of import protection represented by MFN tari s has been reduced. Owing to their exporter-speci c nature, AD measures have often led to increases in imports from third countries (which { as shown by Brenton (2001) { may also have supported the initial AD petitions), and, hence, can hardly be seen as a policy substitute for a general reduction in import protection. Adopting the methodology by Moore and Zanardi (2011), Aisbett and Pearson (2012) try to address this problem by using SPS measures noti ed to the WTO as a proxy for NTMs. However, their analysis reverts to the use of bound tari s and su ers from the common shortcoming that noti cation information does not only include trade-restricting practices (WTO, 2012). In their most conservative (and econometrically most rigourous) estimation, the authors nd evidence of policy substitution. Namely, they obtain a negative correlation between changes in bound tari s and the probability of new SPS noti cations at the country-HS2 sector level.

Building in particular on the econometric methodology by Moore and Zanardi (2011), we re ne existing identi cation strategies of policy substitution, including by employing measures of actual import protection and of general application.

3 Theoretical model

Our model uses the basic set-up of Gulati and Roy (2008). Let `Home' be a small open economy with perfectly competitive markets. There are two goods, 1 and 2. Good 2 is the numeraire. Good 1 is produced with labor (l) and capital (k). As in Battigalli and Maggi (2003), labor is perfectly mobile between sectors but capital is speci c to each sector. The import price of good 1 is normalized to 1; however, the domestic producer price for this good need not be equal to 1. We suppose that a costly standard W7t28(e)-.3l3(7t2d)-1-21(As)-3pds

on the production of good 1.[7] The overall domestic production function after the standardization process is:

$$y_1 \quad \frac{1}{1 \quad \hat{} \bullet} f \hat{} k; l \bullet \tag{3.1}$$

The production function $f \hat{} \bullet$ is twice di erentiable, homogeneous of degree one, and concave in its arguments. Given that the import price of good 1 is normalized to 1, the function $\hat{} \bullet$ is readily interpreted as the net cost of meeting the standard . We assume that $\hat{} \bullet \quad \frac{\hat{} \bullet}{\hat{} \bullet}$. The numerator is interpreted as the cost of meeting the standard . As in Gulati and Roy (2008), this function is increasing and strictly convex (A 0, A 0), with $\hat{} 0 \bullet \quad 0$.[8] The denominator, $\hat{} \bullet$, captures the bene t accruing to the producer that meets a standard . There are various channels through which meeting a (costly) standard can be bene cial.[9] We highlight two. First, the rm may bene t from an increase in the quality of its products that can be perceived by consumers (may they be nal consumers, wholesalers, retailers or downstream rms). Second, the rm may bene t from a reduction in per-unit inspection costs related to delivering the good to the consumer.[10] The function $\hat{} \bullet$ is assumed to be increasing and strictly concave (A 0, @0), with $\hat{} 0 \bullet \quad 0$.[11] Furthermore, we assume that the domestic industry does not export.

Domestic demand for good 1 is

borne by exporters in meeting the standard , $\ddagger\hat{}\bullet \quad \frac{\ddagger\hat{}\bullet}{\ddagger\hat{}\bullet}$.[12]

With positive imports, subject to a speci c import tari (and the standardization process by foreign suppliers), the e ective consumer price for one unit of the imported good is:[13]

$$p^{\ddagger} \quad 1 \quad \ddagger\hat{}\bullet \tag{3.3}$$

Consumers buy the domestically produced good only if the consumer price of the domestically produced good is no greater than that of the imported good. Therefore, (3.3) is also the e ective consumer price for one unit of the domestically-produced good. By selling at this price, domestic producers of good 1 get an e ective producer price equal to:

$$p \quad \frac{1 \quad \ddagger\hat{}\bullet}{1 \quad \hat{}\bullet} \tag{3.4}$$

Given pro t maximization and equation (3.4), the pro t function of domestic producers, $\hat{}p\bullet$, can be written as $\hat{}p\bullet \quad \hat{}\,;\ \bullet$. In the initial situation, the standard is set as $_0$ and the tari at $_0$. The pro t function is therefore $\hat{}p_0\bullet \quad \hat{}\ _0;\ _0\bullet$.

To evaluate the incentives for producers to lobby for policy substitution, consider a new situation in which the tari falls to $_1 @ _0$.[14] The standard that makes domestic producers indi erent between the initial and the new situation, which we de ne as $_1$, is implicitly de ned by the following condition:

$$\hat{}p\hat{}\ _1;\ _1\bullet\bullet \quad \hat{}p\hat{}\ _0;\ _0\bullet\bullet \tag{3.5}$$

which states that pro ts are unchanged between the initial situation with a standard $_0$ and a tari $_0$ and the new situation with a standard $_1$ and a tari $_1$. This condition is satis ed when $p\hat{}\ _1;\ _1\bullet \quad p\hat{}\ _0;\ _0\bullet$.

[12] Unlike Gulati and Roy (2008), we assume that foreign exporters need to meet the same standard , rather than a foreign-speci c standard $\ddagger$, to be able to export good 1 to the home market. The function $\ddagger\hat{}\bullet$ is, like $\hat{}\bullet$, increasing and strictly convex ($\ddagger$ A 0, $\ddagger$ A 0), with $\ddagger\hat{}0\bullet \quad 0$. And $\ddagger$ is increasing and strictly concave ($\ddagger$ A 0, $\ddagger$ @0), with $\ddagger\hat{}0\bullet \quad 0$: Therefore, $\ddagger\hat{}\bullet$ is continuous and twice di erentiable, with $\ddagger\hat{}0\bullet \quad \hat{} \ddagger\sim \ddagger\bullet S_{\ 0} \quad 0$.

[13] Note that exporters are willing to sell to Home only if the price they could receive for one unit of good 1 (equal to 1) equals the revenue from selling the good after meeting the standard and after paying the import tari . Thus $1 \quad p^{\ddagger} \ \frac{1}{1 \quad \ddagger\hat{}\bullet}$. Equation (3.3) follows directly from this expression.

[14] We do not model, in this context, the determination of tari s. The basic intuition we exploit is that { in a political economy setting (such as `protection for sale') applied to the baseline model with costly standards { domestic producers lobbying for

Setting, for simplicity, $_1$ 0, rede ning $_0$ and $_1$ and using (3.4), the iso-pro t condition becomes:

$$\frac{1 \quad ‡ˆ \; _0•}{1 \quad ˆ \; _0•} \quad \frac{1 \quad ‡ˆ \; •}{1 \quad ˆ \; •} \tag{3.6}$$

Solving equation (3.6) for and totally di erentiating, we obtain:

$$\frac{d}{d} \quad ! \quad \frac{1 \quad ˆ \; •^2}{‡ \; 1 \quad ˆ \; • \qquad •^2}$$

F38 9.9626 Tf 18.177 7.107 T J/F11 9.963933 -1.494 Td 0 T Td [(•)]TJ ET q 1 1 F38 9.9626 Tf 18.177 7.107 T J/F11 9.963933 -34 Td 8 Tf 6. 7.99obtain: d

rewritten as:

$$\frac{d}{d} \qquad \frac{1 \quad \hat{} \bullet^{2}}{} \frac{1}{1} \tag{3.10}$$

Like in Gulati and Roy (2008), we now de ne `cost advantage' in meeting the standard.

De nition 1. The domestic industry has a cost advantage in meeting the standard relative to foreign exporters if $\ddagger \sim$ A1. The domestic industry has a cost disadvantage in meeting the standard relative to foreign exporters if $\ddagger \sim$ @1.

Since A0 and A0, the sign of the relationship in (3.10) only depends on the cost advantage parameter . If the domestic industry has a cost advantage (A1), the standard will be negatively related to the tari (policy substitution). If, conversely, the domestic industry has a cost disadvantage (@1), the standard will be positively related to the tari (policy complementarity).

The intuition behind this result is simple. If domestic producers nd it relatively less costly than foreign producers to meet a given standard, they will want the standard to be tightened after tari liberalization to restore their competitive advantage vis-a-vis foreign exporters. Conversely, if they nd it relatively more costly than foreign producers to meet a given standard, they will resist a tightening of the standard after tari liberalization in order not to see their competitive position vis-a-vis foreign exporters being further eroded.

3.2 Costly, but bene cial, standards

In our second scenario, where standards entail both costs and bene ts for producers, the functions $\hat{}\bullet$ do not simplify to a constant. Impose the proportionality assumption (3.9) for the $\hat{}\bullet$ functions and the following proportionality assumption for the $\hat{}\bullet$ functions:

$$\frac{\ddagger \hat{} \bullet}{\hat{} \bullet} \quad \frac{\ddagger}{} \qquad \text{A0 and} \quad x \; k \tag{3.11}$$

where the rst equality in (3.11) stems from the fact that, by assumption, the $\hat{}\bullet$ functions are continuous and always concave in their domain.

Using the proportionality conditions, we can rewrite equation (3.7) as:

$$\frac{d}{d} \; ! \; \frac{1 \quad \hat{} \bullet^{2}}{} \frac{1}{- \quad 1} \tag{3.12}$$

The sign of this expression depends both on the sign of and on whether I . The sign of is, in principle, ambiguous, as it depends on whether ^ • I ^ •. In the following, we present an illustration in which is positive, i.e. the reasonable scenario where for higher levels of the standard, net costs increase. We can therefore focus on the economically meaningful term – 1.

1A]TJ/F8 9.9626 Tf 78.5280 Td [(10)-4575The

3.2.1 Illustration

With little loss of generality, let the ^ • and ^ • functions take the following functional forms:

$$\hat{} \bullet \quad \int_{0}^{\bullet}$$

]TJ/FT3 9.9626 Tf 7.887 0 Td [(

1A]TJ/F8 9.9626 Tf 7.7

foreign producers).[16]

other countries. The WTO's Information Management System (IMS) contains information about STCs. For each concern, it reports the maintaining country, the HS product codes a ected by the measure and the date of initiation. [20] We consider STCs raised between 1996 and 2011 (included). Table A-1 provides a full list of countries involved as maintaining countries in SPS and/or TBT STCs.

Table 1 collects information on the number of concerns, the number of maintaining countries and the number of HS headings and chapters covered, both for TBT and SPS concerns.

@Table 1 about here A

In the area of TBT, 327 STCs were raised between 1996 and 2011. Out of these, we were able to identify HS codes for 291 concerns. In the area of SPS, we were able to identify HS codes for 269 out of the 326 STCs raised over the period under analysis. An HS code could not be assigned in cases in which: i) there was no information on the members maintaining the measure (indicated as `certain members' in the original data); or ii) the contested measure was too broad in scope. An example of a concern with no information on maintaining members is SPS concern number 124, raised by the US on `noti cations [by unspeci ed countries] related to avian in uenza'. An example of a concern that is too broad in scope for our analysis is SPS concern number 117, raised by Argentina, Canada and the US vis-a-vis the EU, on `traceability and labelling of [products that contain or comprise] genetically modi ed organisms and food and feed [products produced from genetically modi ed organisms]'.

As mentioned in Section 1 and further discussed in Section 5, our identi cation strategy relies on the use of STCs based on new measures. For each TBT and SPS concern with information on HS codes, we have recorded the date of introduction of the underlying measure by the maintaining country, whenever available. In cases in which an STC refers to a noti ed measure, we have checked the noti cation by the maintaining country. In all other cases, we have looked for information on the date of introduction of the measure in the STC description in the WTO's IMS. If such information was not available, we have searched for it in the domestic legislation of the maintaining country. In cases of uncertainty, we have consulted WTO experts who regularly attend and service TBT and SPS Committee meetings.

[20] For the purposes of this study, we have engaged in substantial re-coding of the SPS dataset, to ensure consistency. The nal dataset, with consistent HS-4 coding across SPS concerns, is available upon request. A consistently-coded TBT dataset was already publicly available (see http://www.wto.org/english/res_e/publications_e/wtr12_dataset_e.htm). For TBT, we simply extended the dataset to include the STCs raised in the second half of 2011.

Table 1 shows the resulting classi cation of STC-related measures. In the table, `new measures' refer to measures introduced by countryi during the year of the STC initiation ( t), or the year before (t 1); `old measures' refer to measured introduced by countryj in year s @t 1 . To remain on the conservative side, we have decided to code as `uncertain' { and to drop in the econometric estimations { not only STCs for which we could not nd any information on the year of introduction of the related measure, but also STCs that we strongly suspected to be based on a new measures, but for which we could not nd de nitive evidence in support of this presumption. In the TBT sample, 258 STCs refer to new measures, accounting for 88.7% of the 269 STCs potentially usable in the estimations. In the SPS sample, 185 STCs out of 269, that is 68.8%, are based on new measures.

Overall, 40 WTO members (10 OECD, 30 non-OECD) were involved at least once as maintaining country in a TBT concern. This roughly amounts to 29% of WTO members (considering an overall average membership of 140 between 1996 and 2011). The number of members involved as maintaining country in an SPS concern is 59 (15 OECD, 44 non-OECD), which roughly amounts to 40% of WTO members.[21]

There are 82 HS chapters (HS 2-digit codes) covered by at least one TBT concern, out of 99 chapters contained in the HS classi cation. In terms of HS headings (HS 4-digit codes), 919 are covered out of the 1241 headings under the HS system. The corresponding gures for SPS are quite di erent. SPS STCs cover less HS chapters (33) and HS headings (219) than TBT STCs. This is not surprising, because, as discussed below, SPS measures cover almost exclusively a subset of animal and vegetable products and foodstu s. In contrast, the almost ubiquitous nature of technical regulations and product standards covered by the WTO's TBT Agreement explains the wide sectoral coverage of TBT STCs.

The last two rows of Table 1 report that the average number of HS headings covered by a TBT STC is 34.1, while the median is equal to 4. That is, labelling HS 4-digit codes as `sectors', one half of the TBT concerns cover less than 4 sectors, the other half covers more than 4 sectors. Each SPS concern, instead, covers a limited number of HS headings (7.8) on average. The median (5) is however higher than in the case of TBT

Figure 1 clearly shows that TBT measures can be found across a wide array of sectors, while SPS measures cover almost exclusively a small subset of sectors. As the gure indicates, SPS concerns are concentrated in HS sectors 01-05 (`Animal & Animal Products'), 06-15 (`Vegetable Products') and 16-24 (`Foodstu s'), while TBT concerns are much less concentrated and also cover sectors such as HS 28-38 (`Chemicals & Allied Industries'), 39-40 (`Plastics / Rubbers'), 50-67 (`Textiles and Footwear') and 84-85 `Machinery / Electrical').

@Figure 1 about here A

The evolution of the number of TBT and SPS concerns over time is shown in Figure 2.[22] In SPS, there is a wide uctuation in the number of STC initiations. The peaks of 1997-8, 2001-3 and 2005 roughly correspond to the outbreakes of the avian in uenza, the foot-and-mouth (FMD) disease and the bovine spongiform encephalopathy (BSE, or `mad cow disease'), respectively.[23]

For TBT concerns, there seem to be three distinct trends. A period of low activity between 1996 and 2001; a spike in 2002, followed by a declining trend until 2004; and an increasing number of STCs since 2005 (with the only exception being the year 2010). The absence of pronounced peaks in the case of TBT may be explained by the fact that, contrary to SPS measures, the demand for technical regulations and product standards is more or less steady rather than subject to sudden `crisis'-related surges.

@Figure 2 about here A

The evolution of TBT and SPS concerns is disaggregated by country group in the left and right panels of Figure 3, respectively. It can be seen that the trends identi ed for TBT concerns { and the peaks in SPS STCs { are not systematically driven by a particular group of countries.

@Figure 3 about here A

[22] The gure includes all raised concerns, not only the ones for which an HS code could be identi ed or the subset of STCs based on new measures. Exclusion of STCs without HS codes or of STCs that are not based on new measures would make no relevant di erence.

[23] Even during these episodes, the nature of concerns varied widely, with several STCs covering issues such as pesticide maximum residue level (MRL) in food products, just to mention one.

5 Empirical strategy

In this section, we provide empirical evidence of the central prediction of our model linking the probability of observing trade policy substitution to country and sector attributes that de ne a relative net cost advantage in meeting a standard. To that end, we estimate the determinants of the probability that a maintaining country's TBT or SPS measure is subject to a Speci c Trade Concern (STC). We establish our dependent response as a Bernoulli random variable taking a value of 1 if in a given year an STC against country i was raised by any other country.

There are two main reasons why we do not exploit the bilateral dimension of STCs. First, a country may

data indicates whether an STC is resolved and, if this is the case, the date of resolution. In principle, even for concerns that are not reported as resolved (including TBT ones), an arbitrary rule of thumb could be used to assign a resolution date.[26] Our interest is, however, not in the duration of STCs, but in their initiation. To initiate a concern, a raising country must overcome a xed political cost and the opportunity cost of putting resources on the case. This is an indication that the measure at issue is, or has the potential to be, trade-restrictive. The duration of a concern, even if it was perfectly measured, would not provide any additional information on the relationship between pre-determined sectoral tari s cuts in a given sector and the imposition of NTMs.[27]

The predictions of our theoretical model are given by equation (3.12). On the basis of this, we postulate the following econometric speci cation to determine the e ects of past sectoral tari cuts on STC initiations, controlling for other factors that could potentially a ect such initiations:

$$\Pr\left(y_{ikt} = 1 \mid x_{ikt}; \ ; \ _{ik}\right) = \hat{} \left(\ _{ik} + x_{ikt}^{\text{œ}}\right) \quad (5.1)$$

In equation (5.1), i indexes maintaining countries (importers); k indexes HS headings (4 digit sectors); t indexes years. $\hat{}(\cdot)$ is the logistic cdf with $\hat{}(z) = e^{z}/(1+e^{z})$; $_{ik}$ are country-sector xed e ects. As described in Table 2, the left-hand side variable is an initiation dummy variable. It takes value one if there was an initiation in country-sector ik in year t, and value zero in all years s x t. Explanatory variables (also described in Table 2) are in the vector x_{ikt}.

For estimation, we employ a conditional logit model. Given the way the dependent variable is constructed, this is a natural modeling strategy. It uses only information on ik's for which there is at least one STC inititation over the sample period, and discards all country-sector combinations in which there is no STC initiation.[28] The conditional logit is also the most conservative regression model that can be used with the data at hand, because it allows for identi cation within country-sectors over time, controlling for common

[26] A possible rule of thumb would be: if a concern is raised in year t, possibly re-raised any number of times until year t j and never raised again, consider it resolved in year t j 2.

[27] Since TBT and SPS committees typically meet three times a year, it is possible that an STC is raised and resolved the same year. Since we focus on initiation, this is not a serious issue for our estimation strategy. For the SPS dataset, we have, however, conducted robustness analysis excluding concerns that are reported as resolved in the same year as, or one year after, their inititation (see Section 7.2 for details). The estimation results are una ected.

[28] It turns out that for each ik there is at most one initiation between 1996 and 2011, both in the SPS and in the TBT datasets. Therefore, we do not have to worry about multiple initiations.

shocks related to business cycle uctuations with year dummies.[29]

The main explanatory variable of interest is the tari percentage change of maintaining country i in sector k. It is computed as the percentage decrease between t 2 and t 1. Although we cannot exclude a priori the possibility that tari cuts are a ected by the imposition of NTMs, which may in turn become subject to an STC, an identi cation strategy based on new measures (see Section 4) and lagged tari cuts goes a long way in addressing concerns related to reverse causality. When compared to pre-existing NTMs, or to NTMs

to reduce applied tari s at any time (and have indeed done so on many occasions).

We estimate our regressions separately for TBT and SPS to test for the expected di erences in policy dynamics outlined in Section 3. If TBT and SPS measures are e ectively used as policy tools to substitute for tari s, the tari percentage decrease will positively a ect the probability that a concern is raised against country i in sector k. We control for a set of trade-related and macroeconomic variables that may a ect the probability that an STC is brought against country i in sector k.

Trade-related control variables include:

Tari level, computed as the unweighted applied tari in sector k in t 2. This variable can control for systematic di erences across sectors, deriving, for instance from lobbying activity. As explained by

this variable.

Macroeconomic control variables include:

The growth rate of GDP between $t-2$ and $t-1$, which controls for swings in the business cycle. Under the expectation that an economic upturn reduces protectionist pressure, this variable should negatively a ect the probability that a concern is raised. On the other hand, faster economic growth could also increase regulatory demand from consumers, which would imply a positive coe cient.

several positive bilateral trade balances. The initiation of an STC by country j vis-a-vis country i may be triggered by a large bilateral trade de cit. If this is so, the expected sign of this variable is positive.

A major implication of the theoretical model of Section 3 is that a country's level of economic development should a ect the substitutability/complementarity relationship between tari s and standards. If the bene ts from adopting standards are not too large relative to the costs, policy substitution should occur in more developed economies (where meeting product standards is relatively less costly), whereas policy complementarity should occur in less developed economies (where meeting product standards is relatively more costly). To test this prediction, we add an interaction term to the empirical speci cation (5.1), equal to the product of the tari percentage change and an OECD dummy, which, as noted in table 2, is equal to 1 if the maintaining country was an OECD member in t 2 (and therefore also in t).[34] If signi cant, the coe cient on this interaction term should be positive.

Although the theoretical model is silent on political economy aspects, we conjecture that the incidence of trade policy substitution should also vary across sectors depending on the `policy space' available to countries to increase tari s again at any time, without renegotiation or violation of international commitments. Reductions in applied tari s may be less politically costly, and they may be associated with lower degrees of trade policy substitution, in sectors with `deep' water.[35] We therefore add an interaction term to the empirical speci cation (5.1), equal to the product of the tari percentage change and a tari water dummy variable. As noted in Table 2, this variable is equal to 1 in ik observations in which the tari water in t 2 is less than its median. We prefer to use the tari water dummy, rather than the level of the tari water, for three main reasons. First, since the dummy is based on the median, it su ers less from the relatively poor quality of data on bound tari s. Second, computing and properly interpreting tari water can be challenging and likely to induce severe errors.[36] Finally, using a dummy makes it easier to compare results with the

[34] OECD membership status and entry dates are indicated in Table A-1.

[35] In a recent paper, Kuenzel (2013) constructs a political-economy model showing that a lower tari overhang (i.e. less water) increases the probability that a country breaches its obligations under a trade agreement in the event of a favourable productivity shock for its trading partner. The same logic could apply to our set-up. Foletti et al. (2011) argue that not all the di erence between the bound and the applied tari is e ective policy space, notably because the bound tari may be higher than the prohibitive one. However, they show that on average only around 31% of the tari water is `smoke' that does not represent truly available policy space. The other 69% does.

[36] Using theoretically sound measures of tari water, Foletti et al. (2011) estimate that the world's tari water is 11%, with signi cant variations across countries (with high-income countries having a level of tari water equal to 7%, middle-income countries 16% and low-income countries 36%) and across sectors (tari water is around 27% in agriculture and around 9% in manufacturing). In our analysis, Table 3 indicates that the median of tari water, used to de ne the water dummy, is equal to 11.6% in the TBT sample and to 21.7% in the SPS sample. With HS4 data varying across years, it is not possible

OECD interaction term. If signi cant, the coe cient on the interaction term between tari reductions and the tari water dummy should be positive.

@Table 2 about here A

6 Data and descriptive statistics

between -1.25 (125% tari increase) and 1 (the tari is reduced to zero) in the TBT sample and between -1.36 and 1 in the SPS sample.

@Table 3 about here A

The data show that there has been a clear reduction in tari s in sectors a ected by TBT and SPS concerns (see Figure 4). Between 1996 and 2011, the average, unweighted tari applied by countries involved in TBT (SPS) concerns in sectors a ected by such concerns fell from 13% (11%) to 5% (for both)[37].

@Figure 4 about here A

The average applied tari s in TBT and SPS sectors are consistently higher in non-OECD that in OECD countries, as shown in Figure 5. However, and more importantly, the gure also shows that tari reductions have occurred in both groups of countries between 1996 and 2011, and these reductions have been sizeable. In particular, for the group of OECD countries included in our sample, the average applied tari s went down from 7.3 to 2.3% in TBT sectors, and from 7.8 to 2.1% in SPS sectors. Likewise, for the group of non-OECD countries included in our sample, the average applied tari s went down from 15.2 to 6.2% in TBT sectors, and from 12.4 to 6.2% in SPS sectors. The size of the reduction in applied tari s is larger in OECD countries (68% reduction in TBT sectors and 73% reduction in SPS sectors over the sample period) than in non-OECD countries (59% reduction in TBT sectors and 50% reduction in SPS sectors), but both groups have certainly made substantial cuts.

@Figure 5 about here A

standards is relatively less (more) costly.

There are other possible explanations for our finding of policy substitution in OECD countries and policy complementarity in non-OECD countries in the TBT sample. An intriguing possibility is that developed countries may experience Bagwell and Staiger's (2014) `globalization fatigue' (see Section 2). Developing countries, on the other hand, may be willing to reduce their overall level of protection to better integrate into global value chains. This may not only involve tariff liberalization (especially on intermediate products), but also the lifting of behind-the-border measures affecting trade.[38]

The results of columns (6) and (7) of Table 4 also indicate a difference between country-sector observations with shallow and deep tariff water. The coefficient on the tariff water interaction term is distinctly above 1. This implies policy substitution when tariff water is shallow, and policy complementarity when tariff water is deep. In part, this result is owed to the fact that OECD countries have relatively shallow tariff water, and we should, therefore, expect the results on shallow vs. deep tariff water to be in line with those on OECD vs. non-OECD countries. It should be kept in mind, however, that the correlation between the OECD dummy and the tariff water dummy is not very high (0.31 in the TBT sample). Hence, for TBT, there is *prima facie* evidence in support of our conjecture that reductions in applied tariffs in sectors with more policy space may reduce some of the political pressure for policy substitution.

All of the coefficients on the trade-related and macroeconomic control variables for which we have clear-cut predictions (set forth in Section 5) have the correct sign and are statistically significant. For the four variables for which we did not have strong priors, the following results are obtained in the TBT sample. The tariff level has an odds ratio of less than one, indicating a negative effect of high sectoral tariffs on the probability that a TBT concern is raised. This is consistent with the insight that sufficiently high tariffs shield a sector from competition from abroad, leaving producers in less of a need for other forms of protection. An odds ratio below unity on GDP growth seems to suggest that slower economic growth may increase the demand for regulatory intervention to deliver a momentary respite to domestic producers. A higher level of GDP per capita is associated with a higher probability of facing a TBT STC, in line with the interpretation that rich countries regulate more given their higher level of regulatory capacity. The odds ratio associated with the

[38] See WTO (2014) for an analysis of the trade and trade-related policies that are conducive to integrating into regional or global value chains. See specifically Baldwin (2010) for an account of tariff liberalization as a means to join international production networks.

real e ective exchange rate is less than one. This is consistent with the idea that sectors that are hurt by real exchange rate appreciation either become small enough for policymakers not to pay much attention to their demands for restoring their competitiveness, or they seek policy interventions other than TBT.

Consider now the results from the SPS sample, shown in Table 5. In all speci cations, the coe cient on the main variable of interest, tari percentage change, is signi cant and above one. Tari reductions by country i in sector k are therefore associated with an increase in the probability that an SPS concern is led against country i in sector k. This is evidence of policy substitution for the whole sample. The coe cients on the interaction terms in columns (5) and (7) (the speci cations with all controls) are not statistically signi cant, indicating that there is policy substitution in both groups of countries (OECD and non-OECD) and in observations in sectors with shallow and deep tari water. This result strongly supports the second main prediction of our theoretical model, postulating that policy substitution occurs even in high-cost countries if the bene ts for producers from adopting product standards are su ciently large. As we have explained extensively in Section 3, with SPS measures being exclusively about the primordial objectives of life and health protection, such bene ts arguably are particularly prevalent in this area.

In the regressions of Table 5, the coe cients on the trade-related variables are generally not statistically signi cant. The main exception is a coe cient larger than one associated with the import share variables in columns (1)-(6). This is in line with our theoretical prediction. In columns (2) and (3), the coe cient associated with the tari level variable is less than one and statistically signi cant. As in the case of TBT, higher sectoral tari s reduce the need to obtain other forms of protection. Concerning the macroeconomic control variables, the signs of the variables for which expectations were ambiguous are opposite to what they are in the TBT regressions. This is another indiciation of the di erent regulatory dynamics across sectors where SPS, rather than TBT measures prevail. The coe cient on GDP per capita is less than one. In the SPS sample, therefore, higher regulatory capacity reduces the probability of being targeted by an STC. An intuitive explanation is that such capacity is also associated with more transparency and, in particular, with easier access to the scienti c evidence that { unlike in the area of TBT { is explicitly required by Article 2.2 of the SPS Agreement as a justi cation for higher standards. A coe cient above one on GDP growth implies that for SPS an upswing in the business cycle may be associated with a higher demand for regulation

from consumers. The coe cient on the real e ective exchange rate is also larger than one, which may point to some political pressure for regulation in response to a loss in competitiveness from producers that are concentrated in the few sectors a ected by SPS measures (see Figure 1).

7.1 Economic signi cance

The odds ratios reported in Tables 4 and 5 indicate whether a given variable has a positive or negative e ect on the probability that a concern is led against country i in sector k. However, when discussing interaction terms in logistic regressions, Ai and Norton (2003) point out that odds ratios alone are not informative. Marginal e ects could even be of opposite signs for given values of the interacted variables. To show that this is not the case for our estimations, we have computed marginal e ects in the form of semi-elasticities. Table 6 presents the results for the whole sample. The results in column (1), which refer to TBT concerns, are calculated using the speci cation in column (3) of Table 4, while the results in column (2), which refer to SPS concerns, are calculated using the speci cation in column (3) of Table 5. The marginal e ects are always positive, con rming the odds-ratios for the whole sample from tables 4 and 5 for any level of tari liberalization.

@Table 6 about here A

In light of the results of columns (4)-(5) and (6)-(7) of Table 4, we have disaggregated the marginal e ects for TBT concerns by country group (OECD vs. non-OECD) and by tari water group (shallow vs. deep). The results are in Table 7. The table clearly shows that policy substitution holds only in the OECD group of countries, while policy complementarity holds in the non-OECD group. Moreover, the results indicate policy substitution (complementarity) in country-sector observations with shallow (deep) tari water. Consider rst columns (1) and (2). The estimated semi-elasticity when the tari percentage reduction is equal to zero (rst row) implies that reducing the tari by 0.1% increases the probability of an STC initiation by 1.4%,

the tari by 0.1% reduces the probability of an STC initiation by 2.3% relative to no change in tari . In the case of full tari liberalization, the probability of facing a concern falls (roughly) by 3.7%. A graphical representation of these heterogenous marginal e ects across groups of countries for TBT concerns is given in panel (i) of Figure 6.

@Table 7 and Figure 6 about hereA

Consider now columns (3) and (4). The estimated semi-elasticity when the tari percentage reduction is equal to zero (rst row) implies that reducing the tari by 0.1% increases the probability of an STC initiation by 3.6%, relative to no change in tari , when tari water is shallow. In the case of full tari liberalization, the probability of facing a concern rises (roughly) by 2.8-3.5% for shallow tari water. Conversely, in the case of deep tari water, tari reductions are associated with a decrease in the probability of TBT concerns. In particular, reducing the tari by 0.1% reduces the probability of an STC initiation by 2.6-2.8% relative to no change in tari . A graphical representation of these heterogenous marginal e ects for TBT concerns is given in panel (ii) of Figure 6.

7.2 Robustness

In this section, we show that the main result validating our theoretical model { policy substitution (complementarity) in developed (developing) countries in TBT { is robust across several di erent estimations. We further show that the result of policy substitution holding in both groups of countries in SPS is also robust to such di erent estimations. Conversely, the result on the tari water dummy in the TBT sample, which does not rest on equally solid theoretical foundations, is not as robust.

A rst robustness check that we have performed is the adoption of a linear probability model (LPM), using the same sample of regressions in tables 4 and 5. There are two main aws in the LPM (Baum, 2013). The rst one, which is widely recognized, is that its tted values are not constrained to lie in the unit interval. The second, less recognized aw, is that the error" cannot be independent of any regressors, unless the matrix of explanatory variables X consists of a single binary regressor.

salt. Nonetheless, they are qualitatively the same as the baseline results, with policy substitution holding throughout in the SPS sample and holding only for OECD countries and for observations with shallow tari water in the TBT sample.[40]

@Table 8 about here A

The second, and in our view most important, robustness check concerns the measurement of tari s. In the baseline regressions, we have used the minimum between the e ectively applied and the MFN tari . By doing this, we may have included tari cuts that only apply preferentially. We have re-estimated model (5.1), including the OECD and tari water interactions, using only MFN tari s. The results are in columns (1) and (2) of tables 9 and 10 for TBT and SPS, respectively. The main result of policy substitution in OECD countries, and policy complementarity in non-OECD countries in the TBT sample is con rmed and becomes even more economically signi cant. This can be visualized in panel (i) of Figure 7, where we plot the semi-elasticities estimated from column (1) of Table 9. Compared with the semi-elasticites represented in panel (i) of Figure 6, they are larger for OECD countries. The result of policy substitution in both groups of countries in the SPS sample is also con rmed (the odds ratio being largely above one in the rst row of columns (1) and (2) of Table 10). In the TBT sample, the tari water interaction loses statistical signi cance

9 and 10 show results with WTO members as of 1995 only. The baseline results are not a ected, as also graphically represented in panels (ii) of gures 7 and 8.

The two next robustness checks concern country groups. In the main regressions, we have used OECD membership to indicate whether a country is developed. Not every OECD country is, however, a `high-income economy' (using the World Bank's de nition). And there are several high-income economies that do not belong to the OECD. Moreover, some OECD countries are considered as `developing' in the WTO. Developing country status in the WTO brings certain rights. There are for example provisions in some WTO Agreements which provide developing countries with longer transition periods before full implementation of the agreement. To address possible concerns related to country groupings, we have re-estimated the regressions of tables 4 and 5 using, instead of OECD membership, high income economy status and WTO-developing country status.[41] The regression results, reported in columns (5) and (6) of tables 9 and 10, are qualitatively similar to, and quantitatively larger than, the corresponding results of column (5) of tables 4 and 5. This can be clearly seen by confronting panel (i) of Figure 6 with panels (iii) and (iv) of Figure 7.

a product standard are relatively low, we have produced clear and robust evidence of policy substitution in advanced economies, both in the TBT and in the SPS samples. Our nding can also be interpreted as providing empirical support for the oft-quoted argument by Bagwell and Staiger (2014) that developed countries su er from `globalization fatigue', having bound their tari s at relatively low rates. We have also found some evidence of policy substitution being more likely in sectors where `tari water' is shallow, i.e. where `policy space' is limited, as highlighted elsewhere in the literature. However, this result, which is outside the predictions of our own model, is not con rmed in regressions that use MFN tari s only.

While the occurrence of policy substitution is limited to advanced economies in the TBT sample, for SPS we have provided clear and robust evidence of policy substitution across all country groups and across sectors

the prominence of its discussion among lawyers. Robert Hudec, one of the most distinguished scholars in the

References

Abel-Koch, J., 2013, \Endogenous Trade Policy with Heterogeneous Firms," Discussion paper No. 1306, Johannes Gutenberg University Mainz.

Battigalli, P., and G. Maggi, 2003, \International agreements on product standard: an incomplete contracting theory," NBER Working Paper No. 9533.

Baum, C. F., 2013, \Implementing new econometric tools in Stata," Mexican Stata Users' Group Meetings 2013 09, Stata Users Group. Available at http://www.stata.com/meeting/mexico13/abstracts/materials/mex13_baum.pdf .

Beghin, J., A.-C. Disdier, and S. Marette, 2014, \Trade Restrictiveness Indices in Presen 7eiftin 7eifEx28(telities:et-)]TJ 9.

.

Essaji, A., 2010, \Trade Liberalization, Standards and Protection," The B.E. Journal of Economic Analysis & Policy, 10, 1{21.

Feinberg, R. M., and K. Reynolds, 2007, \Tari Liberalization and Increased Administrative Protection: Is There a Quid Pro Quo?," World Economy, 30, 948{961.

Fischer, R., and P. Serra, 2000, \Standards and Protection,"Journal of International Economics, 52, 377{400.

Foletti, L., M. Fugazza, A. Nicita, and M. Olarreaga, 2011, \Smoke in the (Tari) Water," The World Economy, 34, 248{264.

German Institute for Standardization (DIN), 2000, Economic Bene ts of Standardization, Beuth Verlag, Berlin.

Goldberg, P. K., and N. Pavcnik, 2005, \Trade, wages, and the political economy of trade protection: evidence from the Colombian trade reforms," Journal of International Economics, 66, 75{105.

Gulati, S., and D. Roy, 2008, \National Treatment and the Optimal Regulation of Environmental Externalities," Canadian Journal of Economics, 41, 1445{1471.

Hoda, A., 2001, Tari Negotiations and Renegotiations under the GATT and the WTO: Procedures and Practices, Cambridge University Press and World Trade Organization, Cambridge (UK) and Geneva.

Hudec, R. E., 1998, \GATT/WTO Constraints on National Regulation: Requiem for an \Aim and E ects" Test," The International Lawyer, 32, 619{649.

Keck, A., and A. Lendle, 2012, \New Evidence on Preference Utilization," Sta Working Paper ERSD-2012-12, World Trade Organization, Geneva.

Kee, H. L., A. Nicita, and M. Olarreaga, 2009, \Estimating Trade Restrictiveness Indices," Economic Journal, 119, 172{199.

Ketterer, T. D., 2014, \EU Antidumping and Tari Cuts: Trade Policy Substitution?," GEP Research Paper No. 2014/05, University of Nottingham.

Kuenzel, D. J., 2013, \WTO Dispute Determinants," Job Market Paper, University of Washington. Available at http://econ.washington.edu/files/2013/12/kuenzel_jmpaper.pdf .

Limão, N., and P. Tovar, 2011, \Policy choice: Theory and evidence from commitment via international trade agreements," Journal of International Economics, 85, 186{205.

Maskus, K., T. Otsuki, and J. S. Wilson, 2005, \The Cost of Compliance with Product Standards for Firms in Developing Countries: An Econometric Study," World Bank Policy Research Working Paper No. 3590.

Milner, C., 2013, \Declining Protection in Developing Countries: Fact or Fiction?," The World Economy, 36, 689{700.

Moore, M. O., and M. Zanardi, 2011, \Trade Liberalization and Antidumping: Is There a Substitution E ect?," Review of Development Economics, 15, 601{619.

Staiger, R. W., 2012, \Non-tari Measures and the WTO," Sta Working Paper ERSD-2012-01, World Trade Organization, Geneva.

Staiger, R. W., and A. O. Sykes, 2011, \International Trade, National Treatment, and Domestic Regulation," The Journal of Legal Studies, 40, 149 { 203.

Sturm, D., 2006, \Product Standards, Trade Disputes, and Protectionism," Canadian Journal of Economics, 39, 564{581.

Swinnen, J. F. M., and T. Vandemoortele, 2009, \Are food safety standards di erent from other food standards? A political economy perspective,"European Review of Agricultural Economics, 36, 507{523.

Whalley, J., 2005, \Pitfalls in the Use of Ad Valorem Equivalent Representations of the Trade Impacts of Domestic Policies," CESifo Working Paper No. 1480.

Wilson, J. S., and T. Otsuki, 2004, \Standards and Technical Regulations and Firms in Developing Countries: New Evidence from a World Bank Technical Barriers to Trade Survey," available at http://siteresources.worldbank.org/INTRANETTRADE/Resources/Topics/Services/TBT_Data_Description.pdf .

World Trade Organization (WTO), 1996, \Japan { Taxes on Alcoholic Beverages (Japan { Alcoholic Beverages II)," Panel and Appellate Body Reports, WT/DS8/R, WT/DS10/R, WT/DS11/R and WT/DS8/AB/R, WT/DS10/AB/R, and WT/DS11/AB/R, adopted on 1 November, World Trade Organization, Geneva.

World Trade Organization (WTO), 2001a, \European Communities { Measures A ecting Asbestos and Asbestos-Containing Products (EC { Asbestos)," Panel and Appellate Body Reports, WT/DS135/R and WT/DS135/AB/R, adopted on 5 April, World Trade Organization, Geneva.

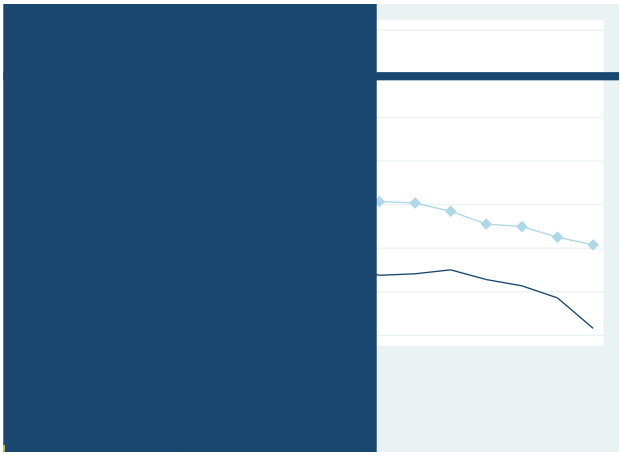
World Trade Organization (WTO), 2001b, \Korea { Measures A ecting Imports of Fresh, Chilled and Frozen Beef (Korea { Beef)," Panel and Appellate Body Reports, WT/DS161/R and WT/DS169/R, and WT/DS161/AB/R and WT/DS169/AB/R, adopted on 10 January, World Trade Organization, Geneva.

World Trade Organization (WTO), 2007, World Trade Report 2007. Six decades of multilateral trade cooperation: What have we learnt?, World Trade Organization, Geneva.

World Trade Organization (WTO), 2012,

Figure 3: Evolution of TBT and SPS concerns, OECD vs. non-OECD, 1996-2011

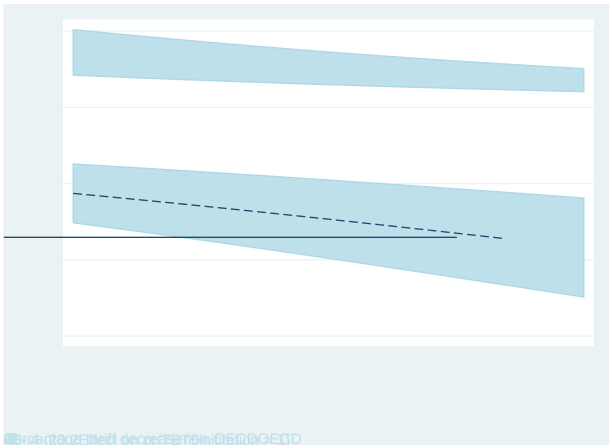
Figure 5: Evolution of tari s in SPS- and TBT-sectors, OECD vs. non-OECD, 1996-2011 (%)



Source: Authors' calculations based on UNCTAD TRAINS

Figure 6: TBT, interaction e ects

(i) OECD dummy



(ii) Water dummy

Figure 7: TBT, OECD interaction e ects, robustness checks

(i) MFN tari s only

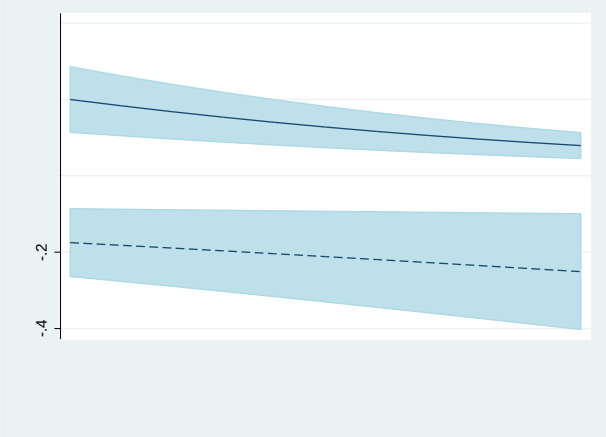


Figure 8: TBT, water dummy interaction e ects, robustness checks

(i) MFN tari s only

(ii) WTO members as of 1995

90 % con dence intervals based on Delta method
Panel (i): Semi-elasticities based on estimations in column (2) of Table 9
Panel (ii): Semi-elasticities based on estimations in column (4) of Table 9
Semi-elasticities at means assuming the xed e ects to be zero

Tables

Table 1: STCs: Sample outlook

	TBT	SPS
Sample period	1996-2011	1996-2011
Number of STCs	327	326
STCs with acquainted HS codes		
New measures	258	185

Table 2: Variables list

Variable	Description
TBT initiation (ikt)	Dummy equal to 1 if TBT STC is initiated against i in sector k in t
SPS initiation (ikt)	Dummy equal to 1 if SPS STC is initiated against i in sector k in t
Tari % change (ikt)	Percentage tari decrease between t 2 and t 1
Tari level (ikt)	Unweighted applied tari in t 2
Import share (ikt)	Import share of sector k of country i imports in t 1
Import % change (ikt)	Percentage change in imports between t 2 and t 1
World tari % change (kt)	Percentage decrease in world average applied tari in sector k between t 2 and t 1
GDP per capita (it)	Per capita Gross Domestic Product in t 1
GDP growth (it)	Gross Domestic Product growth between t 2 and t 1
Exchange rate (it)	Real e ective exchange rate of country i in t 1
In ation (it)	Annual in ation rate in country i in t 1
Current account (it)	Average current account (as % of GDP) between t 2 and t 1
OECD (it)	Dummy equal to 1 if country i is an OECD country in t 2
Water dummy (ikt)	Dummy equal to 1 if tari water * in t 2 @median

i is an STC maintaining country; k is an HS 4-digit heading; t is time (year)

* Tari water (ikt) de ned as di erence between bound and applied tari

Table 3: Summary statistics

	Mean	Median	Std	Min	Max
TBT sample					
Tari % change	0.03	0.01	0.26	= 1.25	1.00
Tari level	12.92	7.50	22.27	0.01	672.51
Import % change	2.68	0.06	358.24	= 1.00	78849.93
Import share	0.07	0.01	0.29	@0.01	10.05
World tari % change	0.04	0.05	0.21	= 4.56	0.84
GDP growth	4.21	4.05	3.92	= 14.80	18.29
GDP per capita	16.12	8.63	14.40	0.40	70.57
In ation	5.18	2.92	8.75	= 1.71	99.88
Exchange rate	101.51	99.84	20.95	60.43	234.61
Current account	0.51	0.22	4.85	= 16.30	28.54
Tari water	11.57	3.25	28.56	= 672.51	1608.60
SPS sample					
Tari % change	0.04	0.00	0.29	= 1.36	1.00
Tari level	17.67	10.00	29.07	0.01	583.54
Import % change	2.71	0.05	88.01	= 1.00	7380.97
Import share	0.05	0.01	0.12	@0.01	2.45
World tari % change	0.01	0.04	0.27	= 4.56	0.82
GDP growth	3.59	3.92	4.54	= 14.80	18.29
GDP per capita	13.88	5.48	14.59	0.40	70.57
In ation	9.04	3.95	14.23	= 1.71	99.88
Exchange rate	102.84	100.00	22.41	60.43	234.61
Current account	0.93	0.53	5.39	= 18.05	32.86
Tari water	21.74	15.48	38.25	= 258.25	867.58

Statistics computed from estimation samples (column (3) of Table 4 for TBT and of Table 5 for SPS)

Table 5: SPS: conditional logit estimation results (odds ratios)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tari % change	1.422***	1.636***	1.785***	2.047***	2.261***	2.212***	2.453***
	(0.162)	(0.209)	(0.244)	(0.349)	(0.476)	(0.399)	(0.526)
Tari level		0.992**	0.995*		0.996		1.003
		(0.003)	(0.003)		(0.003)		(0.004)
Import % change		0.999	0.998		0.998		0.997
		(0.001)	(0.002)		(0.002)		(0.002)
Import share		2.900*	2.771*		2.761*		1.233
		(1.800)	(1.696)		(1.680)		(0.864)
World tari % change		0.842	0.863		0.865		0.960
		(0.101)	(0.109)		(0.110)		(0.179)
GDP growth			1.055***		1.055***		1.022*
			(0.012)		(0.012)		(0.013)
GDP per capita			0.920***		0.921***		0.971**
			(0.013)		(0.013)		(0.014)
In ation			0.998		0.998		0.986***
			(0.004)		(0.004)		(0.005)
Exchange rate			1.016***		1.017***		1.011***
			(0.002)		(0.002)		(0.003)
Current account			1.060***		1.060***		1.078***
			(0.012)		(0.012)		(0.015)
OECD # Tari % change				0.469***	0.632*		
				(0.107)	(0.173)		
Water dummy						0.717*	0.756
						(0.144)	(0.221)
Water dummy # Tari % change						0.500***	0.525**
						(0.133)	(0.157)
Number of observations	14656	9817	9309	14656	9309	11010	7766
Pseudo-R squared	0.126	0.165	0.184	0.128	0.184	0.134	0.175

Estimated odds ratios

All regressions contain year dummies and country-sector (HS headings) xed e ects

Clustered standard errors (cluster: country-sector) in parentheses

OECD dummy omitted because of collinearity

* p@0.10, ** p@0.05, *** p@0.01

Table 7: TBT marginal e ects, OECD vs. non-OECD and shallow vs. deep tari water

	OECD	non-OECD	Shallow water	Deep water
	(1)	(2)	(3)	(4)
Tari % reduction				
0.00	0.144***	= 0.226***	0.359***	= 0.260***
	(0.036)	(0.047)	(0.061)	(0.075)
0.10	0.135***	= 0.239***	0.351***	= 0.261***
	(0.034)	(0.050)	(0.059)	(0.076)
0.20	0.126***	= 0.252***	0.344***	= 0.263***
	(0.032)	(0.053)	(0.058)	(0.077)
0.30	0.118***	= 0.265***	0.337***	= 0.265***
	(0.030)	(0.056)	(0.056)	(0.078)
0.40	0.110***	= 0.279***	0.329***	= 0.267***
	(0.028)	(0.059)	(0.055)	(0.079)
0.50	0.102***	= 0.293***	0.322***	= 0.268***
	(0.026)	(0.062)	(0.053)	(0.080)
0.60	0.095***	= 0.308***	0.314***	= 0.270***
	(0.024)	(0.066)	(0.051)	(0.081)
0.70	0.089***	= 0.323***	0.306***	= 0.272***
	(0.023)	(0.069)	(0.050)	(0.081)
0.80	0.083***	= 0.337***	0.299***	= 0.273***
	(0.021)	(0.072)	(0.048)	(0.082)
0.90	0.077***	= 0.353***	0.291***	= 0.275***
	(0.020)	(0.076)	(0.046)	(0.083)
1.00	0.071***	= 0.368***	0.283***	= 0.276***
	(0.018)	(0.079)	(0.045)	(0.084)
Observations	49277	49277	41800	41800

Semi-elasticities at means assuming the xed e ects to be zero

Semi-elasticities in columns (1)-(2) calculated from column (5) of Table 4

Semi-elasticities in columns (3)-(4) calculated from column (7) of Table 4

Delta method standard errors between parenthesis

* p @0.10, ** p @0.05, *** p @0.01

Table 8: TBT and SPS: Linear probability model

	TBT		SPS	
	(1)	(2)	(3)	(4)
Tari % change	0.949***	0.971***	1.070***	1.079***
	(0.007)	(0.008)	(0.019)	(0.017)
Tari level	1.000	1.000	1.000	1.000
	(@0.0001)	(@0.0001)	(@0.0001)	(@0.0001)
Import % change	1.000***	1.000***	1.000**	1.000**
	(@0.0001)	(@0.0001)	(@0.0001)	(@0.0001)
Import share	1.039***	1.063***	1.060	1.006
	(0.014)	(0.014)	(0.047)	(0.045)
World tari % change	1.019***	1.027***	0.985	0.993
	(0.006)	(0.008)	(0.010)	(0.013)
GDP growth	0.994***	0.991***	1.003***	1.000
	(0.001)	(0.001)	(0.001)	(0.001)
GDP per capita	1.002***	1.005***	0.993***	0.998*
	(0.001)	(0.001)	(0.001)	(0.001)
In ation	1.000	1.001	1.000	0.999***
	(@0.0001)	(@0.0001)	(@0.0001)	(@0.0001)
Exchange rate	1.000**	1.000***	1.001***	1.001***
	(@0.0001)	(@0.0001)	(@0.0001)	(@0.0001)
Current account	1.008***	1.008***	1.004***	1.006***
	(@0.0001)	(0.001)	(0.001)	(0.001)
OECD	0.995		0.771***	
	(0.010)		(0.057)	
OECD # Tari % change	1.129***		0.967	
	(0.011)		(0.022)	
Water dummy		0.972***		0.971
		(0.008)		(0.019)
Water dummy # Tari % change		1.088***		0.956*
		(0.012)		(0.024)
Number of observations	56759	48890	10546	9257
Adjusted-R squared	0.076	0.069	0.098	0.086

Estimated odds ratios

TBT and SPS regressions respectively based on the samples of columns (5) and (7) of Tables 4 and 5

All regressions contain year dummies and country-HS headings xed e ects

Clustered standard errors (cluster: country-sector) in parentheses

* p @0.10, ** p @0.05, *** p @0.01

Table 9: TBT, conditional logit estimation results (odds ratios), robustness checks

	MFN tari s only		WTO members as of 1995		WB HIC	WTO Developed
	(1)	(2)	(3)	(4)	(5)	(6)
Tari % change	0.564***	1.429**	0.539***	0.746***	0.591***	0.604***
	(0.082)	(0.241)	(0.058)	(0.071)	(0.054)	(0.052)
Tari level	0.985***	0.987***	0.997	0.997	0.991***	0.991***
	(0.003)	(0.004)	(0.002)	(0.002)	(0.003)	(0.003)
Import % change	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***
	(@0.0001)	(@0.0001)	(@0.0001)	(@0.0001)	(@0.0001)	(@0.0001)
Import share	1.788***	2.012***	2.683***	2.471***	1.775***	1.781***
	(0.307)	(0.361)	(0.567)	(0.523)	(0.310)	(0.311)
World tari % change	1.162	1.211*	1.225**	1.270**	1.205**	1.203**
	(0.121)	(0.137)	(0.114)	(0.130)	(0.102)	(0.102)
GDP growth	0.920***	0.918***	0.868***	0.867***	0.928***	0.928***
	(0.006)	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)
GDP per capita	1.020***	1.054***	1.036***	1.050***	1.021***	1.021***
	(0.006)	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)
In ation	0.992***	1.001	0.991**	1.000	0.990***	0.990***
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)
Exchange rate	0.998***	0.996***	0.997***	0.999	0.998***	0.998***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Current account	1.077***	1.062***	1.013*	1.009	1.079***	1.080***
	(0.005)	(0.005)	(0.008)	(0.008)	(0.006)	(0.006)
OECD # Tari % change	5.111***		3.644***			3.663***
	(0.989)		(0.464)			(0.410)
HIC # Tari % change					3.465***	
					(0.389)	
WTO Dev # Tari % change						3.663***
						(0.410)
Water dummy		0.644***		0.585***		
00.464)						

Table 11: SPS, conditional logit estimation results (odds ratios), excluding STCs raised in yeat and resolved in yeart or t 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tari % change	1.252**	1.330**	1.466***	2.105***	2.072***	1.610***	2.150***
	(0.139)	(0.162)	(0.190)	(0.384)	(0.463)	(0.274)	(0.425)
Tari level		0.997	0.999		0.999		1.002
		(0.002)	(0.002)		(0.002)		(0.003)
Import % change		0.999	0.998		0.998		0.997
		(0.001)	(0.002)		(0.002)		(0.002)
Import share		1.009	0.992		0.991		0.719
		(0.582)	(0.588)		(0.587)		(0.479)
World tari % change		0.897	0.930		0.931		0.928
		(0.105)	(0.113)		(0.112)		(0.156)
GDP growth			1.009		1.008		1.019*
			(0.009)		(0.009)		(0.011)
GDP per capita			0.927***		0.928***		0.958***
			(0.012)		(0.012)		(0.013)
In ation			1.009**		1.009**		1.004
			(0.004)		(0.004)		(0.004)
Exchange rate			1.017***		1.017***		1.014***
			(0.002)		(0.002)		(0.002)
Current account			1.051***		1.051***		1.049***
			(0.013)		(0.013)		(0.015)
OECD # Tari % change				0.404***	0.572**		
				(0.092)	(0.153)		
Water dummy						0.599***	0.751
						(0.114)	(0.206)
Water dummy # Tari % change						0.729	0.634*
						(0.177)	(0.170)
Number of observations	14726	10257	9670	14726	9670	12019	8467
Pseudo-R squared	0.090	0.135	0.146	0.093	0.147	0.111	0.153

Estimated odds ratios

All regressions contain year dummies and country-sector (HS headings) xed e ects

Clustered standard errors (cluster: country-sector) in parentheses

OECD dummy omitted because of collinearity

* p@0.10, ** p @0.05, *** p @0.01

Table A-1: List of countries

Country	Dataset	WTO entry	OECD entry	Country	Dataset	WTO entry	OECD entry
Albania	SPS	2000		Argentina	SPS and TBT	1995	
Armenia	SPS	2003		Australia	SPS and TBT	1995	1971
Barbados	SPS	1995		Bahrain, Kingdom of	SPS and TBT	1995	
Bolivia, Plurinational State of	SPS	1995		Brazil	SPS and TBT	1995	
Costa Rica	SPS	1995		Canada	SPS and TBT	1995	1961
Cuba	SPS	1995		Chile	SPS and TBT	1995	2010
Czech Republic	SPS	1995	1995	China	SPS and TBT	2001	
Dominican Republic	SPS	1995		Chinese Taipei	SPS and TBT	1995	
Gabon	SPS	1995		Colombia	SPS and TBT	1995	
Guatemala	SPS	1995		Croatia	SPS and TBT	2000	
Honduras	SPS	1995		Egypt	SPS and TBT	1995	
Hungary	SPS	1995	1996	El Salvador	SPS and TBT	1995	
Iceland	SPS	1995	1961	European Union	SPS and TBT	1995	1961*
Jordan	SPS	2000		India	SPS and TBT	1995	
Norway	SPS	1995	1961	Indonesia	SPS and TBT	1995	
Oman	SPS	2000		Israel	SPS and TBT	1995	2010
Panama	SPS	1997		Japan	SPS and TBT	1995	1964
Poland	SPS	1995	1996	Korea, Republic of	SPS and TBT	1995	1996
Romania	SPS	1995		Kuwait, the State of	SPS and TBT	1995	
Senegal	SPS	1995		Malaysia	SPS and TBT	1995	
Singapore	SPS	1995		Mexico	SPS and TBT	1995	1994
Slovak Republic	SPS	1995	2000	New Zealand	SPS and TBT	1995	1973
Slovenia	SPS	1995	2010	Philippines	SPS and TBT	1995	
Suriname	SPS	1995		Qatar	SPS and TBT	1996	
Trinidad and Tobago	SPS	1995		South Africa	SPS and TBT	1995	
United Arab Emirates	SPS	1996		Switzerland	SPS and TBT	1995	1961