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Determinants of Specific Trade Concerns Raised on Technical Barriers to Trade

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Abstract

This contribution evaluates determining factors of Specific Trade Concerns (STCs) raised on Technical Barriers to Trade (TBT) notifications over the period 1995-2011. While multilateral and international agreements bind countries concerning the imposition of tariffs on imports, TBTs have become political instruments to conceal the true motivations of governments. The main legitimate reasons behind the imposition of TBTs are to increase environmental qualities and human health, or to improve market efficiencies. However, in addition to these reasons, governments are also in pursuit of protecting their domestic industries. Various effective factors of TBT STC notifications are considered in the econometric analysis using fixed effect Poisson (FEP) estimation as the main technique, and Poisson GMM as robustness specification. Results suggest that bilateral trade and tariffs are one of the forces of TBT STC notifications, acknowledging the protectionist behaviour of authorities. Moreover, countries with high quality of humans' health-related environmental issues, and low environmental vitalities, are more likely to impose new TBTs. Overall, this study confirms the complex nature of TBT STCs affected by economic, technological, institutional, and health and environmental issues.

Keywords: trade policy, technical barriers to trade

JEL classification: F13, F14, F18

CONTENTS

TABLES AND FIGURES

1. Introduction*

Since the creation of the General Agreement on Tariffs and Trade (GATT) in 1948, tariffs on trade between the World Trade Organisation (WTO) members have fallen. However, non-tariff measures (NTMs) have received worldwide attention. Even the World Trade Report 2012 and the United Nations Conference on Trade and Development (UNCTAD) in 2010 and 2013 were specifically focusing on these policy measures. Technical barriers to trade (TBTs) are one of the most important categories of NTMs that are 'measures referring to technical regulations, and procedures for assessment of conformity with technical regulations and standards, excluding measures covered by the Sanitary and Phytosanitary (SPS) Agreement'.[1]

In the context of WTO regulations, countries can impose TBTs for some legitimate motivations. For instance, when a foreign imported product may potentially harm human or environmental health, countries are authorised to impose restrictive regulations such as TBT and SPS measures to avoid damage to their domestic society. On the other hand, since these measures may dramatically change the patterns of trade, countries might also apply these instruments in the pursuit of protecting their domestic industries. It is not easy to clearly distinguish between these two motivations. However, it is possible to find proxies for these issues and discover the relationship between the imposition of new measures and those motivations.

To increase the transparency of governments' trade policies, the WTO obliges member states to notify their imposed policy instruments. Any kind of NTM imposed by a government should be notified directly to the WTO secretariat. However, other member states facing the policy instruments may also discuss them in TBT and SPS committees. Then, the information is noted in committee minutes. These reverse notifications are called Specific Trade Concerns (STCs) that enable members to discuss the issues related to a policy instrument imposed by another member. Even if a country does not inform WTO about its new NTM, there is a chance that WTO will be informed by other members facing the NTM. The WTO secretariat has provided data on TBT STCs which cover TBT notifications that have been raised as an STC by members.

TBTs differ from other NTMs such as anti-dumping measures that follow only economic reasoning. TBTs may also be imposed on account of e.g. environmental and health issues. Such issues are among the main reasons for WTO regulations to legitimise these kinds of NTMs. Some of them might be completely observable in a regulation with scientific motivations behind, and will be considered officially permitted by WTO member states and the organisation itself. However, other measures might raise concerns on the part of some of the member states because, firstly, the scientific non-economic issues behind are not

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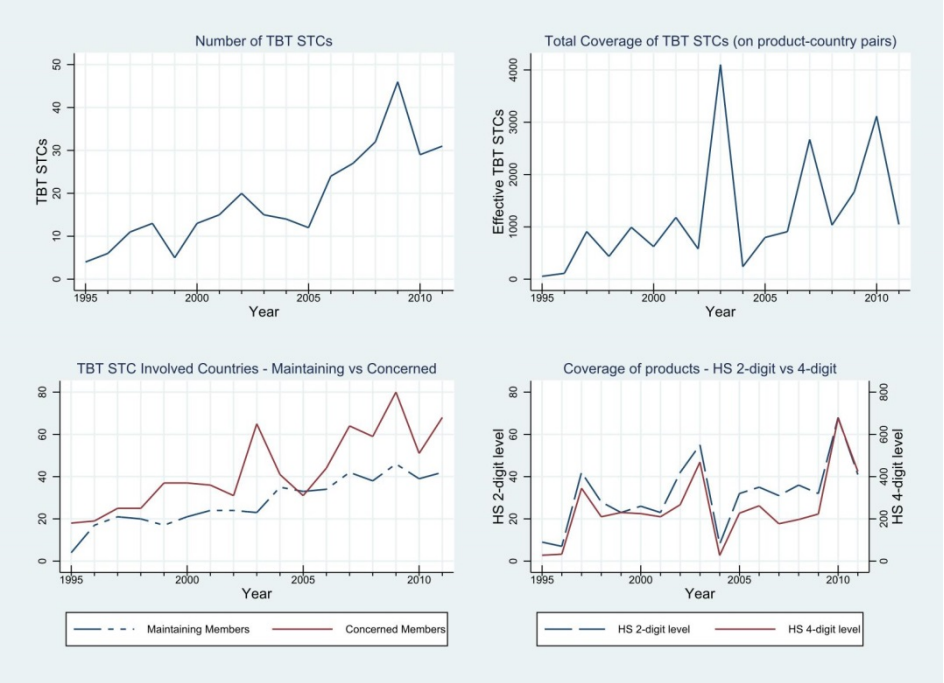
1 World Integrated Trade Solution (WITS), 2012.

easily verifiable and, secondly, the trade disturbance effects are significantly large. Therefore, some of these measures will not be easily acceptable by the members and will be notified to the WTO secretariat within a reverse notifying system. This way of proceeding has been laid down in the WTO regulations to prevent any member from concealing imposed measures by not notifying them directly, and to secure liberalised trade. This system allows for Specific Trade Concerns (STCs) on the imposed TBT notifications, to provide information on specific regulations which might possibly be based on protectionist objectives and economic intuitions.

In the TBT STC dataset some regulations are marked as unnecessary barriers to trade or as discriminatory. Therefore, the main motivation of this study is to find whether these TBT STCs pursue any protectionist objectives which are not acceptable by the WTO regulations. This also includes environmental, health, technological progress standards, and market potential differences which are also covered by this analysis to provide the full picture of motivations behind TBTs.

Figure 1 shows the trend of TBT STCs over the period 1995-2011. It is observed that the number of these TBT STCs was gradually increasing over time (see upper left panel). Especially during the 2007-2008 crisis, there was a sharp rise in these notifications. According to the World Trade Report (2012) the usage of NTM instruments has increased during the recent financial crisis to adjust to market inefficiencies and in order to assist countries in finding a way out of the crisis. Each TBT STC involves various groups of products. The product coverage (at 2-digit HS on the left vertical axis, and at 4-digit level on the right axis) of all TBT STCs during this period is shown in the lower right panel. The majority of TBT STCs are raised by many different countries facing the new regulations, which increases the total effective coverage of these NTMs.

Figure 1 / Trend of TBT STCs and their coverage



The upper right panel of Figure 1 shows how the effective coverage of TBT STCs evolves over time involving various maintaining and concerned countries, and different products (at 2-digit level of HS). The big jump of effective coverage in 2003 is mainly due to a TBT maintained by the 15 EU Member States for the Regulation on the Registration, Evaluation, and Authorisation of Chemicals (REACH). This TBT covers a vast category of products processed using chemicals that raised concerns by many countries in the world. This STC was first raised by the representative of the United States. Based on the WTO documents, the US believed that the white paper on chemicals issued by the EU would have a significant impact on trade, and its economic consequences had not been adequately assessed. The lower left panel of the figure shows that during the recent financial crisis, the number of countries that are concerned about others' TBTs has also increased. This suggests that not only the usage of TBTs by importing countries has increased during this period, but these TBTs have also been more painful for the trading partners because of their vulnerability during the period.

Although this TBT STC database does not cover all TBT notifications, the information provided is very helpful in conducting economic analyses. Ghodsi and Michalek (2014) found that TBT STCs have positive linkages to the Dispute Settlement (DS) cases of WTO citing the TBT agreement. Therefore, finding the causes of these policy instruments can contribute to a better understanding of trade conflicts and disputes. This study aims to reveal the determinants of TBT STCs through a bilateral trade relationship.

The goal of this contribution is therefore to clarify, firstly, the true motivations of governments for the imposition of TBT measures for which an STC is raised by other members. Secondly, the analysis will show the characteristics of the countries raising STCs. Therefore, factors affecting both sides of TBT STC notifications will be analysed applying a semi-gravity framework. Possible economic, institutional, technological, health and environmental variables are included in the analysis to examine their statistical impact on the probability of raising STCs related to maintained TBTs. Not only the determinants of the imposition of such TBTs are analysed, but also the factors behind raising STCs are investigated within this research. Since STCs cover a subset of TBTs that are very trade-restrictive, raising concerns on the part of other countries, they seem to be the most impeding TBTs to be analysed. This group of STCs has two-sided effects and determinants, on which the gravity regression can provide rich information concerning the characteristics of countries imposing and facing them. Protectionism and trade issues are analysed by inclusion of bilateral Tariff Binding Overhang (TBO), imports and exports. The novelty of this research is that the estimated data comprise the bilateral relationship between the two sides of the TBT. Estimations include economic and environmental variables for both the imposing country and the concerned country.

In the next section, a brief overview of the literature is provided. In the third section the estimation specifications, description of data, variables and their expected results are presented. Results of the regressions and their interpretations are discussed in the fourth section. Finally, section five contains concluding remarks.

2. Literature review

The relationship between the type of regimes and the type of trade policies has been elaborated in many studies. From this literature, it is evident that countries that are more democratic prefer more liberalised trade. The history in some developing countries confirms such a relationship. For example, after the Bolivian regime change to democracy in 1982, the economic reform agenda called 'New Economic Policy' in 1985 established the stages towards liberalisation in trade. Quantitative restrictions (QRs) were gradually removed and tariffs were decreased. A similar story occurred after the regime transition to democracy in Argentina in 1983; few years after that, in 1988, economic and trade reforms were started to reduce tariffs and to eliminate import licensing (Rodrik, 1992; Haggard and Kaufman, 1997; Munoz, 1994).

Similar developments have taken place in many other countries in their transition to democracy. The first parliamentary elections in the Philippines in 1986 were followed by trade policy reforms reducing tariffs (Haggard, 1990). The lowering of trade barriers in South Korea in 1992 took place after its democratic transition in 1987-88 (WTO, 1996). In Bangladesh, tariffs dropped from 90% in 1990 to 20% by 1996 after the transition to democracy during 1986-1992 (WTO, 2000). Even in Central and Eastern Europe the transition to democracy facilitated the liberalisation of trade and the accession of many of the post-communist countries to the European Union.

Mansfield et al. (2000) and Edward et al. (2002) argue that if trade policies are transparent, democratic countries are more likely to implement liberalised trade. The reasoning behind that argument is that consumers as the general voters of the government have imperfect information about policies, while interest groups lobbying with the government have access to information that is more unbiased. In a more democratic regime, the government will be questioned or might lose power if its rent-seeking behaviour becomes excessive. Thus, authorities should find a balance between the support of interest groups and the general public as voters. In order to gain the median voter's support, a suitable way to show the support for liberalised trade is to establish a preferential trade agreement (PTA) with other countries.

PTAs provide transparency of trade policies, because a violation of the agreement will bring public disputes, hurting consumers' trust in the government. In other words, a trade policy violating bilateral regulations and reducing consumer welfare can be publicised by the trading partner; thus, democratic governments will try to be more transparent and law-abiding rather than allowing for more rent-seeking behaviour of domestic interest groups. PTAs are thus following the domestic purpose to monitor governments in addition to worldwide support for the improvement of welfare. Therefore, it will no longer be easy to impose restrictions on trade by transparent policies such as tariffs within a PTA.

In autocracies there is no powerful opponent trying to inform people. On the other hand, people in democracies are better informed but with greater disparities. This might explain why governments, even in the most democratic countries, try to implement opaque and complex trade policies instead of simple tariffs (Kono, 2006). Kono (2006) found evidence that democratic countries impose lower tariffs than

autocratic countries. This result is very similar to former studies such as Milner and Kubota (2005). NTMs are more likely to be imposed by regimes that are more democratic. And, those measures are more likely to be sophisticated quality NTMs rather than core NTMs in democratic countries.

While institutional and regime types of governments play important roles in the imposition of trade policies, many other factors can affect such decisions as well. Kono (2006) achieved his results by adding some variables as control for interest-group industries. The employment share of an industry in total employment is one of the main variables showing the importance of a sector in a country's economy. Import penetration is another variable representing the ratio of imports to domestic output in a sector, thus measuring the importance of imports in that sector. Kono (2006) finally found that these variables increase the probability of the imposition of quality NTMs more strongly than of the imposition of core NTMs.

Ray (1981) analysed the determinants of tariffs and NTMs in the United States using a cross-sectional database for 225 four-digit manufacturing industries in 1975. He considered both tariffs and NTMs as protectionist measures and found a causal relationship from tariffs to NTMs. In other words, he stated that NTMs are supplements to tariffs. Both of these two types of policy instruments in the US are more often used for industries with comparative disadvantages. Moreover, for those industries in which welfare losses due to protectionism are large, these instruments are less often implemented. He also found that the imposition of tariffs is significantly related to labour-intensive industries while NTMs are imposed on more capital-intensive industries as NTMs include a variety of technical measures.

Lee and Swagel (1997) analysed the determinants of NTMs in 1988 over 41 countries in the world. They included tariff rates as one of the main factors for imposing NTMs. They also considered labour productivity, wage per worker, and labour share of value added variables as the comparative advantage indices within each sector. The authors concluded that protectionism by way of NTMs is not related to countries and industries, but to the conditions of sectors in each country. Their conclusion is that governments are willing to protect weak industries with comparative disadvantages threatened by imports. Moreover, large industries of national importance and with relative comparative advantages are given more protection using policy instruments. However, the authors did not include country-level variables to explain the true relationship between the imposition of NTMs and the characteristics of each country.

The substitutability of trade policy instruments has been widely studied in the literature. Yu (2000) provided a model to show the substitution of NTMs for tariffs, while Rosendorff (1996) presented a model for the substitutability of one type of NTM for another. Moore and Zanardi (2011) investigated the usage of anti-dumping strategies as substitutes for sectoral applied tariff reduction. Controlling for unobserved time-variant sectoral information and country-level characteristics, they found such substitutability only in heavy anti-dumping users among developing countries. On the other hand, Aisbett and Pearson (2013) found a negative relationship between a large tariff binding overhang (TBO) and the probability of SPS notifications. In fact, lower applied tariffs are linked to a lower probability of notifying SPS. The difference between the applied tariff rates at the border and the committed bound tariffs negotiated within WTO is referred to as 'tariff water' or 'binding overhang'. This gap cannot be easily tightened due to its observability for retaliations (Nicita et al., 2013). Thus, countries prefer to impose non-tariff restrictions rather than handing in a visible excuse for retaliation.

Retaliation is another important motive behind the imposition of trade policy instruments which has been studied by various scholars. Vandenbussche and Zanardi (2008) found empirically that retaliation is a strong reason behind the proliferation of anti-dumping measures. Prusa and Skeath (2002), Blonigen and Bown (2003), Feinberg and Reynolds (2006), and Moore and Zanardi (2011) have also studied the retaliation strategies on anti-dumping (AD) petitions. Retaliation can be motivating enough for the imposition of other NTMs such as TBTs as well. For instance, de Almeida et al. (2012) showed that the Brazilian TBT and SPC notifications against the United States are forms of retaliation, while against the EU they are forms of conciliation. Sanjuán López et al. (2013) also found retaliatory grounds for US impositions of NTMs against EU bans on the trade of cattle.

Health and environmental issues have also been studied in the TBT and SPS context. Since health and environmental issues are the most important legitimate reasons behind TBT and SPS measures, it is quite reasonable to link these issues with each other. Moreover, many TBT notifications and Dispute Settlement (DS) cases citing TBT agreements convey health and environmental concerns. For instance, DS381 requested by Mexico within the Dispute Settlement Mechanism of WTO on 24 October 2008 against US regulations on the importation of tuna cites 'Dolphin-safe requirements for tuna harvested in the ETP [Eastern Tropical Pacific Ocean]'[2], which obviously has an environmental life protection objective. Or DS291, DS292 and DS293 responded by the EU in 2003, which are related to 'Measures affecting the approval and marketing of biotech products' that can have hazard consequences for human health.[3] The strand of literature was also frequently connecting these quality issues with these types of NTMs. Otsuki et al. (2001) quantified the impact of EU food safety standards prohibiting the import of high Aflatoxin nuts from Africa. Such regulations can decrease the death risk by 1.4 out of one billion per year, while on the other hand imposing huge economic costs on the developing exporters. Van Tongeren et al. (2009) and Beghin et al. (2012) motivated their theoretical framework analysing the costs and benefits of prohibitive NTMs by the potential harms of the products.

Innovation, technological advancement, and standards are closely related to TBT and SPS measures. New standards embodied in the TBT regulations are usually caused by technical improvement in production procedures. Besides, standards can play an important role in fostering technological progress. The close linkages between these issues and TBTs are widely studied in the literature. Decreasing the transaction costs and gaining economies of scale, standards can foster growth (Kindleberger, 1983). By contrast, when standards are used as a weapon to hinder competition, they can effectively limit innovation and economic growth (Lemley, 2002). Ernst et al. (2014) call this phenomenon a dual channel for latecomer economies such as Korea and China. Moreover, they address intellectual property rights (IPRs) in the form of patents – successful innovative efforts (Van Hove, 2010) – as interconnected sources of growth. Furukawa (2010) investigates the complex relationship between IPRs and growth. While protecting the innovation process of firms motivates them to become more competitive in the market, suppressing the learning-by-doing (imitation) process will hinder long-run growth.

The number of products covered within a trade policy is another important motive for the imposition of effective trade policies. Broda et al. (2008) analysed the importance of supply and demand elasticity for the imposition of trade policies. They considered the number of products at each chapter as a factor

2 Documentations can be found at: http://www.wto.org/english/tratop_e/dispu_e/cases_e/ds381_e.htm

3 Documentations can be found at: http://www.wto.org/english/tratop_e/dispu_e/cases_e/ds293_e.htm

controlling for varieties within the preferences of consumers. Their study emphasised the significance of the market share in the introduction of trade instruments.

The opaque nature of TBTs often leads to trade conflicts. Ghodsi and Michalek (2014) analysed the relationship between TBT STC notifications and dispute settlement cases citing TBT agreements within the WTO. Their econometric analysis points towards a positive relationship between the two. The conclusions of their research marked TBT STC notifications as an early system of warning for DS cases. While these notifications can be a good proxy for future trade disputes, it is very important to identify their determinants.

In the literature considered, the study conducted by Aisbett and Pearson (2013) is very close to the analysis of this paper. They investigated the link between SPS notifications and boundaries on tariffs. A dataset of 98 countries that reported SPS notifications in 69 product types (at 2-digit level of HS) to the WTO was applied in their analysis. In a simple regression, they found support to the traditional claim that protectionist motives such as large tariff binding overhang, positive current account balance and lower valued exchange rates are statistically significantly associated with lower probability of SPS notifications. Besides, higher imports and exports give rise to notifying SPS measures. The authors suggested that governments are following good motivations for the imposition of SPS measures, which are mainly due to the importance of healthcare and environmental qualities in those imposing countries.

Aisbett and Pearson (2013) implemented environment, health and governance measures in a new regression to identify their effects on the imposition of SPS. The result was in line with their first predictions: high indices of these measures statistically significantly increase the probability of notifying SPS measures. They also found that high environmental health standards are more important than any other protectionist measures in previous regressions. Therefore, as their conclusion shows, this type of NTM is in the majority of cases not imposed due to tariff tightness or any industrial protectionism, but because of some other factors that are in good faith (i.e. pursuing legitimate objectives rather than protectionism).

In the current study, the previous literature on the determinants of NTMs will be extended with a special focus on TBT STCs. The merit of this contribution compared to previous studies is the usage of bilateral trade data in a gravity model framework for all countries in the world between 2000 and 2011. Using these variables in the analysis helps to increase the coverage of different factors studied in the literature. Moreover, since STCs are two-sided notifications, the factors affecting them from both sides of trade will be investigated in this study. Protectionist measures, trade, institutional characteristics, environmental and health issues, and comparative advantages of sectors will be tested as determinants of TBT STCs. This research will comprise some previous studies in one single analysis to identify the real factors behind these specific NTMs.

3. Model specification and potential determinants

The data applied in the analysis are taken from an unbalanced panel database compiled from seven sources covering the period 2000-2011[4], which will be discussed in detail in the following subsections. The following model will be applied for the estimation:

$$Y_{ijht} = \alpha X_{ijht} + \beta_1 Z_{it} + \beta_2 Z_{jt} + \delta_i + \rho_j + \mu_h + \sigma_t + \varepsilon_{ijht} \quad (1)$$

where Y_{ijht} refers to the dependent variable which is a new STC raised by partner country *j* on a TBT imposed by reporter country *i* on product *h* (at 2-digit level of HS) at time *t*.[5] *X* is the vector of bilateral-product-specific variables comprising economic protectionism and product level variables. *Z* denotes a vector of country variables encompassing economic, technological, institutional and environmental variables. All variables in the model will be elaborated in the following parts of this section. Further, δ_i, ρ_j, μ_h, and σ_t are respectively reporter country, partner country, product (industry), and time fixed effects and ε_{ijht} represents the error term. The model specified here is akin to that of Moore and Zanardi (2011) investigating the determinants of anti-dumping petitions.

Since the dependent variable is a count discrete variable that ranges between 0 and 3 (respectively minimum and maximum numbers of STC TBT in the data sample), log-likelihood techniques should be applied for the estimation. Ordered logistic and probit estimations are usually used for such estimations. Nonetheless, since there are potential country and sector fixed effects in the unbalanced panel data, fixed effect Poisson (FEP) regression is chosen for the estimation. The Hausman test also suggests the consistent application of fixed effect estimators for the Poisson regression. Time dummies are also included in the regressions to relax the assumption of time-invariant regressor functions (Wooldridge, 2012: 668-669). Moreover, a robust estimator is used to control for the heteroscedasticity of the error term.

It is important to mention that FEP regression will drop those observations of the dataset for which no variation within the dependent variable is detected during the period. Moreover, single observations within each group of individual (i.e. product-paired-country) are dropped. This omission of the variable is consistent with the econometric specification of the FEP model giving robust results. However, the estimation of pooled Poisson regression will be represented in the appendix as a robustness check.

It is worth mentioning that the interpretations of panel and pooled sample regressions are slightly different. In fact, in panel estimation, the variations of an explanatory variable can affect the variations of the dependent variable. Using FE regression the position of a panel individual will stay constant relative

4 The data on some variables cover only this period. However, estimations on a larger sample for the period 1995-2011 are additionally presented in the appendix.

5 In this analysis, the country imposing the TBT is accounted for as the Reporter country, and the concerned member is referred to as the Partner country.

to other individuals. What matters will be then the changes of variables during time. Pooled estimation on the other hand would consider each observation in relative position to other observations, neglecting the variations during time. Therefore, if two opposite results are achieved from these two regressions, the interpretation will differ, but it will not be necessarily contradictory.

The explanatory variables will be described below. Among these variables, trade flows, tariffs and TBT STCs of the partner country might have an endogenous impact on the dependent variable. To control for consistency and unbiasedness, and the potential endogeneity, the contemporaneous variables are excluded. This is in line with the consistent and unbiased assumption of the FEP model (Wooldridge, 2012). In other words, in a robustness-check specification, a lagged version of endogenous variables will be included in the FEP model.[6]

Two estimation specifications are tested. The benchmark specification will include all WTO member states in the sample. To have a robustness test for the benchmark, a second specification will separate countries in an EU and a non-EU sample. The motivation behind that split is the harmonised regulations, standards and trade policy instruments within the whole EU. Moreover, a major part of TBT STCs (64 out of 317 measures) is maintained by the EU. It is also important to mention that the evolutionary accession of EU Member States is considered in this specification. In the benchmark specification, a dummy variable indicating EU membership of both trade partners is included in order to provide consistent outcomes. Since the EU has a single voice in the WTO, in a separate robustness check, all EU Member States will be considered as one single economy.[7]

It would be wise to control for product-time effects in regressions. This would make sure that the estimation results are not picking up product-specific time trends. However, including numerous binary variables in Poisson regressions does not allow for convergence in the maximisation procedure after 6500 iterations. Thus, the estimation would render biased results including product-year dummies. Possible correlated shocks across products traded by a given pair of countries are another concern giving biased estimation results. This problem in standard errors can be corrected for estimations clustering by country-pairs. Moreover, TBTs are likely to be persistent over time and their implementation mostly stretches over a long period. Addressing the endogeneity issues above, in addition to FEP estimation, exponentiated GMM estimation over a pooled sample will be conducted as robustness check. In a two-step random effect Poisson GMM model, the benchmark specification with few modifications will be estimated. The heteroscedasticity and autocorrelation consistent (HAC) estimators proposed by Newey and West (1994) will be used in conjunction with the two-step GMM estimators, which considers an optimal lag selection algorithm. The variance-covariance matrix (VCE) will also be corrected clustering country-pairs to suppress the correlated shocks mentioned above. Moreover, in two separate specifications, robust VCE and clustered VCE by panel individuals (country-pair-products) will be used. The selection of exogenous, endogenous, and instrumental variables will be specified based on the Hansen overidentification restriction tests.[8]

6 The estimation results for this specification will be represented in Table 8 in the appendix.

7 The estimation results for this specification are presented in Table 9 in the appendix.

8 The estimation results for this specification are presented in Table 10 in the appendix.

3.1. TBT NOTIFICATIONS

The WTO secretariat provided a dataset on TBT notifications which covers 317 STC measures on various types of products (at two to six-digit level of the Harmonised System revision 2) for the period 1995-2012. 81 products at 2-digit level of HS are in the focus of TBT STCs imposed by 69 countries. These data were gathered from two internal sources: First, from WTO notifications, including all direct notifications by imposing countries. The second source is represented by TBT Committee minutes, which comprise STCs raised by members facing TBTs imposed by others. In fact, the former source comprises only direct notifications, while the latter corresponds to reverse notifications. Governments imposing TBT measures are sometimes reluctant to inform the WTO directly and concerned members inform the TBT Committee in return. WTO members can discuss issues related to specific measures imposed by other members at the meetings of TBT and SPS committees. When the information from the two sources is not equivalent, the one from the Committee minutes recording is preferred and mentioned in the dataset. Moreover, it can be stated that the TBT STC dataset is a subset of all TBTs regulated by WTO members.

Since the majority of TBT STCs are maintained on a vast variety of products, the data applied in the analysis are aggregated to two-digit level of HS-2. There is some duplication in the database even before aggregation of products, which makes the analysis biased (Ghodsi and Michalek, 2014). In order to correct this bias, duplicated observations are removed. Thus, there is one unique observation for a TBT STC notification by its item number, first date raised, maintaining member, concerned member, and product at two-digit level. Variable $TBT\ STC_{ijht}$ created for the estimation is a counting variable that counts the new STC raised by member *j* over the TBT maintained by member *i* on product *h* at time *t*.[9]

3.2. ECONOMIC PROTECTIONISM VARIABLES

As discussed in the literature review, governments might impose TBTs in response to or as retaliation for their trade partner's policy instruments. In order to control for such behaviour, TBT STCs maintained by the partner country which is concerned by the reporter country are included in the regressions.

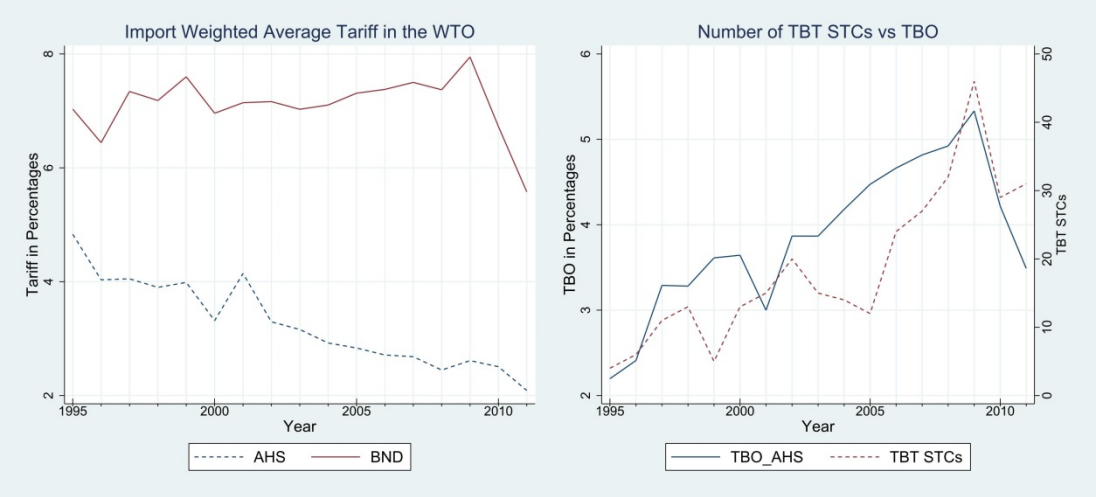
One of the main variables of interest for the analysis is the Tariff Binding Overhang (TBO), which is the difference between the effectively applied tariff (AHS) and the bound tariff (BND). The World Integrated Trade Solution (WITS) provides data for AHS and BND from two different sources: WTO and Trains (maintained by UNCTAD)[10]. The difference between the two sources is mainly due to the coverage of the data for tariffs. Data from Trains are chosen as the main source for the analysis because of larger coverage than the WTO source. However, when there are missing values in the former, the available data are replaced from the latter. TBO_{ijht} in the estimation is thus the BND minus AHS tariff imposed by reporter country *i* on the import of product *h* from partner country *j* at time *t*. The simple average of tariff lines for the aggregation at 2-digit level of HS is considered for the calculation of these tariffs. However, the weighted average was also considered, and the results between the two types of tariff calculation are almost identical.

9 It is important to mention that, wherever the original database refers to the European Union as the maintaining or concerned member, depending on the year of the notifications, individual Member States at the time are accounted for.

10 Information regarding this database can be found at: http://wits.worldbank.org/wits/

The left panel of Figure 2 shows the trend of weighted average tariffs within the WTO member states. As it is observed, the BND tariff is moving within a very small variance over time with small fluctuations, while AHS is decreasing gradually since 1995. The right panel of this figure depicts the trend of TBO and TBT STC notifications. In general, the two series move together. However, in some years these two are going in opposite directions. Higher values of TBO refer to a lower level of the applied tariff with respect to the bound tariffs. When the applied tariff drops as a political gesture in bilateral agreements (increase of TBO), governments might impose NTMs to protect their domestic industries from the risk exposed by the higher level of imports. Hence, it is expected that this variable would increase the probability of notifying a new TBT STC, which is not statistically evident in Figure 2.

Figure 2 / Tariffs vs TBT STC notifications



Bilateral imports and exports of the products (at 2-digit level of HS) are further explanatory variables obtained from WITS. The original provider of the data for these variables is UN COMTRADE. When an increasing trend of imports of the product that potentially can harm the domestic producers is observed, an easy way to protect the domestic industry with attracting little attention is the imposition of specific NTMs rather than a rise in tariffs. As argued earlier, even governments might be reluctant to notify the WTO regarding this temporary NTM. Therefore, it is expected that the probability of new TBT notifications is higher when imports rise. However, the opposite relationship might not be necessarily true for the trend of exports. From the protectionism perspective, a country might impose new TBTs to strengthen the domestic market when the domestic industry is growing as a result of an increase in its exports. In other words, growth of a domestic industry which is replicated in its increased exports might get special support from the government to foster sustainable growth of that industry. Hence, a protectionist trade policy can support a growing industry.

3.3. PRODUCT LEVEL VARIABLES

As discussed in the previous section, comparative advantage (CA) of industries can be a good determinant for the imposition of trade policy instruments. Besides, as Broda et al. (2008) emphasised, the market share of a country within a specific sector, and the number of varieties within each product

category, are important issues to control for in the regression. In this analysis, trade of all products is considered for all countries. There are different measurements of CA using detailed data at industrial level such as value added and unit labour cost. However, since such data are not available for all products and all countries in this analysis, a simple Ricardian index is applied. Specifically, the revealed comparative advantage (RCA) index firstly introduced by Balassa (1965) is calculated and included in the estimations. To make these data comparable with all countries in the world, it is calculated by dividing a country's export share of a given product in total exports, relative to this share for all countries in the world, thus:

$$RCA_{iht} = \frac{\left[\frac{export_{iht}}{\sum_{h=1}^{H} export_{iht}}\right]}{\left[\frac{\sum_{i=1}^{I} export_{iht}}{\sum_{i=1}^{I}\sum_{h=1}^{H} export_{iht}}\right]} = \frac{export_{iht}/export_{it}}{export_{ht}/export_{t}} \quad (2)$$

Here, *H* is the total number of products (in this analysis H=96), and *I* is the total number of countries. When the value of this index is greater than one, the country has a relative comparative advantage in the export of that product, and vice versa. It is expected that industries with comparative disadvantages (with lower values of RCA) are more likely to be aimed at by policy instrument for protectionist issues (Ray, 1981). The RCA of the partner country is also included in the regression, which can follow a similar argument. In other words, the trade partner is more likely to raise an STC on a TBT affecting its weak industry with comparative disadvantages.

For years, technology and innovation have increased the variety of products, which will be defined in global product classifications. TBT STCs focusing on 2-digit level products are covering all varieties of products at more highly disaggregated levels. As discussed earlier, the larger the number of products in the focus of the new regulations, the higher would be the probability of STCs being raised against a TBT. However, the description of regulations within a TBT is sometimes very detailed, affecting few categories of products at a very disaggregated level. Hence, another product level variable to include in the analysis is the number of 8-digit Combined Nomenclature (CN8) products within each of the 2-digt categories of products[11].

3.4. ECONOMIC VARIABLES

The difference between the GDP per capita of the two trade partners is commonly used in trade econometric analyses, especially in bilateral gravity models. The data for real GDP per capita is collected from the World Development Indicators (WDI) database that is provided by the World Bank. This data is in thousands of USD on constant values of 2005 and is a suitable proxy for the similarity/differences in the economic development of the two trade partners. The expected effect of this variable can be two folded.

A highly advanced economy is the more likely to impose a TBT the less developed its trade partner is as, for example, production in poorer countries may be more environmentally damaging. Besides, such a partner can be more affected by a TBT due to a bigger gap in technological advancement of

[11] It would be better to control for the number of products (CN8) traded by each country pair, rather than for the total number of products within each 2-digit category. However, there are no available data for that issue and here in this study, the number of CN8 products is included to mainly control for some product level effects.

production, and is consequently more likely to raise an STC on the policy instrument. Therefore, a positive relationship between this variable and TBT STC notifications is expected to be observed.

However, one can also argue that countries with high similarities in development are more likely to engage in trade conflicts protecting their own domestic industries from each other, based on the large impact they can impose on each other. Therefore, the more similar the two countries are in respect of development, the more likely it is for TBT STCs to be maintained and/or raised. These two argued effects working in opposite directions are studied by the econometric analysis in the next section.

Since real GDP per capita is used for the analysis, inflation of both trade partners is also included in the regressions as a control variable. It is expected that authorities impose international policies in order to control for imperfections of the market prices of goods. For instance, assume an exporting country with a high level of deflation, which can gain market shares as its prices are relatively going down (assuming constant exchange rates). The country importing products from the deflated economy would impose TBT measures to stabilise its domestic market. The GDP deflator as annual percentages is collected from the WDI database.[12]

3.5. TECHNOLOGICAL VARIABLES

Generally, when a country imposes new TBTs, its domestic industries are producing in line with the standards in the focus of the policy instrument. An innovative industry producing efficiently would induce its government to increase the acceptable standards in the market. Research and Development (R&D) investment has an effective impact on the new production procedures establishing new, higher standards. R&D as a percentage of GDP appears to be a suitable proxy for technological innovations and can be collected from WDI. Higher values of this factor can potentially increase the introduction of new regulations and standards and consequently new TBTs.

Moreover, the number of patent registrations in a society can be a good proxy representing successful innovative efforts (Van Hove, 2010). WDI provides data for two suitable variables measuring patent registrations. The number of patents by residences of a country can represent applied innovations in the production procedures of a domestic industry. It is expected that a large number of patents registered by residents would increase the probability of the imposition of new TBTs, which increases the homogenous standards of the products in the domestic market. However, the number of patents by non-residents in a society does not necessarily reflect innovative production procedures in the domestic market. On the other hand, non-residents can increase innovation in their own country of residence. Besides, in case of an increase in the number of patents by non-residents, when domestic producers cannot keep up with industrial innovations abroad, the government authorities would not like to impose standard restrictions that keep their own home industries out of the market. Thus, it can be expected that the number of patents registered by non-residents would decrease the probability of the imposition of new TBTs.

[12] Instead of inflation, it seems more sensible to include bilateral exchange rates among the regressors. However, lack of available data on exchange rates would shrink the estimated sample by more than half, which also changes the estimation results of some regressors dramatically. The estimations with bilateral exchange rates instead of the deflator are available on request.

These three variables are also included for the partner country, which can follow a similar argument for raising STCs on the maintained TBTs. Assume that the trade partner has already an innovative environment for advanced technologies of production comparable to the maintaining country: this environment can be measured by above-mentioned proxies. Hence, such an economy will raise concerns against regulations prohibiting its exports while the quality of production and products might be comparably compatible with what the importing country offers.

3.6. GOVERNANCE INDICATORS

Whether or not a government is following good faith when imposing trade policy instruments is commonly related to the country's institutions. Some governance variables are used in the regressions that can represent qualitative measures for the institutions of a country.

The main institutional variable of this study is the polity variable, gathered from the Polity IV project[13] and determining the level of democracy in a country. This indicator ranges from -10, showing the most autocratic country, to 10, representing the most democratic institution. According to the respective strand of literature, democratic governments care more about healthcare and environmental issues. Moreover, democratic countries prefer the imposition of complex and opaque instruments such as TBTs rather than simple tariffs. However, democratic countries are more likely to have more liberalised trade than autocratic ones. It is expected that higher values of this index would represent a higher probability of the imposition of new TBT measures aiming at good purposes instead of protectionism. Nevertheless, the estimation results can give insights about the true influence of regimes on TBT imposition if other factors are controlled for in the regression.

There are some other institutional variables used in empirical trade studies. The World Governance Indicators (WGI) of the World Bank database is commonly used in empirical studies analysing the impact of institutional qualities on patterns of trade and trade protectionism (Essaji, 2008; Ghodsi, 2013). There are strong correlations between these variables and the inclusion of all might lead to biased estimations. Therefore, only the one which is most relevant to the imposition of trade policies will be included in the regressions. Regulatory Quality (RQ) shows 'perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development'.[14] Higher values for this index represent higher institutional quality. For instance, in 2011, the Democratic People's Republic of Korea had the lowest RQ with an estimated value -2.46; and New Zealand had the highest RQ with an estimated value 1.967.

These institutional variables are known to be relatively stable over the studied period. The observable variation in the data is likely driven by measurement errors. Because the estimation specifications include fixed effects, measurement error may potentially induce a bias on the coefficients. It thus seems preferable to exclude the institutional variables from the analysis. It is worth mentioning that the differences in institutional quality are already captured by the GDP per capita. In the GMM Poisson estimation (robustness checks presented in Table 10 in the appendix), institutional variables are used as instruments variables instead of main explanatory variables of the model. This also gives acceptable

[13] Information regarding this database can be found at: http://www.systemicpeace.org/polity/polity4.htm

[14] Data on RQ are available for the period 1996-2011, but values for 1997, 1999 and 2001 are missing. A simple average of data from adjacent years (at most one year earlier and one year later) is interpolated for these missing years.

Hansen test statistics for overidentification restrictions. Exclusion of these variables from the instruments would give higher Chi squared statistics of the Hansen test rejecting the exogeneity of the remaining instruments. In addition, the convergence in the maximisation procedure of the Poisson regression is not achieved excluding these variables from the instruments. Hence, these institutional variables are believed to be essential instruments in GMM models.

3.7. ENVIRONMENTAL VARIABLES

The Environmental Performance Index (EPI) provided by the joint project of Yale University and Columbia University is used as another variable in the regressions.[15] As discussed earlier, environmental qualities and human health are the most legitimate motivations behind the imposition of TBT and SPS measures. Countries concerned about these issues are imposing more TBTs than less concerned ones. This index is the weighted average of Environmental Health (EH) and Environmental Vitality (EV). The former variable encompasses 30% of EPI and the latter 70%. EH involves child mortality rate, indoor air pollution, particulate matter in air pollution, access to drinking water, and access to water sanitation. Different weights of these factors are given to the calculation of EH affecting human health. EV comprises sulphur dioxide emissions per capita, sulphur dioxide emissions per GDP, change in water quantity, biome protection, marine protection, critical habitat protection, agricultural subsidies, pesticide regulation, growing stock change, forest loss, forest cover change, fishing stocks overexploited, coastal shelf fishing pressure, CO_2 per capita, CO_2 per GDP, CO_2 emissions per electricity generation, and renewable electricity with different weights in the calculation.

The expected results of these indices are quite straightforward. It can be expected that EPI, EH and EV of a country have a positive impact on the probability of imposing new TBTs on trade. Consequently, because countries enforcing specific regulation on environmental and healthcare issues have better quality indices, they may try to impose TBT measures to sustain high qualities. However, the reverse relationship is also possible because these indices represent general existing qualities rather than regulative issues. For the regulative issues, only agricultural subsidies and pesticide regulations are respectively considered in the calculation of EPI and EV as 5.83 and 12.16 per cent. For instance, if a small country is highly polluted and suffering from a low EV index, a government with high institutional quality will try to establish regulations and standards to increase the environmental qualities. While the quality of governance and institutions is controlled for by other variables explained earlier, the negative relationship between these three indices and the imposition of new TBTs might acknowledge the good motives of the government behind these measures. In spite of these two opposite impacts of environmental measures on new TBT notifications, their inclusion in the analysis can improve the consistency of the estimations.

[15] Information regarding these data can be found at: /

Table 1 / Summary of explanatory variables in the analysis

Explanatory variables	Indicators	Exp. sign	Description	Data Sources
Economic protectionism variables	TBT STC $_{partner}$	(+)	Number of TBT STC maintained by the partner country on product at 2 digit level of HS	WTO
	TBO	(+)	Difference between the effective applied tariff and the Bound Tariff (BND)	WITS
	Import	(+)	Natural logarithm of bilateral imports of the products (at 2-digit level of HS)	WITS
	Export	(+)	Natural logarithm of bilateral exports of the products (at 2-digit level of HS)	WITS
Product level variables	RCA	(-)	Own calculated Balassa (1965) RCA Index for reporter	WITS
	RCA $_{partner}$	(+)	Own calculated Balassa (1965) RCA Index for partner	
	No. CN8	(+)	Own calculated number of products at CN8 digit level within each HS2 digit category	Eurostat
Economic variables	ΔGDP	(+/-)	Natural logarithm of the absolute differences between the GDP per capita of trade partners	WDI
	Deflator	(+)	GDP deflator in annual percentage points for reporter	WDI
	Deflator $_{partner}$	(+)	GDP deflator in annual percentage points for partner	WDI
Technological variables	Pat-Non-Resident	(-)	Number of patents registered by non-residents in reporter	WDI
	Pat-Non-Resident $_{partner}$	(-)	Number of patents registered by non-residents in partner country	WDI
	Pat-Resident	(+)	Number of patents registered by residents in reporter	WDI
	Pat-Resident $_{partner}$	(-)	Number of patents registered by residents in partner country	WDI
	R&D%GDP	(+)	R & D expenditure share of GDP of reporter	WDI
	R&D%GDP $_{partner}$	(-)	R & D expenditure share of GDP of partner	WDI
Institutional variables	RQ	(+)	Regulatory Quality	WGI
	Polity2	(-)	Level of democracy (autocracy)	Polity IV
Environmental variables	EPI	(+)	Environmental Performance Index (for both trade partners)	EPI
	EH	(+)	Environmental Health (for both trade partners)	EPI
	EV	(+)	Environmental Vitality (for both trade partners)	EPI

4. Estimation results

4.1. BENCHMARK SPECIFICATION

Table 2 presents the FEP estimation results for the benchmark regression. As is observed, from the first model (second column from left) to the last one to the right, additional variables are added step-wise to the estimation. The estimations are conducted for the period 2000-2011 to have identical sampling in the regression for checking the consistency of coefficients. The restriction of sample to this period was necessary because of the lack of data for Polity2 and EPI variables before this period. However, regressions for the whole period (1995-2011) with diverse sampling are presented in the appendix. The Akaike information criterion (AIC) and the Bayesian information criterion (BIC) suggest improvement of the estimations after adding variables to the models. Since the Environmental Performance Index (EPI) has two main components, model 7 includes Environmental Health (EH) and Environmental Vitalities (EV) instead of EPI in model 6. As explained in the previous section, time dummies are also included in the regressions to control for trends and year effects. Trade policy impositions might be affected by previous trade policies of the partner country; hence, a lag of this variable is also included in the model. A similar issue can be also stated for previous TBO, imports and exports; thus, lags of these variables are also included in the regressions.

In general, consistency in signs and statistical significance of coefficients are observed in the different models. Since Incidence-Rate Ratios (IRR) are reported as coefficients of Poisson regressions, a variable may have a positive effect on TBT STCs if the value of the coefficient is statistically significantly greater than one. Contemporaneous and lagged STCs raised by the reporter country on the TBTs maintained by the trade partner have a statistically significantly negative effect on the dependent variable. This suggests that governments are less motivated to impose TBTs as retaliation on the same category of products that their trade partner has focused on.

Indicators for Tariff Binding Overhang (TBO), imports, exports, patents of residents, and R&D to GDP ratios of both trade partners have a statistically significantly positive impact on the probability of TBT STC notifications according to all models.

When TBO increases by one per cent, meaning that the applied tariff drops by one per cent[16], the rate ratio of imposing a new TBT STC is expected to increase by a factor 1.02 while holding all other variables in the last two models constant. Tariffs are aimed at a wide range of products considered as like products depending on the aggregation level of classification. If a country decreases its applied tariff on the import of a specific category of products from different countries as a good gesture for trade liberalisation, it is difficult to point out a more specific good for which classification does not allow and impose a higher tariff. In the respective strand of literature, the complementarity or substitutability of trade policy instruments has been argued.

[16] Here, it can be mainly assumed that the bound tariff is held constant, because generally bound tariffs are commitments within WTO for a long period.

Table 2 / FEP regression results – sample (2000-2011)

Dep: TBT STC	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
TBT STC $_{partner}$	0.745***	0.719***	0.696***	0.704***	0.672***	0.668***	0.683***
	(0.043)	(0.042)	(0.041)	(0.042)	(0.040)	(0.040)	(0.041)
TBT STC $_{partner\ (t-1)}$	0.686***	0.656***	0.635***	0.662***	0.631***	0.620***	0.638***
	(0.052)	(0.051)	(0.050)	(0.053)	(0.052)	(0.051)	(0.052)
TBO	1.028***	1.028***	1.028***	1.026***	1.024***	1.024***	1.022***
	(0.0053)	(0.0051)	(0.0050)	(0.0050)	(0.0049)	(0.0049)	(0.0048)
TBO $_{(t-1)}$	1.001	0.999	0.998	0.997	0.996	0.996	0.995
	(0.0029)	(0.0031)	(0.0031)	(0.0033)	(0.0033)	(0.0033)	(0.0035)
Import		1.099***	1.098***	1.102***	1.093***	1.098***	1.097***
		(0.018)	(0.018)	(0.019)	(0.018)	(0.019)	(0.019)
Import $_{(t-1)}$		1.055***	1.050**	1.052**	1.039*	1.042**	1.046**
		(0.017)	(0.017)	(0.017)	(0.016)	(0.017)	(0.017)
Export		1.093***	1.091***	1.089***	1.074***	1.073***	1.070***
		(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.018)
Export $_{(t-1)}$		1.114***	1.106***	1.110***	1.090***	1.086***	1.085***
		(0.020)	(0.019)	(0.020)	(0.019)	(0.019)	(0.019)
No. CN8			0.994***	0.994***	0.995***	0.995***	0.995***
			(0.00054)	(0.00054)	(0.00057)	(0.00058)	(0.00057)
RCA			0.876**	0.884**	0.912*	0.918	0.913*
			(0.038)	(0.038)	(0.040)	(0.040)	(0.040)
RCA $_{partner}$			0.918*	0.920*	0.917*	0.917*	0.909**
			(0.031)	(0.032)	(0.031)	(0.031)	(0.032)
ΔGDP $_{ij}$				0.955	0.910**	0.926*	0.932
				(0.038)	(0.032)	(0.033)	(0.033)
Deflator				1.050*	1.005	1.007	1.019
				(0.025)	(0.024)	(0.024)	(0.024)
Deflator $_{partner}$				0.794***	0.824***	0.809***	0.816***
				(0.018)	(0.018)	(0.018)	(0.018)
Pat-Non-Resident					0.750***	0.748***	0.777***
					(0.026)	(0.027)	(0.028)
Pat-Non-Resident $_{partner}$					0.624***	0.611***	0.623***
					(0.023)	(0.023)	(0.024)
Pat-Resident					1.357***	1.354***	1.223**
					(0.093)	(0.095)	(0.086)
Pat-Resident $_{partner}$					1.394***	1.312***	1.411***
					(0.091)	(0.086)	(0.098)
R&D%GDP					2.886***	2.872***	2.123***
					(0.32)	(0.32)	(0.24)
R&D%GDP $_{partner}$					2.244***	2.291***	2.562***
					(0.24)	(0.24)	(0.28)
RQ						0.814	0.932
						(0.094)	(0.11)
Polity2						0.955	0.949
						(0.032)	(0.030)
EPI						0.970*	
						(0.012)	
EPI $_{partner}$						0.911***	
						(0.013)	
EH							1.095***
							(0.016)
EH $_{partner}$							0.924***
							(0.012)
EV							0.964***
							(0.0087)
EV $_{partner}$							0.957***
							(0.010)
N	38588	38588	38588	38588	38588	38588	38588
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	22976.7	22777.6	22679.3	22574.7	22128.8	22085.9	22007.5
BIC	23096.5	22931.7	22859.1	22780.2	22385.6	22377.0	22315.7

Exponentiated coefficients reported indicate Incidence-Rate Ratios (IRR)
Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Here, the results acknowledge the substitutability of tariffs and non-tariff barriers. Thus, it is easier for the authorities to impose restrictive regulations on that specific product rather than increasing the tariff for the whole group of products. Nonetheless, the lag of TBO coefficient is not statistically significantly different from one, which shows no relationship between previous tariffs and current TBT STC notifications.

Table 4 (in the appendix) shows the regressions during 1995-2011 in models 1 to 4. In most of these models, TBO shows no statistically significant relationship with the dependent variable. After the WTO regulations implemented in 1995, a large number of TBT regulations were suddenly notified to the WTO secretariat. Moreover, the reduction of tariffs has been implemented gradually over time (as observed in Figure 2). This may be one of the reasons why the regression over the whole period since 1995 cannot represent the statistical relationship between tariffs and TBT STCs.

According to what has been outlined above concerning the expected results, imports and exports have a positive effect on the probability of TBT STC notifications. The results also suggest that products with less comparative advantages are more likely to be in the focus of TBT STCs, from the perspective of either the maintaining country or the concerned country. In other words, if an industry becomes weaker over time, it is more probable that the government pays more attention to that industry. In general, these results acknowledge the protectionist motivation behind the imposition of TBTs.

A rise in the number of varieties of CN8 products within each 2-digit product category corresponds to a smaller probability of TBT STC notifications. However, the results of the pooled sample Poisson regressions in Table 5 (in the appendix) suggest that HS 2-digit product categories with a larger number of varieties at CN8 level are more likely to be aimed at by a TBT STC.

The difference between the GDP per capita of trade partners is statistically significantly smaller than one in two of the models. This indicates that if trade partners are more similar with respect to their economic development, they are more likely to be involved in a TBT STC notification. Since advanced economies have more similarities in production technology and involvement in trade liberalisation, they are more likely to be the two sides of a TBT STC notification. Besides, controlling for technological, institutional and environmental qualities, a large gap between the two trade partners' development make them less likely to engage in raising STCs on the TBTs notified for technological reasons.

The results are inconclusive concerning the relationship between changes in the importer countries' inflation over time and their TBT STC notifications. For partners, if inflation of the trade partner increases over time, it will be less likely to observe a TBT STC. An increase in prices in an exporting country can be responded to by lower demand of the importing country. In this manner, the market can automatically affect the trade patterns even without government intervention by way of a trade policy instrument.

While the number of patents of non-residents decreases the probability of new TBT STCs, patents of residents and R&D investments increase the probability of new TBTs. This result shows that countries with a higher level of technology and innovation would impose more technological regulations and standards rather than countries with a lower level of technology. Besides, such countries with advanced technologies would be more eager to raise STCs on regulations opposed to their production procedures.

Institutional qualities have no statistically significant impact on TBT STCs. This might be due to the small variation of these variables over time. However, pooled Poisson regressions (Table 5 and Table 6 in the appendix) show that countries with higher regulatory qualities (RQ) are more likely to maintain TBT STCs. According to the definition of RQ, governments with higher RQ are more able to formulate and implement sound policies and regulations that permit and promote private sector development. This might also acknowledge the protectionist behaviour of governments to support their private sector industries. Moreover, while controlling for tariffs and other variables, those tables also refer higher probability of maintaining TBT STCs to countries with higher autocracies. This result is in line with the literature stating that democratic countries are more liberalised in trade than autocratic countries are. In fact, democracy brings less trade policy (TBTs in this case) and in general more liberalisation in trade.

Another interesting result is that a country with lower environmental and health qualities (EPI) is more likely to maintain TBT STCs. This might suggest that the government is trying to improve its domestic qualities by way of imposition of new regulations. However, it is important to mention that European countries that are imposing TBT STCs are enjoying, more than any other countries relatively high environmental health and vitality. Another issue that can be mentioned here is that when environmental quality in a country is very low, restrictive regulations such as TBTs for the import of products from other countries might raise STCs by those other countries. In fact, while a government does not care about its own domestic environmental and health issues, the imposition of TBTs seems to represent unnecessary obstacles to trade rather than protecting the domestic environment or health in the eyes of other countries raising STCs.

Model 7 denotes a positive relationship between human health related qualities (EH) and TBT STC notifications, while environmental vitalities (EV) show the opposite relationship. 30% of EPI is explained by EH and 70% by EV. This might be the reason why EPI is more affected by the negative relationship of EV rather than by EH. A country with higher environmental health and human qualities is more likely to maintain new TBT STCs. However, a country suffering from low environmental vitalities is more likely to impose restrictive regulations in order to improve its domestic environment. In general, it is observed that a trade partner with lower EPI, EH and/or EV indices is more likely to face a TBT STC imposed by another WTO member.

After removing contemporaneous endogenous variables from the regressors, Table 8 (in the appendix) represents the robustness regressions with two lags of endogenous variables and other explanatory ones. The results are still consistent with the main benchmark specification with few alterations. It is observed that a country's imposition of a TBT STC is more probable when its trade partner has imposed a TBT STC on the same category of product two years earlier. In other words, the retaliation of this trade policy on the same product will take place after two years. Moreover, inflation and regulatory quality of the reporter country are now statistically significantly increasing the probability of a TBT STC notification. Besides, patents of residents of the partner country have no statistically significant impact on the dependent variable in this specification.

Table 10 (in the appendix) shows the GMM Poisson estimations of Model 6. Compared to the benchmark specification in Table 5, in this specification, lags of variables, number of CN8 products, inflation, and institutional variables are excluded from the main regressors. However, these variables are included as exogenous instruments. According to the Hansen test statistics and checking various specifications, this model includes the most fitted regressors. The HAC weight matrix proposed by

Newey West (1994) additionally helps to improve of the model and the test statistics. The difference between the three models presented in Table 10 is mainly the estimated variance covariance (VCE) matrix. VCE is clustered for bilateral country-pairs, and for panel individuals (country-pair-product) in Model 6A and 6B respectively. In Model 6C, the robust VCE is used to control for the heteroscedasticity within the errors. All three models have similar estimation results except for the level of significance of their coefficients. Comparing these results with Model 6 in Table 5 reveals the consistency of the pooled estimations. The results are quite similar in most of the regressors except for the import and EPI of the partner. The sign of the coefficient for import changes from positive in the Poisson regression to negative in the GMM Poisson model. This result is mainly due to the control for endogeneity of import. Inclusion of the lag of import in the instrumental variables rejects the instruments exogeneity hypothesis of the Hansen test. Therefore, this variable seems endogenous in the benchmark model giving biased results. According to this result controlling for endogeneity, it could be argued that when bilateral import rises, the probability of a new TBT STC notification decreases. The two sides of trade might affect this phenomenon. From the side of the maintaining country, this shows no protectionist motive behind the imposition of the TBT when trade flows are increasing. From the side of the trade partner, this result indicates that when the product trade is flowing smoothly after a TBT having been imposed, that country is less likely to raise a concern on the TBT. In fact, higher product exports from the partner country to the TBT imposing country stands for a lower probability of raising an STC.

4.2. EU VS. NON-EU SPECIFICATION

Table 3 represents the FEP regressions on Models 6 and 7 on the sample of EU and non-EU reporter countries.[17,18] The differences between the estimation results of the two samples explain how heterogeneous the TBT STCs notified by these two economies are. The non-EU countries' TBT STCs presented here are no longer affected by their partners' TBT STCs. However, TBO and bilateral imports and exports for both samples have similar characteristics as those presented in Table 2. The number of varieties of CN8 products within each 2-digit category of products has a statistically negative impact on the imposition of TBT STCs only in the non-EU sample.

Differences between the trade partners in their economic development are increasing the probability of notifying TBT STCs of non-EU countries only in Model 6, but not at a very high level of statistical significance. An increase in inflation decreases the probability of notifying TBT STCs only in non-EU countries. Besides, inflation does not statistically significantly affect the imposition of TBT STCs in the EU, which might be due to the lack of variations in inflation among EU Member States following the harmonised monetary policy by the European Central Bank (refer also to the regressions of Table 7 in the appendix).

17 The remaining number of observations in the panel shows that two thirds of the whole sample cover EU reporter countries. This is mainly because of the dropping out of time-invariant observations in the dependent variable. However, in the pooled sample regression, presented in Table 7 in the appendix, a reverse situation is observed.

18 It is worth mentioning that partner countries are not classified separately in these regressions.

Table 3 / FEP regression results – EU vs. non-EU – sample (2000-2011)

Sample:	Non-EU		EU	
Dep: TBT STC	**Model 6**	**Model 7**	**Model 6**	**Model 7**
TBT STC $_{partner}$	1.067	1.112	0.600***	0.582***
	(0.11)	(0.11)	(0.066)	(0.064)
TBT STC $_{partner\ (t-1)}$	0.374***	0.385***	0.646***	0.645***
	(0.040)	(0.041)	(0.072)	(0.072)
TBO	1.013**	1.010*	1.133***	1.131***
	(0.0046)	(0.0043)	(0.025)	(0.025)
TBO $_{(t-1)}$	1.003	1.001	1.141***	1.146***
	(0.0033)	(0.0033)	(0.035)	(0.036)
Import	1.063*	1.045	1.111***	1.110***
	(0.028)	(0.027)	(0.025)	(0.025)
Import $_{(t-1)}$	1.052*	1.059*	1.043	1.039
	(0.025)	(0.025)	(0.023)	(0.023)
Export	1.060*	1.054	1.070**	1.065**
	(0.029)	(0.029)	(0.026)	(0.026)
Export $_{(t-1)}$	1.028	1.030	1.042	1.039
	(0.027)	(0.027)	(0.025)	(0.025)
No. CN8	0.987***	0.988***	0.999	0.999
	(0.0013)	(0.0013)	(0.00089)	(0.00092)
RCA	1.020	1.002	0.836*	0.836*
	(0.044)	(0.050)	(0.070)	(0.070)
RCA $_{partner}$	0.950	0.937	0.939	0.950
	(0.058)	(0.060)	(0.049)	(0.048)
ΔGDP $_{ij}$	2.000*	1.560	0.979	0.977
	(0.58)	(0.41)	(0.039)	(0.039)
Deflator	0.515***	0.426***	0.961	0.956
	(0.037)	(0.032)	(0.036)	(0.037)
Deflator $_{partner}$	1.004	1.025	0.656***	0.643***
	(0.038)	(0.039)	(0.023)	(0.022)
Pat-Non-Resident	0.417***	0.397***	1.298**	1.295**
	(0.080)	(0.075)	(0.10)	(0.10)
Pat-Non-Resident $_{partner}$	0.690***	0.698***	1.467***	1.591***
	(0.035)	(0.036)	(0.10)	(0.12)
Pat-Resident	9.597***	6.941***	0.975	0.986
	(2.26)	(1.73)	(0.11)	(0.11)
Pat-Resident $_{partner}$	0.701**	0.744*	2.627***	2.402***
	(0.092)	(0.10)	(0.27)	(0.25)
R&D%GDP	49.03***	18.44***	0.946	0.957
	(18.5)	(6.86)	(0.15)	(0.16)
R&D%GDP $_{partner}$	0.848	0.807	3.089***	2.602***
	(0.19)	(0.19)	(0.45)	(0.38)
RQ	0.135***	0.0940***	0.953	0.948
	(0.052)	(0.041)	(0.19)	(0.19)
Polity2	0.906***	0.916***	0.977	0.977
	(0.010)	(0.012)	(0.063)	(0.063)
EPI	0.825***		1.021	
	(0.037)		(0.017)	
EPI $_{partner}$	0.918***		0.867***	
	(0.022)		(0.018)	
EH		1.279***		0.998
		(0.050)		(0.019)
EH $_{partner}$		1.007		1.009
		(0.021)		(0.015)
EV		0.640***		1.015
		(0.030)		(0.012)
EV $_{partner}$		0.941***		0.855***
		(0.016)		(0.017)
N	13499	13499	24267	24267
Time FE	Yes	Yes	Yes	Yes
AIC	7419.7	7337.5	11083.4	11070.2
BIC	7675.1	7607.9	11318.2	11321.2

Exponentiated coefficients reported indicate Incidence-Rate Ratios (IRR)
Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

However, as observed in the whole sample, an increase in inflation of the trade partner reduces the probability of raising STCs on TBTs imposed by the EU. While there is no statistical evidence for the role of RCA on the imposition of TBT STCs by non-EU countries, the results suggest a special focus of TBT STCs maintained by EU members on their weak industries with comparative disadvantages. The support for agricultural products within the EU regulations is a good example.

Technological variables have a completely diverse impact on TBT STC notifications in the two samples. The results of the non-EU sample on technological variables are very similar to what was shown for the whole sample. By contrast, the results of the EU sample are very different. While patents of EU residents and R&D within the EU are not statistically affecting the imposition of TBT STCs by the EU, other technological variables are increasing the probability of notifying these trade instruments by the EU. EU Member States are mostly pioneers of technological progress in the world, harmonising their regulations and standards among each other. The high imposition of TBT STCs by the EU when other countries are progressing technologically might indicate the EU's support for global advancement in technology.

Institutional variables as well as environmental and health indices of the EU are not statistically indicating any impact on the imposition of TBT STCs by EU members. However, a rise in EPI and EV of the trade partners will reduce the probability of notifying new TBT STCs by the EU, which again might show the good faith and supportive attitude of the EU concerning the progress of their trade partners. Moreover, the relationship between environmental indices and the dependent variables in the non-EU sample is very similar to the whole sample. Besides, an increase in the RQ and democracy level of non-EU countries decreases the probability of their TBT STC notifications.

Table 9 (in the appendix) represents the estimation results of the benchmark specification with one alteration. In this regression, all EU members are considered as one single economy (either as reporter or partner). Aggregated or average data are calculated for variables of the model wherever applicable. Coefficients of lagged TBT STCs of the partner, export, RCA and R&D of the partner are no longer statistically significant in this robustness check. Inflation and RQ are now decreasing the probability of a new TBT STC notification. These results are compatible with the ones presented in Table 3. Table 9 considers all EU members as one single unity. Therefore, the influence of non-EU reporters (Table 3) is becoming statistically dominant against the single EU impact. Hence, the altered results stated here are mainly affected by the fact that EU observations have become less prominent in the regressions than the benchmark. Moreover, the coefficient of patents by non-residents in the partner has become statistically significantly positive in this robustness check. The explanation for that phenomenon is the overestimation of the raw aggregated non-residents' patents over all EU members. In fact, this variable does not show the non-EU patent registrations for the EU, but the total non-residents' patents of all EU Member States. Even the negative impact of non-residents' patents of the reporter country has become stronger due to this overestimation.

5. Summary and concluding remarks

In this research, the determinants of Specific Trade Concerns (STCs) raised on Technical Barriers to Trade (TBTs) have been identified. While tariffs have been reduced constantly since the creation of GATT and WTO, the usage of TBTs and many other NTMs has dramatically increased. WTO members are obliged to notify their imposed TBTs to the WTO secretariat. Further, member states can discuss issues related to all TBTs imposed by other members and inform the TBT committee. Reverse notifications by STCs can show some specific cases of TBTs that might have not been reported directly to the WTO by the maintaining members.

Such data on STCs have been provided by the WTO secretariat as they have good informative properties to increase the transparency of members' trade policies. Using fixed effect Poisson (FEP) regressions, it has been shown that TBT STCs have increasingly become substitutes for applied tariffs especially during 2000-2011. The concept of substitutability between tariffs and NTMs has been frequently emphasised in the literature (Kono, 2006; Feinberg and Reynolds, 2006; Moore and Zanardi, 2011). The results of this analysis are broadly in line with these former findings. The panel regression results indicate that if the number of TBT STCs on a given product increases, the trade partner will be less likely to impose a TBT on the same product. Nonetheless, the results on the pooled sample suggest otherwise. In fact, countries maintaining TBT STCs are more likely to raise STCs on the TBTs notified by their trade partners. However, econometric robustness checks showed that retaliation takes place on the same category of product after two years.

The role of bilateral imports and exports provides another key finding of this study. The imposition of new TBTs and increases in STCs will be more likely when bilateral trade flows of a country increase over time. Protectionist issues of TBTs can be concealed behind various standards dictated by the maintaining member. On the other side of trade, when trade of a specific industry is increasing, the trade partner will be much more eager to raise an STC on TBTs imposed within that industry.

Findings also show that TBT STCs are generally aimed at weak industries from both sides of trade. In other words, it was shown that in case the specialisation and comparative advantage within a specific industry decrease, the probability of aiming a TBT STC at that sector increases over time. This is mainly the case for EU countries maintaining TBTs, while such a result for non-EU countries does not find any statistical evidence.

According to the results, technology also plays an important role for both maintaining TBTs and raising STCs. When technology in a country improves, the government tends to become more persistent in requiring products at a high level of quality and standards. That will be a good motivation for the government to introduce new TBTs or new regulations and amendments within already existing TBTs. Besides, a government will be more sensitive to facing technical regulations and will be more likely to raise STCs on those measures when the technology of the trade partner is improving.

Political and institutional qualities do not vary much during the period of analysis to see their statistical impact which is mostly caused by the lack of variations among EU members. For the sample of non-EU countries maintaining TBT STCs, when regulatory qualities are going down, the probability of maintaining new TBTs is increased. Moreover, when a non-EU country's regime is becoming more autocratic, the usage of TBT STCs becomes more frequent. However, regressions using the pooled samples suggest that autocratic countries are more likely to impose TBTs. Controlling for the differences in tariffs across different products and countries, this result confirms the strand of the literature (Milner and Kubota, 2005; Kono, 2006) emphasising that free trade is correlated with democracy.

The last but not least result of the analysis is about the negative role of environmental qualities on TBT STC notifications. The results suggest that countries with lower qualities according to the EPI measurement are more likely to maintain TBTs and also to raise STCs on those TBTs. It seems logical for the governments of areas with populated and polluted cities to impose some technical regulations in order to improve environmental qualities. However, regressions on the subcategories of EPI suggest differently. FEP outcomes suggest that when health qualities (EH index) are increasing over time, the country (specifically non-EU country) will be more likely to maintain TBT STCs; while the situation is the reverse for environmental qualities (EV). However, the results of the pooled sample suggest an opposite relationship. In other words, countries with higher EH and lower EV are less likely to maintain TBT STCs. In fact, given the FEP results and considering the relative position of a country with respect to all other countries in the world, if health qualities of the given country increase over time, the respective country is more likely to maintain TBT STCs. Given the pooled regressions and considering the position of a country at a certain point of time relative to the whole period, countries with lower human qualities are more likely to impose TBT STCs. Thus, if a country's health qualities are increasing, one should expect more TBT STC notifications. However, considering which countries at a certain time are more likely to notify TBT STCs, one should look for the ones with lower EH.

The major conclusion of this paper confirms the complex nature of TBTs that was highlighted in the literature. There are various factors behind the imposition of TBTs and raising STCs. It is not evidently feasible to show the true motivations of governments behind imposing TBTs by such general research over all TBT STCs. Autocracy also increases the probability of maintaining TBT STCs, which is showing the protectionist intuition of governments according to the literature. Protectionism of domestic industries, technology improvements, phases to autocracy, and environmental and human health issues are determinants of the introduction of TBT STCs. However, the complexities in the nature of TBTs do not allow for providing a completely general conclusion regarding these regulations.

It was further shown that TBTs are to a lesser extent than tariffs aimed at the protection of domestic industries, but are motivated by various factors. In other words, in this study the general motivations behind TBT regulations have been investigated, which cannot be used on a very specific TBT causing trade disputes. As a final conclusion, the results recommend Dispute Settlement (DS) bodies of the WTO to consider all factors underlying the motivations behind the imposition of TBTs. A global standardisation of qualities either in the technology of production or environmental and health issues can decrease the asymmetries among nations, which leaves the determinants of TBT STCs to fewer factors such as protectionist behaviour. Then, since TBT STCs have proved to be causes of trade disputes (Ghodsi and Michalek, 2014), this will lead to less frequent trade conflicts for which the aims of trade policy impositions will be much clearer.

Overall, the results point towards significant protectionist motives behind these TBT STCs, and consequently higher probabilities of new DS cases within the WTO. As the main conclusion and policy recommendation, harmonisation of regulations and standards are the major issues to decrease TBT STC conflicts. Moreover, decreasing the incentives and power of governments to pursue industrial protectionism by using much more rigid regulations might decrease the possibility of trade conflicts. To avoid economic tools and those motivated by protectionism, more restrictive rules in the WTO regulations are recommended leading to further liberalisation of trade in the future. The restrictive rules might, for instance, consider a penalty (an economic penalty) for a country violating a TBT agreement (if proved by the analysis of the Panel or the Appellate bodies irrespective of the final resolution of the case). This mechanism does not exist in the regulations, and that might be the main reason for the application of protectionist issues behind TBTs. The imposition of (even a small) punishment to the violating country might limit the cases where governments pursue protectionist strategies (even if for a short period). Elaborating a mechanism design might be a fruitful avenue of future research. Further, an interesting issue to be followed is to undertake cost-benefit analysis of a specific TBT concentrating on its implications for consumers and producers. Moreover, in a parallel research, the impact of these TBT STCs on trade patterns and potential third-country effects can be analysed as another extension which will help understand the further implications of these policy instruments.

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Appendix: Robustness check regressions

Table 4 / FEP regression results – sample (1995-2011)

Dep: TBT STC	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
TBT STC $_{partner}$	0.592***	0.586***	0.578***	0.514***	0.639***	0.668***	0.683***
	(0.024)	(0.024)	(0.023)	(0.028)	(0.038)	(0.040)	(0.041)
TBT STC $_{partner\ (t-1)}$	0.718***	0.711***	0.702***	0.690***	0.627***	0.620***	0.638***
	(0.035)	(0.035)	(0.034)	(0.039)	(0.048)	(0.051)	(0.052)
TBO	1.003	1.002	1.002	1.005*	1.004	1.024***	1.022***
	(0.0018)	(0.0018)	(0.0018)	(0.0025)	(0.0028)	(0.0049)	(0.0048)
TBO $_{(t-1)}$	0.999	0.998	0.998	0.994**	0.996	0.996	0.995
	(0.0015)	(0.0015)	(0.0015)	(0.0021)	(0.0022)	(0.0033)	(0.0035)
Import		1.063***	1.069***	1.068***	1.082***	1.098***	1.097***
		(0.010)	(0.011)	(0.012)	(0.017)	(0.019)	(0.019)
Import $_{(t-1)}$		1.020	1.018	1.027*	1.045**	1.042**	1.046**
		(0.010)	(0.010)	(0.012)	(0.015)	(0.017)	(0.017)
Export		1.039***	1.039***	1.045***	1.065***	1.073***	1.070***
		(0.011)	(0.011)	(0.012)	(0.017)	(0.019)	(0.018)
Export $_{(t-1)}$		1.035***	1.034**	1.042***	1.076***	1.086***	1.085***
		(0.011)	(0.011)	(0.012)	(0.017)	(0.019)	(0.019)
No. CN8			0.998***	0.997***	0.998***	0.995***	0.995***
			(0.00033)	(0.00040)	(0.00051)	(0.00058)	(0.00057)
RCA			1.019	0.997	1.019	0.918	0.913*
			(0.019)	(0.022)	(0.032)	(0.040)	(0.040)
RCA $_{partner}$			0.925***	0.928***	0.933*	0.917*	0.909**
			(0.012)	(0.018)	(0.027)	(0.031)	(0.032)
ΔGDP $_{ij}$				0.999	0.945*	0.926*	0.932*
				(0.027)	(0.026)	(0.033)	(0.033)
Deflator				1.000	0.961	1.007	1.019
				(0.015)	(0.020)	(0.024)	(0.024)
Deflator $_{partner}$				0.755***	0.795***	0.809***	0.816***
				(0.011)	(0.016)	(0.018)	(0.018)
Pat-Non-Resident					0.811***	0.748***	0.777***
					(0.029)	(0.027)	(0.028)
Pat-Non-Resident $_{partner}$					0.662***	0.611***	0.623***
					(0.020)	(0.023)	(0.024)
Pat-Resident					1.734***	1.355***	1.223**
					(0.11)	(0.095)	(0.086)
Pat-Resident $_{partner}$					1.767***	1.313***	1.411***
					(0.10)	(0.086)	(0.098)
R&D%GDP					1.927***	2.871***	2.122***
					(0.18)	(0.32)	(0.24)
R&D%GDP $_{partner}$					1.346***	2.291***	2.561***
					(0.11)	(0.24)	(0.28)
RQ						0.814	0.933
						(0.094)	(0.11)
Polity2						0.955	0.949
						(0.032)	(0.030)
EPI						0.970*	
						(0.012)	
EPI $_{partner}$						0.911***	
						(0.013)	
EH							1.095***
							(0.016)
EH $_{partner}$							0.924***
							(0.012)
EV							0.964***
							(0.0087)
EV $_{partner}$							0.957***
							(0.010)
N	163146	163146	160511	116465	49993	38588	38588
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EU Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	75090.1	74948.8	74233.3	54957.5	27935.0	22085.8	22007.3
BIC	75290.1	75188.9	74502.9	55247.5	28243.7	22376.9	22315.5

Exponentiated coefficients reported indicate Incidence-Rate Ratios (IRR)
Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5 / Poisson regression results – pooled sample (2000-2011)

Dep: TBT STC	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
TBT STC $_{partner}$	2.129***	1.868***	1.868***	1.849***	1.496***	1.519***	1.509***
	(0.095)	(0.086)	(0.087)	(0.087)	(0.069)	(0.071)	(0.070)
TBT STC $_{partner\ (t-1)}$	2.236***	1.814***	1.765***	1.758***	1.311***	1.335***	1.332***
	(0.14)	(0.12)	(0.12)	(0.12)	(0.094)	(0.096)	(0.096)
TBO	0.991***	0.991***	0.991***	0.992***	1.007***	1.006***	1.006***
	(0.0015)	(0.0016)	(0.0016)	(0.0016)	(0.00091)	(0.00091)	(0.00100)
TBO $_{(t-1)}$	0.992***	0.991***	0.991***	0.991***	0.993***	0.994***	0.992***
	(0.0015)	(0.0015)	(0.0015)	(0.0016)	(0.0015)	(0.0014)	(0.0013)
Import		1.068***	1.061***	1.061***	1.027	1.026	1.030*
		(0.015)	(0.015)	(0.015)	(0.014)	(0.014)	(0.014)
Import $_{(t-1)}$		0.994	0.990	0.983	0.955***	0.967*	0.969*
		(0.014)	(0.014)	(0.014)	(0.013)	(0.013)	(0.013)
Export		1.051***	1.051***	1.052***	1.022	1.017	1.013
		(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Export $_{(t-1)}$		1.046***	1.047***	1.045**	1.003	1.006	1.005
		(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
No. CN8			1.000***	1.000***	1.001***	1.001***	1.001***
			(0.000045)	(0.000045)	(0.000048)	(0.000048)	(0.000048)
RCA			0.971***	0.972***	0.990	0.987	0.987
			(0.0079)	(0.0078)	(0.0069)	(0.0076)	(0.0075)
RCA $_{partner}$			1.004	1.006**	1.019***	1.017***	1.017***
			(0.0023)	(0.0021)	(0.0016)	(0.0017)	(0.0018)
ΔGDP $_{ij}$				1.037**	1.003	1.005	0.999
				(0.013)	(0.014)	(0.013)	(0.013)
Deflator				0.931***	1.105***	1.002	1.009
				(0.011)	(0.019)	(0.018)	(0.018)
Deflator $_{partner}$				0.823***	0.832***	0.829***	0.826***
				(0.0095)	(0.011)	(0.012)	(0.012)
Pat-Non-Resident					0.676***	0.662***	0.638***
					(0.0048)	(0.0048)	(0.0047)
Pat-Non-Resident $_{partner}$					0.994	1.004	0.997
					(0.0083)	(0.0085)	(0.0085)
Pat-Resident					1.835***	1.750***	1.824***
					(0.021)	(0.019)	(0.021)
Pat-Resident $_{partner}$					1.290***	1.267***	1.268***
					(0.012)	(0.012)	(0.012)
R&D%GDP					0.902***	1.039	1.083***
					(0.018)	(0.020)	(0.022)
R&D%GDP $_{partner}$					0.903***	0.909***	0.899***
					(0.012)	(0.013)	(0.015)
RQ						1.027	1.421***
						(0.039)	(0.072)
Polity2						0.957***	0.974***
						(0.0037)	(0.0037)
EPI						0.985***	
						(0.0025)	
EPI $_{partner}$						0.996**	
						(0.0015)	
EH							0.976***
							(0.0015)
EH $_{partner}$							0.999
							(0.00072)
EV							1.007***
							(0.0019)
EV $_{partner}$							0.996*
							(0.0019)
N	579830	579830	579830	579830	579830	579830	579830
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EU Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes
pseudo R^2	0.055	0.070	0.072	0.075	0.133	0.138	0.141
AIC	77988.7	76686.6	76604.8	76332.7	71594.6	71183.3	70895.6
BIC	78169.0	76912.1	76864.0	76625.7	71955.2	71589.1	71323.9

Exponentiated coefficients- IRR reported indicate Incidence-Rate Ratios
Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6 / Poisson regression results – pooled sample (1995-2011)

Dep: TBT STC	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
TBT STC $_{partner}$	2.355***	2.018***	1.748***	1.409***	1.399***	1.519***	1.509***
	(0.072)	(0.065)	(0.057)	(0.059)	(0.061)	(0.071)	(0.070)
TBT STC $_{partner\ (t-1)}$	2.896***	2.413***	2.066***	1.974***	1.304***	1.335***	1.332***
	(0.10)	(0.089)	(0.079)	(0.088)	(0.088)	(0.096)	(0.096)
TBO	0.990***	0.990***	0.990***	0.990***	1.003	1.006***	1.006***
	(0.0011)	(0.0011)	(0.0010)	(0.0010)	(0.0018)	(0.00091)	(0.00098)
TBO $_{(t-1)}$	0.994***	0.994***	0.994***	0.995***	0.990***	0.994***	0.992***
	(0.00063)	(0.00063)	(0.00063)	(0.00062)	(0.0011)	(0.0014)	(0.0013)
Import		1.084***	1.098***	1.082***	1.024	1.026	1.030*
		(0.0086)	(0.0091)	(0.010)	(0.014)	(0.014)	(0.014)
Import $_{(t-1)}$		0.996	1.007	1.002	0.968*	0.967*	0.969*
		(0.0078)	(0.0082)	(0.0094)	(0.013)	(0.013)	(0.013)
Export		1.054***	1.061***	1.064***	1.029*	1.017	1.013
		(0.0083)	(0.0087)	(0.0096)	(0.013)	(0.014)	(0.014)
Export $_{(t-1)}$		1.026**	1.034***	1.042***	0.996	1.006	1.005
		(0.0082)	(0.0085)	(0.0094)	(0.013)	(0.014)	(0.014)
No. CN8			1.000***	1.000**	1.001***	1.001***	1.001***
			(0.000029)	(0.000033)	(0.000044)	(0.000048)	(0.000048)
RCA			0.986***	0.978***	0.997	0.987	0.987
			(0.0022)	(0.0031)	(0.0042)	(0.0076)	(0.0075)
RCA $_{partner}$			0.989***	0.989***	1.016***	1.017***	1.017***
			(0.0014)	(0.0017)	(0.0016)	(0.0017)	(0.0018)
ΔGDP $_{ij}$				1.008	0.959***	1.005	0.999
				(0.0080)	(0.011)	(0.013)	(0.013)
Deflator				0.942***	1.044**	1.002	1.009
				(0.0084)	(0.015)	(0.018)	(0.018)
Deflator $_{partner}$				0.799***	0.813***	0.829***	0.826***
				(0.0056)	(0.0087)	(0.012)	(0.012)
Pat-Non-Resident					0.690***	0.662***	0.638***
					(0.0048)	(0.0048)	(0.0047)
Pat-Non-Resident $_{partner}$					1.034***	1.004	0.997
					(0.0085)	(0.0085)	(0.0085)
Pat-Resident					1.742***	1.750***	1.824***
					(0.018)	(0.019)	(0.021)
Pat-Resident $_{partner}$					1.251***	1.267***	1.268***
					(0.011)	(0.012)	(0.012)
R&D%GDP					0.885***	1.039	1.082***
					(0.017)	(0.020)	(0.022)
R&D%GDP $_{partner}$					0.910***	0.909***	0.899***
					(0.012)	(0.013)	(0.015)
RQ						1.027	1.421***
						(0.039)	(0.072)
Polity2						0.957***	0.974***
						(0.0037)	(0.0037)
EPI						0.985***	
						(0.0025)	
EPI $_{partner}$						0.996**	
						(0.0015)	
EH							0.976***
							(0.0015)
EH $_{partner}$							0.999
							(0.00072)
EV							1.007***
							(0.0019)
EV $_{partner}$							0.996*
							(0.0019)
N	2280157	2280157	2051587	1566943	727326	579830	579830
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EU Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
pseudo R^2	0.056	0.074	0.081	0.084	0.132	0.138	0.141
AIC	209699.4	205664.7	199609.4	156197.5	85361.7	71183.0	70895.5
BIC	209964.8	205980.7	199960.4	156577.7	85775.6	71588.7	71323.8

Exponentiated coefficients reported indicate Incidence-Rate Ratios (IRR)
Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7 / Poisson regression results – EU vs. non-EU – pooled sample (2000-2011)

Sample:	Non-EU		EU	
Dep: TBT STC	**Model 6**	**Model 7**	**Model 6**	**Model 7**
TBT STC $_{partner}$	1.689***	1.680***	1.284***	1.253**
	(0.13)	(0.13)	(0.094)	(0.092)
TBT STC $_{partner\ (t-1)}$	1.085	1.066	0.948	0.913
	(0.11)	(0.11)	(0.096)	(0.094)
TBO	1.008***	1.008***	1.052***	1.051***
	(0.00091)	(0.00092)	(0.0054)	(0.0057)
TBO $_{(t-1)}$	1.000	0.999	0.986**	0.987*
	(0.0013)	(0.0014)	(0.0051)	(0.0054)
Import	1.019	1.015	1.049*	1.045*
	(0.020)	(0.020)	(0.020)	(0.019)
Import $_{(t-1)}$	0.979	0.988	0.958*	0.958*
	(0.018)	(0.019)	(0.017)	(0.017)
Export	0.997	0.990	1.023	1.025
	(0.021)	(0.021)	(0.017)	(0.017)
Export $_{(t-1)}$	0.991	0.987	1.009	1.014
	(0.021)	(0.020)	(0.017)	(0.017)
No. CN8	1.002***	1.002***	1.001***	1.001***
	(0.000079)	(0.000080)	(0.000071)	(0.000071)
ΔGDP $_{ij}$	1.258***	1.203***	0.907***	0.883***
	(0.029)	(0.031)	(0.013)	(0.012)
Deflator	1.159***	1.206***	0.999	1.000
	(0.032)	(0.034)	(0.030)	(0.032)
Deflator $_{partner}$	0.909***	0.947*	0.838***	0.839***
	(0.024)	(0.025)	(0.019)	(0.018)
RCA	0.952	0.958	0.997	0.996
	(0.030)	(0.030)	(0.0031)	(0.0033)
RCA $_{partner}$	1.011***	1.011***	1.031***	1.030***
	(0.0024)	(0.0024)	(0.0033)	(0.0033)
Pat-Non-Resident	1.209***	1.070*	0.999	0.994
	(0.031)	(0.035)	(0.025)	(0.025)
Pat-Non-Resident $_{partner}$	0.708***	0.732***	1.908***	1.966***
	(0.0095)	(0.0097)	(0.058)	(0.069)
Pat-Resident	1.619***	1.733***	0.994	0.993
	(0.031)	(0.039)	(0.026)	(0.026)
Pat-Resident $_{partner}$	1.526***	1.486***	0.949**	0.925***
	(0.031)	(0.030)	(0.018)	(0.020)
R&D%GDP	1.152***	1.300***	0.972	0.963
	(0.043)	(0.054)	(0.026)	(0.027)
R&D%GDP $_{partner}$	0.894***	0.841***	0.736***	0.855***
	(0.023)	(0.023)	(0.019)	(0.026)
RQ	0.308***	0.461***	1.033	1.051
	(0.020)	(0.053)	(0.066)	(0.067)
Polity2	1.052***	1.048***	0.998	0.998
	(0.0046)	(0.0053)	(0.033)	(0.034)
EPI	0.955***		0.994	
	(0.0044)		(0.0046)	
EPI $_{partner}$	1.032***		0.986***	
	(0.0032)		(0.0022)	
EH		0.971***		0.999
		(0.0029)		(0.0043)
EH $_{partner}$		1.025***		0.990***
		(0.0023)		(0.00087)
EV		0.995		0.996
		(0.0042)		(0.0033)
EV $_{partner}$		1.009**		1.008*
		(0.0029)		(0.0033)
N	359107	359107	220723	220723
Time FE	Yes	Yes	Yes	Yes
pseudo R^2	0.257	0.262	0.213	0.215
AIC	25669.9	25524.6	36477.5	36408.5
BIC	26047.6	25923.9	36827.9	36779.5

Exponentiated coefficients reported indicate Incidence-Rate Ratios (IRR)
Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8 / FEP regression results – controlling for possible endogeneity – sample (2000-2011)

Dep: TBT STC	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
TBT STC $_{\text{partner (t-1)}}$	0.835*	0.812**	0.789**	0.832*	0.825*	0.813*	0.833*
	(0.064)	(0.063)	(0.063)	(0.069)	(0.071)	(0.070)	(0.071)
TBT STC $_{\text{partner (t-2)}}$	1.838***	1.771***	1.693***	1.785***	1.768***	1.740***	1.724***
	(0.076)	(0.072)	(0.072)	(0.077)	(0.078)	(0.078)	(0.072)
TBO $_{\text{(t-1)}}$	1.011*	1.010*	1.010*	1.007	1.004	1.004	1.003
	(0.0046)	(0.0046)	(0.0046)	(0.0045)	(0.0047)	(0.0047)	(0.0049)
TBO $_{\text{(t-2)}}$	1.015**	1.013**	1.013**	1.012**	1.010**	1.010**	1.010**
	(0.0052)	(0.0049)	(0.0047)	(0.0040)	(0.0033)	(0.0032)	(0.0032)
Import $_{\text{(t-1)}}$		1.073***	1.071***	1.075***	1.073***	1.075***	1.077***
		(0.019)	(0.019)	(0.020)	(0.020)	(0.020)	(0.020)
Import $_{\text{(t-2)}}$		1.047*	1.045*	1.043*	1.017	1.019	1.025
		(0.019)	(0.019)	(0.019)	(0.018)	(0.018)	(0.019)
Export $_{\text{(t-1)}}$		1.082***	1.080***	1.083***	1.069***	1.064**	1.065**
		(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Export $_{\text{(t-2)}}$		1.126***	1.122***	1.125***	1.104***	1.100***	1.092***
		(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.021)
No. CN8			0.996***	0.996***	0.997***	0.997***	0.997***
			(0.00059)	(0.00060)	(0.00065)	(0.00066)	(0.00065)
RCA			0.838***	0.846***	0.871**	0.886*	0.881*
			(0.042)	(0.043)	(0.044)	(0.044)	(0.044)
RCA $_{\text{partner}}$			0.910*	0.913*	0.922*	0.920*	0.910*
			(0.034)	(0.037)	(0.035)	(0.034)	(0.035)
ΔGDP $_{\text{ij}}$				0.939	0.897**	0.911**	0.921*
				(0.036)	(0.031)	(0.032)	(0.033)
Deflator				1.191***	1.161***	1.154***	1.180***
				(0.034)	(0.032)	(0.032)	(0.032)
Deflator $_{\text{partner}}$				0.711***	0.746***	0.736***	0.745***
				(0.017)	(0.018)	(0.018)	(0.018)
Pat-Non-Resident					0.771***	0.766***	0.799***
					(0.028)	(0.028)	(0.030)
Pat-Non-Resident $_{\text{partner}}$					0.611***	0.600***	0.621***
					(0.025)	(0.025)	(0.026)
Pat-Resident					1.750***	1.704***	1.477***
					(0.14)	(0.14)	(0.12)
Pat-Resident $_{\text{partner}}$					1.086	1.037	1.121
					(0.073)	(0.070)	(0.079)
R&D%GDP					2.538***	2.551***	1.712***
					(0.29)	(0.30)	(0.20)
R&D%GDP $_{\text{partner}}$					2.498***	2.562***	2.870***
					(0.29)	(0.30)	(0.34)
RQ						1.299*	1.536**
						(0.17)	(0.20)
Polity2						0.982	0.977
						(0.031)	(0.029)
EPI						0.954**	
						(0.014)	
EPI $_{\text{partner}}$						0.921***	
						(0.014)	
EH							1.125***
							(0.017)
EH $_{\text{partner}}$							0.928***
							(0.012)
EV							0.943***
							(0.0098)
EV $_{\text{partner}}$							0.967**
							(0.011)
N	35293	35293	35293	35293	35293	35293	35293
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	20814.0	20670.2	20610.2	20377.6	19962.1	19928.0	19821.7
BIC	20932.6	20822.7	20788.1	20580.9	20216.2	20216.0	20126.7

Exponentiated coefficients reported indicate Incidence-Rate Ratios (IRR)
Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 9 / FEP regression results – EU as single economy – sample (2000-2011)

Dep: TBT STC	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
TBT STC $_{partner}$	0.482***	0.472***	0.458***	0.442***	0.440***	0.446***	0.465***
	(0.10)	(0.099)	(0.096)	(0.094)	(0.093)	(0.095)	(0.099)
TBT STC $_{partner\ (t-1)}$	0.702	0.670	0.639*	0.697	0.678	0.689	0.736
	(0.15)	(0.14)	(0.13)	(0.14)	(0.14)	(0.14)	(0.15)
TBO	1.034**	1.034**	1.034**	1.035**	1.030**	1.024*	1.022*
	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
TBO $_{(t-1)}$	1.003	1.002	1.002	1.004	0.999	1.002	1.002
	(0.0039)	(0.0042)	(0.0041)	(0.0046)	(0.0057)	(0.0058)	(0.0059)
Import		1.226**	1.227**	1.194**	1.158*	1.208*	1.165
		(0.083)	(0.084)	(0.081)	(0.085)	(0.096)	(0.092)
Import $_{(t-1)}$		1.060	1.060	1.051	1.056	1.156*	1.190*
		(0.066)	(0.066)	(0.064)	(0.064)	(0.077)	(0.082)
Export		1.016	1.022	1.021	0.953	0.922	0.936
		(0.078)	(0.079)	(0.080)	(0.076)	(0.073)	(0.073)
Export $_{(t-1)}$		1.167*	1.156	1.155	1.120	1.142	1.131
		(0.089)	(0.088)	(0.089)	(0.080)	(0.081)	(0.083)
No. CN8			0.994***	0.993***	0.993***	0.993**	0.993**
			(0.0017)	(0.0017)	(0.0020)	(0.0022)	(0.0022)
RCA			0.939	0.938	0.989	1.013	0.974
			(0.076)	(0.075)	(0.074)	(0.084)	(0.087)
RCA $_{partner}$			0.943	0.950	0.946	0.944	0.940
			(0.049)	(0.050)	(0.053)	(0.057)	(0.056)
ΔGDP $_{ij}$				0.634***	0.730**	0.718**	0.765*
				(0.068)	(0.082)	(0.085)	(0.091)
Deflator				0.740***	0.602***	0.475***	0.438***
				(0.056)	(0.053)	(0.050)	(0.047)
Deflator $_{partner}$				0.872*	0.914	0.796***	0.812**
				(0.051)	(0.054)	(0.052)	(0.053)
Pat-Non-Resident					0.486**	0.215***	0.179***
					(0.12)	(0.066)	(0.054)
Pat-Non-Resident $_{partner}$					1.317	1.287*	1.348*
					(0.19)	(0.16)	(0.19)
Pat-Resident					3.079***	8.011***	6.774***
					(0.76)	(2.78)	(2.28)
Pat-Resident $_{partner}$					0.983	0.735*	0.883
					(0.13)	(0.097)	(0.13)
R&D%GDP					5.881***	19.63***	9.069***
					(1.66)	(7.85)	(3.92)
R&D%GDP $_{partner}$					0.732	0.987	0.968
					(0.19)	(0.27)	(0.27)
RQ						0.0420***	0.0453***
						(0.021)	(0.023)
Polity2						1.071	1.015
						(0.14)	(0.083)
EPI						0.794***	
						(0.043)	
EPI $_{partner}$						0.769***	
						(0.039)	
EH							1.123**
							(0.048)
EH $_{partner}$							0.909***
							(0.025)
EV							0.766***
							(0.035)
EV $_{partner}$							0.849***
							(0.034)
N	6346	6346	6346	6346	6346	6346	6346
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	3525.8	3506.7	3501.8	3462.6	3385.1	3302.6	3281.8
BIC	3620.4	3628.3	3643.6	3624.7	3587.8	3532.3	3525.0

Exponentiated coefficients reported indicate Incidence-Rate Ratios (IRR)
Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 10 / GMM Poisson regression results – pooled sample (1995-2011)

Dep: TBT STC	Model 6A	Model 6B	Model 6C
TBT STC $_{partner}$	9.663**	9.663**	9.663**
	(4.75)	(4.21)	(4.19)
TBO	0.0335**	0.0335**	0.0335**
	(0.015)	(0.013)	(0.013)
Import	-1.826*	-1.826**	-1.826**
	(0.95)	(0.87)	(0.87)
Export	1.266**	1.266**	1.266**
	(0.58)	(0.54)	(0.54)
RCA	-1.267**	-1.267***	-1.267***
	(0.52)	(0.47)	(0.47)
RCA $_{partner}$	0.188*	0.188**	0.188**
	(0.10)	(0.092)	(0.092)
ΔGDP $_{ij}$	1.424	1.424*	1.424*
	(1.09)	(0.83)	(0.82)
Pat-Non-Resident	-5.298**	-5.298**	-5.298**
	(2.60)	(2.29)	(2.28)
Pat-Non-Resident $_{partner}$	-0.104	-0.104	-0.104
	(0.64)	(0.52)	(0.52)
Pat-Resident	6.853*	6.853**	6.853**
	(3.56)	(3.07)	(3.06)
Pat-Resident $_{partner}$	1.133	1.133**	1.133**
	(0.69)	(0.54)	(0.53)
R&D%GDP	2.079*	2.079*	2.079*
	(1.25)	(1.15)	(1.14)
R&D%GDP $_{partner}$	-2.121	-2.121	-2.121
	(1.57)	(1.38)	(1.38)
EPI	-0.345*	-0.345*	-0.345*
	(0.20)	(0.18)	(0.18)
EPI $_{partner}$	0.275	0.275*	0.275*
	(0.19)	(0.16)	(0.16)
Constant	-59.28*	-59.28**	-59.28**
	(35.9)	(29.9)	(29.7)
N	711183	711183	711183
Hansen's J chi2(2)	3.59698	3.59698	3.59698
Hansen's J p	0.1655	0.1655	0.1655
Two-Step	Yes	Yes	Yes
vce	Country Pair	ID	Robust
Wmatrix	Newey-West	Newey-West	Newey-West

Instruments: TBT STC $_{partner\ (t-1)}$, TBO $_{(t-1)}$, Export $_{(t-1)}$, No. CN8, RQ, Polity2, ΔGDP $_{ij}$, Real GDP, Real GDP $_{partner}$, RCA, RCA $_{partner}$, EU, EU $_{partner}$, EH, EH $_{partner}$, EV, EV $_{partner}$

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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