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Technical Barriers to Trade:
Determinants and Implications

Tesi di Dottorato di: Mahdi Ghodsi
Matricola: 4011031
Anno Accademico 2013/14

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Coordinatore: Ch.mo Prof. Gianluca Femminis

Advisor: Prof. Carsten Krabbe Nielsen

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ABSTRACT

Almost all tariff lines are bound within the schedules of concessions of developed countries, and duties cannot be used to increase the level of protection. Instead, increasing number of non-tariff measures (NTMs) have given rise to disputes and trade conflicts. World Trade Organization (WTO) regulations consider certain motivations behind imposition of these instruments to be legitimate such as those related to human, environment, health, and safety issues. While regulations of the WTO oblige governments to provide justifiable reason behind their trade policy instruments, they might as well seek for the sale of their industrial protection to some special interest groups supporting them. Technical Barriers to Trade (TBTs) are a sub-category of NTMs with complex nature whose either motivations or implications are not very clear. In this dissertation, I shed light on some aspects of NTMs with specific focus on TBT and Specific Trade Concerns (STCs). In the first chapter, I study the determining factors of TBT STCs over the period 1995-2011. In the second chapter, the trade effects of these TBT STCs maintained by the European Union, China, and the United States at 4-digit level of Harmonized System will be analysed. In the third chapter, I provide a cost-benefit analysis in a partial equilibrium framework to quantify the welfare consequences of a prohibitive NTM which is aimed at a foreign product with negative characteristics. Overall, this dissertation emphasizes more on the complexity of NTMs and it provides us with better insights on the determinants and implications of these trade policy measures.

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INTRODUCTION

Liberalization in trade, and free market access to resources and products beyond borders have been vital need for societies. Economists have tried to acknowledge this fact using theoretical modeling frameworks. International economic theorists have tried to establish frameworks for providing sufficient and logical motivations behind trade. Moreover, they delivered policy implications providing benchmarks for peaceful exchange of goods, services, resources, and commerce that could be beneficial for all economies involving in international trade. Gradually during history, conflicts and wars are replaced by international relations interlinked with international economics and trade. Governments have also become pursuant of a solid framework to negotiate their mutual desires and benefits within agreements and organizations established after the Second World War.

The welfare increasing effects of trade has been widely studied in the economic literature starting by economic pioneers such as Adam Smith and David Ricardo. Smith (1776) and Smith and Nicholson (1887) countered the dominant ideas of mercantilism during 17th and 18th century by developing the idea of the absolute advantage. It was the pioneer theory describing the enjoyment of both sides of trade from free trade while mercantilists had argued that only exports would have increased the wealth of a nation. Later, David Ricardo improved this concept by indicating benefits of free trade from comparative advantages in the production of products by the two trade partners. There was no more necessity to explain the motivation behind trade by having absolute advantage in production of goods and services. Even if the labor productivity in a country in every good is lower than another country, there will be a win-win situation in trade where all labors can consume more in all trading countries (Ricardo, 1891). The simple assumptions of Ricardian model have become more realistic using many other factors of productions and varieties of products within the strand of the literature (Stolper and Samuelson, 1941; Oniki and Uzawa, 1965).

The Heckscher-Ohlin theorem has later produced a framework to the mobility of factors of production that can be considered as another type of trade in resources. Trade based on the abundance of factors of production grounded by this theorem has been tested by Leontief (1953). He found the well-known paradox that the United States had been exporting goods that were less capital-intensive than those being imported, while US was more capital abundant than other trading partners. Later work of Leamer (1980) questioned the findings of Leontief and suggested that correct interpretations would not bring Leontief Paradox. Continuous criticisms on these theories of trade have brought other scholars to the New Trade Theory emphasizing on monopolistic competition, increasing returns to scale, and firms heterogeneity (Armington, 1969; Krugman, 1979, 1980, 1981, 1987; Helpman, 1981; Melitz, 2003; and Bernard et al., 2007).

The recent improvement in theoretical modelling of trade has brought more realistic policy implications of international trade studies. Theories of International Trade have been widely tested using various datasets by different scholars (Loertscher and Wolte, 1980; Helpman, 1988, and 1998; Evenett and Keller, 1998; Bernhofen, 1999; Cieślik, 2005, 2009). While

benefits of liberalization in international trade have been emphasized in the literature, trade policy has been used as a means to control trade flows. Tariffs and non-tariff measures (NTMs) encompassing various instruments such as trade quotas, subsidies, reciprocal dumping, antidumping, technical standards, and etc. are different approaches to control the trade flows.

Issues related to trade policy, its determinants and consequences have been discussed within textbooks and economic articles (Helpman and Krugman, 1989; Francois and Reinert, 1997). In their seminal paper, Grossman and Helpman (1992) established a framework to show how governments will support special interest groups by imposing trade policies. Governments are protecting the domestic industry against foreign competitors using policy instruments. In fact, they called this process protection for sale. This protectionism is disturbing trade and raising trade conflicts among trade partners. However, this is one of the motivations behind some trade policies, which does not receive the approval of trading partners. In order to satisfy trade partners with the imposed policy, governments need to provide acceptable and justifiable reasoning behind their actions. Motivations behind protectionism and many other trade policies are described broadly in the literature.

By signing General Agreement on Tariffs and Trade (GATT) in 1948, countries have decided to improve the liberalization of international trade, which consequently was replaced by World Trade Organization (WTO) by the end of 1994. The ultimate aim of GATT signatories was to provide an organization overseeing the multilateral trading system. This system firstly monitors the implementation of its regulations to ensure that trade is flowing as freely, smoothly, and predictability as possible. Secondly, it provides litigation at the time of trade disputes and conflicts between the member states.

Trade policies can serve governments pursuing various motivations. Some policy measures can be helpful for acceleration and liberalization of trade flows, or even for market efficiency improvement which are carefully but broadly described within international regulations of WTO. In contrast, some other policy measures can be purely unnecessary obstacles to trade serving as protectionist actions benefitting domestic industries of member states. These protectionist obstacles are considered as violations of international trade agreements causing trade disputes and conflicts. Studying the determining factors behind impositions of trade policy instruments can be a helpful approach to understand the main motivations of governments behind their policies. Moreover, studying the consequences and effects of trade policies can show the level of trade protectionism. More precisely, the consequences of policy instruments in various environments with different types of products can provide better insights to countries and WTO secretariat for understanding the true nature of policies.

Since GATT in 1948, tariffs on trade between the WTO members have fallen dramatically to foster trade liberalization. Instead, Non-tariff measures (NTMs) have been drawing global attention, due to their complex nature. Tariffs, quotas, and subsidies are quantifiable trade policy instruments whose causes and effects are commonly straightforward. These measures are showing their true nature because they are ad-valorem tax rates imposed on the importation of products. Moreover, the motivation behind their imposition is mainly to

reduce the amount of products imports by increasing the final consumer pricing. In fact, tariffs can disturb the free market system, and consumers' behavior will be affected dramatically. On the other hand, the exporting producer will also change its strategy in response to the new behavior of consumer and new market disturbances. The consequences of these issues can be simply evaluated due to the transparent nature of tariffs. Consequently, the motivation and reasoning of the government manipulating tariffs can be very clear.

NTMs are specific trade policy instruments with complex implications and opaque reasoning. Bilateral and multilateral agreements and international regulations mandated by the WTO are set to increase the liberalization in trade. Some categories of NTMs, such as Technical Barriers to Trade (TBTs), Sanitary and Phytosanitary Measures (SPSs) are qualitative measures whose neither causes nor effects are obvious. Technical issues and new standards have brought governments to mutual understanding of imposition of NTMs in order to increase market efficiencies, consumers' welfare, and global safety and health. Therefore, in the context of international rules and regulations, countries are eligible to impose restrictions on imports for some technical, safety, health, and environmental issues. However, the imposition of NTMs needs to have justifiable and/or scientific reasoning. Otherwise, the NTMs will be considered as unnecessary obstacles to trade and should be abolished as soon as trading partners are concerned. For instance, a TBT can be introduced to prohibit the import of a specific product to a country because of its harms for the human health of the society. Nonetheless, the government might conceal its other motives behind the technical evidence for such trade measure. Therefore, it is not quite clear what the real causes of such trade policy are in addition to safety issues. When trading partners cannot get to mutual agreements regarding the policy instrument, they will have consultation within the dispute settlement mechanism (DSM) of the WTO.

While the causes and motives behind TBTs are not very clear, its impact on trade flows and economies are not very obvious as well. For instance, the mandatory labeling of products can increase the information symmetries in the market improving efficiencies. This might lead to higher demand of well-informed consumers, which improves the trade flows. However, depending on the product characteristics, such mandatory regulation might be very costly. A huge cost burden on the exporter might negatively affect the trade flows if the product has a large price elasticity of demand. Therefore, two-folded consequences of these trade policy measures would make it more difficult to provide direct policy recommendation. The opaque and complex nature of NTMs is the main issue of this dissertation.

In this dissertation, I am trying to shed light on some aspects of NTMs, studying both their causes and effects. I contribute to the existing literature on international trade policy by focusing on a specific TBT whose implications raise Specific Trade Concerns (STCs) by WTO members. As mentioned earlier, the determinants of trade protectionism and motivations behind policy impositions are widely studied in the literature. While governments provide various justifiable reasoning behind their policy instruments, they might as well seek for the sale of their domestic protection to some special interest groups supporting their elections. In the first chapter of this dissertation, I will focus on various determining factors inducing TBT STC measures. In words, within an empirical analysis, I

show the motivations behind imposition of these specific NTMs by a country, and also identify the causes behind raising STCs on these policy measures by other countries. The econometric analysis is covering a data on all WTO member states over the period 1995-2011. The outcomes of the analysis acknowledge the aforementioned issues regarding the complexity of NTMs. More precisely, in addition to safety and technical issues, industrial protectionism, institutional qualities, and economic development are other drivers of TBT STC imposition.

The European Union, China, and the United States of America are respectively the largest WTO members using TBT STCs. Besides, the EU and the US have been asked for consultations within the DSM of the WTO regarding the violations of TBT agreement more than any other members have. In the second chapter of this dissertation, the trade impact of TBT STCs imposed by these three major world economies will be analyzed. Controlling for unbiasedness and consistency of estimations, the econometrics analysis of the chapter covers the period 1995-2011. The results of the study support the complex implications of these trade policy instruments. Depending on the characteristics of the TBT STCs, the imposing country, and the trade partners, these types of NTMs have diverse impact on trade flows.

Following the benefits of liberalization, the third chapter establishes a cost-benefit analysis in a partial equilibrium to dig deeper in the benefits of free trade, when a prohibitive NTM halts the importation of a specific product that is believed to be harmful by a group of concerned consumers in that society. This chapter helps governments, trade partners, and WTO secretariat to have better insights on the consequences of NTMs. Due to the opaque nature of NTMs it will be very difficult to figure out the true motivation of governments. Consumer awareness and information policies by the government are major issues affecting the welfare changes of the economy. Within the context of international regulations, it is important to justify NTMs by their motivations. Generally, a faithful NTM can improve the consumers' welfare rather than the industrial profits. The former can be defined as protection of health, environment, and safety issues, while the latter might stem from protectionism for sale. The distinction between the two and the policy impact on them can show a guideline for the true motivations behind impositions of NTM.

CHAPTER 1

Determinants of Specific Trade Concerns on Technical Barriers to Trade Notifications

1.1. Introduction:

Since the General Agreement on Tariffs and Trade (GATT) in 1948 tariffs on trade between the World Trade Organization (WTO) members have fallen. However, non-tariff measures (NTMs) have received worldwide attention. Even the World Trade Report 2012 and United Nations Conference on Trade and Development (UNCTAD) in 2010 and 2013 are specifically focusing on these policy measures. Technical Barriers to Trade (TBTs) are one of the most important category 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 can potentially harm human or environmental health, countries are authorized to impose restrictive regulations such as TBT and SPS measures to avoid the damage concerning their domestic society. On the other hand, since these measures can dramatically change the patterns of trade, countries might also apply these instruments in the pursuit of their domestic industries protection. It is not clearly understandable to distinguish between these two motivations. However, it is possible to find proxies for these issues and discover the relationship between imposition of new measures and these motivations.

To increase transparency of trade policies of governments, 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 can also inform WTO minutes recording. 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 will be a chance that WTO becomes informed by other members facing NTM. WTO secretariat has provided a data on TBT STCs, which covers TBT notifications that have been raised as an STC by members.

TBTs are not similar to some other NTM measures such as antidumping following only economic reasoning. They might have also some non-economic reasoning behind such as due to environmental and health issues. Such issues are one of the main important reasons that WTO regulations legitimize these kinds of NTMs. Some of these faithful incentives might be completely observable in a regulation with scientific motivations behind, which will be considered officially permitted by WTO member states and the organization itself. However, some of these measures might arise some concerns by some of the member states because firstly the scientific non-economic issues behind are not easily verifiable, and secondly the trade disturbance effects are significantly large. Therefore, some of these regulations cannot

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[1] World Integrated Trade Solution (WITS) 2012

be **Figure 1.1- Trend of TBT STCs and their coverage**
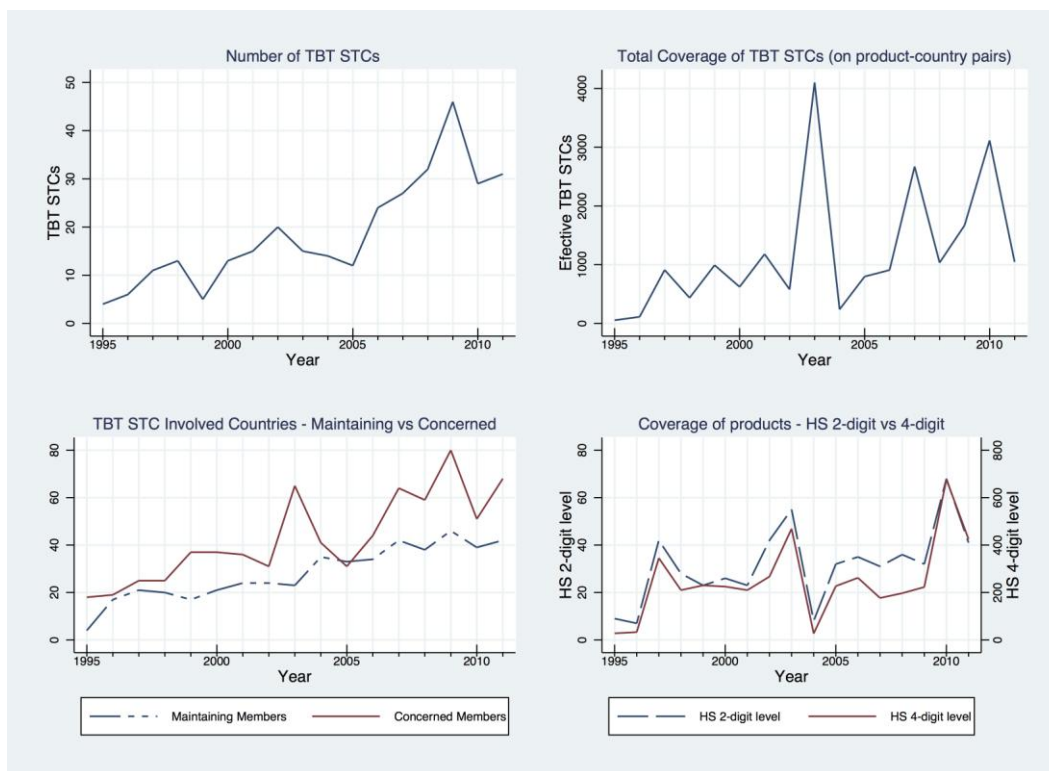
easily acceptable by the members and they will be notified to the WTO secretariat within a reverse notifying system. This process format was written in the regulations to avoid any member concealing the imposed regulations by not notifying it directly. Hence, such system shall provide an assured security providing liberalized trade. This system provides Specific Trade Concerns (STC) on the imposed TBT notifications, to provide some information about the specific regulations which might possibly follow protectionism and economic intuitions.

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

Figure 1.1 shows the trend of TBT STCs over period 1995-2011. It is observed that the number of these TBT STCs has been gradually increasing during time (see upper left panel). Especially during the 2007-2008 crises, there was a sharp rise in these notifications. The World Trade Report (2012) states that usage of NTM instruments have been increased during the recent financial crisis to adjust the market inefficiencies in order to assist countries finding a way out of crisis. Each TBT STC involves various groups of products. The product (at 2-digit HS on the left vertical axis, and at 4-digit level on the right axis) coverage 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.

The upper right panel of figure 1.1 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 Authorization of Chemicals (REACH). This TBT covers a vast category of products processed using chemicals that raised concerns of many countries in the world. This STC was firstly raised by the representative of the United States. Based on the WTO documents, US believed that the white paper on chemicals issued by the EU would have 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 are concerned of others' TBTs have also been increased. This suggests that not only usage of TBTs by importing countries have increased during this period, but also these TBTs have been more painful for trade partners because of their vulnerability during the period.

Although this TBT STC database does not cover all TBT notifications information is very helpful for conducting economic analyses. Ghodsi and Michalek (2014) found that these TBT STCs have positive linkages to the Dispute Settlement (DS) cases of WTO citing the TBT agreement. This paper 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 the governments for the imposition of TBT measures for which an STC is raised by the 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 analyzed applying a semi-gravity framework. Possible economic, institutional, technological, health and environmental variables are included in the analysis to realize their statistical impact on the probability of raising STCs on maintained TBTs. Not only the determinants of imposition of such TBTs are analyzed, but also the factors for raising STCs are investigated within this research. Since STCs cover a subset of TBTs that are very trade restrictive rising concerns of other countries, they seem to be the most impeding TBTs to be analyzed. This group of STCs has two-sided effects and determinants, on which the gravity regression can provide rich information on the characteristics of countries imposing and facing them. Protectionism and trade issues are analyzed by inclusion of bilateral Tariff Binding Overhang (TBO), imports, and exports. The novelty of this research is that the estimated data comprises 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 will be 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 will be elaborated in the fourth section. Finally, in section five the concluding remarks will be discussed.

1.2.   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 liberalized trade. Even 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 liberalization in trade. Quantitative restrictions (QRs) have been removed gradually and tariffs have been 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 have been 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. First parliamentary elections in Philippines in 1986 were followed by trade policy reforms reducing tariffs (Haggard, 1990). Lowering trade barriers in 1992 in South Korea took place after its democratic transition in 1987-88 (WTO, 1996). In Bangladesh, tariff dropped from 90% in 1990 to 20% by 1996 after transition to democracy during 1986-1992 (WTO, 2000). Even transition in Central and Eastern Europe to democracy facilitated the liberalization in trade and accession of many of the post-communist countries to the European Union.

Mansfield et al. (2000) and Edward et al. (2002) argue that in case trade policies are transparent, democratic countries are more probable to implement liberalized 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 country whose regime is more democratic, government shall be questioned or even might lose power if the rent seeking behavior becomes excessive. Thus, authorities should find a balance between support of interest groups and the general public as voters. A suitable way to show the support for liberal trade as a good gesture for the median voters' support 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 the bilateral regulations that reduces the consumers' welfare of the society can be publicized by the trade partner; thus, democratic governments will try to be more transparent and law-abiding rather than allowing for more rent seeking behavior of domestic interest-groups. PTA is thus following a domestic purpose to monitor governments in addition to worldwide support for the improvement of welfare. Therefore, it will not be easy anymore to impose restrictions on trade by transparent policies such as tariffs within a PTA.

In their empirical analysis for the post World War II, Mansfield et al. (2000) found that type of regime in a country significantly influences the choices for trade policies. According to their findings, democracy promotes international trade cooperation. Countries with democratic regimes are about two times more probable to establish a PTA with other countries rather than are autocratic regimes. Moreover, they found that when both bilateral partners are democratic countries, the probability of signing a PTA between them is four time as large as when at least one of the partners is not democratic.

According to Baba (1997), informing voters and in general consumers is costly. For instance, for the campaigns of presidency or parliament, candidates are trying to give information to voters for their support. These campaigns are quite costly, which are often supported by special interest-groups. Also other methods of informing consumers such as advertisement in the media are costly. Thus, in order to have informed consumers who are seeking for liberal trade, there should be a support from the lobbying groups or from the taxation of consumers

themselves. Politicians can easily inform the society with low costs for the simple transparent policy instruments such as tariffs, while they conceal the role of opaque and complex ones such as NTMs due to its high costs for informing.

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 explains why governments, even in the most democratic countries, try to implement opaque and complex trade policies instead of simple tariffs (Kono, 2006). Kono (2006) evidently found that democratic countries impose lower tariffs than autocratic countries do. This result is very similar to former studies such as Milner and Kubota (2005). NTMs are more likely imposed by regimes that are more democratic. Sophisticated Quality NTMs are more probable to be imposed than core NTMs in democratic countries.

While institutional and regime types of governments play important roles in imposition of trade policies, many other factors can affect such decision. Kono (2006) achieved his results by adding some variables as control for interest-group industries. Employment share of the industry in the total employment of the society is one of the main variables showing the importance of the sector in the country. Import penetration was another variable representing the ratio of imports to domestic output in the sector, which measures the importance of import in the sector. He finally found that these variables increase the probability of imposition of quality NTMs more than imposition of core NTMs.

Ray (1981) analyzed the determinants of tariff 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 protectionism measures and found a causal relationship from tariffs to NTMs. In other words, he stated that NTMs are supplements for tariffs. Both of these two types of policy instruments in US are more often used for the industries with comparative disadvantages. Moreover, for the industries in which welfare losses of the protectionism are large, these instruments are less often implemented. He also found that imposition of tariffs is significantly related to labor-intensive industries while NTMs are imposed on more capital-intensive industries as NTMs include a variety of technical measures.

Lee and Swagel (1997) analyzed the determinants of NTMs in 1988 over 41 countries in the world. They included tariff rates as one of the main factors for imposition of NTMs. They also considered labor productivity, wage per worker, and labor share of value added variables as the sector comparative advantage in each country. They conclude that protectionism by 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 with political importance and with relative comparative advantages are given more protection using policy instruments. However, they have not included country level variables to explain the true relationship between the imposition of NTMs and the characteristics of each country.

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) provided a model for the substitutability of one type of NTM for another. Moore and Zanardi (2011) investigated the usage of antidumping 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 antidumping users among developing countries. On the other hand, Aisbett and Pearson (2013) found a negative

relationship between the large tariff biding overhang and probability of SPS notifications. In fact, lower applied tariffs are linked with lower probability of notifying an 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 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 proliferation of antidumping measures. Prusa and Skeath (2002), Blonigen and Bown (2003), Feinberg and Reynolds (2006), Moore and Zanardi (2011) have also studied the retaliation strategies on Anti Dumping (AD) petitions. Retaliation can be motivating enough for 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 USA are forms of retaliation, while against the EU are forms of conciliation. Sanjuán López et al. (2013) also found retaliatory grounds on US impositions of NTMs against EU bans on the trade of cattle.

Health and environmental issues have been also 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 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 definitely follows some environmental life protection of marines. Or DS291, DS292, and DS293 responded by the EU in 2003, is related to Measures Affecting the Approval and Marketing of Biotech Products, which can have hazard consequences for human health[3]. The strand of the literature was also connecting these quality issues with these types of NTMs frequently. Otsuki et al. (2001) quantified the impact of EU food safety standards prohibiting the import of high Aflatoxin nuts from Africa. Such regulation can decrease the death risk by 1.4 out of one billion per year, which on the other hand imposes huge economic costs on the developing exporters. Van Tongeren et al. (2009) and Beghin et al. (2012) motivated their theoretical framework for analyzing the costs and benefits of prohibitive NTMs, when consumers are potentially harmed by 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. On the other hand, standards can play an important role in fostering technological progress. The close linkages between these issues and TBT are widely studied in the literature. Decreasing the transaction costs and gaining economies of scale, standards can foster growth (Kindleberger, 1983). On the contrary, 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

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[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

(IPR) in the form of patents – successful innovative efforts (Van Hove, 2010) – as interconnected sources of growth. Furukawa (2010) explains a complex relationship between (IPR) 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 the long run growth.

The number of products covered within a trade policy is another important motive for imposition of effective trade policies. Broda et al. (2008) analyzed the importance of supply and demand elasticity on the imposition of trade policies. They considered the number of products at each chapter as a factor controlling for varieties within the preferences of consumers. Their study emphasized the significance of market share in the introduction of trade instruments.

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

Within the literature, 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 WTO was applied in their analysis. In a simple regression, they found support to the traditional claim that protectionist motives like 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 notify SPS measures. They suggested that governments are following good motivations for imposition of SPS and it is 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 see their effects on the imposition of SPS. The result was according to their first predictions, as 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 not mainly imposed due to tariff tightness or any industrial protectionism, but in majority of cases they are maintained because of some other factors that are in the good faiths of the governments.

In the current study, the previous literature on the determinants of NTMs will be extended with 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 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. Protectionism 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 find out the real factors behind these specific NTMs.

1.3.   Model Specification and Potential determinants:

The data applied in the analysis is 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:

$$Y_{ijht} = \alpha X_{ijht} + \beta_1 Z_{it} + \beta_2 Z_{jt} + \delta_i + \rho_j + \mu_h + \sigma_t + \varepsilon_{ijht} \qquad (1.1)$$

Where, Y_{ijht} refers to the dependent variable which is new STC raised by the partner country j on 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 antidumping 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, robust estimator is used to control for the heteroskedasticity 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 variable is consistent with the econometric specification of 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 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 with other observations, neglecting the variations during time.

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[4] The data on some variables only covers this period. However, the estimations on larger sample during 1995-2011 is presented in the appendix.

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

Therefore, if two opposite results are achieved from these two regressions, the interpretation will differ, but it will not be necessarily contradictory.

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 a EU and a non-EU sample. The motivation behind that split is the harmonized regulations, standards and trade policy instruments within the whole EU. Moreover, a major part of TBT STCs (64 out of 317) is maintained by the EU. It is also important to mention that 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 EU has single voice in the WTO, in a separate robustness-check, all EU member states will be considered as one single economy.[6]

The explanatory variables will be described below. Among these variables, trade flows, tariffs, and TBT STC of the partner country might have endogenous impact on the dependent variable. To control for consistency and unbiasedness, the potential endogeneity the contemporaneous variables are excluded. This is in line with the consistent and unbiased assumption of FEP model (Wooldridge, 2012). In other words, in a robustness-check specification, lagged version of endogenous variables will be included in the FEP model.[7]

1.3.1. TBT notifications:

The WTO secretariat has recently provided a dataset on TBT notifications, which covers 317 STC notifications over various types of products (at two to six-digit level of the Harmonized System revision 2) for period 1995-2012. 81 products at 2-digit level of HS are at the focus of TBT STCs imposed by 69 countries. This data was gathered from two internal sources. The first source is WTO notifications, which includes all direct notifications by imposing countries. The second source is from TBT Committee minutes, which comprises STCs raised by members facing TBT imposed by others. In fact, the former has only direct notification, while the latter corresponds to reverse notifications. Governments imposing TBT measures are sometimes reluctant to inform WTO directly and concerned members inform Committee Minutes 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 both sources is not equivalent, the one from the Committee Minutes recording is preferred and mentioned in the dataset. Moreover, it can be stated that TBT STC data is a subset of all TBTs directly notified to WTO.

Since majority of TBT STCs are maintained on a vast variety of products, the data applied in the analysis is 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*

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[6] The estimation results for this specification will be represented in the appendix.
[7] The estimation results for this specification will be represented in the appendix.

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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.[8]

1.3.2. Economic Protectionism Variables:

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

One of the main variables of the interest for the analysis is Tariff Binding Overhang (TBO), which is the difference between the effectively applied tariff (AHS) and the Bound Tariff (BND). World Integrated Trade Solution (WITS) provides the data for AHS and BND from two different sources of WTO and Trains (maintained by UNCTAD)[9]. The difference between the two sources is mainly due to the coverage of the data for tariffs. Data from Trains is 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 is replaced from the latter. TBO_{ijht} in the estimation is thus the BND minus AHS tariff imposed by the 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, weighted average was also considered and the results are almost identical between the two types of calculation of tariffs.

The left panel of Figure 1.2 shows the trend of weighted average tariffs within the WTO member states. As it is observed, 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 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 1.2.

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 few attentions is imposition of specific NTMs rather than a rise in tariffs. As argued earlier, even governments might be reluctant to notify WTO about this temporarily 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

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[8] 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.

[9] The information regarding this database can be found at: http://wits.worldbank.org/wits/

domestic market when the domestic industry is growing as a result of an increase in its exports. In words, growth of a domestic industry which is replicated in its increased exports, might get special support from government to foster sustainably. Hence, a protectionism trade policy can support the growing industry.

Figure 1.2- Tariffs vs TBT STC notifications
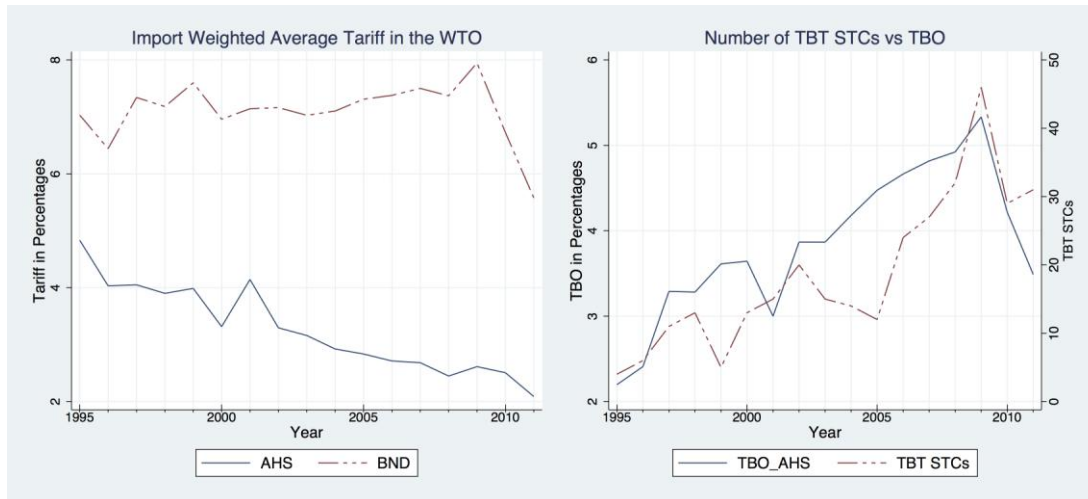
1.3.3. Product Level Variables

As discussed in previous section, Comparative Advantage (CA) of industries can be a good determinant for imposition of trade policy instruments. Besides, as Broda et al. (2008) emphasized, 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. However, since such data is 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 this 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 of all countries in the world, thus:

$$RCA_{iht} = \frac{\left[\frac{export_{iht}}{\sum_{h=1}^{H} export_{iht}}\right]}{\left[\frac{\sum_{i=1}^{I} export_{iht}}{\sum_{i=1}^{I} \sum_{h=1}^{H} export_{iht}}\right]} = \frac{export_{iht}/export_{it}}{export_{ht}/export_{t}} \tag{1.2}$$

Here, *H* is the total number of products (in this analysis H=96), and *I* is the total number of countries. When 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 probable to be aimed by the policy instrument for protectionism 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 probable to raise STC on a TBT affecting its weak industry with comparative disadvantages.

During years, technology and innovation have increased the variety of products, which will be defined in global product classifications. TBT STCs focusing at 2-digit level products are covering all varieties of products at higher disaggregate levels. As discussed earlier, the larger the number of products at the focus of the new regulations, the higher would be the probability of raising STCs on 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 category of products.

1.3.4. Economic Variables:

The difference between the GDP per capita of the two trade partners is commonly used in trade econometric analyses, especially bilateral gravity models. The data for real GDP per capita is collected from the World Development Indicators (WDI) database 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 imposes more probably a TBT, the less developed its trade partner is, as for example production in poorer countries is more environmentally damaging. Besides, such partner can be more affected by a TBT due to a bigger gap in technological advancement of production, which can be consequently more probable to raise an STC on the policy instrument. Therefore, it is expected to observe a positive relationship between this variable and TBT STC notifications.

However, one can also argue that countries with high similarities in development are more probable 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, it would be more probable to maintain and/or raise TBT STCs. 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 control variables. 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 (ceteris paribus exchange rates). The country importing products from the deflated economy would impose TBT measure to stabilize its domestic market. GDP deflator as annual percentages is collected from WDI.

1.3.5. Technological variables:

Generally, when a country imposes new TBTs, its domestic industries are producing in line with the standards at 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 is a suitable proxy for technological innovations, which is 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 patents registration in a society can be a good proxy representing successful innovative efforts (Van Hove, 2010). WDI provides data for two suitable variables measuring patents registration. 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 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 the 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 industries innovations abroad, 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 number of patents registered by non-residents would decrease the probability of imposition of new TBTs.

These three variables are also included for the partner country, which can follow a similar argument for raising STC on the maintained TBT. 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 the regulations prohibiting its exports while the quality of production and products might be comparably compatible with what the importing country offers.

1.3.6.   Governance Indicators:

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

Polity variable gathered from the Polity IV project[10] determining the level of democracy in countries is the main institutional variable of the study. This indicator ranges from -10 showing the most autocratic country, to 10 representing the most democratic institution. According to the strand of the literature, democratic governments care more about healthcare and environmental issues. Moreover, democratic countries prefer imposition of complex and opaque instruments such as TBTs rather than simple tariffs. However, democratic countries are more probable to have liberalized trade more than autocratic ones are. It is expected that higher values of this index would represent higher probability of imposition of new TBT measures aiming at good purposes instead of protectionism. Nevertheless, the estimation

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

results can give insights about the true influence of regimes on TBT impositions when other factors are controlled 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 analyzing the impact of institutional qualities on patterns of trade and trade protectionism (Essaji, 2008; Ghodsi, 2013). There are strong correlations between these variables and 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."[11] Higher values for this index represent higher institutional quality. For instance in 2011, Democratic Republic of Korea has the lowest RQ with estimated value -2.46; and New Zealand has the highest RQ with estimated value 1.967.

1.3.7. Environmental Variable:

Environmental Performance Index (EPI) provided by the joint project of Yale University and Columbia University is used as another variable in the regressions[12]. 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 sulfur dioxide emissions per capita, Sulfur 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 might 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 health care issues have better quality indices, they might try to impose TBT measures to sustain high qualities. However, reverse relationship might also be 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 percent. For instance, if a small country is highly polluted suffering from a low EV index, high institutional government will try to establish regulations and standards to increase the environmental qualities. While quality of the governance and institutions are controlled with other variables explained earlier, the

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

[12] The information regarding this data can be found at: http://epi.yale.edu/

negative relationship between these three indices and imposition of new TBTs might acknowledge the good incentives of the government behind these measures. Although these two opposite impact of environmental measures on new TBT notifications is a controversy, their inclusion in the analysis can improve the consistency of the estimations.

Table 1.1- 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

1.4. Estimation Results

1.4.1. Benchmark Specification

Table 1.2 represents the FEP estimation results for the benchmark regression. As it 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. Estimations are conducted for period 2000-2011 to have exactly similar sampling in the regression for checking the consistency of coefficients. Restriction of sample to this period was dictated because of lack of data for Polity2 and EPI variables before this period. However, regressions for the whole period (1995-2011) with different sampling are represented in the appendix. Akaike information criterion (AIC) and Bayesian information criterion (BIC) suggest improvement of the estimations after adding variables in to the models. Since 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.

Table 1.2- 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
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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

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

When Tariff Binding Overhang increases by one percent, meaning that the applied tariff drops by one percent[13], 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. When a country decreases its applied tariff to the import of a specific category of products from different countries as a good gesture for trade liberalization, it is difficult to point out a more specific good where the classification does not allow and impose higher tariff. In the strand of the literature, complementarity or substitutability of trade policy instruments have been argued. Here, the results acknowledge the substitutability of tariffs and non-tariff barriers. Thus, it is easier for authorities to impose restrictive regulations on that specific product rather than increasing the tariff for the whole group of products. Nonetheless, lag of TBO coefficient is not statistically significantly different from one, which shows no relationship between previous tariffs and current TBT STC notifications.

Table 1.4 (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 WTO regulations implemented in 1995, a large number of TBT regulations have been notified to the WTO secretariat suddenly. On the other hand, reduction of tariffs has been implemented gradually during time (as observed in Figure 1.2). This can 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 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 probable to be at the focus of TBT STCs, from the perspective of either the maintaining country or concerned country. In other words, when 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 imposition of TBT.

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

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, results of the pooled sample Poisson regressions in table 1.5 (in the appendix) suggest that HS 2-digit product categories with larger number of varieties at CN8 level are more probable to be aimed 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 when trade partners are more similar with respect to their economic development, they are more probable to be involved in a TBT STC notification. Since advanced economies have more similarities in the technology production and involvement in trade liberalization, they are more probable 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 probable to engage in raising STCs on the TBTs notified for technological reasons.

The results are inconclusive concerning the relationship between changes of reporter's inflation during time and the TBT STC notifications. For partners, when inflation of the trade partner increases over time, it will be less probable to observe a TBT STC. Increase of prices in an exporting country can be responded by a lower demand of the importing country. In this manner, market can automatically affect the trade patterns even without government intervention within 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 increases the probability of new TBTs. This result shows that countries with higher technologies and innovations 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 the regulations opposed to their production procedures.

Institutional qualities have no statistically significant impact on the TBT STCs. This might be due to the small variation of these variables over time. However, pooled Poisson regressions (Table 1.5 and 1.6 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 better able to formulate and implement sound policies and regulations that permit and promote private sector development. This might also acknowledge the protectionist behavior 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 liberalized in trade than autocratic countries are. In fact, democracy brings less trade policy (TBT in this case) and in general more liberalization in trade

Another interesting result is that a country with lower Environmental and Health qualities (EPI) is more probable to maintain TBT STCs. This might suggest that the government is trying to improve its domestic qualities with imposition of the new regulations. However, it is important to mention that European countries that are imposing TBT STCs more than any other countries are enjoying 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 TBT 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, imposition of TBT seems to be unnecessary obstacles to trade rather than protection of domestic environment or health in the eyes of other countries raising STCs.

Model 7 represents positive relationship between humans' health related qualities (EH) and TBT STC notifications, while environmental vitalities (EV) has 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 probable to maintain new TBT STCs. However, a country suffering from low Environmental Vitalities is more probable 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 probable to face a TBT STC imposed by another WTO member.

After removing contemporaneous endogenous variables from the regressions, table 1.8 (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 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.

1.4.2. EU vs. non-EU Specification

Table 1.3 represents the FEP regressions on Models 6 and 7 on the sample of EU and non-EU reporter countries[14] [15]. The differences between the estimation results of the two samples explain how heterogeneous the TBT STCs notified by these two economies are. Non-EU countries' TBT STCs represented here are no longer affected by their partners' TBT STCs. However, TBO, bilateral imports and exports for both samples have similar situation as the ones represented in table 1.2. Number of varieties of CN8 products within each 2-digit category of product has statistically negative impact on the imposition of TBT STCs only in non-EU sample.

The difference between the trade partners' economic development is 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 a harmonized monetary policy by the European Central Bank (refer also to the regressions of table 1.7 in the appendix). However, as observed in the whole sample, increase in the inflation of trade partner reduces the probability of raising STC on TBTs imposed by the EU.

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[14] Remaining number of observations in the panel shows that two third of the whole sample covers EU reporter countries. This is mainly because of dropping out of time-invariant observations in the dependent variable. However, in the pooled sample regression represented in table 1.7 in the appendix a reverse situation happens.

[15] It is worth mentioning that partner countries are not classified separately in these regressions.

While there is no statistical evidence for the role of RCA on the imposition of TBT STCs by the non-EU countries, the results suggest special focus of TBT STCs maintained by the EU members on weak industries with comparative disadvantages.

Table 1.3- 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)	(0.00089)	(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

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Technological variables have 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 were achieved for the whole sample. On the contrary, the results on 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 harmonizing their regulations and standards among each other. High imposition of TBT STCs by the EU, when other countries are progressing technologically might indicate the EU support for global advancement in technology.

Institutional variables, environmental and health indices of EU are not statistically indicating any impact on the imposition of TBT STCs by the EU members. However, rise in EPI and EV of the trade partners will drop the probability of notifying new TBT STCs by the EU, which again might show a good faith and supportive attitude of EU for the progress of their trade partners. Moreover, the relationship between environmental indices and the dependent variables in the non-EU sample is almost 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 1.9 (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 is calculated for variables of the model wherever applicable. Coefficients of lagged TBT STC of the partner, export, RCA, and R&D of the partner are not statistically significant anymore 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 represented in table 1.3. Table 1.9 considers all EU members as one single unity. Therefore, the influences of non-EU reporters (table 1.3) are 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 such 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 patents registration 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.

1.5.   Summary and Concluding Remarks:

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

Such data on STCs have been provided by the WTO secretariat as they have good informative properties to increase transparency of trade policies of members. 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 have been frequently emphasized in the literature (Kono, 2006; Feinberg and Reynolds, 2007; Moore and Zanardi, 2011). Results of this analysis are broadly in line with these former findings. These panel regression results indicate that if the number of TBT STCs on a given product increases the trade partner is less probable 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 probable 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 the increases in STCs will be more probable, when bilateral trade flows of a country increases. Protectionist issues of the 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 a STC on TBT 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 specialization and comparative advantage within a specific industry decrease, the probability of aiming a TBT STC at that sector increases. 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 TBT and raising STCs. When technology in a country improves, the government tends to become more persistent on requiring products at a high level of quality and standard. That will be a good motivation for the government to introduce new TBT or new regulations and amendments within already existing TBTs. Besides, a government will be more sensitive to face technical regulations and it will be more probable 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 mainly caused by the lack of variations among EU countries. 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 the 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 probable to impose TBTs. This result confirms the strand of the literature emphasizing 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 the TBT STC notifications. Results suggest that countries with lower qualities based on the EPI measurement, are more probable to maintain TBT 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 the quality. However, regressions on the subcategories of EPI suggest differently. FEP outcomes suggest that when Health qualities (EH index) is increasing overtime, the country (specifically non-EU country) will be

more probable to maintain TBT STCs; while the situation is reverse for the environmental quality (EV). However, the results of the pooled sample suggest an opposite relationship. In other words, countries with higher EH and lower EV are less probable 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, when health qualities of the given country increases over time, the respective country is more probable to maintain TBT STCs. Given the pooled regressions and considering the position of a country in a certain point of time relative to the whole period, countries with lower human qualities are more probable to impose TBT STCs. Thus, if a country's health quality is increasing, one should expect more TBT STC notifications. However, considering which countries in a certain time are more probable 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 imposition of TBTs and raising STCs. It is not evidently feasible to show the true motivations of the governments behind imposition of TBTs by such general research over all TBT STCs. Autocracy also increases the probability of notifying TBT STCs, which is showing protectionism 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 introduction of TBT STCs. However, 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 aim at the protection of domestic industries, but are motivated by various factors. In other words, in this study 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 motivations behind the imposition of TBTs. A global standardization of qualities either in the technology of production or environmental and health issues can decrease the asymmetries among nations, which leaves determinants of TBT STCs to fewer factors such as protectionist behavior. Then, since TBT STCs are earlier proved to be causes of trade disputes, this will lead to less frequent trade conflicts for which the aims of trade policy impositions will be much clearer.

Overall, results point towards significant protectionist motives behind these TBT STCs, and consequently higher probabilities of new DS case within the WTO[16]. As the main conclusion and policy recommendation, harmonization of regulations and standards are the main 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 (DS). More restricted rules in WTO regulations will be recommended to avoid economic and protectionist motivating tools leading to further liberalization of trade in the future. The restrictive rules might be, for instance, to consider a penalty (an economic penalty considering monetary or merchant) for a country violating the TBT agreement (if proved by the analysis of the Panel or the Appellate bodies irrespective of final resolution of the case). This mechanism does not exist in the regulations, and that might be the main reason behind application of protectionism 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

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[16] As shown by Ghodsi and Michalek (2014)

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 analyzed as another extension which will help understanding further implications of these policy instruments.

Appendix 1: Robustness Check Regressions

Table 1.4- 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 1.5- 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 R²	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 1.6- 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 R²	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 1.7- 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 1.8- 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 $_{partner\ (t-1)}$	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 $_{partner\ (t-2)}$	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 $_{(t-1)}$	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 $_{(t-2)}$	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 $_{(t-1)}$		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 $_{(t-2)}$		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 $_{(t-1)}$		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 $_{(t-2)}$		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 $_{partner}$			0.910*	0.913*	0.922*	0.920*	0.910*
			(0.034)	(0.037)	(0.035)	(0.034)	(0.035)
ΔGDP $_{ij}$				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 $_{partner}$				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 $_{partner}$					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 $_{partner}$					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 $_{partner}$					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 $_{partner}$						0.921***	
						(0.014)	
EH							1.125***
							(0.017)
EH $_{partner}$							0.928***
							(0.012)
EV							0.943***
							(0.0098)
EV $_{partner}$							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 1.9- 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

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

CHAPTER 2

Role of Specific Trade Concerns on TBT in the import of products to EU, USA, and China

2.1. Introduction:

Since the start of the General Agreement on Tariffs and Trade (GATT) in 1948, tariffs between the member states of the World Trade Organization (WTO) have fallen dramatically. However, a considerable number of non-tariff measures (NTMs) have been implemented drawing global attention nowadays. Technical Barriers to Trade (TBTs) are one of the most important subcategories of these NTMs that have been frequently used by governments. The nature of these instruments is very complex and opaque and the true motivation of governments for implementing them is by no means evident.

Introduction of legitimate regulations and standards within TBT are expected to improve market efficiencies. For instance, with mandatory labeling of products, transparency can increase the information provided to the consumers and producers in the market, which will improve the welfare of consumers, producers, and the whole society. Moreover, these measures can be levied for protection of human health, environmental quality, national security, etc. These aims behind TBTs have been usually referred to as faithful approach to the introduction of TBTs. Member states can provide evidence for their claims to the WTO secretariat in order to make their policy instruments affordable by other members. On the other hand, some TBTs might be in pursuit of restrictive protectionism of domestic producers, which might raise concerns of other WTO members[17].

While countries are obliged to notify their NTMs directly to the WTO secretariat, another system is also structured by the WTO regulations. Other countries can also discuss the issues related to other members' policies and notify them to the meetings of TBT committees, WTO minutes recording sessions. Whether or not a country is reluctant to notify its own policies directly to the secretariat, other countries can raise their own Specific Trade Concerns (STCs). These reverse notifications are documented and data on TBT STCs have been provided by the WTO secretariat. This data covers 317 reverse notification items on TBTs for all member states during 1995-2011. Each item might cover various products and various concerned countries.

TBT STCs are specific cases of NTMs and the STC data is a subset of all TBTs notified to the WTO secretariat. In other words, the actual number of TBTs imposed by the WTO members is much more than the number of STCs on TBT. In the context of STCs, countries are becoming increasingly concerned because of significant impact of TBT on their trade. The important issue for STCs is that these notifications have been more at the focus of

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[17] In the first chapter of this thesis, I provided empirical evidence behind various determinants of TBT STCs.

countries facing TBTs than any other general TBTs have. Therefore, the impact of TBT STCs on products import can show the significant role of these notifications in international trade.

The European Union is with 64 of these STCs the largest member maintaining them. China - accessed to the WTO few days before 2002 - is the second largest member maintaining 39 TBT STCs. United State of America is the third largest WTO member maintaining 35 items during 1995-2011.

When a WTO member believes that another member is violating one of the WTO agreements, it can request for consultation within the Dispute Settlement Mechanism (DSM). During 1995-2012, there have been 45 DS cases citing the TBT agreement. European Union has been requested for the consultation for violating the TBT agreement (20 DS cases) more than any other members have. However, only one of the EU cases (DS 231 complained by Peru and some other third parties) has been proved by Dispute Settlement Body (DSB) to be a violation of TBT agreement. United States of America is the second member requested for consultation for violation of TBT agreement for 11 times. DSB finally concluded that the USA had violated TBT agreement for four times (DS cases 381, 384, 386, and 406). The interesting issue is that China has not been requested for violation of TBT agreement until 2014.

Ghodsi and Michalek (2014) have shown a strong positive relationship between the TBT STC notifications and request for consultations citing the TBT agreement within the DS mechanism. Therefore, TBT STCs might follow some protectionist incentives causing trade conflicts. Hence, the aim of this paper is to find out the impact of these measures on trade flows, in order to discover their protectionist motivations.

Overall, the main goal of this contribution is to investigate the impact of TBT STCs maintained by the EU, USA, and China on their import of products at 4-digit level of Harmonized System classification during 2004-2011. The structure of the rest of the paper is as follows: In the next section, a short literature review is provided. The third section then focuses on the methodology of the analysis, data description and estimation specifications. In the fourth section, the estimation results are presented. The last section provides a summary of the main findings and concluding remarks.

2.2. Literature review

The empirical analysis of bilateral trade was first introduced by Jan Tinbergen in 1962. Since he was both a physicist and an economist, he formulated a gravity framework for international bilateral trade based on the Newton's law of gravity. The main issue of this framework is that bilateral trade between the two countries is positively affected by their economic attractors, which is similar to the mass of the two objects forcing gravity on each other. For the economic potential of partners, Gross Domestic Product (GDP) is usually used. Moreover, the geographical distance between the two is decreasing their trade flows.

After Tinbergen (1962), this strand of the literature has been largely extended. Anderson (1979) introduced a theoretical framework for the gravity model using constant elasticity of substitution proposed by Armington (1969). Monopolistic competition framework using Armington-type consumer preferences has been implemented in the gravity model several times (Krugman, 1980; Helpman and Krugman, 1985; Bergstrand, 1985, 1989). Deardorff (1998) also analyzed the Heckscher-Ohlin model within the gravity framework, while Eaton and Kortum (2002) implemented the gravity framework for the Ricardian theory. Melitz (2003) and Bernard et al. (2007) introduced firm heterogeneity and intra-industry trade. Anderson and van Wincoop (2004) tried to modify the gravity equation considering not only trade obstacles existing at the bilateral level, but also relative size adjusted obstacles with respect to other countries.

According to the underlying theoretical frameworks of the gravity models, costs of transportation and information are the main factors explaining the negative effect of distance on bilateral trade. Usage of only geographical distance between the two partners seems not to be appropriate in such investigations. Studies have included some other variables in the analysis that are crucial for decreasing the bilateral trade costs, like having a common language, common historical heritage, common religion or ethnicity. Since the geographical distance between the two partners is usually calculated between the capitals or large cities of the two countries, having a common border variable can suit as a better proxy for contiguity of the two countries enhancing trade. (Frankel and Wei, 1993; Frankel and Rose, 1998; Anderson and van Wincoop, 2001, 2004; Groot et al., 2004; De Benedictis and Taglioni, 2011).

In the early strand of the literature, cross-sectional data was used in the empirical analysis of gravity equation. Later on, Ghosh (1976) and Mátyás (1997) pointed out the existence of exporter, importer, and time effects in the estimation of gravity model using panel databases. Application of panel data techniques controlling for country-pair fixed effects was firstly introduced by Hummels and Levinsohn (1995) and the next scholars tried to follow such approach. However, using fixed effect techniques will drop the time-invariant variables such as, bilateral distance, common language, and common borders.

The volume of bilateral trade is furthermore highly affected by the similarities between the two partner countries. Not only similarities in ethnicities, language and historical heritage matter, but also similarities in economic factors. Similarity of factor endowments between the two partners had been ignored within classical international trade theory but not in Ricardian models. That is why New Trade Theory is characterized by economies of scale, product differentiation, and transportation costs in models of Krugman (1980) or Helpman and Krugman (1985), which have been implemented in gravity models by many other scholars.

Helpman (1987) empirically found that the similarity of income between 14 industrial partner countries increases the volume of trade. Hummels and Levinsohn (1995) tried to reconsider this evidence with inclusion of both developed and less developed countries. Their result suggested that when product differentiation provides good fit of the model, dissimilarities between partners could not fit well. However, their sample of homogenous countries showed

similar results to Helpman (1987). Bergstrand (1990) on the other hand, found that differences in factor endowments negatively affect the bilateral trade.

Baltagi, Egger, and Pfaffermayr (2003) included the similarity index of the two partner countries' GDP measuring the relative country size, and absolute difference in relative factor endowments in a modified gravity model. Their empirical analysis was focused on bilateral trade between the triad (EU 15, USA, and Japan) and their 57 trading partners in an unbalanced panel database for the period 1986-1997. They found a positive relationship between relative country size and bilateral trade flows, while such a positive relationship between relative factor endowment similarities and trade would depend on the model specification and inclusion of various fixed effects.

Wang et al. (2010) also included similarities in the regression of gravity equation. They also added similarities of foreign direct investment between the two trade partners. As suggested by other scholars such as Egger (2000), they included country fixed effects in the estimation of their model. They used generalized method of moments (GMM) to control for the possible endogeneity of some explanatory variables with trade flows in the existence of possible heteroskedasticity.

While similarity indices of the two trade partners were used in Egger (2002), the application of a new estimation technique was firstly introduced. It was suggested that AR(1) model in the framework of Hausman and Taylor (1981) would eliminate the systematic difference between observed and in-sample predicted trade values, which provides consistent and also efficient estimators. Egger (2002) stated that although Fixed Effect Estimator (FEE) is consistent rather than Random Effect Estimator (REE) only in the absence of endogeneity. Later on, Hausman Taylor (HT) estimation was used by other researchers studying gravity model (Baltag, Bresson, and Pirotte, 2003; Egger and Pfaffermayr, 2004; Serlenga and Shin, 2004; Carrere, 2006; Stack and Pentecost, 2011).

Many authors analyzed the impact of NTMs and specifically TBTs on international trade. Essaji (2008) analyzed the impeding effect of technical regulations imposed by the US government on the imports of 6-digit HS products. He found that these regulations imply a huge burden on poor countries with weak capacities, keeping them away from these industries characterized by the prohibitive instruments.

Disdier et al. (2010) studied the impact of TBT and Sanitary and Phytosanitary (SPS) measures on imports of tropical products. In a gravity estimation controlling for fixed effects in 2004, their results showed a significant negative influence of these measures on imports. Li and Beghin (2012) also found a negative effect of TBTs on trade controlling for enodogeneity and time fixed effect in gravity estimations.

In a recent study, Yousefi and Liu (2013) investigated the role of TBTs on trade between China, Japan, Korea and the USA for manufacturing industries. In a gravity framework, they found negative impact of TBT on trade in the long run. Bao and Chen (2013) also tested the influence of TBT on trade components. Their empirical analysis covering 103 countries over the period 1995-2008 suggested that TBT decreases the probability of trade while it increases

the number of products traded (extensive margin). However, it was found that TBTs have no statistically significant impact on trade value of each product (intensive margin). Many scholars investigated the role of NTMs on trade for specific sectors. For instance, Wilson et al. (2003), Wilson and Otsuki (2004), Chen et al. (2008), and Disdier and Fontagné (2010) focused on trade of agricultural products; Blind (2001), Blind and Jungmittag (2005), and Fontagné et al. (2005) studied manufacturing sectors.

This contribution extends the literature by having a special focus on TBT STCs. Since European Union, China, and the United States of America have maintained these notifications to a larger extent than any other WTO members have, this contribution is concentrated on the imports of products to these countries over the period 1995-2011. An augmented gravity model is implemented using econometric techniques to control for the problems concerning endogeneity, country fixed effects, time effects, and heteroskedasticity as reviewed above, which will be controlled for by using HT estimation elaborated next.

2.3. Methodology and data description

In this paper the impact of TBT STCs on the trade flows of products at the 4-digit level of Harmonized System revision 2 (HS2) to the EU, USA, and China for period 1995-2011 is analyzed using a gravity framework. Since China joined the WTO at the end of 2001, its TBT STCs have been notified after that period. Thus, the benchmark analysis for China is over the period 2002-2011[18]. Since policy measures might affect both prices and amount of products imported, both import values and quantities are considered. However, in the benchmark analysis, effect of TBT STCs on the value of imports is presented whereas the analysis concerning quantities of imports is presented as one of the robustness checks in the appendix. I use a gravity model similarly applied by Nunn (2007) and Essaji (2008) as follows:

$$Im_{ijht} = \alpha + \beta_0 TBT_{iht} + \beta_1 T_{ijht} + \beta_2 Y_{ijt} + \beta_3 D_{ij} + \beta_4 S_{ijt} + \gamma_i + \delta_j + \theta_h \\ + \vartheta_t + \varepsilon_{ijht}$$

(2.1)

Where Im_{ijht} is the import (either value or quantity) of product h to the reporter country i from partner country j at time t. TBT_{iht} is a dummy variable with a value of 1 at time t indicating that there is a TBT STC imposed by country i on product h. TBT STC hits are included in such variable for two reasons: Firstly, some TBT STCs are not permanently maintained during a long period. However, there is no enough information regarding the withdrawal of these measures in the data. Secondly, some TBT STCs are modified or amended over years. Again, it is not known whether these amendments are major or minor modifications on previous measures. Therefore, to separate all of these TBT STCs during different periods of time, only TBT STCs at the time of impositions (or raising concerns) are considered as hits in the analysis.

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[18] The analysis for China over period 1995-2011 and for EU and US over period 2002-2011 is presented in the appendix.

Since some TBTs are maintained permanently and their impact might remain, one lag of this variable is also included in the regressions. Y_{ijt} refers to the summation of total real GDP of both partners, which can be considered as market potentials based on traditional gravity framework. T_{ijht} is the import weighted average effective applied tariff rate on all subcategories of product h imposed by the reporter country from the partner. D_{ij} captures the effects of the average distance between the two trade partners' main cities. $\gamma_i, \delta_j, \theta_h$ and ϑ_t are respectively reporter country, partner country, product, and time fixed effects; and ε_{ijht} is the error term. In order to control better for product level characteristics, the number of varieties of products at 8-digit level within each product group j is included in the equation as well. S denotes a vector of variables capturing similarities between the two partners which will be discussed in more detail in the following.

As it was discussed earlier, similarities between countries can be an important factor for increasing the volume of trade lowering the transaction costs. Similarity in development (SimY) and factors endowment (SimF) between the two partners are one of the main variables discussed in the literature, which are calculated as follows:

$$SimY_{ijt} = 1 - \frac{Yp_{it}^2}{\left(Yp_{it} + Yp_{jt}\right)^2} - \frac{Yp_{jt}^2}{\left(Yp_{it} + Yp_{jt}\right)^2} \tag{2.2}$$

$$SimF_{ijt} = \left| ln\left(\frac{K_{jt}}{L_{jt}}\right) - ln\left(\frac{K_{it}}{L_{it}}\right) \right| \tag{2.3}$$

Here Yp refers to the GDP per capita, and K and L are respectively capital stock and labor force. Index SimY ranges between zero when the two countries are very far from each other and one half ($SimY_{ijt} \in (0, 1/2]$) when the two partners are the same in term of GDP per capita. Index SimF equals zero if the two countries have the same proportion of factor endowments; otherwise, it will receive higher value.

In matrix S of the gravity equation, sharing the same border (Contiguity), having a colonial history (Colony), common official language (Language) of the two partners, and a dummy for being WTO members are included. Besides, to control for similarities in terms of trade, having a free trade agreement (FTA) between the two trade partners is also considered as a dummy variable. This variable gets a value of 1 when there is a bilateral FTA into force between the two countries and zero otherwise. Moreover, since a large share of partner countries are EU member states sharing similar regulations and trade policies, a dummy variable for EU member receiving value 1 when the partner country is part of the EU at time t is included in the estimation

Due to possible endogeneity of some variables with the dependent variable (specifically policy instruments), and the possibility of including time-invariant variables in the panel, the estimation technique proposed by Hausman and Taylor (HT) in 1981 will be used for the benchmark analysis. Heterogeneity across countries and products might lead to different structure of variances within each individual group in the panel regressions. Thus, there

might be possible heteroskedasticity in the error term. Therefore, the variance-covariance matrix is modified using bootstrap technique to achieve robust estimators, as robust estimator is not feasible with HT. Moreover, as a robustness check specification, Fixed Effect (FE) estimator will be applied separately being represented in the appendix.

TBT STC data is provided by the WTO secretariat[19]. The data on trade flows is gathered from three different sources. Values and quantities of imports to the EU are gathered from COMEXT database provided by the Eurostat[20]. Value of imports and tariffs are collected from Trade Analysis and Information System (TRAINS) provided by World Integrated Trade Solution (WITS)[21]. Quantity of imports is compiled from UN COMTRADE database provided by WITS. Data on GDP, GDP per capita, capital formation, and labor force are gathered from the World Development Indicators (WDI) provided by the World Bank[22]. Data on distances, colony, common language, and contiguity are downloaded from CEPII database[23].

In this analysis, the European Union is considered as a single economy with the number of countries expanding over time. Thus, the data is constructed for all of the members as aggregates or averages wherever applicable according to their time of accession to the EU. For instance, distance is considered as the average distance of members from the trading partners, while GDP of EU is the summation of all members' GDP at the time.

All the variables except dummies and tariffs are in logarithmic forms. Since logarithm of trade flow is considered in the regression, zero values become missing values in the estimation. In the literature various different ways to handle this problem have been proposed. One way of controlling such problem is estimation using Poisson maximum-likelihood regression. Because of using panel data, fixed-effect Poisson estimation drops out some observations due to zero outcomes or single observation in groups. On the other hand, using normal Poisson regression with the inclusion of country, product, and time dummies controlling for fixed effects, convergence in the maximization process cannot be achieved. Even after 6500 iterations, Poisson regression cannot produce maximum-likelihood estimation results with fixed effect dummies using various techniques. However, there is no zero observation in the imports data of China and the US, while there are some zeros for the sample of EU. Therefore, for regressions over China and US normal panel FE estimator is applied, while for the EU Poisson FE is applied as the technical robustness check.

In the TBT STC database, some information is provided regarding the issues raised for a specific TBT. Discrimination and unnecessary barrier to trade (UBT) are two important issues stated by the concerned countries for some of the TBT STCs which might be the most important issues behind raising a concern over a regulation. Thus, in a separate estimation specification, instead of the TBT STC variable, three other variables will be included:

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[19] Can be found at: http://www.wto.org/english/res_e/publications_e/wtr12_dataset_e.htm
[20] Can be found at: http://epp.eurostat.ec.europa.eu/portal/page/portal/international_trade/introduction
[21] Can be found at: http://wits.worldbank.org/wits/
[22] Can be found at: http://data.worldbank.org/data-catalog/world-development-indicators
[23] Can be found at: http://www.cepii.fr/anglaisgraph/bdd/distances.htm

Discriminatory, UBT, and rest of TBT STCs are the three separate explanatory variables replacing TBT STC in the new specification[24].

TBTs are mainly imposed for technical issues that might be more related to manufacturing no-food products. On the other hand, regulations on food products will be mostly imposed within a SPS measure. Therefore, samples of food and non-food products will be analyzed in two separate estimation specifications[25].

Finally, the impact of trade policy of the three advanced economies under consideration might differently affect the trade patterns of the respective country depending on their advancement. Specifically with technical regulations, advanced countries seem to be more flexible to a trade instrument. In other words, an advanced country is enjoying high standard productions procedures, which can be easily complied with effective technical barriers. Therefore, four different categories of countries will be analyzed within four estimations. Low, lower-middle, upper-middle, and high income countries are categorized separately using the evolutionary classifications of the World Bank, based on the income per capita.

2.4. Estimation results

2.4.1. EU

Table 2. presents the regression results of imports to the EU during 1995-2011. From the first column to the left (M1) it can be observed that TBT STCs have no statistically significant impact on imports values of products to the EU. However, Table 2. in the appendix shows that these regulations are hampering traded quantities at the 5% level of significance. This result suggests that TBT STCs maintained by the EU hamper trade by increasing the price of imported products. This usually happens when new regulations and technical standards need to be met in order to be imported to the EU. Firstly, due to TBT regulations, the quality of products might increase leading to higher prices. However, this cannot fully take place during a short period. In other words, to comply with TBT regulations enhancing products quality, production procedure modifications are usually time consuming. This process might take place partially within one year. Secondly, the increase in the prices and import values might be due to a specific set of products with higher prices and not all subcategories of products. In fact, those products might be substitutes for cheaper products within that specific category.

The second column (M2) shows the coefficients of TBT STCs based on the three concerned issues written in the notifications. Discriminatory STCs have a significantly negative influence on imports values of products to the EU. It seems quite reasonable why such TBT STCs have been concerned as discriminatory ones. In fact, these specific regulations hamper trade by about 5.7 percentage points. The coefficient of TBT STCs that are deemed to be unnecessary barriers to trade excluding discriminatory ones (UBT) is statistically significantly not different from zero. On the other hand, the rest of the TBT STCs maintained

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[24] These three variables are dummies similar to TBT STC variables, whose first lags are also included in the estimation.

[25] Products with HS 2-digit codes 1 to 24 are considered as food products and the rest as non-food.

by the EU strongly increase the imports values of products to the EU. As shown in table 2.6, the rest of TBT STCs do not have any statistically significant impact on imported quantities. As explained earlier, this means that these STCs rather increase the prices of imported products to the EU.

TBT regulations are mostly imposed for technical issues on manufacturing products, and SPS measures are usually imposed on food products. It seems that TBT STCs imposed on food products by the EU have no statistically trade effects, while results on both import values and quantities show that these measures strongly decrease the import of non-food products. This suggests that TBT STCs are hampering trade of non-food products as the regulations related to them are mostly technical issues.

Table 2.1- HT Regression of Imports Values to the EU (1995-2011)

Import Value	M1	M2	Food	Non-Food	Low	Low-mid	Upp-mid	High
TBT STC	-0.0035		0.013	-0.016***	0.058**	0.028*	-0.028**	-0.0025
	(0.0042)		(0.013)	(0.0047)	(0.021)	(0.012)	(0.010)	(0.0048)
TBT STC $_{(t-1)}$	0.0018		-0.018	0.0010	0.026	-0.0034	-0.023*	0.011*
	(0.0041)		(0.013)	(0.0046)	(0.020)	(0.011)	(0.0097)	(0.0047)
T	-0.0070***	-0.0072***	-0.020***	0.0089***	-0.0085	-0.0067**	-0.018***	0.0082***
	(0.0010)	(0.0010)	(0.0015)	(0.0014)	(0.0062)	(0.0023)	(0.0023)	(0.0018)
No. CN8	0.032***	0.032***	0.021***	0.034***	0.022***	0.029***	0.045***	0.037***
	(0.00063)	(0.00063)	(0.0013)	(0.00072)	(0.0020)	(0.0013)	(0.0014)	(0.00081)
GDP	12.7***	12.4***	8.58***	12.8***	70.7***	14.7***	22.3***	12.1***
	(0.17)	(0.17)	(0.48)	(0.18)	(2.07)	(0.48)	(1.14)	(0.21)
SimY	4.19***	4.25***	2.41***	4.59***	17.0***	6.42***	4.53***	9.33***
	(0.10)	(0.10)	(0.28)	(0.11)	(1.40)	(0.34)	(0.34)	(0.24)
SimF	0.16***	0.16***	0.16***	0.16***	-0.14***	-0.0032	0.63***	0.14***
	(0.0089)	(0.0089)	(0.023)	(0.0097)	(0.035)	(0.022)	(0.026)	(0.016)
WTO	0.29***	0.29***	0.16***	0.31***	0.39***	0.33***	0.79***	2.29***
	(0.013)	(0.013)	(0.036)	(0.014)	(0.034)	(0.021)	(0.046)	(0.23)
FTA	-0.046***	-0.049***	0.0095	-0.044***		0.076***	0.14***	-0.25***
	(0.012)	(0.012)	(0.032)	(0.013)		(0.021)	(0.027)	(0.024)
EU Partner	0.60***	0.60***	1.04***	0.56***			0.78***	0.012
	(0.0097)	(0.0097)	(0.029)	(0.010)			(0.018)	(0.019)
Contiguity	2.11***	2.09***	2.44***	2.04***	2.07***	0.82***	0.69***	2.88***
	(0.056)	(0.056)	(0.16)	(0.059)	(0.28)	(0.082)	(0.10)	(0.082)
Language	0.14***	0.15***	0.67***	0.065	-0.66***	-0.63***	-0.86***	0.65***
	(0.032)	(0.032)	(0.089)	(0.035)	(0.092)	(0.054)	(0.073)	(0.042)
Colony	-0.26***	-0.28***	-0.32**	-0.28***	0.97***	0.0091	0.92***	-0.83***
	(0.036)	(0.036)	(0.099)	(0.039)	(0.12)	(0.061)	(0.067)	(0.046)
D	0.0077	0.0079	0.46***	-0.068*	0.44**	0.21***	-0.31***	-0.33***
	(0.030)	(0.030)	(0.084)	(0.032)	(0.15)	(0.043)	(0.058)	(0.046)
Disc. STC $_{(t-1)}$		-0.057***						
		(0.0061)						
Disc. STC		-0.057***						
		(0.0065)						
UBT. STC $_{(t-1)}$		0.062***						
		(0.0067)						
UBT. STC		0.012						
		(0.0066)						
Rest. STC $_{(t-1)}$		-0.0080						
		(0.0069)						
Rest. STC		0.031***						
		(0.0074)						

Constant	-380.7***	-369.9***	-259.8***	-381.4***	-2144.1***	-443.3***	-665.1***	-364.8***
	(5.19)	(5.14)	(14.3)	(5.49)	(62.5)	(14.4)	(33.9)	(6.16)
N	843472	843472	120020	723452	55394	155179	165048	467851
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The estimations distinguishing four income classifications of trade partners show interesting results. In fact, countries are affected differently by the EU regulations. TBT STCs are increasing the imports values of products from low and lower-middle income countries, which is statistically significant during the whole period of analysis. However, these regulations have no statistically significant impact on the quantities of imports to the EU from these groups of countries. This is clearly due to the fact that technical regulations maintained by the EU increase the value and prices of products in less advanced countries. In order to be able to export the same amount of quantities to the EU, these countries need to make some adjustments affecting their costs of production and final prices, which might as well replicate higher qualities of products. On the other hand, all regressions suggest that imports from high-income countries are not affected by TBT STCs, which suggests that advanced countries can adjust to regulations imposed by the EU very easily. In other words, high-income countries are following similar technological production procedures as EU members are. In contrast, there is strong negative effect of these regulations on the imports of products (either in values or quantities) from upper-middle income economies. While other categories of countries are trying to adjust their products and conform to EU regulations, upper-middle income countries might not do the same. Perhaps, it will be less costly for them to direct their exports to other countries rather than adjusting them for exportation to the EU.

Tariffs are known to be one of the traditional protectionist measures impeding trade, which is observable in most of the estimation results. However, it is observed that tariffs on non-food products (i.e. covering majority of the sample) enhance value and quantities of imports to the EU. However, such results do not seem to be consistent because FE regression controlling for specific product-country-pair effects is not showing any impact of tariffs changes on the importation of non-food products into the EU. Moreover, import values from high-income countries are decreasing with tariffs, while quantities of imports are increasing. This surprisingly suggests that traditional protectionist measures are working in the opposite direction for very advanced countries. It can be argued that in order to increase the market share in a high taxed market, advanced economies would rather decrease their prices (relatively even more than tariffs) to become competitive with the domestic producers within that market.

Having a free trade agreement (FTA) on goods with a partner country has negative effect on imports of all products and non-food product to the EU when considering the whole period. However, since 2002, this effect is not significantly different from zero, but positive for value of food imports. However, quantities of imports are not affected by FTA during 1995-2011. Another interesting issue is that FTAs are increasing the imports from middle-income countries, while these FTA are hampering trade from high-income countries. This result

might have some policy implications for the current rounds of transatlantic FTA negotiations. USA as an advanced economy might have lower trade with the EU after signing a FTA based on the regression results of the EU and USA (being represented next). While controlling for policy measures such as tariffs and TBT STCs, signing FTA between these two high-income economies might affect their bilateral trade negatively.

Another surprising result is found concerning the coefficients of colony and distance[26]. While colonial history with two partner countries is expected to improve the trade relationships of the trading partners, the results suggest otherwise. However, outcomes suggest that such negative colonial relationship is mainly between EU members and high-income partners (such as US or Australia). In fact, historical connections improve the imports from other categories of countries. Distance does not affect the value of imports of all products, while it reduces the quantity of imports. In other words, in order to export products with the same price in the EU market, more distant countries need to decrease the quantity of their exports to the EU. However, the imports of food products (non-food) are more from longer (shorter) distant countries. Besides, distance has negative effect on the importation of upper-middle and high-income countries. Countries within low and lower-middle income classifications are exporting more products to the EU when they are farther away.

The estimated coefficients of other variables such as number of varieties of products, GDP, economic advancement similarities, and factor endowment dissimilarities between the two trading partners, WTO and EU membership of the partner, sharing the same border and language, are straight forward and similar to other gravity estimations in the literature.

2.4.2. USA

Table 2. provides the estimation results of imports values to the USA during 1995-2011. An overview on the coefficients of TBT STCs and different issues of them in all regressions (also robustness checks) shows a trade creation effect of these measures. Generally legitimate TBTs are imposed to provide higher standards and qualities of products. As shown in the first chapter of this dissertation, there are various reasons behind imposition of TBT STCs, among which are environmental and health issues. However, STCs are raised when there is a concern on the TBT measure. The results suggest that this specific subcategory of TBTs is not having negative effects on the trade flows of products to the USA. In other words, TBT STCs maintained by US is enhancing the imports, which might be due to the legitimate issues of these regulations. In spite of raised concerns for these measures, these are not actually impeding trade flows but improving them. It can be concluded from various estimations that TBT STCs maintained by the USA are based on faithful motivations. These results are in line with findings of Bao and Chen (2013) discussed in the literature review.

Tariffs levied by the US government are hindering import values of products in most of the

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[26] Gravity time-invariant variables are not dropped out of FE regressions of the EU. The reason is that these variables are changing during time as the whole EU is considered during time. After accession of members during time, these variables are also changing for the whole EU sample. However, the variables are not statistically significantly different from zero because of very small variations during the sample

estimations. However, values of imports from middle and high-income economies are increasing with tariffs. This issue is surprisingly very clear for upper-middle income countries from which import quantities to the US are also increased by tariffs. In contrast, tariffs have no statistically significant impact on quantities imported from lower middle and high-income countries, which might suggest the increase of prices due to higher tariffs.

Similarities in economic development (SimY) with trade partners increase the imports values, but decrease the quantities imported to the US. In other words, USA imports larger quantities of products from countries that are less developed (considering US as a highly developed economy), but the values of imports from them are higher. This suggests that countries distant from US in terms of economic development have higher prices than others. However, considering the regression for low-income countries, those that are closer to USA in terms of GDP per capita in that category exports more quantities of products to the US.

Table 2.2- HT Regression of Imports Values to USA (1995-2011)

Import Value	M1	M2	Food	Non-Food	Low	Low-mid	Upp-mid	High
TBT STC	0.10***		0.12***	0.080***	0.0045	0.094***	0.11***	0.093***
	(0.0061)		(0.018)	(0.0074)	(0.025)	(0.013)	(0.014)	(0.0080)
TBT STC (t-1)	0.079***		0.090***	0.080***	0.035	0.067***	0.079***	0.070***
	(0.0063)		(0.018)	(0.0074)	(0.027)	(0.014)	(0.014)	(0.0081)
T	-0.015***	-0.015***	-0.0028***	-0.024***	-0.044***	0.0075***	0.023***	0.0032**
	(0.00061)	(0.00061)	(0.00083)	(0.00080)	(0.0010)	(0.0016)	(0.0020)	(0.00099)
No. CN8	0.021***	0.021***	0.0071***	0.024***	0.022***	0.020***	0.025***	0.027***
	(0.00065)	(0.00065)	(0.0014)	(0.00074)	(0.0023)	(0.0013)	(0.0014)	(0.00091)
GDP	11.0***	11.0***	6.03***	11.8***	36.2***	13.5***	26.6***	7.03***
	(0.17)	(0.17)	(0.43)	(0.18)	(1.46)	(0.33)	(0.83)	(0.34)
SimY	0.25*	0.25*	-0.68*	0.58***	50.3***	2.54***	3.81***	2.58***
	(0.12)	(0.12)	(0.32)	(0.13)	(2.80)	(0.50)	(0.39)	(0.37)
SimF	-0.093***	-0.092***	-0.15***	-0.059***	-0.022	0.095***	0.37***	0.15***
	(0.0097)	(0.0097)	(0.023)	(0.011)	(0.043)	(0.022)	(0.030)	(0.020)
WTO	0.42***	0.42***	0.32***	0.42***	0.35***	0.17***	0.47***	1.69***
	(0.015)	(0.015)	(0.034)	(0.016)	(0.038)	(0.023)	(0.055)	(0.32)
FTA	0.022*	0.019	0.14***	-0.045***		0.11***	0.16***	-0.073***
	(0.011)	(0.011)	(0.022)	(0.012)		(0.021)	(0.025)	(0.016)
EU Partner	0.32***	0.32***	-0.034	0.37***			0.25***	0.11***
	(0.013)	(0.013)	(0.038)	(0.013)			(0.020)	(0.030)
Contiguity	4.03***	4.02***	2.69***	4.34***			2.37***	4.08***
	(0.11)	(0.11)	(0.27)	(0.12)			(0.15)	(0.24)
Language	-0.19***	-0.19***	0.14	-0.25***	-0.36***	-0.062	-0.30**	-0.24***
	(0.043)	(0.043)	(0.12)	(0.046)	(0.10)	(0.080)	(0.100)	(0.067)
Colony	0.61***	0.60***	0.24	0.65***		0.40*		0.88***
	(0.068)	(0.068)	(0.19)	(0.072)		(0.16)		(0.083)
D	0.73***	0.72***	-0.14	0.91***	1.00***	0.75***	0.36***	0.42***
	(0.046)	(0.046)	(0.11)	(0.050)	(0.14)	(0.061)	(0.074)	(0.12)
Disc. STC (t-1)		0.14***						
		(0.014)						
Disc. STC		0.18***						
		(0.014)						
UBT. STC (t-1)		0.043***						
		(0.011)						
UBT. STC		0.13***						

	(0.0100)							
Rest. STC (t-1)	0.087***							
	(0.0083)							
Rest. STC	0.060***							
	(0.0082)							
Constant	-333.8***	-333.5***	-175.8***	-357.8***	-1099.8***	-405.3***	-801.5***	-212.8***
	(5.03)	(5.03)	(13.0)	(5.41)	(43.9)	(9.80)	(24.9)	(10.1)
N	586544	586544	71018	515526	40492	118717	124344	302991
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

While FTA increases the trade flows of products to the US among high-income trade partners, having an FTA with US has statistically significantly negative impact on trade. This result was also found for the EU, which might give similar policy implication for the transatlantic agreement. However, being an EU partner increases the trade flows to the US statistically significantly in almost all regressions. This might on the other hand suggest a good trade relationship between the US and EU member state, which might not necessarily need an FTA.

While EU was importing more from countries with dissimilarities in factors endowment ratio, US is importing more from those countries that have more similarities in these terms. However, classifying trade partners within development groups suggest similar results as for the EU.

Estimated coefficients of varieties of products, GDP, WTO membership, contiguity and colonial similarities of the partner, and distance have impact and interpretations almost similar to the ones obtained for the EU sample. Conversely, similarity of the language (considered to be a communicative cost of trade) between the USA and its trade partner has negative impact on imports. Since the main official language of the US is English and this is supposed to be a common international language in the world, the result suggests that US has lower trade with countries using English as their official languages.[27] These countries are mostly developing and least developed countries in Africa, Oceania, and Caribbean. Although highly advanced countries such as UK, Canada, and Australia are part of these countries with English as the main official language, trade effects of those least developed ones might seem to be bigger. However, such negative impact of similar language is observed also within the category of high-income economies.

2.4.3. China

Table 2. presents the estimation results on imports values of products to China over period 2002-2011 which is the period starting after accession of China to the WTO. Since 2002, TBT STCs are maintained by the Chinese government. That is the main reason why the benchmark estimation covers this period. The benchmark estimation (M1) shows that impact

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[27] It is worth mentioning that these gravity variables have been tested separately in some regressions, and the results were still consistent with the presented outcomes.

of TBT STCs on imports values of all products are not statistically different from zero. However, it is observed that these measures hamper import of food products and imports of all products from the high-income economies. More precisely, imposition of these measures decreases the value of food imports by about 18% and the quantity of food imports by about 20%. To explain this large impact of the measures observe that technical issues of food products related to health of human should be implemented within SPS measures rather than TBTs. Thus, TBTs aiming at food products might relate to the technical issues common within all categories of products (e.g. mandatory labeling).

After decomposing Chinese TBT STCs, strong hampering effect of discriminatory and UBT notifications is observed. Estimation results of the issues related to TBT STCs represented in M2 are showing that there are certain impeding effects behind some of these measures. This confirms the concerns of other countries raising STCs on these specific TBTs.

Table 2.3- HT Regression of Imports Values to China (2002-2011)

Import Value	M1	M2	Food	Non-Food	Low	Low-mid	Upp-mid	High
TBT STC	-0.015		-0.18***	0.015	0.015	0.054	-0.016	-0.039***
	(0.0100)		(0.044)	(0.011)	(0.055)	(0.028)	(0.027)	(0.012)
TBT STC $_{(t-1)}$	0.032**		-0.12**	0.062***	0.21***	0.11***	0.050	-0.017
	(0.0100)		(0.042)	(0.011)	(0.058)	(0.027)	(0.027)	(0.012)
T	-0.014***	-0.015***	-0.018***	-0.011***	-0.028***	-0.011***	-0.023***	-0.011***
	(0.0014)	(0.0014)	(0.0030)	(0.0015)	(0.0054)	(0.0033)	(0.0037)	(0.0018)
No. CN8	0.038***	0.039***	0.017***	0.048***	0.023***	0.029***	0.036***	0.045***
	(0.0013)	(0.0013)	(0.0024)	(0.0016)	(0.0050)	(0.0030)	(0.0028)	(0.0017)
GDP	1.79***	1.78***	1.10***	1.91***	2.25*	7.03***	2.35***	1.28***
	(0.058)	(0.058)	(0.17)	(0.061)	(0.91)	(0.40)	(0.31)	(0.057)
SimY	-3.79***	-3.84***	0.026	-4.27***	13.2***	3.41***	3.58***	-7.55***
	(0.19)	(0.19)	(0.60)	(0.20)	(1.71)	(0.95)	(0.98)	(0.46)
SimF	-0.28***	-0.29***	-0.035	-0.32***	0.37*	0.22**	-0.16	-1.00***
	(0.022)	(0.022)	(0.068)	(0.023)	(0.17)	(0.075)	(0.10)	(0.044)
WTO	0.35***	0.34***	-0.33**	0.43***	0.029	-0.092	1.62***	-9.55***
	(0.042)	(0.042)	(0.13)	(0.045)	(0.079)	(0.089)	(0.26)	(1.40)
FTA	-0.19***	-0.19***	-0.041	-0.21***	0.30***	-0.0022	-0.13*	-0.39***
	(0.022)	(0.022)	(0.063)	(0.023)	(0.080)	(0.051)	(0.054)	(0.034)
EU Partner	0.34***	0.34***	-0.62***	0.40***			0.32***	0.072
	(0.040)	(0.040)	(0.14)	(0.041)			(0.076)	(0.062)
Contiguity	-0.46***	-0.46***	0.012	-0.53***	0.89***	0.55***	1.80***	-1.03***
	(0.078)	(0.078)	(0.22)	(0.082)	(0.26)	(0.14)	(0.30)	(0.20)
Language	0.35***	0.33***	-0.088	0.38***			1.18***	-0.27
	(0.092)	(0.092)	(0.26)	(0.097)			(0.17)	(0.15)
Colony	-1.02*	-1.03*	0.21	-1.11*	0.96	0.71		
	(0.41)	(0.41)	(0.97)	(0.44)	(0.52)	(0.48)		
D	-1.34***	-1.35***	0.18	-1.53***	0.98***	-0.029	-0.88***	-1.65***
	(0.037)	(0.037)	(0.10)	(0.040)	(0.22)	(0.097)	(0.079)	(0.058)
Disc. STC $_{(t-1)}$		-0.063**						
		(0.021)						
Disc. STC		-0.16***						
		(0.037)						
UBT. STC $_{(t-1)}$		0.043*						
		(0.017)						
UBT. STC		-0.044**						
		(0.014)						
Rest. STC $_{(t-1)}$		0.047***						

	(0.012)							
Rest. STC	0.0091							
	(0.012)							
Constant	-35.2***	-34.6***	-28.7***	-37.0***	-75.0**	-202.2***	-58.7***	-5.65*
	(1.80)	(1.80)	(5.34)	(1.90)	(25.8)	(12.6)	(9.41)	(2.56)
N	241670	241670	21418	220252	9959	36103	40434	155174
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

While imports values are not affected by Chinese TBT STCs in most regressions, quantities imported to China are statistically significantly decreased by these policy measures. This again suggests that prices of imported products have raised because of technical issues related to the regulations.

During the period 1995-2011 the EU and the USA were more often than any other country requested to participate in WTO consultations regarding the TBT agreement more than any other countries. Nonetheless, there has been no case against China – second largest country maintaining TBT STCs - violating TBT agreements. In spite of finding trade hampering effects of some particular TBT STCs on trade values to China, results remain slightly inconclusive with respect to the above-mentioned issue. In general, the estimation outcomes suggest a price disturbing stimulus of these regulations. In fact, China does not significantly hinder imports using these policy instruments. While these measures are mostly increasing the prices rather than hindering total import values, it would be difficult to address them as obstacles to trade. Moreover, positive impact of previous TBT STCs on current imports values might imply the adjusted quality (or any other technical issue) of the imported products after a short time. This will lead to an increase in the trade values as prices are increased but quantities are decreased. In other words, after one year, fewer products with higher quality corresponding to a much higher price will enter the Chinese market. This issue seems very realistic and natural in terms of standards and regulations and does not indicate protectionism.

Statistically significant coefficients of similarity in economic development show that China imports products mostly from countries with greater dissimilarities. Especially for the group of high-income economies this relationship is larger. Conversely, for other groups of countries, China imports more from countries with more similarities in terms of GDP per capita. During 2002-2011, imports of products to China are larger from countries with similar share of factors endowment, which is similar to the pattern observed in the USA.

Estimation results suggest that imports to China stem more from WTO members. However, a negative relationship is observed for foods imports and all imports from high-income countries. In other words, being a WTO member facilitates trade of non-food products to China. Moreover, having an FTA with China reduces the exports of products to China. However, low-income countries can enjoy having FTA with China based on statistically significant positive coefficients. We saw that situation was the opposite for the EU and the US.

According to the regression outcomes, being an EU member state would increase the values of exports to China. However, this issue is due to the higher prices of imports from EU members considering the estimation results on quantity of imports. In fact, higher prices of imports from EU might be attributed to the higher qualities of products.

In contrast to the surprising results for the USA and the EU, the impact of distance and languages on the imports to China are consistent with the results found elsewhere in the literature. In addition, tariffs, number of variety of products, and GDP of both trade partners have the expected signs. Nevertheless, sharing the same border with China decreases the trade flows of products to this country, especially from high-income economies. The opposite expected effect of contiguity on imports values can be observed on other categories of countries. This result is not very surprising as most of the countries sharing the same border with China are not high-income economies. It is also worth mentioning that lower imports of products to China are from countries sharing similar colonial heritage.

2.5.   Summary and Concluding Remarks

This paper investigates the impact of Specific Trade Concerns (STC) raised on Technical Barriers to Trade maintained by the EU, USA, and China on their product imports. While imposition of TBTs is allowed in the framework of WTO regulations for justifiable reasons, some of them have raised STC. During 1995-2011, these countries have used TBT STCs more than any other WTO member state. EU and USA have been requested for consultation within the dispute settlement mechanism (DSM) of WTO citing TBT agreement more than any other countries, while there has been no case against China.

Imports of products at 4-digit level of Harmonized Systems during 1995-2011 were considered in the analysis. Import values and import quantities have been separately analyzed using the gravity model framework. A modified gravity equation, based on the ones used by others in the literature, was estimated using Hausman-Taylor (HT) estimation controlling for endogeneity. Fixed Effect (FE) estimations were also applied as a robustness check. Including gravity variables in the model augmented with product level and policy instruments variables, the results shed light on the nature of TBT STCs maintained by the EU, USA, and China.

There is some evidence pointing towards hampering effects of TBT STCs maintained by the EU. This relationship is stronger for those measures that are claimed to be discriminatory. Thus, these policy instruments can evidently reduce the value of non-food imports to the EU. On the other side of the Atlantic, TBT STCs maintained by the US government seem to follow good faith as it was consistently showed that – also subject to various robustness checks - these measures are enhancing trade of products to the US.

The analysis showed that FTA with low-medium and upper-medium income countries would increase trade to the EU and the USA. However, controlling for EU partners (majority of high-income countries in the sample), FTA with high-income countries (other than EU members) have negative influence on trade to the USA and the EU. However, without an

FTA between the two nations, the results highlighted a good strong trade relationship between them, given the positive impact of being EU membership on trade. Considering current negotiations on Transatlantic Trade and Investment Partnership (TTIP), signing an FTA between the two nations might be beneficial improving the current trade relations. Specifically, since TBT STCs maintained by the US have positive influence on bilateral trade flows of the products, a harmonized system of regulations might enhance the trade relationships between the two economies.

Results also confirmed the hampering effect of Chinese TBT STCs on the imported quantities to China. Moreover, discriminatory and unnecessary barriers to trade, the main important issues regarding Chinese measures, impede imports of products to China significantly. However, TBT STCs in general do not cause any statistically significant impact on imports value of products to this country. Therefore, it can be argued that such measures rather increase the price of products imports, which consequently would decrease the import quantities. In other words, these regulations impose some costs of adjustment to the exporting firms. Nonetheless, this study remains inconclusive as to why there has been no DS case within WTO against China citing TBT agreement. It seems that either the TBT measures imposed by China are not causing sufficient distortion to request a case in the WTO, or there is some specific political intuition behind. China's role in international trade has dramatically expanded during the last years, which might have some political reasons for countries requesting cases against it.

Appendix 2:

Appendix 2.1. Robustness Check for the EU

Table 2.4- HT Regression of Imports Values to the EU (2002-2011)

Import Value	M1	M2	Food	Non-Food	Low	Low-mid	Upp-mid	High
TBT STC	-0.0081		0.019	-0.027***	0.054**	0.022	-0.038***	-0.0018
	(0.0044)		(0.014)	(0.0048)	(0.021)	(0.011)	(0.0099)	(0.0053)
TBT STC (t-1)	-0.0072		-0.034**	-0.0088	0.020	-0.0073	-0.031**	0.0037
	(0.0042)		(0.013)	(0.0048)	(0.020)	(0.011)	(0.0095)	(0.0050)
T	-0.018***	-0.018***	-0.029***	0.0061**	0.0043	0.0083*	-0.047***	-0.016***
	(0.0017)	(0.0017)	(0.0023)	(0.0024)	(0.0073)	(0.0037)	(0.0035)	(0.0028)
No. CN8	0.037***	0.038***	0.029***	0.040***	0.022***	0.032***	0.048***	0.049***
	(0.00074)	(0.00074)	(0.0015)	(0.00086)	(0.0022)	(0.0015)	(0.0016)	(0.0010)
GDP	15.4***	15.6***	11.5***	15.7***	94.2***	16.5***	18.2***	15.9***
	(0.23)	(0.23)	(0.62)	(0.24)	(3.53)	(0.47)	(1.17)	(0.25)
SimY	3.94***	3.90***	2.22***	4.30***	13.9***	6.08***	5.38***	8.05***
	(0.11)	(0.11)	(0.30)	(0.12)	(1.47)	(0.40)	(0.40)	(0.29)
SimF	0.26***	0.26***	0.23***	0.27***	-0.033	-0.015	0.66***	0.15***
	(0.010)	(0.010)	(0.026)	(0.011)	(0.042)	(0.028)	(0.029)	(0.018)
WTO	0.42***	0.42***	0.44***	0.42***	0.41***	0.51***	0.94***	2.33***
	(0.017)	(0.017)	(0.046)	(0.018)	(0.037)	(0.025)	(0.073)	(0.22)
FTA	0.020	0.020	0.087*	0.027		0.21***	0.089*	-0.20***
	(0.015)	(0.015)	(0.039)	(0.017)		(0.024)	(0.038)	(0.028)
EU Partner	0.64***	0.64***	1.13***	0.58***			0.75***	-0.016
	(0.010)	(0.010)	(0.031)	(0.011)			(0.018)	(0.020)
Contiguity	2.28***	2.29***	2.57***	2.23***	2.40***	0.73***	0.78***	2.98***
	(0.054)	(0.054)	(0.15)	(0.058)	(0.32)	(0.085)	(0.11)	(0.077)
Language	0.062*	0.059	0.55***	-0.0088	-0.83***	-0.58***	-0.83***	0.55***
	(0.031)	(0.031)	(0.083)	(0.033)	(0.10)	(0.057)	(0.081)	(0.040)
Colony	-0.17***	-0.16***	-0.20*	-0.17***	0.56***	-0.060	0.78***	-0.70***
	(0.035)	(0.035)	(0.094)	(0.038)	(0.12)	(0.067)	(0.069)	(0.044)
D	-0.00029	0.00070	0.48***	-0.086**	0.67***	0.20***	-0.18**	-0.38***
	(0.029)	(0.029)	(0.080)	(0.031)	(0.17)	(0.044)	(0.063)	(0.043)
Disc. STC (t-1)		-0.054***						
		(0.0061)						
Disc. STC		-0.039***						
		(0.0068)						
UBT. STC (t-1)		0.049***						
		(0.0075)						
UBT. STC		-0.0097						
		(0.0072)						
Rest. STC (t-1)		-0.020**						
		(0.0070)						
Rest. STC		0.036***						
		(0.0081)						
Constant	-465.0***	-468.8***	-348.1***	-473.9***	-2858.0***	-498.5***	-549.8***	-479.9***
	(6.91)	(6.87)	(18.6)	(7.41)	(106.7)	(14.2)	(35.4)	(7.37)
N	701392	701392	98673	602719	49850	140641	155730	355171
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2.5- FE Poisson Regression of Imports Values to the EU

Period	1995-2011				2002-2011			
Import Value	M1	M2	Food	Non-Food	M1	M2	Food	Non-Food
TBT STC	0.050***		-0.033**	0.053***	0.043***		-0.027**	0.042***
	(0.0080)		(0.011)	(0.0090)	(0.0094)		(0.0090)	(0.010)
TBT STC $_{(t-1)}$	0.019**		-0.025*	0.014	0.013		-0.019	0.0057
	(0.0063)		(0.013)	(0.0074)	(0.0070)		(0.011)	(0.0081)
T	-0.0030	-0.0028	-0.010**	0.00051	-0.012*	-0.012	-0.013*	-0.010
	(0.0038)	(0.0038)	(0.0039)	(0.0053)	(0.0063)	(0.0063)	(0.0060)	(0.0084)
No. CN8	0.015***	0.015***	0.0029	0.016***	0.022***	0.021***	-0.0028	0.022***
	(0.0024)	(0.0024)	(0.0020)	(0.0025)	(0.0027)	(0.0028)	(0.0030)	(0.0028)
GDP	1.47	1.54	-2.02	1.65	1.91	1.99*	1.85*	1.86
	(0.88)	(0.87)	(1.15)	(0.92)	(1.02)	(1.02)	(0.82)	(1.07)
SimY	6.72***	6.64***	4.10***	6.90***	6.31***	6.23***	3.34***	6.56***
	(1.14)	(1.13)	(0.93)	(1.21)	(1.13)	(1.12)	(0.90)	(1.19)
SimF	0.066	0.062	0.063	0.071	0.066	0.065	0.094	0.064
	(0.059)	(0.058)	(0.051)	(0.065)	(0.063)	(0.062)	(0.050)	(0.070)
WTO	0.34***	0.34***	0.53***	0.31***	0.22**	0.22**	0.65***	0.16
	(0.067)	(0.067)	(0.12)	(0.073)	(0.082)	(0.082)	(0.15)	(0.089)
FTA	-0.070	-0.070	-0.025	-0.073	-0.11	-0.11	0.013	-0.12
	(0.061)	(0.061)	(0.11)	(0.064)	(0.069)	(0.069)	(0.17)	(0.071)
EU Partner	0.075	0.078	0.62***	0.044	0.031	0.035	0.67***	-0.0073
	(0.060)	(0.059)	(0.087)	(0.062)	(0.056)	(0.055)	(0.084)	(0.058)
Contiguity	8.6e-19	-4.1e-16	2.9e-23	3.3e-13	4.0e-24	1.6e-12	-1.7e-13	-8.9e-19
	.	(0)	.	.	.	.	(0)	(0)
Language	1.3e-18	-1.1e-15	2.5e-22	1.7e-13	1.0e-24	1.1e-12	1.4e-14	-3.7e-17
	.	(0)	.	.	.	.	.	(0)
Colony	8.0e-19	2.0e-16	-2.4e-22	7.2e-13	2.6e-24	6.5e-13	-1.6e-13	-3.0e-17
	.	.	(0)	.	.	.	(0)	(0)
D	-0.28	0.41	-0.59	0.19	3.42	-0.14	-1.3e-12	4.33
	(0)	.	(11.0)	(3.22)	(17.2)	(6.06)	(2.61)	(19.6)
Disc. STC		0.014				0.033*		
		(0.013)				(0.015)		
Disc. STC $_{(t-1)}$		0.025*				0.038***		
		(0.011)				(0.010)		
UBT. STC		0.047***				0.029*		
		(0.011)				(0.012)		
UBT. STC $_{(t-1)}$		0.062***				0.047***		
		(0.010)				(0.0089)		
Rest. STC		0.062***				0.061***		
		(0.015)				(0.015)		
Rest. STC $_{(t-1)}$		-0.041**				-0.043**		
		(0.014)				(0.013)		
N	851867	851867	121360	730507	706283	706283	99364	606919
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	5.48316e+09	5.47344e+09	342676028.9	5.10740e+09	3.54778e+09	3.53962e+09	199772979.1	3.32431e+09
BIC	5.48316e+09	5.47344e+09	342676291.0	5.10740e+09	3.54778e+09	3.53962e+09	199773169.2	3.32431e+09

Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2.6- HT Regression of Imports Quantity to the EU (1995-2011)

Import Quant.	M1	M2	Food	Non-Food	Low	Low-mid	Upp-mid	High
TBT STC	-0.0094*		0.0079	-0.023***	0.029	0.012	-0.050***	0.0048
	(0.0044)		(0.014)	(0.0050)	(0.021)	(0.012)	(0.011)	(0.0052)
TBT STC $_{(t-1)}$	-0.0060		-0.021	-0.0097*	0.072***	-0.0054	-0.029**	0.00040
	(0.0043)		(0.013)	(0.0049)	(0.020)	(0.012)	(0.010)	(0.0051)
T	0.00029	0.00048	-0.016***	0.021***	-0.0047	0.0014	-0.015***	0.015***
	(0.0011)	(0.0011)	(0.0016)	(0.0015)	(0.0057)	(0.0023)	(0.0024)	(0.0019)
No. CN8	0.023***	0.023***	0.017***	0.023***	0.014***	0.021***	0.034***	0.030***
	(0.00068)	(0.00068)	(0.0014)	(0.00078)	(0.0023)	(0.0015)	(0.0016)	(0.00088)
GDP	11.5***	11.4***	7.97***	11.8***	61.7***	13.0***	16.6***	11.1***
	(0.18)	(0.18)	(0.51)	(0.20)	(2.17)	(0.48)	(1.27)	(0.23)
SimY	3.45***	3.48***	2.52***	3.70***	20.5***	4.44***	4.68***	10.2***
	(0.11)	(0.11)	(0.30)	(0.12)	(1.51)	(0.37)	(0.39)	(0.26)
SimF	0.15***	0.15***	0.19***	0.14***	-0.0047	0.019	0.74***	0.13***
	(0.0097)	(0.0097)	(0.024)	(0.011)	(0.037)	(0.023)	(0.028)	(0.018)
WTO	0.26***	0.26***	0.16***	0.28***	0.38***	0.16***	0.74***	1.70***
	(0.014)	(0.014)	(0.038)	(0.015)	(0.034)	(0.022)	(0.050)	(0.28)
FTA	0.0049	0.0035	-0.0051	0.022		0.100***	0.081**	-0.26***
	(0.013)	(0.013)	(0.034)	(0.014)		(0.021)	(0.029)	(0.026)
EU Partner	0.51***	0.51***	1.06***	0.45***			0.66***	0.038
	(0.010)	(0.010)	(0.030)	(0.011)			(0.018)	(0.021)
Contiguity	2.24***	2.23***	2.43***	2.16***	2.30***	1.24***	0.85***	3.01***
	(0.064)	(0.064)	(0.17)	(0.068)	(0.32)	(0.092)	(0.12)	(0.095)
Language	0.036	0.037	0.55***	-0.078*	-0.66***	-0.67***	-0.92***	0.39***
	(0.037)	(0.037)	(0.095)	(0.040)	(0.11)	(0.062)	(0.085)	(0.047)
Colony	-0.20***	-0.21***	-0.29**	-0.20***	0.86***	0.079	0.75***	-0.62***
	(0.041)	(0.041)	(0.11)	(0.044)	(0.14)	(0.069)	(0.079)	(0.052)
D	-0.12***	-0.12***	0.23**	-0.19***	0.53**	0.21***	-0.33***	-0.57***
	(0.034)	(0.034)	(0.090)	(0.037)	(0.17)	(0.049)	(0.068)	(0.053)
Disc. STC $_{(t-1)}$		-0.065***						
		(0.0065)						
Disc. STC		-0.039***						
		(0.0069)						
UBT. STC $_{(t-1)}$		0.041***						
		(0.0071)						
UBT. STC		-0.0056						
		(0.0069)						
Rest. STC $_{(t-1)}$		0.012						
		(0.0073)						
Rest. STC		0.015						
		(0.0079)						
Constant	-344.7***	-340.3***	-239.9***	-351.8***	-1874.3***	-395.0***	-496.4***	-331.5***
	(5.54)	(5.50)	(15.3)	(5.88)	(65.4)	(14.6)	(37.9)	(6.84)
N	793420	793420	117410	676010	47459	142049	153058	450854
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix 2.2. Robustness Check for the USA

Table 2.7- HT Regression of Imports Values to the USA (2002-2011)

Import Value	M1	M2	Food	Non-Food	Low	Low-mid	Upp-mid	High
TBT STC	0.047***		0.032	0.022**	-0.013	0.056***	0.065***	0.050***
	(0.0059)		(0.018)	(0.0072)	(0.026)	(0.013)	(0.013)	(0.0079)
TBT STC $_{(t-1)}$	0.040***		0.0063	0.044***	0.011	0.033*	0.051***	0.048***
	(0.0061)		(0.019)	(0.0073)	(0.028)	(0.013)	(0.013)	(0.0080)
T	-0.0019	-0.0024*	-0.00012	-0.0034**	-0.019***	0.018***	0.019***	0.0025
	(0.00099)	(0.00099)	(0.0023)	(0.0011)	(0.0014)	(0.0024)	(0.0026)	(0.0026)
No. CN8	0.021***	0.021***	0.015***	0.023***	0.024***	0.020***	0.028***	0.029***
	(0.00083)	(0.00084)	(0.0016)	(0.00098)	(0.0030)	(0.0017)	(0.0017)	(0.0012)
GDP	11.7***	11.7***	5.64***	12.5***	51.3***	13.1***	18.6***	17.8***
	(0.22)	(0.22)	(0.56)	(0.24)	(3.40)	(0.37)	(0.90)	(0.60)
SimY	0.84***	0.85***	-0.55	1.22***	38.4***	3.30***	1.35*	-0.80
	(0.13)	(0.13)	(0.34)	(0.14)	(3.53)	(0.58)	(0.53)	(0.44)
SimF	-0.014	-0.012	-0.17***	0.031*	-0.16*	0.11***	0.50***	0.072**
	(0.012)	(0.012)	(0.029)	(0.014)	(0.061)	(0.031)	(0.037)	(0.023)
WTO	0.56***	0.56***	0.41***	0.58***	0.29***	0.19***	1.21***	2.16***
	(0.023)	(0.023)	(0.052)	(0.025)	(0.040)	(0.038)	(0.11)	(0.31)
FTA	0.087***	0.083***	0.19***	0.033*		0.13***	0.12***	0.0027
	(0.012)	(0.012)	(0.024)	(0.014)		(0.023)	(0.027)	(0.021)
EU Partner	0.15***	0.15***	-0.28***	0.20***			0.13***	0.18***
	(0.015)	(0.015)	(0.044)	(0.016)			(0.022)	(0.036)
Contiguity	3.88***	3.88***	2.63***	4.18***			3.16***	2.89***
	(0.100)	(0.100)	(0.24)	(0.11)			(0.15)	(0.23)
Language	-0.29***	-0.29***	0.049	-0.34***	-0.82***	-0.16*	-0.54***	0.17*
	(0.041)	(0.041)	(0.11)	(0.044)	(0.12)	(0.079)	(0.10)	(0.068)
Colony	0.58***	0.59***	0.43*	0.61***		0.38*		-0.19*
	(0.065)	(0.065)	(0.18)	(0.069)		(0.15)		(0.092)
D	0.73***	0.72***	-0.15	0.90***	0.80***	0.91***	0.66***	0.081
	(0.043)	(0.043)	(0.10)	(0.048)	(0.15)	(0.062)	(0.074)	(0.12)
Disc. STC $_{(t-1)}$		0.13***						
		(0.013)						
Disc. STC		0.16***						
		(0.013)						
UBT. STC $_{(t-1)}$		0.017						
		(0.010)						
UBT. STC		0.085***						
		(0.0092)						
Rest. STC $_{(t-1)}$		0.043***						
		(0.0082)						
Rest. STC		-0.00019						
		(0.0081)						
Constant	-356.2***	-355.2***	-164.1***	-381.4***	-1551.5***	-401.1***	-563.6***	-535.0***
	(6.66)	(6.66)	(16.8)	(7.22)	(102.3)	(11.2)	(27.0)	(18.0)
N	389020	389020	47040	341980	22698	79553	84301	202468
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2.8- FE Regression of Imports Values to the USA

Period	1995-2011				2002-2011			
Import Value	M1	M2	Food	Non-Food	M1	M2	Food	Non-Food
TBT STC	0.098***		0.12***	0.073***	0.041***		0.030	0.013
	(0.0065)		(0.021)	(0.0080)	(0.0060)		(0.022)	(0.0075)
TBT STC (t-1)	0.072***		0.087***	0.070***	0.029***		0.0024	0.028***
	(0.0069)		(0.020)	(0.0083)	(0.0061)		(0.020)	(0.0074)
T	-0.015***	-0.015***	-0.0025	-0.025***	-0.0029	-0.0032	0.0019	-0.0052*
	(0.0025)	(0.0025)	(0.0020)	(0.0027)	(0.0019)	(0.0019)	(0.0043)	(0.0021)
No. CN8	0.012***	0.012***	-0.0061	0.014***	-0.00044	-0.00043	-0.0054	-0.00094
	(0.0019)	(0.0019)	(0.0037)	(0.0021)	(0.0022)	(0.0022)	(0.0044)	(0.0024)
GDP	9.49***	9.51***	5.06***	10.2***	8.89***	8.94***	3.87***	9.80***
	(0.36)	(0.36)	(0.89)	(0.38)	(0.39)	(0.39)	(0.96)	(0.42)
SimY	-0.60	-0.60	0.38	-0.54	-1.59*	-1.61**	-0.14	-1.81**
	(0.54)	(0.54)	(1.13)	(0.60)	(0.62)	(0.62)	(1.28)	(0.69)
SimF	-0.11***	-0.11***	-0.15***	-0.083***	-0.091***	-0.088***	-0.19***	-0.051
	(0.020)	(0.020)	(0.044)	(0.022)	(0.024)	(0.024)	(0.053)	(0.026)
WTO	0.48***	0.47***	0.31***	0.48***	0.47***	0.46***	0.32***	0.48***
	(0.031)	(0.031)	(0.062)	(0.034)	(0.049)	(0.049)	(0.080)	(0.056)
FTA	0.022	0.020	0.12**	-0.043	0.087***	0.084***	0.18***	0.036
	(0.025)	(0.025)	(0.046)	(0.028)	(0.022)	(0.022)	(0.040)	(0.025)
EU Partner	0.34***	0.34***	-0.040	0.39***	0.17***	0.16***	-0.27***	0.22***
	(0.031)	(0.031)	(0.086)	(0.033)	(0.029)	(0.029)	(0.073)	(0.031)
Disc. STC		0.18***				0.16***		
		(0.014)				(0.013)		
Disc. STC (t-1)		0.14***				0.13***		
		(0.014)				(0.012)		
UBT. STC		0.13***				0.076***		
		(0.011)				(0.0097)		
UBT. STC (t-1)		0.037**				0.0042		
		(0.012)				(0.011)		
Rest. STC		0.055***				-0.0075		
		(0.0085)				(0.0086)		
Rest. STC (t-1)		0.076***				0.026**		
		(0.0093)				(0.0089)		
Constant	-278.3***	-278.9***	-146.7***	-300.5***	-261.4***	-263.0***	-110.4***	-290.1***
	(10.6)	(10.6)	(26.8)	(11.4)	(11.6)	(11.6)	(29.1)	(12.6)
N	586544	586544	71018	515526	389020	389020	47040	341980
R²	0.049	0.049	0.085	0.048	0.023	0.023	0.050	0.023
adj. *R²*	0.049	0.049	0.085	0.048	0.023	0.023	0.050	0.023
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	1779057.3	1778907.8	192672.9	1581143.4	1072024.1	1071816.9	112998.1	955013.3
BIC	1779339.4	1779235.0	192902.2	1581422.3	1072230.7	1072066.9	113164.5	955217.4

Robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2.9- HT Regression of Imports Quantities to the USA (1995-2011)

Import Quant.	M1	M2	Food	Non-Food	Low	Low-mid	Upp-mid	High
TBT STC	0.11***		0.13***	0.054***	-0.042	0.078***	0.15***	0.11***
	(0.0097)		(0.023)	(0.013)	(0.038)	(0.021)	(0.022)	(0.013)
TBT STC (t-1)	0.068***		0.099***	0.043**	-0.072	-0.029	0.091***	0.079***
	(0.011)		(0.024)	(0.014)	(0.043)	(0.023)	(0.023)	(0.014)
T	-0.014***	-0.014***	-0.0027**	-0.026***	-0.038***	-0.0025	0.019***	0.0018
	(0.00086)	(0.00086)	(0.00099)	(0.0012)	(0.0015)	(0.0022)	(0.0027)	(0.0014)
No. CN8	0.018***	0.018***	0.011***	0.018***	0.029***	0.021***	0.022***	0.023***
	(0.0011)	(0.0011)	(0.0017)	(0.0014)	(0.0035)	(0.0021)	(0.0023)	(0.0016)
GDP	13.4***	13.4***	7.00***	14.7***	34.6***	16.5***	24.7***	4.23***
	(0.26)	(0.26)	(0.53)	(0.29)	(2.05)	(0.50)	(1.35)	(0.53)
SimY	-2.69***	-2.66***	-1.92***	-2.28***	47.3***	-0.31	0.88	4.87***
	(0.18)	(0.18)	(0.38)	(0.20)	(3.99)	(0.74)	(0.64)	(0.61)
SimF	-0.12***	-0.11***	-0.16***	-0.062***	-0.0086	0.10**	0.50***	0.16***
	(0.015)	(0.015)	(0.029)	(0.017)	(0.067)	(0.033)	(0.047)	(0.034)
WTO	0.43***	0.43***	0.31***	0.43***	0.29***	0.14***	0.62***	-0.23
	(0.023)	(0.023)	(0.043)	(0.027)	(0.060)	(0.034)	(0.086)	(0.51)
FTA	0.12***	0.11***	0.13***	0.030		0.21***	0.24***	-0.081**
	(0.017)	(0.017)	(0.027)	(0.020)		(0.032)	(0.040)	(0.027)
EU Partner	0.14***	0.14***	-0.11*	0.19***			0.12***	-0.021
	(0.022)	(0.022)	(0.047)	(0.024)			(0.034)	(0.051)
Contiguity	4.10***	4.11***	3.25***	4.48***			2.49***	5.87***
	(0.15)	(0.15)	(0.31)	(0.17)			(0.24)	(0.36)
Language	-0.12	-0.12	0.15	-0.22**	-0.48***	0.038	-0.29	-0.58***
	(0.063)	(0.063)	(0.14)	(0.069)	(0.14)	(0.12)	(0.16)	(0.100)
Colony	0.50***	0.50***	0.17	0.54***		-0.085		1.32***
	(0.095)	(0.095)	(0.22)	(0.10)		(0.23)		(0.12)
D	0.40***	0.41***	-0.31*	0.68***	0.83***	0.39***	0.016	0.92***
	(0.068)	(0.068)	(0.13)	(0.076)	(0.20)	(0.089)	(0.12)	(0.19)
Disc. STC (t-1)		0.21***						
		(0.020)						
Disc. STC		0.24***						
		(0.021)						
UBT. STC (t-1)		-0.047*						
		(0.020)						
UBT. STC		0.084***						
		(0.016)						
Rest. STC (t-1)		0.056***						
		(0.015)						
Rest. STC		0.083***						
		(0.014)						
Constant	-394.6***	-396.7***	-197.7***	-437.3***	-1045.1***	-486.3***	-735.5***	-127.9***
	(7.67)	(7.67)	(16.0)	(8.56)	(61.7)	(14.9)	(40.3)	(15.8)
N	415532	415532	65541	349991	29154	84087	85799	216492
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix 2.3. Robustness Check for China

Table 2.10- HT Regression of Imports Values to China (1995-2011)

Import Value	M1	M2	Food	Non-Food	Low	Low-mid	Upp-mid	High
TBT STC	0.095***		-0.021	0.12***	0.12*	0.21***	0.15***	0.042***
	(0.0097)		(0.050)	(0.010)	(0.056)	(0.028)	(0.026)	(0.011)
TBT STC $_{(t-1)}$	0.14***		0.031	0.17***	0.33***	0.25***	0.22***	0.072***
	(0.0098)		(0.047)	(0.011)	(0.059)	(0.027)	(0.026)	(0.011)
T	-0.0049***	-0.0050***	-0.0087***	-0.0046***	-0.012***	-0.0043*	-0.0080***	-0.0039***
	(0.00066)	(0.00066)	(0.0012)	(0.00083)	(0.0032)	(0.0022)	(0.0019)	(0.00078)
No. CN8	0.025***	0.025***	0.0087***	0.031***	0.022***	0.025***	0.023***	0.029***
	(0.0011)	(0.0011)	(0.0022)	(0.0012)	(0.0042)	(0.0026)	(0.0025)	(0.0014)
GDP	0.77***	0.76***	1.01***	0.73***	2.28**	3.92***	0.42	0.74***
	(0.036)	(0.036)	(0.11)	(0.038)	(0.71)	(0.34)	(0.25)	(0.037)
SimY	-1.50***	-1.50***	2.32***	-2.01***	10.2***	-1.19	-1.29	-1.43***
	(0.16)	(0.16)	(0.48)	(0.17)	(1.25)	(0.74)	(0.74)	(0.41)
SimF	0.085***	0.085***	0.26***	0.063***	-0.47***	-0.17**	-0.34***	-0.50***
	(0.017)	(0.017)	(0.054)	(0.018)	(0.11)	(0.061)	(0.079)	(0.036)
WTO	0.44***	0.44***	-0.0078	0.51***	-0.11	-0.23**	1.63***	-10.7***
	(0.041)	(0.041)	(0.12)	(0.044)	(0.080)	(0.083)	(0.25)	(1.59)
FTA	-0.53***	-0.53***	-0.46***	-0.54***	0.36***	0.10*	-0.38***	-1.20***
	(0.014)	(0.014)	(0.045)	(0.015)	(0.068)	(0.046)	(0.044)	(0.019)
EU Partner	0.65***	0.65***	-0.55***	0.73***			0.42***	-0.078
	(0.030)	(0.030)	(0.12)	(0.031)			(0.052)	(0.059)
Contiguity	-0.29***	-0.29***	0.25	-0.36***	-0.44*	0.36**	1.57***	-0.68***
	(0.081)	(0.081)	(0.21)	(0.087)	(0.18)	(0.11)	(0.29)	(0.20)
Language	0.61***	0.60***	0.41	0.61***			0.61***	0.096
	(0.093)	(0.093)	(0.24)	(0.099)			(0.16)	(0.15)
Colony	-1.44***	-1.44***	-0.098	-1.58***	0.46	-0.021		
	(0.43)	(0.43)	(1.02)	(0.47)	(0.50)	(0.47)		
D	-1.49***	-1.49***	0.16	-1.70***	0.57**	-0.42***	-1.69***	-1.71***
	(0.038)	(0.038)	(0.098)	(0.041)	(0.19)	(0.085)	(0.056)	(0.059)
Disc. STC $_{(t-1)}$		0.14***						
		(0.022)						
Disc. STC		0.15***						
		(0.040)						
UBT. STC $_{(t-1)}$		0.12***						
		(0.019)						
UBT. STC		0.032*						
		(0.014)						
Rest. STC $_{(t-1)}$		0.17***						
		(0.012)						
Rest. STC		0.13***						
		(0.012)						
Constant	-6.20***	-6.02***	-27.5***	-3.25**	-69.5***	-105.7***	4.75	10.3***
	(1.11)	(1.11)	(3.47)	(1.17)	(19.5)	(10.5)	(7.37)	(2.24)
N	338287	338287	31900	306387	15893	46287	52407	223700
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2.11- FE Regression of Imports Values to China

Period	1995-2011				2002-2011			
Import Value	M1	M2	Food	Non-Food	M1	M2	Food	Non-Food
TBT STC	0.077***		-0.0095	0.098***	-0.053***		-0.17***	-0.031**
	(0.012)		(0.053)	(0.013)	(0.010)		(0.049)	(0.011)
TBT STC $_{(t-1)}$	0.13***		0.050	0.15***	-0.0077		-0.11*	0.014
	(0.011)		(0.047)	(0.012)	(0.010)		(0.044)	(0.011)
T	-0.0041**	-0.0040**	-0.0081**	-0.0036*	-0.013***	-0.013***	-0.015**	-0.011***
	(0.0014)	(0.0014)	(0.0027)	(0.0016)	(0.0023)	(0.0023)	(0.0050)	(0.0025)
No. CN8	0.011**	0.011**	-0.021*	0.014***	0.017***	0.020***	0.012	0.018***
	(0.0034)	(0.0035)	(0.0084)	(0.0037)	(0.0033)	(0.0034)	(0.0099)	(0.0035)
GDP	-0.17*	-0.17*	0.45	-0.23**	0.16	0.13	0.10	0.21*
	(0.071)	(0.071)	(0.26)	(0.073)	(0.096)	(0.096)	(0.36)	(0.099)
SimY	1.38**	1.38**	3.80**	1.06*	-0.015	-0.054	2.09	-0.24
	(0.45)	(0.45)	(1.25)	(0.48)	(0.52)	(0.52)	(1.47)	(0.55)
SimF	0.34***	0.34***	0.42***	0.32***	0.091*	0.090*	0.18	0.073
	(0.035)	(0.035)	(0.10)	(0.037)	(0.039)	(0.039)	(0.11)	(0.042)
WTO	0.56***	0.56***	0.11	0.64***	0.47***	0.47***	-0.20	0.56***
	(0.086)	(0.086)	(0.23)	(0.092)	(0.082)	(0.082)	(0.21)	(0.088)
FTA	-0.41***	-0.41***	-0.43***	-0.41***	-0.12***	-0.12***	-0.049	-0.14***
	(0.026)	(0.026)	(0.082)	(0.028)	(0.028)	(0.028)	(0.085)	(0.030)
EU Partner	0.98***	0.98***	-0.0036	1.03***	0.65***	0.64***	0.92	0.65***
	(0.080)	(0.080)	(0.29)	(0.082)	(0.12)	(0.12)	(0.60)	(0.12)
Disc. STC		0.13**				-0.23***		
		(0.042)				(0.047)		
Disc. STC $_{(t-1)}$		0.12***				-0.10***		
		(0.022)				(0.025)		
UBT. STC		0.022				-0.070***		
		(0.015)				(0.014)		
UBT. STC $_{(t-1)}$		0.12***				0.027		
		(0.020)				(0.019)		
Rest. STC		0.11***				-0.039**		
		(0.014)				(0.012)		
Rest. STC $_{(t-1)}$		0.14***				-0.0053		
		(0.014)				(0.012)		
Constant	7.10***	7.13***	-9.00	8.91***	-0.51	0.095	1.04	-2.18
	(1.96)	(1.96)	(7.37)	(2.02)	(2.73)	(2.73)	(10.4)	(2.81)
N	338287	338287	31900	306387	241670	241670	21418	220252
R^2	0.119	0.119	0.111	0.121	0.045	0.045	0.081	0.043
adj. R^2	0.119	0.119	0.111	0.121	0.045	0.045	0.080	0.042
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	1217581.4	1217556.8	115593.0	1101545.1	802172.5	802122.6	69813.7	732153.7
BIC	1217817.5	1217835.9	115777.2	1101779.0	802349.2	802340.9	69949.2	732328.8

Robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2.12- HT Regression of Imports Quantities to China (2002-2011)

Import Value	M1	M2	Food	Non-Food	Low	Low-mid	Upp-mid	High
TBT STC	-0.084***		-0.20***	-0.042**	0.10	0.056	-0.13***	-0.14***
	(0.014)		(0.056)	(0.016)	(0.070)	(0.042)	(0.039)	(0.016)
TBT STC (t-1)	-0.033*		-0.13*	-0.0013	0.32***	0.10*	-0.077	-0.11***
	(0.014)		(0.053)	(0.016)	(0.076)	(0.041)	(0.040)	(0.017)
T	-0.015***	-0.015***	-0.021***	-0.0094***	-0.035***	-0.011*	-0.023***	-0.0092***
	(0.0017)	(0.0017)	(0.0034)	(0.0020)	(0.0062)	(0.0043)	(0.0051)	(0.0024)
No. CN8	0.029***	0.030***	0.016***	0.030***	0.011	0.018***	0.030***	0.037***
	(0.0018)	(0.0018)	(0.0028)	(0.0023)	(0.0068)	(0.0044)	(0.0040)	(0.0023)
GDP	1.17***	1.18***	0.94***	1.31***	-1.12	18.4***	2.09**	1.05***
	(0.075)	(0.075)	(0.21)	(0.081)	(1.26)	(1.13)	(0.71)	(0.073)
SimY	-2.67***	-2.70***	0.87	-3.06***	14.5***	6.74***	12.1***	-7.31***
	(0.26)	(0.26)	(0.73)	(0.28)	(2.25)	(1.26)	(1.58)	(0.61)
SimF	-0.17***	-0.17***	-0.045	-0.19***	0.27	0.35***	0.27	-1.26***
	(0.029)	(0.029)	(0.080)	(0.031)	(0.21)	(0.100)	(0.14)	(0.058)
WTO	0.20***	0.20***	-0.48***	0.31***	-0.14	-0.86***	2.46***	-13.6***
	(0.055)	(0.055)	(0.15)	(0.060)	(0.095)	(0.13)	(0.40)	(1.82)
FTA	-0.17***	-0.17***	-0.038	-0.20***	0.22*	-0.18*	-0.10	-0.44***
	(0.027)	(0.027)	(0.072)	(0.029)	(0.094)	(0.075)	(0.069)	(0.044)
EU Partner	-0.36***	-0.35***	-0.85***	-0.25***			0.045	-0.38***
	(0.063)	(0.063)	(0.17)	(0.067)			(0.17)	(0.081)
Contiguity	-0.12	-0.12	0.18	-0.16	1.16**	-0.61**	2.91***	-0.77**
	(0.11)	(0.11)	(0.27)	(0.11)	(0.37)	(0.21)	(0.47)	(0.26)
Language	-0.054	-0.055	-0.32	0.0088			1.35***	-0.50*
	(0.12)	(0.12)	(0.32)	(0.13)			(0.25)	(0.20)
Colony	0.62	0.61	0.40	0.65	1.81*	3.01***		
	(0.53)	(0.53)	(1.20)	(0.58)	(0.71)	(0.66)		
D	-1.35***	-1.35***	-0.11	-1.55***	1.12***	-1.19***	-0.80***	-1.69***
	(0.056)	(0.056)	(0.13)	(0.061)	(0.32)	(0.13)	(0.14)	(0.075)
Disc. STC (t-1)		-0.17***						
		(0.032)						
Disc. STC		-0.30***						
		(0.060)						
UBT. STC (t-1)		0.022						
		(0.026)						
UBT. STC		-0.091***						
		(0.019)						
Rest. STC (t-1)		-0.034*						
		(0.017)						
Rest. STC		-0.068***						
		(0.017)						
Constant	-12.8***	-12.8***	-15.7*	-15.1***	27.3	-519.7***	-50.9*	10.1**
	(2.31)	(2.31)	(6.30)	(2.47)	(35.8)	(32.9)	(20.2)	(3.28)
N	185490	185490	20270	165220	8060	25030	28766	123634
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

CHAPTER 3

Distinguishing Between Genuine and Non-Genuine reasons for imposing TBTs; A Proposal Based on Cost Benefit Analysis

3.1.   Introduction:

Since the General Agreement on Tariffs and Trade (GATT) in 1948, tariffs on trade between the World Trade Organization (WTO) members have fallen. However, non-tariff measures (NTMs) have received worldwide attention. The Multi- Agency Support Team (MAST)[28] defined NTMs as follows:

"Non-tariff measures (NTMs) are policy measures, other than ordinary customs tariffs, that can potentially have an economic effect on international trade in goods, changing quantities traded, or prices or both." (MAST, 2008)

According to the classification of World Integrated Trade Solution (WITS) in February 2012, NTMs include 16 categories of which the first and second are the most frequently used for notification by WTO members. These measures described in WITS are the Sanitary and phytosanitary (SPS) measures, and Technical Barriers to Trade (TBT). According to WITS, SPSs are measures that are applied for the aim of: protecting human or animal life from risks arising from additives, contaminants, toxins or disease-causing organisms in their food; protecting human life from plant- or animal-carried diseases; protecting animal or plant life from pests, diseases, or disease-causing organisms; preventing or limiting other damage to a country from the entry, establishment or spread of pests; and protecting bio-diversity. These include measures taken to protect the health of fish and wild fauna, as well as health of forests and wild flora. According to the same source, TBTs are "measures referring to technical regulations, and procedures for assessment of conformity with technical regulations and standards, excluding measures covered by the SPS Agreement."

These measures have attracted worldwide attention: The World Trade Report (2012) specifically discusses them and analyzes their impact on international trade flows which have been very effective instruments for the governments following different motivations. According to this report, there can be three reasons for imposition of these regulatory measures. Firstly, NTM can serve as a public policy and not as an economic issue, which concerns protection of human health or safety, animal or plant life or health, or the environment. For instance, within a TBT or SPS measure, a foreign product with potential negative effects on the consumers is restricted from importation because consumers are not well informed about the harmful attributes of that product. Thus, the NTM policy is imposed aiming at increasing the consumer welfare of the domestic society.

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[28] (MAST) as of July 2008 comprise institutional members: Food and Agriculture Organization of the United Nations (FAO), International Monetary Fund (IMF), International Trade Centre UNCTAD/WTO (ITC), Organization for Economic Cooperation and Development (OECD/TAD), United Nations Conference on Trade and Development (UNCTAD), United Nations Industrial Development Organization (UNIDO), World Bank (WB), World Trade Organization (WTO). Observers: European Commission (EC), and United States International Trade Commission (USITC), United States Department of Agriculture (USDA). UNCTAD and World Bank jointly coordinate MAST. MAST reports to the Group of Eminent Persons, which is convened by the director general of UNCTAD.

Secondly, from an economic aspect, the NTM might focus on an increase in social welfare by correcting market failures without discrimination in trade. Development of market efficiencies and improvement concerning the information for market agents using some technical regulations such as labeling of the products can be a good example for the economic motivations of governments behind NTMs. It can be a case that both producer and consumer welfare will be improved by the imposition of new regulations. Since the government does not introduce import tariffs, there is no revenue for the government.

Thirdly, NTMs can be caused by a pure political motivation that aims to hamper free trade to support special interest groups without even increasing consumer welfare, which leads to a protectionism of the domestic industry. This motivation is addressed as protection for sale in the literature (Grossman and Helpman, 1992; Goldbe and Maggi, 1997). In fact, social welfare is changed by the summation of domestic producer surplus increase and government utility improvement induced by the support of lobbying industry, plus the consumer welfare losses. In such framework, the government would assign lower weight for the latter, resulting in positive social welfare change.

The first two reasons show good faith by the governments and are supported in the agreements of WTO, while the last one can unnecessarily hamper trade and violate the articles related to NTMs. In other words, special interest groups who are lobbying with governments might persuade them to break international rules and provide some protectionism measures for them. However, in an empirical research on all countries in the world, Ghodsi (2013) found no evident linkages between corruption and the level of protectionism or level of trade. TBT, SPS, and other agreements of WTO cover logical frameworks for impositions of NTMs. They give justifiable authority to members for the implementation of their own standards that are not discriminatory. For example, governments might claim health protection for their citizens using NTMs while they might truly protect their own economy or industry at the expense of domestic consumers or other countries.

In general, new standards and new regulations that are imposed in the context of NTMs can have quite substantial impacts on international trade (refer to the second chapter of this dissertation). When a government imposes a new standard, foreign industries need to adopt themselves to these standards in order to get permission to export to that country. The new standards are generally in line with the domestic industries' productions. As long as the new standards are not in line with foreign industries' products, their export will be halted until they comply themselves to these new regulations. If the modification of production procedure is not affordable by those foreign industries, they will simply lose one of their markets. In that case they often ask their own governments to take the legitimate actions within international regulations and WTO agreements. However, sometimes it takes quite a long time to convince the imposing government to eliminate the policy or even comply with the current agreements if violated.

During this period the market structure becomes less competitive and consumers indifferent or unaware of negative characteristics of products in line with outdated standards will bear a cost. On one hand, if the NTM was imposed "correctly", i.e. the standard is in favor of health, consumers gain (as being protected from bad products or getting higher safety standards) though they have to pay a higher price as markets become less competitive. In this situation the net gains or losses need to be quantified. On the other hand, if the NTM was imposed unjustified, consumers bear a net loss as they have to pay higher prices.

Governments pursuing good faith mostly provide scientific and justifiable reasons for the implementation of TBTs and SPSs. Paternalistic behavior of the governments considers protecting their own nation against outdated standards which would allow importation of products with negative characteristics. The new standards and regulations on which the NTM focuses try to faithfully increase the quality of life of the consumers. However, regardless of median voter theorem, it might happen that governments do not follow the true requests from their own consumers. In fact, the paternalistic attitude does not allow consumers to intentionally choose their own characteristics of the product while decisions are made on their behalf. Some consumers do not care about bad properties of products and some are not even informed about them. Nevertheless, governments take the decisions of imposition of new standards for higher qualities whether or not the policy is in line with international agreements.

In a situation where the government claims that consumers are not aware of the harm of a foreign product, consumers cannot internalize the negative effects in their preferences. For instance, if a consumer does not care about the harm of shrimps treated with antibiotics (subjective preferences), his/her utility increases with consumption of any type of shrimps and this satisfaction is even higher than the expected objective future harms of the bad product. Given the overestimation of such utility by consumer, the government is concerned about the harm to the health of a person in the society and considers the following issues: Firstly and most importantly a harmful product might cause death whose loss is priceless and cannot be even measured (i.e. a cost to society that goes to infinity). Secondly, if the product causes diseases that need treatment and health care in the future, costs of treatment can be measured by government and be accounted for as another negative effect of the bad product. Thirdly, a person in the society is one of the main factors of the production and his/her absence due to illness or death decreases the total welfare of the society. The third one can be measured as the average labor productivity relative to the GDP of that society within the period of the absence caused by the negative attributes. In this paper, a specific scenario will be constructed that assumes the government can rationally measure these negative effects of the bad product produced abroad, for which a prohibitive NTM can be imposed.

This paper provides a theoretical framework to analyze and quantify the welfare changes in a country imposing prohibitive NTMs, when consumers are classified into a group being indifferent and a group being concerned about the properties of the two products. Depending on whether consumers are aware of the negative effects of the foreign product, the analysis will be separated into two scenarios. This, first, allows to better judge the paternalistic behavior of the government. Second, when the majority of the domestic consumers are concerned about the negative properties of the foreign product, government NTMs can be better justified in the context of international regulations and WTO agreements. In the next section, a brief literature review on this issue accompanied by anecdotal facts will be provided. In the third section, the basic analysis of the theoretical model will be presented. The effective welfare changes of the country imposing NTM will be illustrated in the fourth section using actual data. Finally, a summary of findings, conclusions and the possible extensions of the model will be discussed in the fifth section.

3.2. Anecdotal fact and literature review

In September 1998, Canada requested for consultation (DS144) with the United States within the Dispute Settlement Mechanism (DSM) with respect to certain measures, imposed by the US state of South Dakota and other states, prohibiting entry or transit to Canadian trucks carrying cattle, swine, and grain. Since then, this Dispute Settlement (DS) case had been pending according to the WTO website[29]. Canada and Mexico requested consultation with the United States of America concerning the mandatory Country of Origin Labelling (COOL) within cases DS384 and DS386 respectively in December 2008. These two cases seem to be similar to the complaint by Canada in DS144. European Union countries (27 member states) with 12 other countries reserved their third party rights in these disputes. COOL was believed to be discriminatory within the framework of WTO agreements. After some years of analyses and investigation in the DSM, the Appellate body issued its findings in June 2012. The USA was proved to violate Article 2.1[30] of TBT agreement and promised to implement the rulings

Figure 3.1- Export of swine from Canada to the USA during 1996-2012

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
020311	23115	20455	18598	19350	8281	2954	3915	5362	10016	10384	12234	13578	5124	4082	956	15	3
010310	275	420	69	163	790	4906	1344	1958	966	1006	839	824	940	415	298	259	334

Source: UN Comtrade
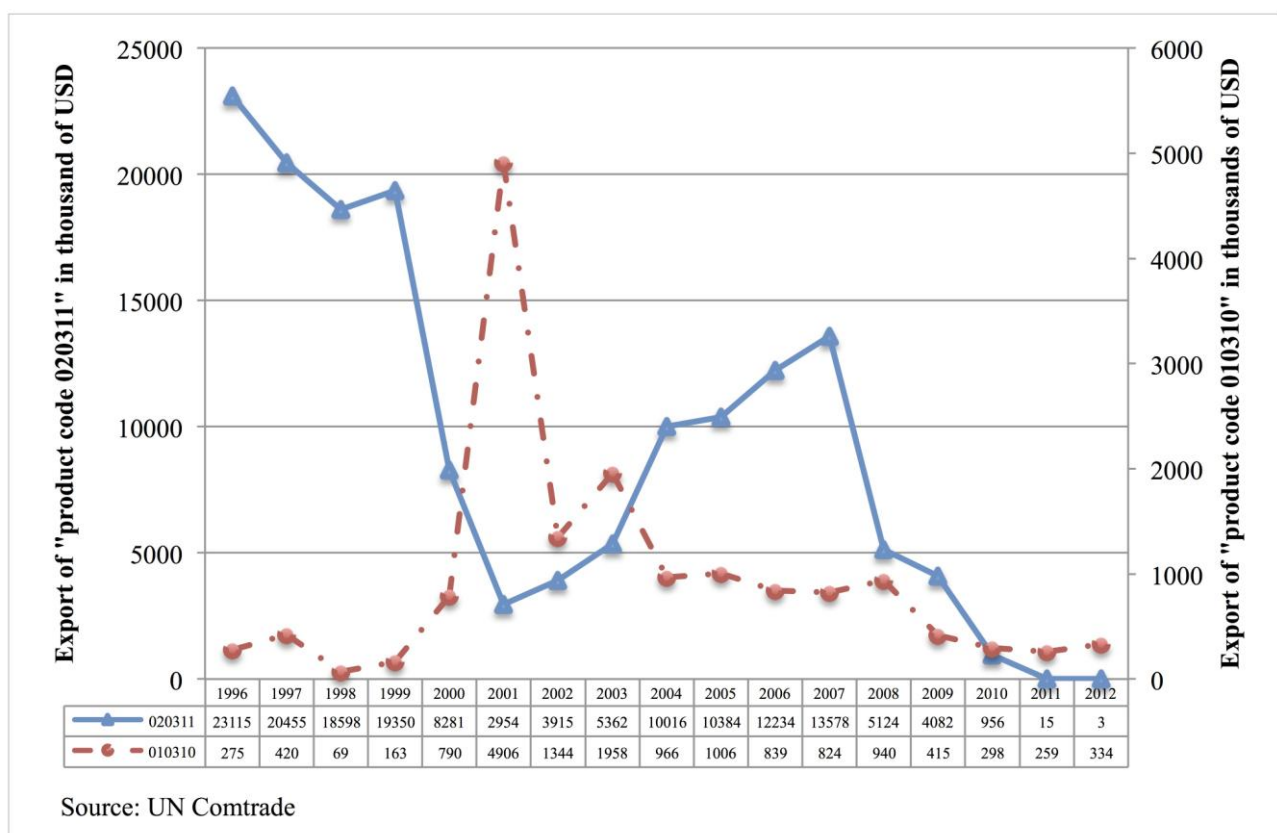
and recommendations of the Dispute Settlement Body (DSB) until May 2013. Figure 3.1 represents the changes of swine export from Canada to the USA.

More exactly, Figure 3.1 shows the export trends of "live swine, purebred and breeding" with Harmonized System (HS) code (revision 1996) 010310 on the right vertical axis (dashed line with round nodes); and "meat of swine, fresh or chilled" with HS-1996 020311 on the left

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[29] Can be found at: http://www.wto.org/english/tratop_e/dispu_e/cases_e/ds144_e.htm
[30] Article 2.1 of the TBT agreement is "Members shall ensure that in respect of technical regulations, products imported from the territory of any Member shall be accorded treatment no less favorable than that accorded to like products of national origin and to like products originating in any other country."

vertical axis (solid line with triangular nodes) from Canada to the USA. As it is observed in the above example, the export of meat of swine has dropped dramatically in 1999 (after DS144). Then in 2001 export of live swine has jumped dramatically, which seems to be a substitute for meat of swine. However, export of live swine dropped after one year and gradually decreased until 2012. After 2001 export of meat of swine has been gradually increased but in 2007 (before DS384) it dropped dramatically. As it is observed, the main reason for the decrease of swine export from Canada can be the prohibitive NTM imposed by US. In addition to this example of this restrictive policy that completely prohibits the import of product, the first category of TBT is prohibitions/restrictions of imports according to the definition by UNCTAD report 2013. This is an example of a restrict NTM which completely halts the imports of a specific product and which will be the topic of this paper.

The first significant effect of US policy was prohibition of the importation of some products from Canada. Even if the industries of Canada had tried to implement the regulations of the USA, it would have taken a long time to comply with them. More generally, during 1995-2011 different WTO members raised 317 specific trade concerns (STCs) on TBT imposed by other members, among which only 251 of them have been notified directly by the imposing countries. In other words, 20% of TBTs have not been notified directly to WTO by imposing members. Therefore, it is quite possible that officials imposing NTMs do not inform anybody even international organizations authorized and responsible for the justification of their policies. Hence, governments trying to conceal their actions are reluctant to spread the information to the public regarding their policies.

In order to quantify welfare implications of NTM policies, a cost-benefit analysis can be conducted in a partial equilibrium framework. Paarlberg and Lee (1998) used a numerical partial equilibrium approach to investigate the linkages between the Foot-and-Mouth Disease (FMD) risky products imported to the US and the level of protectionism. They simply modeled the surplus changes of consumers and producers, and a government maximizing welfare by assigning the optimal tariff. Then they calculated the output losses after the outbreak of the disease by assigning a probability to its risk.

The consequences of liberalized trade are twofold for the domestic people of a society. Inflow of products from international market to a country can potentially threaten the domestic industries. As a result, job market in the domestic industry would shrink or at least require labor market adjustments. On the other hand, import of a variety of products with lower prices, higher quality would increase the satisfaction and welfare of consumers. Baker (2003) tried to construct a theory to relate the earning power to the consumption attitude, which would explain the reason behind the popularity of free trade among developing Latin American countries. He provided surveys and evidences to show why consumers are in favor of consumption concerns rather than earning power or job market concerns[31]. In his model, people are working and putting efforts in the cost of their leisure to earn. On the other hand, as citizens they try to enjoy and get the most satisfaction out of their leisure time, they prefer to have a variety of inexpensive bundles of products with high quality. Baker (2003) claimed this as a reasonable intention for pursuing free trade even in developing countries with high job market volatilities.

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[31] However, it is worth mentioning that the model represented here is more on trade of countries with similar levels of developments.

Kono (2006) analyzed the role of democracy and autocracy on trade policies. His main argument was that democratic governments try to respond to the mass public preference for liberal trade policies. Consumers benefit from variety of products and low prices caused by liberal trade. Nevertheless, in all governments there are pressures from interest-group seeking for protection. Thus, authorities prefer to address liberalization in transparent policies such as tariff reduction. However, there are less transparent policy options to satisfy special interest groups, one of which can be NTMs.

According to Kono (2006) impacts of tariffs can be determined by the degree of pass-through effects. Core NTMs consist of price control measures such as antidumping, and quantity measures such as quotas and voluntary export constraints (VER), which have a bit more complex nature than direct tariffs. Although, the impacts of core NTMs are related to prices and quantities, consumers with lack of expertise or time for analysis, cannot easily evaluate the impact of such policy instruments. Quality NTMs are generally regulations on technical issues and standards, which not only have impact on the quantities and prices of imports, but also have influence on the quality of products perceived in the preferences of the consumers. Thus, effects of these kinds of measures are even more complex for the consumers to evaluate than the previous two instruments.

When a group of politicians want to provide arguments for the implementation of trade policies by their counterpart group, they would simply inform people on the negative impacts of tariffs on consumers' welfare given price changes. However, reduction of tariffs can also be seen as threatening jobs. It becomes more difficult to explain why for instance a VER on autos of 250,000 units increases the prices. At the first glance it seems that this amount is huge and suitable for the economy, but after informing the consumers, they might understand the true impact of such core NTM. Informing the people about the costs and benefits of quality NTMs would become even harder. Besides, political groups in charge know how their competitors are trying to challenge their actions and policies informing the population in various ways. In autocracies there is no powerful opponent trying to inform people whereas in democracies, people tend to be better informed but with greater disparities. That can be an explanation why governments, even in the most democratic countries, try to implement opaque and complex trade policies instead of simple tariffs (Kono, 2006). Hence, general knowledge of the public, awareness of consumers and related government policies and NGOs concerning information might matter.

Van Tongeren et al. (2009) conduct a modular partial equilibrium model that focuses on demand and supply relationships. Changes in social welfare were analyzed in three different scenarios: prohibitive standards that completely bring the market into autarky (NTM), free trade, and mandatory labeling that provides complete information of the goods to the consumers. These three scenarios were considered investigating the effects on consumers, producers, and for global commons externalities. Nevertheless, it seems that they only modeled negative direct characteristics of the product rather than externalities.

Beghin et al. (2012) provided a framework similar to van Tongeren et al. (2009). They considered two scenarios of informed consumers and uninformed consumers about the negative characteristics of foreign products. In doing so, they assumed that informed consumers are also concerned consumers and found that in some circumstances, the prohibitive standards can increase the international welfare. When consumers are unaware of negative attributes of products, only foreign producer's welfare decreases slightly, while

domestic producer and consumers gain from the regulation. When consumers are completely informed, all of these agents gain from the new standards. There are however some important issues in their approach: Firstly, they assume that informed consumers are also concerned ones because preferences do not imply information; secondly, potential negative externalities of consumption are not clearly identified, and only negative direct characteristics of the foreign product are introduced in their model. Negative externalities can be discussed when consumption or production of a product by an agent that gives her positive utility or profit decreases utility or profit of another agent indirectly; Thirdly, they assumed that consumers could not distinguish between foreign and domestic products, yet they are assumed to consider a share of foreign products on total products of the market in their utility functions; Fourthly, as consumers are assumed to be unable to distinguish between the two products, consumers can rationally assign probabilities to the share of foreign products in the market and then make decisions.

This research is similar to the contributions of Beghin et al. (2012) and van Tongeren et al. (2009) with some modifications. Here, in one scenario it is assumed that consumers are aware of negative characteristics of the products but they can be indifferent or concerned about them. In the second scenario it is assumed that consumers are not aware of those damaging effects and the government imposes NTM to increase their welfare objectively. NTM policies are strictly prohibitive and they halt the import of foreign products with damaging attributes, which is the situation before the improvement of foreign production procedures. The market structure in this model differs from those two references, meaning that here, under free trade, the home country has an oligopolistic market (similar to the framework of Brander and Spencer, 1985). Oligopolistic competition instead of perfect competition can provide a clearer situation in which the government uses consumers' safety as an excuse to impose NTM even though the real reason is to increase domestic industry's welfare. The findings of this paper can clarify the motivation of the government behind the imposition of NTMs and implementation of information policy. In fact, if the data is available, the analytical framework discussed in the following can show whether the government is actually increasing consumers' welfare by the restrictive measure.

3.3. Presentation of the model

It is assumed that there are two countries, Home country (H) and Foreign country (F) and that the foreign product contains some characteristics that might cause damages to human health. Here it is simply assumed that the foreign government has a different evaluation of potential risks. The foreign industry or government do not know (care) about these negative characteristics. Particularly, the foreign industry produces a product with lower quality[32] than the domestic firm does. Some domestic consumers might be concerned about these negative attributes and internalize them in their preferences. The domestic government that tries to protect its own population against the harms of the foreign product imposes a prohibitive NTM that increases the standard of the product. Assume that the domestic industry had already been producing in line with new standards. Foreign producers need to comply with

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[32] In this model, the low qualities of products are assumed to directly affect an individual consumer after consumption. These are not negative externalities associated with the consumption or production of others affecting another individual.

the new regulations, in order to be able to export to the home market, which takes time. In this model we attempt to analyze the home welfare changes after imposition of an NTM during the time that the foreign product is not imported to the home market because of lower qualities, before the foreign industry complies with the new standards.

The supply side of the market is an oligopolistic Cournot competition between the two industries of both countries[33] before the prohibitive NTM. It is also assumed that cost of transportation is included in the cost of final good imported from the foreign supplier. Industries are maximizing their outputs with respect to a quadratic cost function in output. Considering N individuals in each society and $Q(p) = \sum_{i=1}^{N} q_i(p)$, where $q_i(p)$ and $Q(p)$ are respectively the demand of individual i, and the total demand at Home; the profit for this industry in each country is:

$$\pi_j = p(Q)q_j - c_{1j}q_j - \frac{1}{2}c_{2j}q_j^2 - K_j \text{ , for } j = \{H, F\} \tag{3.1}$$

Where c_{1j} and c_{2j} are the variable cost parameters, and K_j is the sunk cost related to the market entry for each industry.

Concerning the demand side, it is assumed that consumers are unable to distinguish between the good and bad products. Thus, products are not differentiable. The good product is produced domestically without any negative characteristics, while the bad product is produced abroad with some negative attributes.

In the following subsections, two scenarios are analyzed. In the first scenario it is assumed that consumers are aware of the harms of the foreign products. Consider that media and scientists inform the consumers that there is a specific product in the market produced abroad with certain harmful effects. Moreover, consumers are divided into two groups. A proportion of the society (η) are indifferent about those characteristics. The rest of the population is concerned about the perceived damages of the foreign product and they take this effect into account when deciding on their demand. Consumers can rationally allocate their budget for the demand of products. Given undifferentiated products, they can assign probabilities for getting the foreign or domestic product.

In the second scenario it is assumed that the society is not aware of the harms of the foreign product and only government knows about such attributes. Thus, it can be considered that all consumers are indifferent about the characteristics of foreign product. Government is completely aware of the harms of the imported goods and considers them in the utility of all consumers objectively.

3.3.1. Scenario A

Since consumers do not know whether or not the product they consume is the one with negative or positive characteristics, they cannot include the two types of product in their preferences exclusively. In other words, they cannot distinguish the origin of the two

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[33] It is simply assumed that there exists one industry in each country; each industry acts as a monopoly in autarky even if it comprises various firms (think of a cartel). The intuition behind selection of such market structure is simply to show the possibility of government's support for the home industry, which can be easier to observe here than a perfect competition.

products, and foreign and home goods are mixed in one single market. What they include in their preferences is simply one good (q_i) with mixed characteristics. Assume that by probability τ the consumer gets the foreign product and by probability $(1 - \tau)$ he gets the domestic product. Considering quadratic preferences of the good and an additive numeraire, the utility function of each domestic consumer $i = \{1, \dots, N\}$ is as follows:

$$U_i(q_i, w_i) = \tau\left(aq_i - \overline{b}\, q_i^2/2 - I_i r q_i + w_i\right) + (1 - \tau)\left(aq_i - \overline{b}\, q_i^2/2 + w_i\right) \quad (3.2)$$

Here w_i is the numeraire good, the term $aq_i - \overline{b}\, q_i^2/2$ is the satisfaction of consumer i from consuming quantity q_i. rq_i is the perceived damage of the product for every concerned consumers, which might be at the focus of the technical policy or new regulations. In order for concerned consumers to demand the product with negative characteristics, it is simply assumed that $r < a$. Term I_i represents the concerned knowledge of the consumer regarding the damage of the product. Therefore, if the good is not perceived harmful for the consumer, this term will be equal to zero. Conversely, if $I_i = 1$, it means that the consumer will be concerned about the negative properties of the good. Hence, term $I_i r q_i$ captures the impact of harm and concern of consumption of this good for the representative consumer.

$\eta = N_1/N$ is the proportion of the population who are indifferent about the negative characteristics of the good. It means that $I_i r q_i = 0$ for $i \in [1, N_1]$. The rest of the society is concerned about the damaging effect of the product, which comprises the proportion $1 - \eta = 1 - (N_1/N)$ proportion. Thus, for $i \in (N_1, N]$, $I_i r q_i > 0$.

The demand function for each consumer can be derived by utility maximization subject to a budget constraint. Total demand in the society is simply the summation of demand functions of the two groups. The total demand schedule is truncated where price is equal to $a - \tau r$. In fact, above this price, only indifferent consumers demand good q_i, while the concerned consumers demand nothing because of perception of high negative effects. Therefore, the total inverse demand of the society is given by[34]:

$$p_A^D(Q, r) = \begin{cases} a - \dfrac{b}{\eta} Q, & 0 \leq Q \leq \dfrac{\tau r \eta}{b} \\[3mm] a - \tau r(1 - \eta) - bQ, & Q \geq \dfrac{\tau r \eta}{b} \end{cases} \quad (3.3)$$

The concerned consumers assign a value τ for the probability of getting the foreign variety of the product. Although they cannot distinguish between the two products, they have access to statistical data and consider the ratio of the imported products (with bad characteristics) relative to the whole consumption of product (with two types of characteristics) in the market as τ. This allows to simply assume that $\tau = q_F/(q_F + q_H)$. Firms in both countries maximize their profit in a duopolistic market subject to the inverse demand function (3.3), and they consider the value of τ as given from pre-NTM patterns. It is further assumed that both industries are symmetric and their cost parameters are identical ($c_{1H} = c_{1F} = c_1$; $c_{2H} = c_{2F} = c_2$; $K_H = K_F = K$). Therefore, it is obviously observed that both industries supply the same amount of product in the market, and thus, $\tau = 1/2$. Considering these assumptions and deriving the Cournot Nash Equilibrium for the Best Response (BR) functions of the two

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[34] Calculations can be found in the appendix 2

industries, before imposition of restrictive NTM, total quantity supplied in the oligopolistic market (Q_{AO}) will be[35]:

$$Q_{AO} = \begin{cases} \dfrac{2\eta(a - c_1)}{3b + c_2\eta}, & a - \dfrac{r}{2} \le p \le a \\[4mm] \dfrac{2\left(a - \dfrac{r}{2}(1 - \eta) - c_1\right)}{3b + c_2}, & 0 \le p \le a - \dfrac{r}{2} \end{cases} \qquad (3.4)$$

The equilibrium price in this duopoly (P_{AO}) will be:

$$P_{AO} = \begin{cases} a - \dfrac{2b(a - c_1)}{3b + c_2\eta}, & 0 \le Q \le \dfrac{r\eta}{2b} \\[4mm] a - \dfrac{r}{2}(1 - \eta) - \dfrac{2b\left(a - \dfrac{r}{2}(1 - \eta) - c_1\right)}{3b + c_2}, & Q \ge \dfrac{r\eta}{2b} \end{cases} \qquad (3.5)$$

Consumer welfare in this oligopoly before new regulations (CA_{AO}) will be as follows[36]:

$$CS_{AO} = \int_0^{Q_{AO}} (p_A^D(Q, r) - P_{AO})dQ$$

$$= \begin{cases} 2b\eta\left[\dfrac{(a - c_1)}{3b + c_2\eta}\right]^2, & a - \dfrac{r}{2} \le p \le a \\[4mm] \dfrac{b}{2}\left[\dfrac{2\left(a - \dfrac{r}{2}(1 - \eta) - c_1\right)}{3b + c_2}\right]^2 + \dfrac{r^2\eta(1 - \eta)}{8b}, & 0 \le p \le a - \dfrac{r}{2} \end{cases} \qquad (3.6)$$

Now consider an NTM policy that prohibits the import of goods from abroad completely. Simply assume that it is a high sunk cost imposed to the foreign firm that induces exit from the home market for a long period of time. The market goes to autarky and a single monopoly supplies the product domestically. There can be two cases regarding the information provided by the new NTM which will be presented next.

3.3.1.1.   Case I. Complete information on existence of foreign product after NTM

When government informs the producer and all consumers that there is no product with harmful characteristics in the market, concerned consumers have certainty and assign probability $(1 - \tau) = 1$ for receiving the home product. In other words, their expected utility (3.2) will be reduced to only the second term in the right hand side. There will be no more disutility "rq" in the preferences. The domestic industry becomes a monopolist and

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[35] These are not closed solutions but analytical solutions. A pure strategy Nash Equilibrium may not exist. For the proof of existence refer to the appendix 3. However, the simulation in the next section is based on the existence of pure strategy NE.

[36] Since the demand is truncated where $p = a - \dfrac{r}{2}$, the calculation of CS below this price is:

$$CS_{AO} = \int_{a-\tau r}^{a} \left(\frac{\eta(a - p)}{b}\right)dp + \int_{P_{AO}}^{a-\tau r} \left(\frac{a - \tau r(1 - \eta) - p}{b}\right)dp$$

maximizes its profit subject to an inverse total demand of the society $p_{AI}^D(Q, r) = a - bQ$. The equilibrium price (P_{AMI}) and quantity (Q_{AMI}) supplied by the home monopolist will be:

$$P_{AMI} = a - \frac{ab - bc_{1H}}{2b + c_{2H}} \; ; \; Q_{AMI} = \frac{a - c_{1H}}{2b + c_{2H}} \tag{3.7}$$

Total consumer surplus in this case (CS_{AMI}) will be as follows:

$$CS_{AMI} = \int_0^{Q_{AMI}} (p_{AI}^D(Q, r) - P_{AMI}) dQ = \frac{b}{2} \left(\frac{a - c_{1H}}{2b + c_{2H}} \right)^2 \tag{3.8}$$

3.3.1.2. *Case II: No information on the existence of foreign product after NTM*

Assume that government informs the domestic producer but does not inform the consumers about the new regulations and they believe that the supply of foreign products is still mixed with the home product in the domestic market. As explained in previous section, there are some examples that the government does not inform other countries or WTO about the new imposing measure. Hence, such government does not inform anybody (except special interest group) – not even its domestic citizens - about the new measures and policies. Therefore, this case is an example of what happens in reality. According to Baba (1997), informing voters and in general consumers is costly. Not only can the government be reluctant to inform WTO about their new policy instrument, but they might fear the awareness of consumers about less liberalization on trade.

Consumers do not have information on the origin of products after imposition of NTM. Moreover in the short run, the data for importation and consumption of product is not published and consumers cannot have access to statistics to assign a correct value for τ. Therefore, inverse aggregate demand function remains equivalent to equation (3.3). Profit maximization of the home industry acting as a monopolist yields the analytical solution for total supply (Q_{AMII}) as follows:

$$Q_{AMII} = \begin{cases} \dfrac{a\eta - c_{1H}\eta}{2b + c_{2H}\eta}, & a - \dfrac{r}{2} \leq p \leq a \\[4mm] \dfrac{a - \dfrac{r}{2}(1 - \eta) - c_{1H}}{2b + c_{2H}}, & 0 \leq p \leq a - \dfrac{r}{2} \end{cases} \tag{3.9}$$

Equilibrium price in this case (P_{AMII}) will be as follows:

$$P_{AMII} = \begin{cases} a - \dfrac{ab - bc_{1H}}{2b + c_{2H}\eta}, & 0 \leq Q \leq \dfrac{r\eta}{2b} \\[4mm] a - \dfrac{r}{2}(1 - \eta) - b\dfrac{a - \dfrac{r}{2}(1 - \eta) - c_{1H}}{2b + c_{2H}}, & Q \geq \dfrac{r\eta}{2b} \end{cases} \tag{3.10}$$

Total subjective consumer surplus in this case (CS_{AMI}) will be as follows[37]:

$$CS_{AMII} = \int_{0}^{Q_{AMII}} (p_A^D(Q,r) - P_{AMII})dQ$$

$$= \begin{cases} \dfrac{b\eta}{2}\left[\dfrac{a-c_{1H}}{2b+c_{2H}\eta}\right]^2, & a-\dfrac{r}{2} \leq p \leq a \\ \dfrac{b}{2}\left[\dfrac{a-\dfrac{r}{2}(1-\eta)-c_{1H}}{2b+c_{2H}}\right]^2 + \dfrac{r^2\eta(1-\eta)}{8b}, & 0 \leq p \leq a-\dfrac{r}{2} \end{cases} \qquad (3.11)$$

However, the reality is different and consumers do not receive any damaging effect of the bad product any more ($r = 0$). In the calculation of subjective welfare of consumers (3.11), the negative effect of foreign product is included mainly in the second line where both groups of consumers are demanding. Hence, to calculate the objective surplus, this damaging effect must be excluded. In other words, $\tau r Q(1-\eta)$ should be added to the second line of equation (3.11), while the first line will remain unchanged as it is the demand of unconcerned consumers (in the illustration of the model, this will be referred to as Case II').

In the above cases, the impact of the NTM on welfare of consumers (ΔCS_A) can be evaluated by simply deduction of consumer welfare after NTM (CS_{AM}) from consumer welfare before (CS_{AO}). Domestic producer surplus changes are simply the difference between the home industry's profit in the monopoly and its profit under oligopoly in each case. Since the foreign market is not the issue of the modeling here, it is simply assumed that the foreign producer is out of the home market after NTM, and its welfare losses will be its profit in duopoly before NTM excluding the sunk fixed costs (K_F).

3.3.2. Scenario B

This scenario focuses on the paternalistic behavior of the government when consumers are not aware of the harm of foreign products. Consumers therefore cannot internalize the negative effects in their preferences. On the other hand, government can provide scientific evidence for measuring the harm of foreign product on the society. In this scenario, it is assumed that government can rationally measure these negative effects of the bad product produced abroad (r).

EU new safety aflatoxin standards on the importation of food products decrease the health risk by 1.4 deaths per billion a year (Otsuki et al., 2001). Even if infinite cost for death of 1.4 out of billions is not considered, r can be measured as health care costs and/or less productive labors in the society. To analyze the impact of an NTM on the welfare of society in this scenario, it is simply assumed that all consumers are indifferent or unaware of the negative characteristics of the product as already mentioned above. Before imposition of the NTM the two industries are competing in a duopoly and it does not matter whether or not the origins of

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[37] Since the demand is truncated where $p \leq a - \dfrac{r}{2}$, the calculation of CA below this price is:

$$CS_{AMII} = \int_{a-\tau r}^{a} \left(\frac{\eta(a-p)}{b}\right)dp + \int_{P_{AMII}}^{a-\tau r} \left(\frac{a-\tau r(1-\eta)-p}{b}\right)dp$$

the products are identifiable. However, asymmetry of industries is assumed in this scenario. After maximizing profits of the industries and finding the Nash Equilibrium in the Cournot competition, total quantity supplied in the (Q_{BO}) will be:

$$Q_{BO} = \frac{(a - c_{1H})(b + c_{2F}) + (a - c_{1F})(b + c_{2H})}{(2b + c_{2H})(2b + c_{2F}) - b^2} \tag{3.12}$$

The equilibrium price in this duopoly (P_{BO}) will be:

$$P_{BO} = a - b\frac{(a - c_{1H})(b + c_{2F}) + (a - c_{1F})(b + c_{2H})}{(2b + c_{2H})(2b + c_{2F}) - b^2} \tag{3.13}$$

Considering utility of consumers objectively in the eyes of government, consumer surplus before NTM (CS_{BO}) will be the area below inverse demand function $p_B^D(Q, r) = a - r - bQ$, and above equilibrium price in duopoly:

$$CS_{CO} = \int_0^{Q_{CO}} (p_B^D(Q, r) - P_{BO})dQ$$

$$= \frac{b}{2}\left(\frac{(a - c_{1H})(b + c_{2F}) + (a - c_{1F})(b + c_{2H})}{(2b + c_{2H})(2b + c_{2F}) - b^2}\right)^2 - \frac{r}{2}\left(\frac{(a - c_{1H})(b + c_{2F}) + (a - c_{1F})(b + c_{2H})}{(2b + c_{2H})(2b + c_{2F}) - b^2}\right) \tag{3.14}$$

Where second term on the right hand side of equation (3.14) is the total negative effect caused by the consumption of the foreign product. After imposition of NTM, quantities and prices in the monopoly of domestic producer (Q_{BM}, P_{BM}) will be the same as equation (3.7), and consumer welfare changes (CS_{BM}) will be equal to equation (3.8). Hence, the consumer welfare changes measured by government (ΔCS_B) is as follows:

$$\Delta CS_B = \frac{b}{2}\left(\frac{a - c_{1H}}{2b + c_{2H}}\right)^2 - \frac{b}{2}\left(\frac{(a - c_{1H})(b + c_{2F}) + (a - c_{1F})(b + c_{2H})}{(2b + c_{2H})(2b + c_{2F}) - b^2}\right)^2$$
$$+ \frac{r}{2}\left(\frac{(a - c_{1H})(b + c_{2F}) + (a - c_{1F})(b + c_{2H})}{(2b + c_{2H})(2b + c_{2F}) - b^2}\right) \tag{3.15}$$

A government imposing a prohibitive NTM in this scenario is trying to follow good faith for improvement of consumer welfare in the society. In order to justify its motivations within international regulatory frameworks it should be proved that consumer welfare would increase after new measures ($CS_{BM} > CS_{BO}$). In other words, government should provide scientific reasons that the negative effects related to the consumption of foreign products r is such that the NTM preventing it would not decrease the consumer welfare of the society even after changing the structure of the market to a monopolist one. In fact, harmful attributes of foreign product should impact consumers more than what the inefficiencies associated with monopoly do. A damaging effect of foreign product r that equalizes the objective consumer welfare of the society before and after NTM can be a good benchmark to acknowledge justifications of the government. Thus, an r that gives non-negative changes of consumer surplus after NTM ($\Delta CS_B \geq 0$) can be calculated as follows:

$$\Delta CS_B \geq 0 \;\Rightarrow\; r \geq b \left(Q_{BO} - \frac{Q_{BM}^2}{Q_{BO}} \right) = b \left(\frac{Q_{BO}^2 - Q_{BM}^2}{Q_{BO}} \right) \tag{3.16}$$

If the government declares and proves that the foreign product has negative effects r that satisfies condition (16), it is actually following good faith for improvement of social welfare and healthcare of citizens. Thus, r has to pass a certain threshold to justify the NTM.

3.4. Illustration and Application of Model

According to the United States Department of Agriculture, in 2007, the US was the largest importer of beef in the world (Susanto et al., 2008). Imports of meat have been interrupted by the US government several times during recent years. As stated earlier, there have been also some Dispute Settlement cases in the WTO dealing with this issue. In this section the theoretical model will be calibrated using data on consumption and import of cattle from Canada to the United States of America[38].

The US is one of the biggest producers of red meat in the world. The major part of red meat imports to US is from Canada and Mexico. Canadian products are imported crossing northern borders of the USA and are usually consumed and distributed in the neighboring states, but this does not necessarily mean that these are the most important consumption areas. However, let us assume that these border States are the final consumers of the imported products from Canada, which might be more justifiable for meat products. According to the Ministry of Agriculture and Agri-Food of Canada, the following states have been the only ports of imports of Cattle from Canada to the USA in 2007: Idaho, Maine, Michigan, Montana, New York, North Dakota, Vermont, and Washington. In the illustration of the model, the data of import and production is analyzed for these states. Table 3.1, presents the data gathered from different sources.

Assume that for some reasons American authorities find a negative attribute in the cattle imported from Canada. For instance, assume that bovine spongiform encephalopathy breaks out widely in the US and the media warns consumers about the consumption of meat. Some consumers might become concerned about the foreign products imported to US and they prefer domestic meat rather than the imported one. Thus, they perceive a negative damage of the consumption of the meat imported from Canada. On the other hand, there are some indifferent consumers who do not treat Canadian meat less favorable than the US meat. In other words, they trust the quality of meat produced in Canada. Government authorities also try to insure the health of the domestic market. Therefore, they halt the import of meat products to the USA by implementing an NTM. For the negative characteristics of foreign product, the survey result made by Beghin et al. (2012) will be implemented in the analysis[39]. According to their survey, it is assumed that consumers might perceive the negative characteristics of foreign product as about 367.43 USD.

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[38] The simulation is undertaken to only show the application of the theoretical framework. Therefore, it is assumed that the real world data provided for the analysis is only a proxy for parameterization, and not an accurate replicate of the model in the reality.

[39] Although their survey was for the consumption and import of shrimps to the EU, here it is assumed that consumers behave similarly in US for the consumption of another category of food like red meat.

Table 3.1- Data on consumption of Cattle (measured in head) in 2007

Variable	Description	Data for 8 States[a]
q_H	Domestic Cattle sold on the domestic market (in heads)[b]	7,015,001
q_F	Import of Cattle sold on the domestic market (in heads)[c]	1,425,998
P	Average price per head (US$)[d]	781.63
ε_D	Own-price elasticity of demand[e]	-1.225
ε_S	Own-price elasticity of supply for both industries[f]	1.81
r	Per-unit damage of product (in USD)[g]	367.43

Sources of data are in the following notes:

a: Selection of eight US states is based on their imports from Canada. According to Ministry of Agriculture and Agri-Food of Canada, the following states have been the only ports of imports of Cattle from Canada to the USA in 2007: Idaho, Maine, Michigan, Montana, New York, North Dakota, Vermont, and Washington.[40]

b: Sale of cattle in those states is gathered from National Agricultural Statistical Service, US Department of Agriculture.[41]

c: Import of Cattle is gathered from Food and Agriculture Organization of the United Nations Statistics[42]

d: Average price per head is simply the division of total cash receipts of sale by total sale in heads, obtained from source mentioned in note "b" and "c".

e: Own price elasticity of demand is calculated by Susanto et al. (2008) for live cattle

f: Own price elasticity of supply calculated by Zhang et al. (2006) for live cattle

g: Perception of per unit damage of product is experimented by Beghin et al. (2012)

To calibrate parameters, it is assumed that the data shows a situation in which consumers have not yet received any information regarding the harm of foreign product from media. It is also assumed that the market in the US as represented by the data is a perfect competition between many domestic producers and many Canadian industries. Hence, for the simple calculations of cost parameters, reality is considered to be perfect competition. Then, the parameters will be plugged into the Cournot model specified earlier. Thus, the marginal cost function of each industry represents total supply. The supply of each industry is $(p(q_j) = c_{1j} + c_{2j}q_j, j \in \{H, F\})$. According to the price elasticity of supply presented in table 3.1, cost parameters can be calculated which are then used in each case of the model represented in previous section. Moreover, for Scenario A in which symmetric industries are assumed, it is hypothesized that the cattle imported from Canada is mainly demanded and consumed in some northern counties in the US. Hence, the production of the domestic countries is assumed to be equal to the total import from Canada in the illustration of Scenario A. This is

mainly due to the similarities between costs of production and transportation of the two countries. However, since asymmetries have been assumed in Scenario B, real amounts of import from Canada and production of cattle in those portal States are considered according to the real data. Table 3.2 represents the calculation of parameters of the model, using the data in table 3.1.

Table 3.2- Calculated parameters of the model on consumption of cattle in 2007

Variable	Calculation	Description	Value
b	$b = -P/(\varepsilon_D Q)$	Slope of demand	0.000224
a	$a = (bQ) + P$	Demand intercept	1419.94
c_2	$c_2 = P/\left(\varepsilon_S \dfrac{Q}{2}\right)$	Cost parameter 2 of two symmetric industries in Scenario A	0.000303
c_1	$c_1 = \left(c_2 \dfrac{Q}{2}\right) - P$	Cost parameter 1 of two symmetric industries in Scenario A	-349.85
c_{2H}	$c_{2H} = P/(\varepsilon_S q_H)$	Cost parameter 2 of home industry in Scenario B	0.0000616
c_{1H}	$c_{1H} = (c_{2H} q_H) - P$	Cost parameter 1 of home industry in Scenario B	-349.85
c_{2F}	$c_{2F} = P/(\varepsilon_S q_F)$	Cost parameter 2 of foreign industry in Scenario B	0.000303
c_{1F}	$c_{1F} = (c_{2F} q_F) - P$	Cost parameter 1 of foreign industry in Scenario B	-349.85

Source: own calculations

3.4.1. Scenario A

Table 3.3 represents the calibration of the models in Scenario A. There are three main columns in the table. The first main column from left shows the case when the total population is indifferent about the negative characteristics of the foreign product. As it is observed, different cases elaborated in Scenario A have similar welfare implications when all members of the population are indifferent about the harms of the cattle imported from Canada.

The first main column from the right shows the situation where the whole population is concerned about the negative attributes of the imported cattle. As it is observed here, the initial welfare of consumers and domestic producer is lower as compared to the case where the whole population is indifferent or where half of the population is concerned (second main column to the right). This is mainly because a decrease in demand because of the perceived harm of the Canadian product by concerned consumers. When consumers are not informed about the exclusion of the harmful product from the market after NTM (case II), their subjective welfare drops even more than when they are informed (case I). However, their objective welfare when they are not informed (case II') is higher than when they are

informed. Although they think they still receive products with bad characteristics, they are not actually receiving any harm after NTM. This situation happens because after NTM, the market structure changes to the monopoly. If they become informed that there is no bad product in the market, the total demand curve will shift up. This shift will lead to a burden to them as the market works as a monopoly and also because there is increasing costs due to scale effects.

Table 3.3- Calibration results for Scenario A

Variables	$(\eta = 1)$			$(\eta = 0.5)$			$(\eta = 0)$		
	Case I	Case II	Case II'	Case I	Case II	Case II'	Case I	Case II	Case II'
CS_O	14.77	14.77	14.77	13.47	13.47	13.47	11.86	11.86	11.86
PS_{OH}	12.38	12.38	12.38	11.13	11.13	11.13	9.95	9.95	9.99
CS_M	6.22	6.22	6.22	6.22	5.78	7.84	6.22	5	8.88
PS_M	20.87	20.87	20.87	20.87	18.76	18.76	20.87	16.76	16.76
ΔCS	-8.55	-8.55	-8.55	-7.24	-7.68	-5.63	-5.64	-6.86	-2.98
$\dfrac{\Delta CS}{CS_O}$	-0.58	-0.58	-0.58	-0.54	-0.57	-0.42	-0.48	-0.58	-0.25
ΔPS	8.49	8.49	8.49	9.74	7.63	7.63	10.92	6.82	6.82
$\dfrac{\Delta PS}{PS_O}$	0.69	0.69	0.69	0.87	0.69	0.69	1.10	0.69	0.69
ΔW	-0.06	-0.06	-0.06	2.50	-0.05	2	5.28	-0.05	3.83
$\dfrac{\Delta W}{W_O}$	-0.002	-0.002	-0.002	0.10	-0.002	0.081	0.24	-0.002	0.176
$\Delta IntW$	-12.44	-12.44	-12.44	-8.64	-11.19	-9.13	-4.66	-9.99	-6.11
$\dfrac{\Delta IntW}{IntW_O}$	-0.31	-0.31	-0.31	-0.24	-0.31	-0.26	-0.15	-0.31	-0.19

Source: own calculation
Welfare amounts are in Hundreds Millions of USD.
CS: Consumer Surplus; PS: Producer Surplus; W: Home Total Welfare; IntW: International Welfare.
Case II' is the case II of Scenario A, with objective calculation of welfare after NTM, while case II was mainly calculating the subjective welfare after NTM

Figure 3.2 - Sensitivity test of welfare changes with respect to *r*, Scenario A, Case I
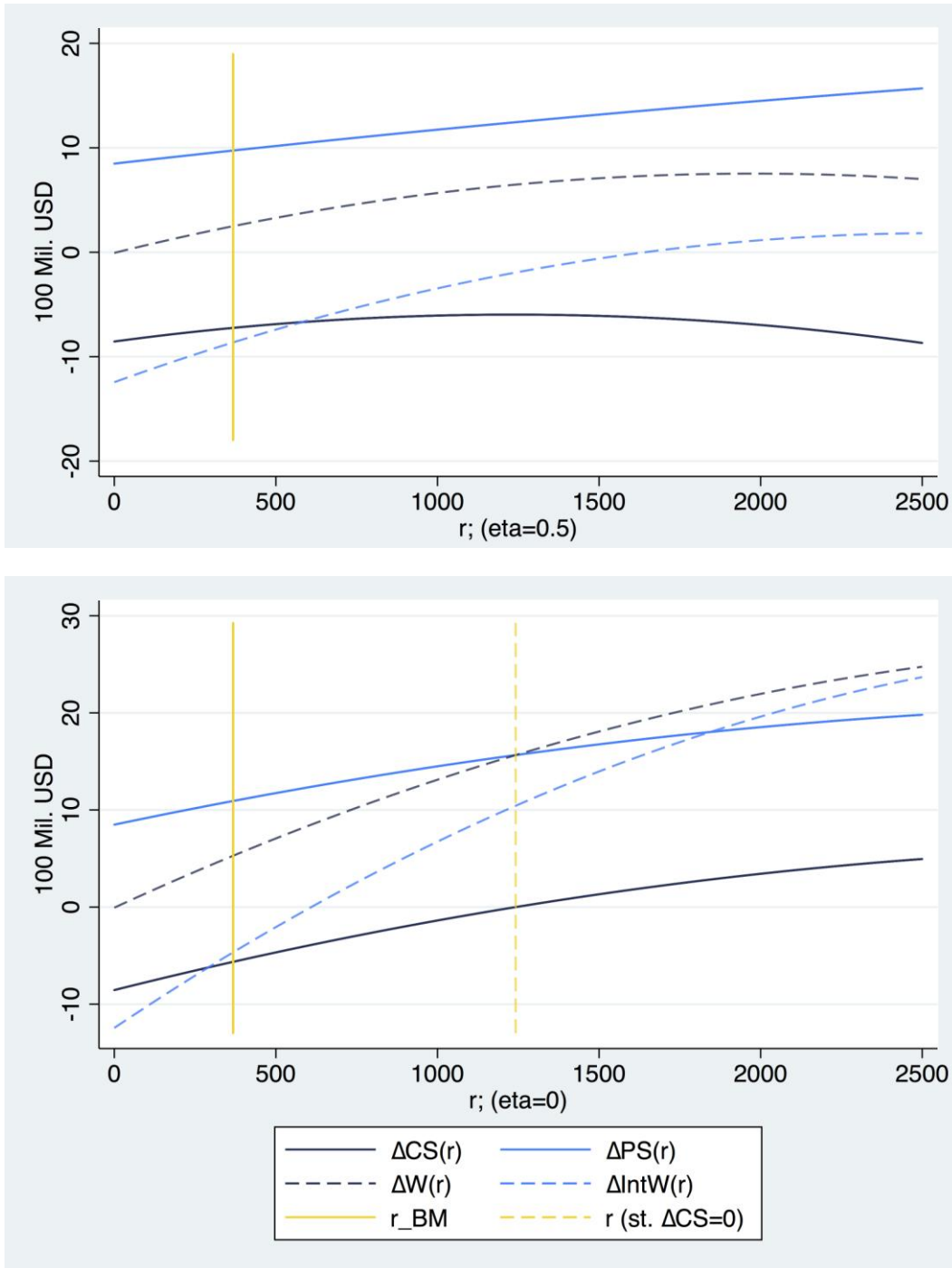
Note: r_BM is the line showing the benchmark value of "r" used in illustration of real data. Dashed vertical yellow line shows the amount of "r" for which the Consumer Surplus increases after NTM (r=1242)

Figure 3.3 - Sensitivity test of welfare changes with respect to *r*, Scenario A, Case II
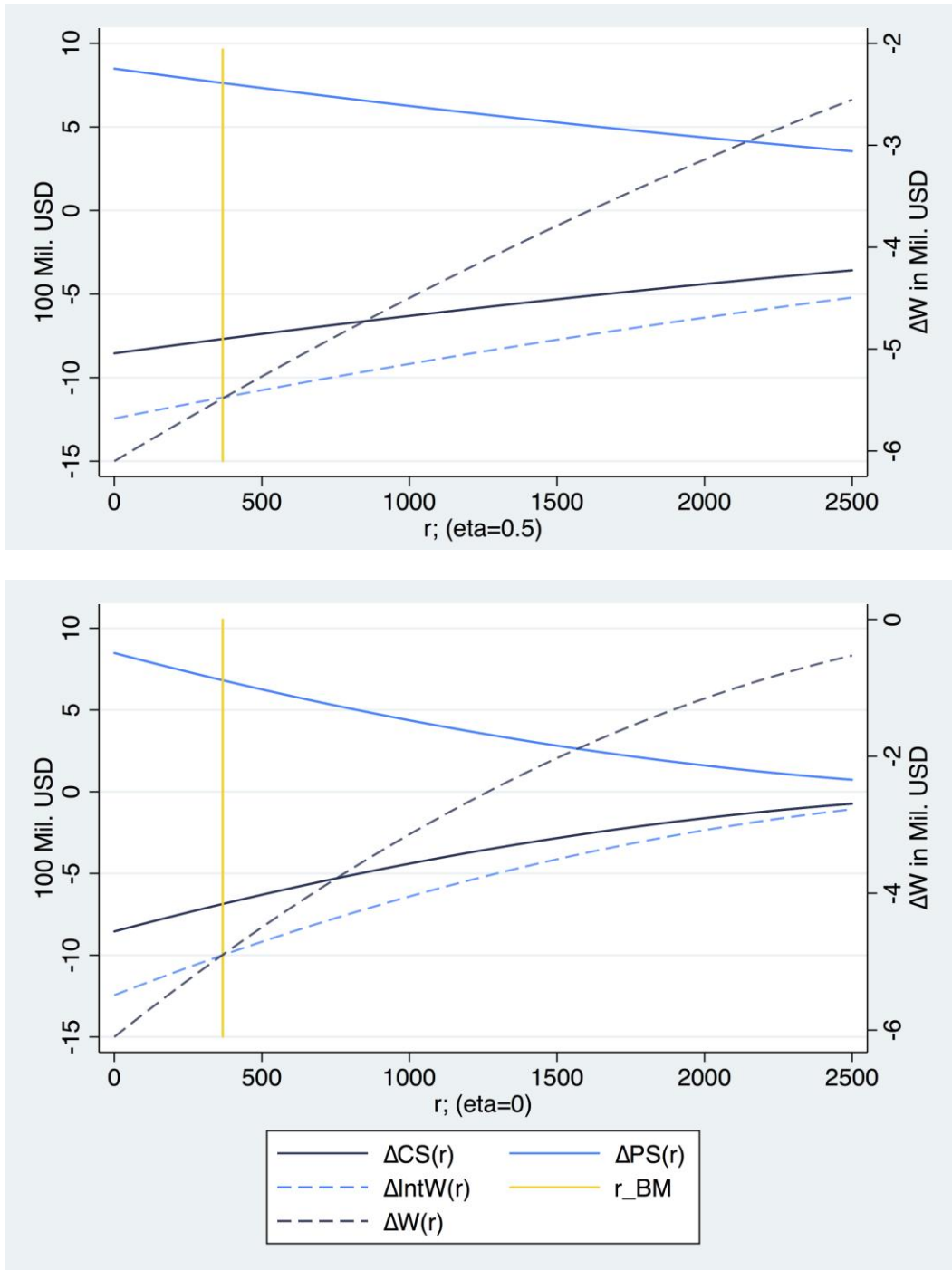
Note: r_BM is the line showing the benchmark value of "r" used in illustration of real data.

Right vertical axis is presenting the changes of domestic social welfare (ΔW) in Millions of USD. Left vertical axis is presenting the changes of CS, PS, and International Welfare in 100 Millions of USD.

Figure 3.4 - Sensitivity test of welfare changes with respect to *r*, Scenario A, Case II'
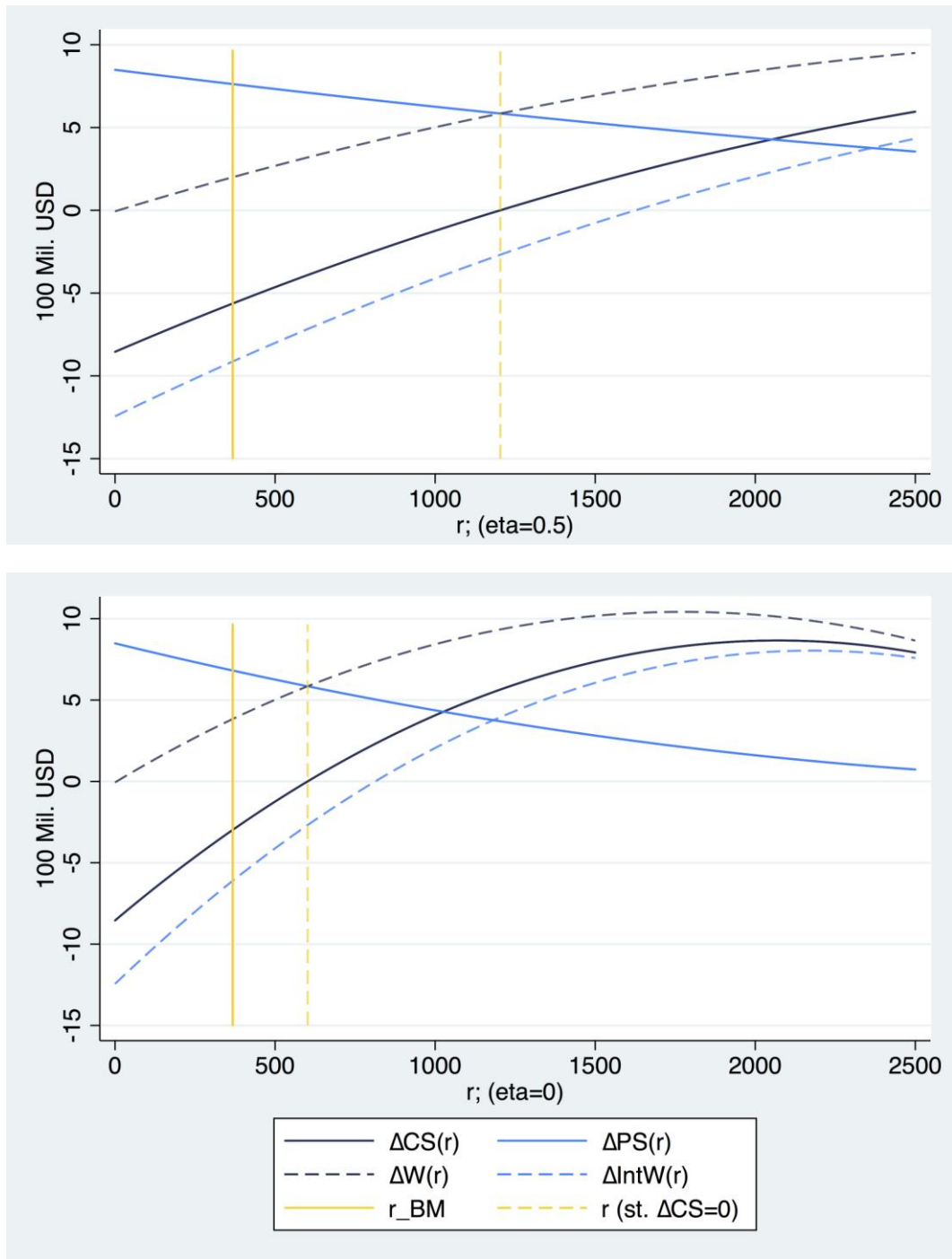
Note: r_BM is the line showing the benchmark value of "r" used in illustration of real data. Dashed vertical yellow line shows the amount of "r" for which the Consumer Surplus increases after NTM (r=1203 when $\eta = 0.5$; and r=601.6 when $\eta = 0$)

When the government informs the consumers that there are no more foreign products in the market, domestic producer's profit will increase more than when government does not. However, as mentioned above, the consumers' welfare is better off when they receive no such information. Therefore, these results might imply a conclusion that the government was rather pursuing a support strategy for the domestic industry. As observed, consumer welfare declines after the prohibition of import by the introduction of the NTM.

Considering consumers as the owners of the domestic industry, it can be shown that in the case with concerned consumers in the society, there are social welfare gains resulting from the introduction of a prohibitive NTM. In other words, an increase in the domestic producer's profit is higher than the consumers' welfare losses when there are larger share of concerned consumers in the society. However, when everybody is indifferent about harms of the foreign product, the NTM will cause losses to the entire society, as the increase in profit in the home industry does not compensate the losses of consumers. This happens also because the government does not earn revenues by imposition of NTM unlike it does by introduction of tariffs. Since the market becomes monopolistic, and the marginal cost is an increasing function of production, such loss is evident.

Figures 3.2, 3.3, and 3.4 are presenting sensitivity analyses of welfare changes with respect to changes of perceived negative damage of Canadian cattle (r) in case I, II, and II' respectively. When the whole society is unconcerned about the negative characteristics of foreign product ($\eta = 1$), welfare is not affected by the changes of r. On the other hand, when the proportion of concerned consumers increases in the society, welfare is becoming more sensitive to the changes of r. As is observed in figure 3.2, only when all consumers are concerned, their welfare can increase by the NTM when r is greater than 1242 USD. Hence, if the perception of the harm of Canadian product is higher than this amount, their initial demand is very low, such that a prohibition of import without informing them can increase their welfare. A similar issue arises for the consumers' objective function after an uninformed NTM (case II'). However, even when half of the population is concerned in this case, the NTM can improve the consumers' welfare if the perception of negative effect of foreign product is higher than 1203 USD. Considering all the population concerned about negative attributes of foreign product, the NTM can improve CS when r is greater than 601.6 USD.

To consider the situation from a protectionism perspective, the following can be argued. Firstly, because the perceived harms by consumers from consumption of the foreign product are not very high, the prohibitive NTM decreases their welfare. Secondly, the domestic industry is always gaining from the market structural change to monopoly. Therefore, according to these findings, it is observed that the government is not pursuing the improvement of consumers' welfare when r is very small. However, when a domestic industry is lobbying with a government, it prefers to attract consumers with the support of government in approving its products. By introducing a prohibitive NTM domestic producer will become firstly a monopolist. Then, after eliminating the competitor, some information regarding the availability of harmless product in the market after NTM will boost the demand of consumers. The information provided by the government will dramatically support the domestic industry and the profit will increase even more than when such information is not issued to consumers. Overall, according to the assumptions of the model that consumers are completely aware of the harms of the products and they can rationally allocate their budget

for the demand of product, such policy instrument is in favor of domestic producer rather than consumers. This assumption is lifted in scenario B which will be illustrated next.

3.4.2. Scenario B

Table 3.4- Calibration results scenario B

Variables	Symmetric Industries			Asymmetric Industries		
r	**3.41**	**367.43**	**470.48**	**91.88**	**367.43**	**392.08**
CS_O	43.53	23.96	18.42	33.49	19.66	18.42
PS_{OH}	36.65	36.65	36.65	46.7	46.7	46.7
CS_M	18.42	18.42	18.42	18.42	18.42	18.42
PS_M	61.77	61.77	61.77	61.77	61.77	61.77
ΔCS	-25.11	-5.54	0	-15.07	-1.24	0
$\dfrac{\Delta CS}{CS_O}$	-0.57	-0.23	0	-0.45	-0.06	0
ΔPS	25.12	25.12	25.12	15.07	15.07	15.07
$\dfrac{\Delta PS}{PS_O}$	0.69	0.69	0.69	0.32	0.32	0.32
ΔW	0	19.58	25.12	0	13.83	15.07
$\dfrac{\Delta W}{W_O}$	0	0.32	0.46	0	0.21	0.23
$\Delta IntW$	-36.65	-17.08	-11.53	-23.34	-9.51	-8.28
$\dfrac{\Delta IntW}{IntW_O}$	-0.31	-0.18	-0.13	-0.23	-0.11	-0.09

Welfare amounts are in 100 Millions of USD.
CS: Consumer Surplus; PS: Producer Surplus; W: Home Total Welfare; IntW: International Welfare.

Table 3.4 represents the results from calibration of scenario B. There are two main columns in this table showing symmetric industries and asymmetric industries. Considering unawareness of consumers about possible damaging effects of Canadian cattle, two values of r are calculated in each main column in addition to the benchmark value (367.43). 3.41 USD and 91.88 USD are the amount of negative effects for which the prohibitive NTM becomes neutral for the social welfare in respectively symmetric and asymmetric cases. Table 3.4 shows that for these values, total welfare of the society is unchanged after imposition of NTM, while consumers face billions of losses. By increasing the amount of r, consumers' welfare losses decrease and from a certain point on, these even increase after the prohibitive regulation. Figures 3.5 and 3.6 also show that consumers' welfare changes after NTM with respect to the negative effect of foreign product, while producer's profit changes is neutral

with respect to r. If r becomes higher than 470.48 USD and 392.08 USD in the symmetric and asymmetric cases respectively, the NTM will increase the consumers' welfare substantially.

If the government tries to legitimately impose NTMs in line with international agreements for the sake of consumers, it should provide evidences that the harm of the imported product is as much as r neutralizing the consumer welfare changes. If the provided evidence shows less damage than this amount, it can be stated that the government is not in the pursuit of consumers' welfare. In such case, protectionism of the domestic industry can be concluded instead of protection of consumers' health.

Figure 3.7 depicts the sensitivity analysis of r neutralizing consumers' surplus changes after the prohibitive NTM, with respect to the relative costs of foreign industry to the domestic industry. When the foreign industry produces with a cost lower than the domestic industry, the government should provide justifications for a very high level of damaging effect of foreign product. In such a situation, dropping the efficient foreign industry out of the domestic market will cause a huge loss to consumers. Thus, such NTM should be based on a sound evidence for high damaging effects of foreign product, whose elimination would compensate such big losses to the society. If the efficiency of the domestic industry is improved, the claim of the government for the measurement of the harm of the foreign product can be loosened. In situations where the domestic industry is the main supplier of the market, the elimination of foreign product has negligible impact on the welfare of consumers. Therefore, it is obvious in such case that the government provides little evidence only for measures of the negative effect of foreign product.

Figure 3.5- Sensitivity test of welfare changes with respect to *r*, Scenario B, Symmetric industries
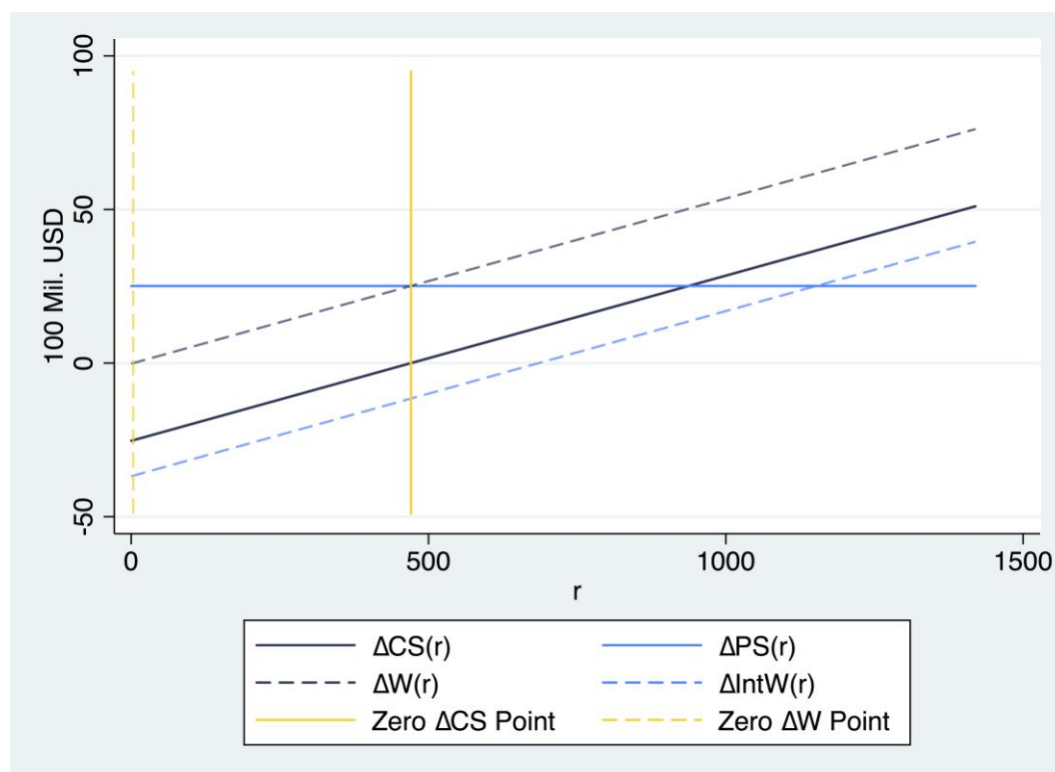
Figure 3.6- Sensitivity test of welfare changes with respect to *r*, Scenario B, Symmetric industries
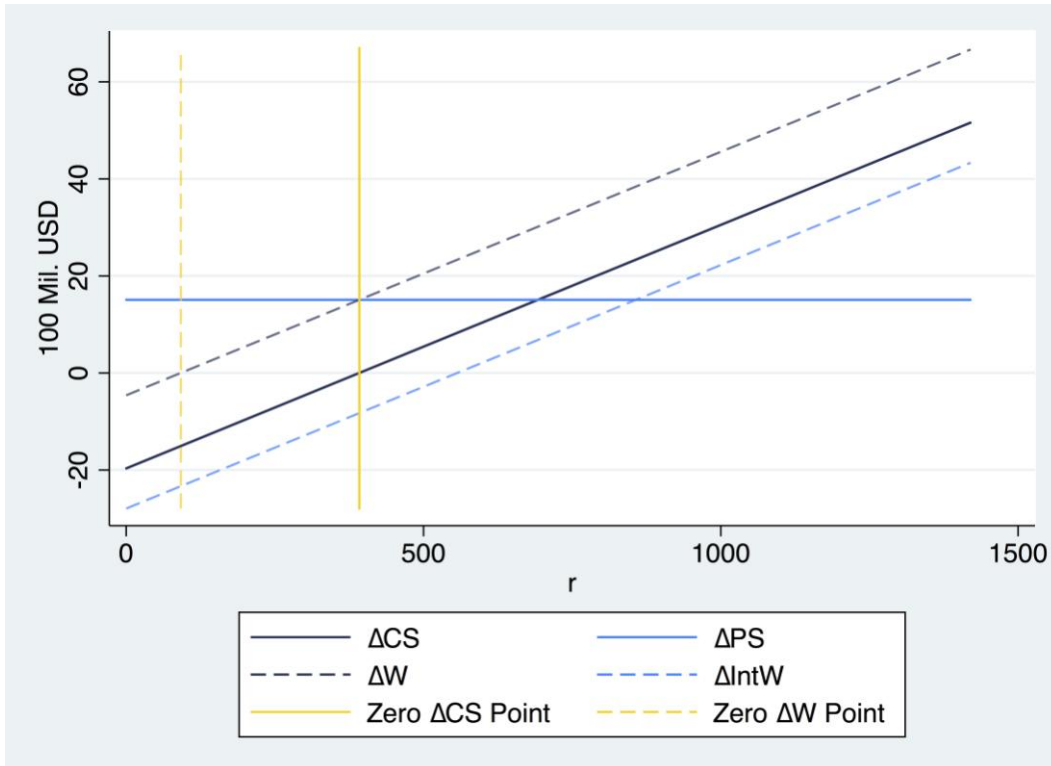
Figure 3.7- Sensitivity analysis of ΔCS neutraulizing *r* with respect to the relative industries' costs
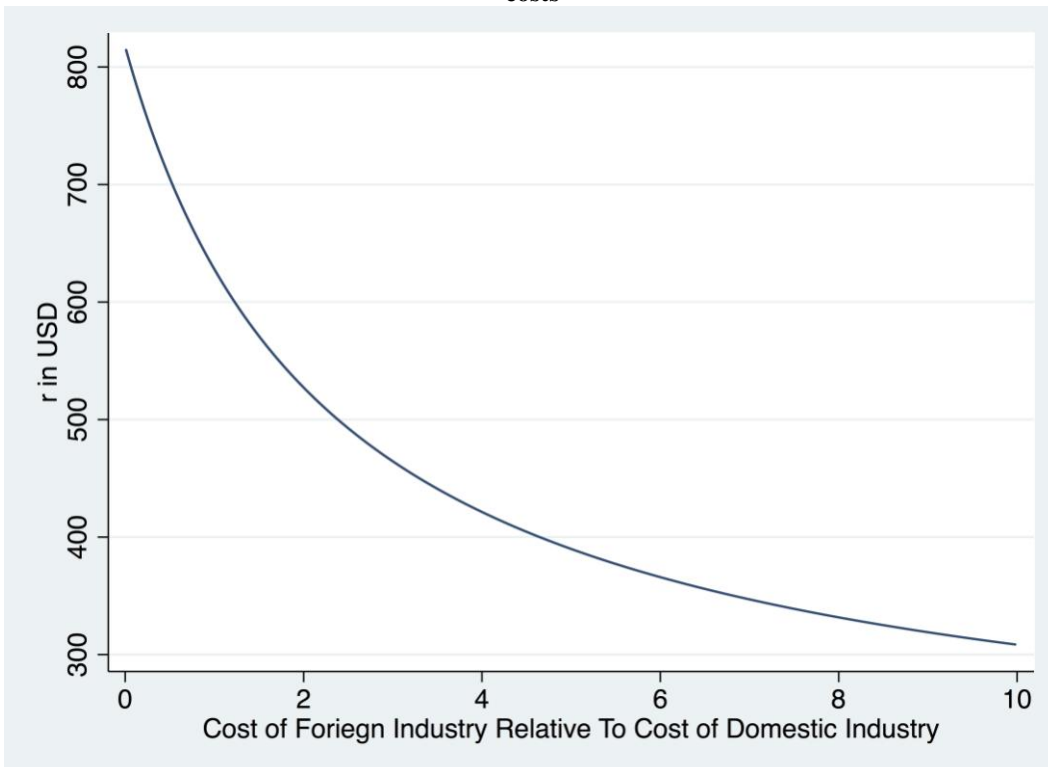
Changes of relative second cost parameters of the two industries are shown in the horizontal axis

3.5. Summary and Conclusions

This paper provides a partial equilibrium framework to analyze the welfare implications of a prohibitive NTM imposed on a foreign product with negative characteristics. A model with a foreign and a domestic supplier to the domestic market was considered to support the idea of the possibility of protectionism of the domestic industry. The analysis is mainly focused on the awareness of consumers about the damaging effects of the good produced abroad. Whether or not the consumers are aware of these characteristics was considered in two different scenarios. However, it was assumed that products cannot be differentiated and consumers cannot distinguish between the origins of the products. A mixture of two types of consumers in the society was considered: The first group of consumers might be indifferent concerning the potential harms of the product whereas the second group is assumed to be concerned about the harms of the foreign products.

In the first scenario of the model, it was assumed that consumers receive valid information from media that there is a harmful product imported from abroad. However, since they cannot distinguish between the two products they assign probabilities for purchasing the harmful product. The equilibrium quantities and prices in the oligopolistic market were calculated analytically and the initial level of welfare for consumers and producers were elaborated on which basis the situation after the imposition of a prohibitive NTM and the monopolistic market was studied. Whether or not the consumers are informed about the resulting non-existence of the harmful product was analyzed in two cases in this scenario.

An application of this model was illustrated using data on consumption of cattle in eight northern states of the United States of America. The calibration of the first scenario showed that a prohibitive NTM decreases the consumer welfare. CS changes can be influenced by two issues: First, consumers' welfare should increase when the foreign product with bad characteristics is removed from the market and there will be gains for concerned consumers after the imposition of the NTM. On the other hand, consumers will lose from the changes in the market structure from oligopoly to monopoly. When the perceived damaging effect of foreign product is very low, the former (gains) is less than the latter (losses); therefore, there will be a net loss in consumers' welfare. The loss of consumers is larger when all (or the majority) of the population is indifferent about the negative effects of Canadian cattle. However, the domestic producer always gains from such policy. It was found that when government informs about the non-existence of the harmful product after NTM, producer's profits increases more than when government does not. On the other hand, the objective consumers' welfare decreases more when this information is revealed. It can be concluded that such information is more in the favor of the producer rather than consumers. Thus, as a signal it can be understood that such policy based on the assumptions of the model is implemented to support and protect the domestic industry.

The second scenario of the model has analyzed a situation when consumers are not aware of the damaging effect of the foreign product. Only government has such knowledge and can introduce a prohibitive NTM to eliminate the harms of foreign products in the domestic market. Since the government is seeking to improve the welfare of consumers by NTM, the minimum damaging effect of the foreign product that leaves the consumers' surplus unchanged after the policy was calculated. The illustration of the model showed that when

the foreign industry has a major share in the domestic market, a high value of the damaging effect of foreign product should be evidently proved by the government imposing NTM. Therefore, it is quite difficult to motivate an NTM for the support of domestic consumers, when the domestic industry is less efficient than the foreign industry.

According to Scenario B, the government might try to overstate the damaging effect of the foreign product to provide a solid motivation behind the policy. Diverging from truth telling, authorities might try to conceal their industrial protectionism. Instead, by overstating the negative attribute of the product at the focus of the NTM, the government tries to be in line with international agreements supporting the consumers. Truth telling behavior of the governments in such situation can be analyzed within a mechanism design framework. Such analysis can be proposed as an extension to this model for the purposes of policy justifications in international disputes such as Dispute Settlement Mechanisms of the WTO.

Constructing a similar model for the NTMs that do not halt trade completely but impose costs to foreign suppliers to comply with new regulations can be another possibility for further research. After prohibitive NTM analyzed in this research, the foreign industry will endure costs to increase the quality of the product for removing the negative characteristics, which allows the foreign industry to reenter the domestic market. Thus, such issue is proposed to be modeled as an extension to this paper.

Furthermore, conducting an experimental survey to evaluate the perception of consumers regarding the harms of a given foreign product can be another future avenue of research on the issue. In this framework, surveys can be conducted to understand the expectations of the people of a country imposing NTM on the foreign product. Such experiment will firstly identify the awareness of consumers regarding the trade policy, and the product characteristics. Secondly, it can verify the compatibility of the trade instrument with the consumers' behavior, which is the major issue for the legitimacy of the imposed NTM. Last but not least, it will facilitate the cost-benefit analyses as suggested in this paper.

Appendix 3

Appendix 3.1. Calculations of Scenario A:

Consumers' utility maximization problem:

The utility function for an indifferent consumer will be as follows:

$$U_i(q_i, w_i) = aq_i - \bar{b}\, q_i^2/2 + w_i\,, i \in [1, N_1] \tag{1}$$

The individuals in the society maximize their utility subject to a budget constraint:

$$pq_i + w_i = y_i \tag{2}$$

Where p represents the price of the good, y_i stands for the income of the representative consumer i, and price of the numeraire is equal to 1. The Lagrangian for utility maximization problem is:

$$\mathcal{L}_i = aq_i - \bar{b}\, q_i^2/2 + w_i + \lambda(y_i - pq_i - w_i), i \in [1, N_1] \tag{3}$$

First Order Conditions (FOC) for utility maximization of an indifferent individual will give the demand of each indifferent individual:

$$q_i = \frac{a - p}{\bar{b}}, i \in [1, N_1] \tag{4}$$

The Lagrangian for utility maximization problem for a concerned individual will be:

$$\mathcal{L}_i = aq_i - \bar{b}\, q_i^2/2 - \tau r q_i + w_i + \lambda(y_i - pq_i - w_i), \qquad i \in (N_1, N] \tag{5}$$

After setting FOC for utility maximization, the demand of each concerned consumer will be:

$$q_i = \frac{a - \tau r - p}{\bar{b}}, \quad i \in (N_1, N] \tag{6}$$

Considering aggregate demand of all consumers as $Q_A^D = \sum_{i=1}^{N} q_i(p, r)$, proportion of indifferent consumers as $\eta = N_1/N$, and assuming $b = \bar{b}/N$, the aggregate demand will be derived as follows:

$$
Q_A^D(p, r) =
\begin{cases}
\dfrac{a - p}{\bar{b}} \eta N, & p \geq a - \tau r \\[2mm]
\dfrac{a - p}{\bar{b}} \eta N + \dfrac{a - \tau r - p}{\bar{b}} (1 - \eta)N, & 0 \leq p \leq a - \tau r
\end{cases}
$$

$$
=
\begin{cases}
\dfrac{\eta(a - p)}{b}, & p \geq a - \tau r \\[2mm]
\dfrac{a - \tau r(1 - \eta) - p}{b}, & 0 \leq p \leq a - \tau r
\end{cases}
\tag{7}
$$

Therefore, the aggregate inverse demand will be:

$$p_A^D(Q,r) = \begin{cases} a - \dfrac{b}{\eta}\,Q, & 0 \leq Q \leq \dfrac{\tau r \eta}{b} \\ a - \tau r(1-\eta) - bQ, & Q \geq \dfrac{\tau r \eta}{b} \end{cases} \tag{8}$$

Firms' profit maximization:

Assuming symmetry, profit of each firm competing in a Cournot duopoly ($Q = q_H + q_F$) is:

$$\pi_j = \begin{cases} \left(a - \dfrac{b}{\eta}\,Q\right)q_j - c_1 q_j - \dfrac{1}{2}c_2 q_j^2 - K, & 0 \leq Q \leq \dfrac{\tau r \eta}{b}, j = \{H,F\} \\ (a - \tau r(1-\eta) - bQ)q_j - c_1 q_j - \dfrac{1}{2}c_2 q_j^2 - K, & Q \geq \dfrac{\tau r \eta}{b}, j = \{H,F\} \end{cases} \tag{9}$$

The FOC for profit maximization of each firm is:

$$\frac{\partial \pi_j}{\partial q_j} = 0 \Rightarrow \begin{cases} a - \dfrac{b}{\eta}q_{j'} - c_1 - \left(\dfrac{2b + \eta c_2}{\eta}\right)q_j = 0, & p \geq a - \tau r \,; (j,j') \in \{(H,F),(F,H)\} \\ a - \tau r(1-\eta) - bq_{j'} - c_1 - (2b + c_2)q_j = 0, & 0 \leq p \leq a - \tau r; \, (j,j') \in \{(H,F),(F,H)\} \end{cases} \tag{10}$$

Therefore, before imposition of restrictive NTM, best response functions of the home industry (BR$_{HA}$) and the foreign industry (BR$_{FA}$) in a Cournot duopoly will be respectively as follows:

$$BR_{HA}(q_F)\colon q_H = \begin{cases} \dfrac{\eta(a - c_1)}{2b + c_2 \eta} - \dfrac{b}{2b + c_2 \eta}q_F, & a - \tau r \leq p \leq a \\ \dfrac{a - \tau r(1-\eta) - c_1}{2b + c_2} - \dfrac{b}{2b + c_2}q_F, & 0 \leq p \leq a - \tau r \end{cases} \tag{11$_{/1}$}$$

$$BR_{FA}(q_H)\colon q_F = \begin{cases} \dfrac{\eta(a - c_1)}{2b + c_2 \eta} - \dfrac{b}{2b + c_2 \eta}q_H, & a - \tau r \leq p \leq a \\ \dfrac{a - \tau r(1-\eta) - c_1}{2b + c_2} - \dfrac{b}{2b + c_2}q_H, & 0 \leq p \leq a - \tau r \end{cases} \tag{11$_{/2}$}$$

After finding the Nash equilibrium, quantities supplied by home industry (q$_{AOH}$) and foreign industry (q$_{AOF}$) in the oligopoly will be as follows:

$$q_{AOH} = q_{AOF} = \begin{cases} \dfrac{\eta(a - c_1)}{3b + c_2 \eta}, & a - \tau r \leq p \leq a \\ \dfrac{a - \tau r(1-\eta) - c_1}{3b + c_2}, & 0 \leq p \leq a - \tau r \end{cases} \tag{12}$$

Domestic monopolist's profit maximization problem, Case I

There is no foreign product with negative characteristics in the market after NTM, and consumers are informed about this. The inverse aggregate demand is $p_{AI}^D(Q,r) = a - bQ$. Profit of home industry acting as monopolist after imposition of NTM to be maximized is as follows:

$$\pi_H = (a - bq_H)q_H - c_1 q_H - \frac{1}{2}c_2 q_H^2 - K_H \tag{13}$$

The FOC of the profit maximization with respect to quantity will give the equilibrium supply quantity (Q_{AMI}) as:

$$\frac{\partial \pi_H}{\partial q_H} = 0 \Rightarrow Q_{AMI} = q_H = \frac{a - c_1}{2b + c_2} \tag{14}$$

Scenario B:

Unaware consumers' aggregate inverse demand is $p_B^D(Q, r) = a - bQ$. The two industries maximize the following profit in the Cournot duopoly:

$$\pi_j = (a - bQ)q_j - c_{1j}q_j - \frac{1}{2}c_{2j}q_j^2 - K_j, \qquad j = \{H, F\}; \ Q = q_H + q_F \tag{15}$$

The first order conditions for profit maximization problem of each firm will be:

$$\frac{\partial \pi_j}{\partial q_j} = 0 \Rightarrow a - bq_{j'} - c_{1j} - (2b + c_{2j})q_j = 0, \ (j, j') \in \{(H, F), (F, H)\} \tag{16}$$

The best response functions of the home industry (BR_{HB}) and the foreign industry (BR_{FB}) in this duopoly will be respectively as follows:

$$BR_{HB}(q_F): q_H = \frac{(a - c_{1H})}{2b + c_{2H}} - \frac{b}{2b + c_{2H}}q_F \tag{17/1}$$

$$BR_{FB}(q_H): q_F = \frac{(a - c_{1F})}{2b + c_{2F}} - \frac{b}{2b + c_{2F}}q_H \tag{17/2}$$

After finding the Nash equilibrium, quantities supplied by home industry (q_{BOH}) and foreign industry (q_{BOF}) in the oligopoly will be respectively as follows:

$$q_{BOH} = \frac{(a - c_{1H})(2b + c_{2F}) - b(a - c_{1F})}{(2b + c_{2H})(2b + c_{2F}) - b^2}$$

$$q_{BOF} = \frac{(a - c_{1F})(2b + c_{2H}) - b(a - c_{1H})}{(2b + c_{2H})(2b + c_{2F}) - b^2} \tag{18}$$

Total quantity supplied in the oligopolistic market (Q_{BO}) will be:

$$Q_{BO} = \frac{(a - c_{1H})(b + c_{2F}) + (a - c_{1F})(b + c_{2H})}{(2b + c_{2H})(2b + c_{2F}) - b^2} \tag{19}$$

Appendix 3.2. Proof of the existence of pure strategy Nash Equilibrium

Given the demand and inverse demand functions in equations (7) and (8), and assuming that q_F is given, define

$$\pi_1(q_H|q_F) = \left(a - \frac{b}{\eta}(q_H + q_F)\right)q_H - c_1 q_H - \frac{1}{2}c_2 q_H^2 - K \tag{20/1}$$

$$\pi_2(q_H|q_F) = \left(a - \tau r(1-\eta) - b(q_H + q_F)\right)q_H - c_1 q_H - \frac{1}{2}c_2 q_H^2 - K \tag{20/2}$$

$$\pi(q_H|q_F) = \pi_1(q_H|q_F) \text{ for } q_H + q_F \leq \frac{\tau r\eta}{b}, \pi(q_H|q_F) = \pi_2(q_H|q_F) \text{ for } q_H + q_F \geq \frac{\tau r\eta}{b}$$

Symmetric pure strategy Cournot equilibrium (Nash Equilibrium in quantities):

Pair (q^*, q^*) s.t.

$$q^* solves \max_{q_H \geq 0} \pi(q_H|q^*)$$

Since for any $q_F \geq 0$, the maximand of $\pi(q|q_F)$ is $\leq \frac{a - \tau r(1-\eta)}{b}$ and, as we shall see, the profit function is continuous, there is a mixed strategy Nash Equilibrium. However, a pure strategy Nash Equilibrium may not exist.

We now consider some properties of the profit functions $\pi_1(.\,|q_F)$ and $\pi_2(.\,|q_F)$.

1. They are both strictly concave
2. Suppose $\frac{\tau r\eta}{b} > q_F$. Then $\pi_1(q_H|q_F) = \pi_2(q_H|q_F)$ if and only if $q_H = \frac{\tau r\eta}{b} - q_F$, in particular, the profit function $\pi(.\,|q_F)$ is continuous.
3. Suppose $\eta < 1$ and $\frac{\tau r\eta}{b} > q_F$. For $q_H > \frac{\tau r\eta}{b} - q_F$. $\pi_2(q_H|q_F) > \pi_1(q_H|q_F)$ and for $q_H < \frac{\tau r\eta}{b} - q_F$. $\pi_2(q_H|q_F) < \pi_1(q_H|q_F)$. This in particular means that
$$\frac{\partial \pi_2}{\partial q_H}(q_H|q_F) > \frac{\partial \pi_1}{\partial q_H}(q_H|q_F) \text{ for } q_H = \frac{\tau r\eta}{b} - q_F$$

Proposition:

(q^*, q^*) is a pure strategy Nash Equilibrium if and only if one of the following three conditions holds:

i (a) $q^* \geq \frac{\tau r\eta}{b}$ and (b) $\frac{\partial \pi_2}{\partial q_H}(q^*|q^*) = 0$

ii (a) $q^* \leq \frac{\tau r\eta}{b}$ and (b) $2q^* \geq \frac{\tau r\eta}{b}$, (c) $\frac{\partial \pi_2}{\partial q_H}(q^*|q^*) = 0$ and (d) with $\hat{q}$ solving $\frac{\partial \pi_1}{\partial q_H}(q^*|q^*) = 0, \pi_1(\hat{q}|q^*) \leq \pi_2(q^*|q^*)$.

iii (a) $q^* \leq \frac{\tau r\eta}{b}$ and (b) $2q^* \leq \frac{\tau r\eta}{b}$, (c) $\frac{\partial \pi_1}{\partial q_H}(q^*|q^*) = 0$ and (d) with $\hat{q}$ solving $\frac{\partial \pi_2}{\partial q_H}(q^*|q^*) = 0, \pi_1(q^*|q^*) \geq \pi_2(\hat{q}|q^*)$.

Proof:

(I) Sufficiency:

In case (i), for any choice $q_H \geq 0$ by domestic firm, $q_H + q^* \geq \frac{\tau r\eta}{b}$, so that the profit of the firm 1 is $\pi_2(q_H|q^*)$, which is by concavity and (i)(b) maximized at $q_H = q^*$. Hence, (q^*, q^*) is a Nash Equilibrium.

In case (ii), if domestic firm chooses $q_H > \frac{\tau r \eta}{b} - q_F$, its profit is $\pi_2(q_H|q^*)$ which by (ii)(b) is maximized at $q_H = q^*$. If domestic firm chooses $q_H \leq \frac{\tau r \eta}{b} - q_F$, its profit is $\pi_1(q_H|q^*) \leq \pi_1(\hat{q}|q^*) \leq \pi_2(q^*|q^*)$ by (ii)(d). Thus, (q^*, q^*) is a Nash Equilibrium.

In case (iii), if domestic firm chooses $q_H < \frac{\tau r \eta}{b} - q_F$, its profit is $\pi_1(q_H|q^*)$ which by (iii)(b) is maximized at $q_H = q^*$. If domestic firm chooses $q_H \geq \frac{\tau r \eta}{b} - q_F$, its profit is $\pi_2(q_H|q^*) \leq \pi_2(\hat{q}|q^*) \leq \pi_1(q^*|q^*)$ by (iii)(d). Thus, (q^*, q^*) is a Nash Equilibrium.

(II) Necessity: If (q^*, q^*) is a symmetric pure strategy Nash Equilibrium, then either (i)(a) or (ii)(a) and (b) or (iii)(a) and (b) holds.

If (i)(a) holds, for any $q_H \geq 0$ chosen by domestic firm, the resulting profit is $\pi_2(q_H|q^*)$. Since domestic firm is maximizing profit, by concavity (i)(b) must then hold.

If (ii)(a) and (b) hold, let q_F^* solve $\max_q \pi_2(q|q^*)$. If $q_F^* < \frac{\tau r \eta}{b} - q^*$ by property (ii), $\pi_1(q_F^*|q^*) \geq \pi_2(q_F^*|q^*) > \pi_2(q^*, q^*)$, so that (q^*, q^*) is not a Nash Equilibrium, i.e. we have a contradiction. Hence, $q_F^* \geq \frac{\tau r \eta}{b} - q^*$, i.e. $q_F^* = q^*$, then, (ii)(c) must hold. If $\hat{q} \geq \frac{\tau r \eta}{b} - q^*$, by property (ii) $\pi_2(q^*, q^*) \geq \pi_2(\hat{q}|q^*) \geq \pi_1(\hat{q}|q^*)$, so (ii)(d) holds. If $\hat{q} \leq \frac{\tau r \eta}{b} - q^*$, since (q^*, q^*) is a Nash Equilibrium, $\pi_1(\hat{q}|q^*) \leq \pi_2(q^*, q^*)$, so again (ii)(d) holds.

If (iii)(a) and (b) hold, let q_H^* solve $\max_q \pi_1(q|q^*)$. If $q_H^* > \frac{\tau r \eta}{b} - q_F^*$ by property (ii), $\pi_2(q_H^*|q^*) \geq \pi_1(q_H^*|q^*) \geq \pi_1(q^*|q^*)$, contradicting that (q^*, q^*) is a Nash Equilibrium. Hence, $q_H^* \leq \frac{\tau r \eta}{b} - q^*$, i.e. $q_H^* = q^*$, then, (iii)(c) must hold. If $\hat{q} \leq \frac{\tau r \eta}{b} - q^*$, $\pi_1(q^*, q^*) \geq \pi_1(\hat{q}|q^*) \geq \pi_2(\hat{q}|q^*)$, where the first inequality comes from (iii)(b) and the last one follows from property (ii), thus, (iii)(d) holds. If on the other hand $\hat{q} > \frac{\tau r \eta}{b} - q^*$, since (q^*, q^*) is a Nash Equilibrium, $\pi_2(\hat{q}|q^*) \leq \pi_1(q^*, q^*)$, so again (iii)(d) holds.

The simulated model in the illustration section fulfills the first condition in the proposition above to constitute a pure strategy Nash Equilibrium for the model.

SUMMARY AND CONCLUSIONS

In this dissertation, I have shed light on a certain trade policy instrument which has attracted global attention since tariffs have fallen down. Technical Barriers to Trade (TBTs) as one of the main categories of non-tariff measures (NTMs) are at the focus of the study. Opaque nature of TBTs does not easily allow for clear identification of motivations behind their impositions and furthermore, for quantification of their consequences on international trade. By studying the causes and implications of these trade policy instruments I have tried to contribute to the literature of international trade policy.

In order to increase transparency, WTO regulations oblige members to notify their trade policy measures. Complexity of TBTs stems from various motivations of governments which might induce them to be reluctant to be transparent. Concealing protectionist motives by authorities behind the legitimate or scientific reasoning makes these types of instruments very opaque. In order to overcome such difficulties, WTO members are allowed to notify others' policy instruments within a reverse notification system. Specific Trade Concerns (STCs) provide information regarding the imposition of policy measures by other members within such system.

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. WTO secretariat provided a dataset on STCs to increase transparency of trade policies of members. In the first chapter of this dissertation, I have analyzed the determinants of TBT STC notifications. Using Fixed Effect Poisson (FEP) regressions, the analysis suggests substitutability of TBT STCs for applied tariffs. These results are in line with the former studies in the literature emphasizing on the substitutability of trade policy instruments.

The empirical results of the first chapter also suggest that governments are less likely to impose a retaliatory TBT STC on a product which is aimed by the TBT STC maintained by the trade partner. Moreover, these measures are aimed at weak industries and they are used more when bilateral trade flows of trade partners are increasing. These outcomes would give insights on protectionist behavior of countries behind such trade policy instruments. Using R&D expenditures as the input for technological improvement, and patents registrations as successful innovative efforts, technological progress is proved to be another major motive of governments to use TBT STC measures. In fact, when technology in a country grows, the government would be more likely to introduce newer regulations within the trade policy measure to keep up with the high standards. Moreover, such government is more sensitive to face technical regulations imposed by other countries and it is more likely to raise STCs on those measures.

Environmental and health issues are other legitimate reasons behind the imposition of TBTs. The study also acknowledged the role of these issues on implementation of these measures. While improvement of health qualities in a society induces governments to maintain more TBT STCs, lack of environmental qualities would force government to introduce technical measures to improve the conditions of the environment. Furthermore, it was shown that autocratic countries are more probable to use these trade policy instruments, which confirms the former studies linking the trade liberalization with democracy.

Since there are various causes of TBT STC notifications, their impositions have also diverse

consequences. Depending on the type of TBT STCs, characteristics of the imposing country and the trade partners, these NTMs have different impacts on trade flows. In the second chapter of this dissertation, trade effects of these trade policy instruments imposed by the European Union, China, and the United States of America have been analyzed between 1995 and 2011. These three economies are the largest users of TBT STCs among all WTO members. Moreover, the EU and the USA have been requested for consultation in the Dispute Settlement Mechanism (DSM) regarding the violations of TBT agreement more than any other members have. Controlling for endogenous characteristics of TBT and tariffs in the regressions, an augmented gravity model at 4-digit level of Harmonized System was implemented to analyze each economy separately.

Empirical results of the second chapter provide some evidence on negative effects of TBT STCs maintained by the EU. This relationship is stronger for those measures that are claimed to be discriminatory by the trade partners. TBT STCs maintained by the US government appeared to enhance the trade flows of products to the United States. This result shows the good faith in motives behind the imposition of TBT STCs by the USA rather than industrial protectionism. Results also confirmed the hampering effect of Chinese TBT STCs on the imported quantities to China. However, these instruments in general do not cause any statistically significant impact on imports value of products to this country. Therefore, it can be argued that Chinese measures rather increase the price of imports, which consequently decrease the imported quantities.

In the third chapter of my dissertation I have attempted to establish a theoretical framework to investigate the implications of a prohibitive NTM. I provided a cost benefit analysis within a partial equilibrium framework to quantify the welfare changes of a society imposing a restrictive NTM to halt the importation of a harmful product. Two groups of consumers, indifferent and concerned about the harms of the foreign product, are distinguished. Domestic industry is competing in a Cournot duopolistic market with a foreign industry exporting the harmful product. Different scenarios concerning the welfare gains of an introduction of an NTM are explored of which results depend on consumer awareness and information policies by the government. The theoretical model is then illustrated with the data on the consumption of cattle in eight northern states of the United States of America.

In the first scenario of the model, it was assumed that consumers are aware of the harms of the product imported from abroad. However, they cannot distinguish between the domestic and the foreign products; hence, they assign probabilities for purchasing the harmful product. Whether or not the consumers are informed about the resulting non-existence of the harmful product after the NTM was analyzed in two cases in this scenario. Using data on consumption of cattle in eight northern states of the United States of America, the calibration showed that a prohibitive NTM affects the consumers in two ways. Firstly, the welfare of the consumers concerned about the negative attributes of the foreign product increases objectively after imposition of the NTM. Secondly, due to market structure changes from duopoly to monopoly, consumers make losses. When the perceived harms of the foreign product are very low, the gains are smaller than losses. The net losses are larger when there are fewer concerned consumers in the society. Nonetheless, the profit of the domestic producer always increases after such policy. Producer's gains are larger when the government informs the consumers about the halt in imports of the harmful product after NTM. Besides, the decrease in the consumer welfare is larger when such information is revealed to consumers. Therefore,

such information is more in the favor of the producer rather than consumers, which might indicate an industrial protectionism motive behind the NTM rather than consumer protectionism.

Considering a situation when consumers are not aware of the damaging effects of the foreign product, the second scenario finds a threshold for the harms of the foreign product for which the restrictive NTM would increase the welfare of consumers. Assuming that only government has such knowledge and seeks for improving the welfare of consumers by the trade instrument, the minimum damaging effect of the foreign product that leaves the consumer surplus unchanged after the policy is calculated. As a conclusion, government needs to provide evidence for larger damaging effects of the foreign product, when the domestic market share of the foreign industry is larger than the domestic industry. This mainly points at stronger legitimate evidence which should be provided by the imposing country following good faith.

As an overall conclusion for this dissertation, I can state that protectionism is still important, especially in the form of TBTs and NTMs. The necessity of trade liberalization is emphasized in the economic literature. Governments and societies are aware of the benefits of open markets and trade liberalization. However, for some specific reasons, either economic or non-economic ones, governments impose restrictions on trade flows. There is a downward trend in tariff protectionism, established in the GATT and WTO schedules of concessions. However, variety of trade measures such as NTMs, raise concerns on these constraints impeding the liberalization in trade. The conflicts between WTO members due to these restrictions inducing high international costs are other issues related to trade protectionism, which should be studied in more details as another future avenue of research on the topic. Introduction of new stricter rules in WTO such as punishment for protectionism might as well restrict protectionist motives of governments. Multidisciplinary studies of legal and economic issues in trade are required to pursue the ultimate goal of achieving progress in global trade liberalization.

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