

Non-Tariff Measures and the World Trading System

*Josh Ederington
Michele Ruta*



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Abstract

With the success of the World Trade Organization and its predecessor, the General Agreement on Tariffs and Trade, in reducing conventional tariff barriers, much of the recent focus of regional and multilateral trade agreements has switched to non-tariff measures, both border and behind-the-border policies. This paper considers the recent empirical and theoretical literature on non-tariff measures in the world trading system. It provides a set of stylized facts based on available data on non-tariff measures and reviews the key methods used to estimate their trade impact. It considers the theoretical treatment of these measures in the trade literature with a focus on the

rules and institutions that govern non-tariff measures in the world trading system. It discusses some of the major issues regarding international cooperation in these policy areas, in particular whether such cooperation should entail deep integration (involving precise legally binding obligations) or shallow integration (which allows countries greater discretion in the setting of non-tariff measures). Finally, this paper reviews some of the specific features the World Trade Organization uses in dealing with non-tariff measures such as national treatment rules and non-violation complaints, and considers policy options beyond the WTO such as harmonization and mutual recognition of standards.

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Non-Tariff Measures and the World Trading System¹

Josh Ederington
University of Kentucky

Michele Ruta
World Bank

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“The old world of trade was a world where production systems were national and where obstacles to trade were about protecting domestic producers from foreign competition. By contrast, the new world is a world where production is transnational along global supply chains of goods and services and where obstacles to trade are about protecting the consumer from risks....We are moving from the administration of protection – quotas, tariffs, and subsidies – to the administration of precaution – security, safety, health, and environmental sustainability. This is a new version of the old divide between tariffs and non-tariff measures.”

Pascal Lamy in the Jan Tumlir Lecture, March 2015, Brussels

1. Introduction

The traditional focus of both trade agreements and the trade literature has been the reciprocal reduction of conventional tariff barriers. With respect to the grab-bag of policies referred to as non-tariff measures (NTMs), trade agreements dating back to the original General Agreement on Tariffs and Trade (GATT) have primarily been concerned with the potential for policy substitution (i.e., as tariffs are bound, countries will respond by using alternate policies as a secondary trade barrier). Consistent with these concerns, the traditional approach in the trade theory literature is to treat NTMs as simply (imperfect) substitutes for tariff barriers. Thus, benchmark papers on NTMs, such as Bagwell and Staiger (2001) and Ederington (2001) are primarily concerned with how to design trade agreements to prevent policy substitution to less efficient NTMs when tariffs are bound. Similarly, this approach to NTMs (as imperfect substitutes for tariffs) was paralleled by the empirical literature which was often concerned with calculating “ad-valorem tariff equivalents” as a means of measuring the severity of NTMs (e.g. Kee, Olarreaga and Nicita, 2009). In many ways, this original theoretical research supported the GATT approach of refraining from negotiating directly over behind-the-border NTMs in favor of general rules designed to prevent policy substitution.

However, many recent preferential trade agreements have begun to involve negotiations and potential cooperation over behind-the-border NTMs (such as environmental regulations,

labor standards and other domestic policies). Indeed, the World Trade Organization (WTO) has taken tentative steps in this direction as well, especially with regards to product and process standards. Thus, this original research is broadening to consider cases where such deeper integration may be justified: such as departures from market-clearing pricing (e.g., Antras and Staiger, 2012) and time inconsistency/commitment issues (e.g., Brou and Ruta, 2013).

In addition, especially with regards to behind-the-border policies like health and safety standards, environmental and labor regulations, technical product standards and the like, NTMs have two additional characteristics that are not shared by conventional tariff barriers. First, such measures are decidedly less transparent than conventional border measures like tariffs and quotas. Partly this can be due to the number, variety and complexity of NTMs which makes hiding protection from foreign governments easier. Partly this is due to the fact that many domestic policies are more qualitative in nature (especially with regard to interpretation or enforcement), which makes ascertaining the severity of the regulation (or its differential application) more difficult. Indeed, this asymmetric information about policy has led to an extended effort on the part of the WTO to catalogue, measure and publicize each country's NTMs in an attempt to increase transparency. As we discuss in this survey chapter, this aspect of domestic policy has led many recent papers to either adopt an imperfect contracting approach (e.g., Horn, Maggi and Staiger, 2010) or an asymmetric information approach (e.g., Park, 2011) in their treatment of NTMs. On the empirical side, the imprecision that characterizes NTMs is dealt with in a narrower focus on specific measures, such as the trade impact of technical standards (e.g. Fontagné, Orefice, Piermartini and Rocha, 2015 or Miravete, Moral and Thurk, 2015).

Second, in many ways it is the diversity of domestic regulations across jurisdictions (especially with respect to product standards such as health and safety regulations) rather than their level that imposes the greatest barriers to international trade. Similar to the transactional costs associated with differences in national currencies and language, there are informational and implementation costs created by having differing environmental or health standards. Incompatible national product standards can complicate the ability of firms to exploit economies of scale in production and differing legal institutions can result in contract enforcement problems. Thus, many of the more recent trade agreements have begun to concentrate as much on making national standards more compatible across countries as they have in reducing conventional tariff

barriers. This has led to an emerging empirical literature that attempts to measure the impact of increased compatibility of standards on trade flows (e.g. Chen and Mattoo, 2008), as well as some new theory papers that investigate the design of trade agreements in the presence of these “coordination externalities” (e.g. Klimenko, 2009).

In this survey chapter we consider the empirical evidence on NTMs in Section 2 – definitions, stylized facts as well as estimates of the trade impact of NTMs. In Section 3, we consider the theoretical literature on the general issue of the degree of integration over NTMs in trade agreements. Specifically, we consider whether international cooperation over NTMs should entail *deep* integration (involving precise legally binding obligations) or *shallow* integration (which allows countries greater discretion in the setting of NTMs). In Section 4 we review some of the specific features the WTO uses in dealing with NTMs such as national treatment rules and non-violation complaints. Section 5 considers some recent papers that investigate issues relevant specifically to product standards such as harmonization and mutual recognition of standards. Finally, Section 6 concludes.

2. Non-Tariff Measures (NTMs): Definitions, Data and Trade Effects

This section has three goals. It first defines what non-tariff measures are and how they can be classified. It then offers a set of stylized facts based on available data. Finally, we review the literature on the trade impact of NTMs. The upshot is that, despite the multiple sources of data on non-tariff measures, our collective information in this area is very imprecise and lacunous. Moreover, the empirical analysis of NTMs suffers from a number of non-trivial conceptual problems. This state of things inevitably affects the ability of researchers to precisely identify the trade (and welfare) impact of non-tariff measures.

2.1 Defining Non-Tariff Measures

NTMs are defined as a negative concept, including the realm of measures that are not import tariffs but that can have an impact on international trade flows. This definition implies that the set of NTMs is extremely diverse in terms of intent (i.e. whether the purpose of the measure is to lower trade or to achieve a public policy goal), type of policy (i.e. whether it is a price, quantity or regulatory measure), or where the action takes place (i.e. whether the measure applies at the border,

discriminating between foreign and domestic producers, or not). In practice, NTMs include policies such as an import quota to shield domestic producers from foreign competition, an export tax to lower the price of an essential good such as staple food, or a domestic regulation to lower the health risks associated with the use of certain chemicals in production.² These measures have in common the fact that they all are not tariffs and have an impact on trade or the potential to do so. But they are at least as distinct from each other as they are collectively different from a tariff.³

A natural question is why the concept of NTMs is used in policy-making circles and in the economic literature and why it is useful to lump together this set of widely heterogeneous measures. As Staiger (2011) points out, the key insight is that import tariffs historically had a special place in the multilateral trading system. In the GATT/WTO system, governments negotiate trade concessions through reciprocal reductions in tariff bindings. The effective granting of these concessions is contingent on the overall policy stance of a country: Market access by foreign producers will eventually depend also on what home governments do with all other measures that can impact trade flows (i.e., what governments do with NTMs). As a result, tariff and non-tariff measures are differentially regulated in the GATT/WTO system. A first issue that we will address below is whether and under what conditions this differential regulation has an economic rationale.

As NTMs are such a broad category, there can be multiple ways to divide them. UNCTAD, the UN agency that collects data on NTMs, currently classifies non-tariff measures into 16 chapters divided in two broad categories: import and export measures (UNCTAD, 2013). Import measures are all those requirements that are imposed by importing countries. These measures are divided into technical measures, which include chapters A (Sanitary and Phytosanitary Standards or SPS), B (Technical Barriers to Trade or TBT) and C (Pre-Shipment Inspections), and non-technical measures that encompass chapters D (Contingent Trade Protection) to O (Rules of Origin). Export measures, which are all requirements imposed only by the exporting country, comprise chapter P.

² Some non-tariff measures are covered elsewhere in this Handbook. Border NTMs also include contingent measures (also called temporary trade barriers) such as safeguard provisions and other escape clauses (studied in Chapter 10 of this Handbook), anti-dumping and countervailing duties (Chapters 11 and 12, respectively), and export subsidies (Chapter 12). Similarly, behind-the-border measures also encompass domestic subsidies, which are just a form of negative taxation (Chapter 12).

³ The definition of NTMs can be extended beyond government policies to include private standards, such as quality requirements set by downstream producers for their foreign providers. The focus of this paper is on government policies only; see WTO (2012) for a discussion on private standards and their impact on international trade.

Table 1 offers an overview of this classification.

Table 1: NTM classification in TRAINS

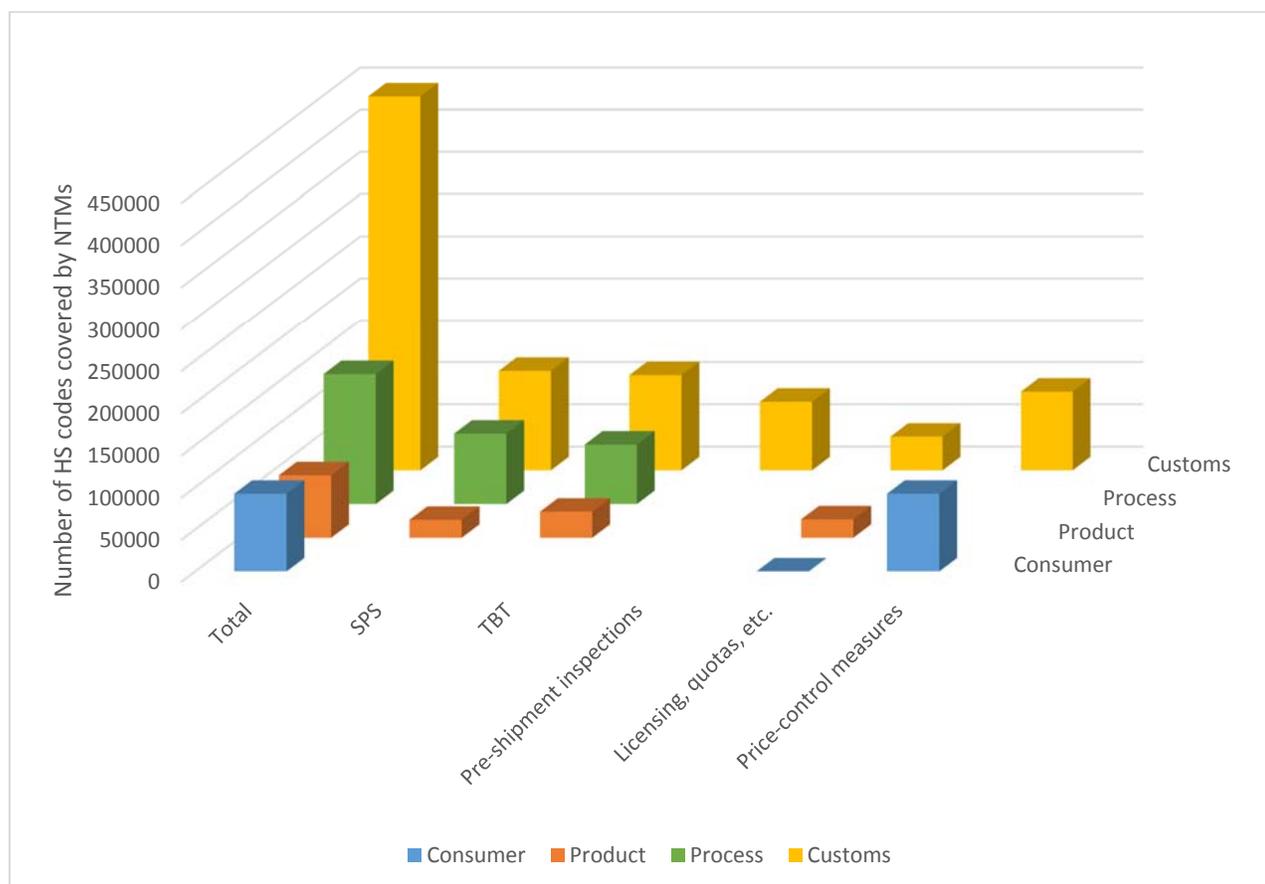
Imports	Technical Measures	A. Sanitary and Phytosanitary Measures (SPS) B. Technical Barriers to Trade (TBT) C. Pre-Shipment Inspection and other Formalities (PSI)
	Non technical Measures	D. Contingent Trade-Protective Measures E. Non-Automatic Licensing, Quotas and other quantitative controls (QC) F. Price Controls (PC) G. Financial Measures H. Measures affecting Competition I. Trade-Related Investment Measures J. Distribution Restrictions K. Restrictions on Post-Sales Services L. Subsidies (Excluding Export Subsidies under P7) M. Government Procurement Restrictions N. Intellectual Property O. Rules of Origin
	Exports	P. Export-Related Measures

The classification of NTMs that is employed in the theoretical literature differs from the one used by data collecting agencies and is based on three categories. A first subset of NTMs are those that directly target imports, including quantitative restrictions, import licensing or customs procedures. A second category encompasses NTMs that directly target exports, such as export taxes or quotas. These measures are discriminatory by definition, as they discriminate between foreign and domestic goods or between domestic goods that are sold at home or in foreign markets. In a general equilibrium sense, these first two categories are somewhat symmetric as they both generate a wedge between the domestic price and foreign price of the good (indeed, in section 3, we refer to both of these categories of NTMs by the general term of customs regulations). A third group encompasses behind-the-border NTMs that include domestic legislation covering health, product, environmental or other types of standards and domestic taxation. Such measures are non-discriminatory, as they apply to production or consumption independently of the origin or destination of a product. However, as we discuss in section 3, this category includes a disparate group of policies (including consumer regulations, product regulations and process regulations) which can have strikingly different effects on prices: And, as we will further discuss in section 3,

the approach to regulating this group of behind-the-border NTMs differs and has evolved over time both in the GATT/WTO system as well as in a number of Preferential Trade Agreements (PTAs).

In Figure 1, we rely on available data from the Trade Analysis Information System (TRAINS) developed by UNCTAD to present a simple correspondence between the theory-based classification and the one used by data collecting agencies. We have limited this exercise to the chapters for which data are publicly available (i.e. Chapters A to F, excluding Chapter E which is not covered by this survey). The mapping between the classifications is based on our own reading of the detailed taxonomy provided by UNCTAD (2013) and the full table of conversion used is presented in the Appendix Table 1. Figure 1 shows that product and process regulations are mostly TBT and SPS measures, while consumer regulations take the form of price control measures such as excise taxes or charges on the consumption of certain goods (e.g. cigarette taxes, CO2 emission charges). The figure also reveals that most available data on NTMs cover customs regulations that are evenly distributed across different policy measures.

Figure 1: Correspondence between the theory-based and collecting agencies' classifications of NTMs



Source: Authors' calculation based on data from UNCTAD NTMs database.

2.2 The landscape of NTMs

This section introduces some stylized facts on NTMs. Before presenting these facts, we quickly review the key data sources available for non-tariff measures, their upsides and their limitations. While we need to be necessarily brief, WTO (2012) and UNCTAD (2013) offer excellent broad surveys of available data and basic facts on NTMs.⁴

⁴ The sources listed here offer data on a large spectrum of NTMs, or of a subset of them, as part of an effort to understand the trade impact of these measures. In addition, there are potentially many other databases that contain information on specific policies that may have an impact on trade, even if this is not the primary purpose of the data collection effort. Examples are the Product Market Regulation indicator of the OECD or the Doing Business indicator of the World Bank.

2.2.1 Key sources of NTM data

Data on non-tariff measures come from three types of sources. First, there are efforts by international organizations, as well as other non-government institutions, to directly collect data on NTMs. As discussed above, a widely used data source is TRAINS, which has information on non-tariff measures by country and sector for HS6 product lines (i.e. a six digit sub-heading in the Harmonized System (HS) classification) and for selected years.⁵ These data are the most complete source of comparable information on NTMs across countries. However, they do have some well recognized limitations. For instance, these data do not provide an assessment of stringency or distinguish measures that are discriminatory from those that are not. Moreover, the coverage is partial and focuses only on a subset of the chapters comprising the classification presented in Table 1, mostly chapters A to F. Another widely used institutional source is the Temporary Trade Barriers (TTB) database by the World Bank, which contains information on a number of contingent trade measures for approximately 30 countries that can date back to 1980 and be at the product level.⁶ The obvious limitation is that the database only contains information on a narrow set of NTMs.⁷

A second source of information is through various forms of government notifications, which are mostly collected by the WTO. These notifications can be direct or indirect. First of all, WTO members are subject to several notification requirements of trade-related measures under the GATT and the TBT and SPS Agreements (direct notifications). In addition, governments can raise Specific Trade Concerns (STC) on TBT and SPS measures that are adopted by other WTO members (indirect notifications). Both sources of information have pros and cons. Direct and indirect notifications are more consistently available for a longer time period relative to data collected by international organizations. However, direct notifications are often incomplete, as they are self-reported by governments that do not necessarily fully abide to their notification requirements. Moreover, this information is not coded and is not readily available for researchers.

⁵ The data are available through the World Integrated Trade Solution (WITS) at: <http://wits.worldbank.org/>

⁶ The TTB database is available at: <http://go.worldbank.org/W5AGKE6DH0>.

⁷ An example of a non-government institution collecting data on NTMs is The Global Trade Alert (GTA), which was set up by the Centre for Economic Policy Research (CEPR) to monitor the protectionist response of governments in the aftermath of the global financial crisis.

STCs are more likely to indicate the presence of a discriminatory measure, and have the additional benefit of having been coded by the WTO Secretariat and made available with the World Trade Report (2012). However, it is not obvious how representative these measures are of the entire spectrum of potentially discriminatory TBT and SPS measures, as governments may have a number of reasons to raise, or avoid raising, a trade concern vis-à-vis other partners.

The third source of information on NTMs focuses on business concerns. The International Trade Center (ITC) regularly conducts business surveys to identify non-tariff measures that create major concerns for exporters. In addition, certain countries compile information on trade barriers faced by their exporting firms, in some cases making this information publicly available.⁸ As for specific trade concerns, business surveys are more likely to identify discriminatory NTMs and can often be quite detailed. However, surveys from different sources tend to be of heterogeneous quality and may suffer from sampling design problems. Moreover, they uniquely represent the view of firms and may be subject to a self-selection bias, as firms that respond are not necessarily a representative sample of the universe of exporters or potential exporters.

In sum, data on NTMs are highly incomplete and subject to measurement problems, particularly with regard to the proper identification of discriminatory measures. However, there are currently a number of initiatives to improve upon the existing situation. One such initiative is a multi-agency consortium on Transparency in Trade (TNT) launched by the African Development Bank, ITC, UNCTAD and the World Bank that, among other things, aims at refining and expanding data collection on NTMs and making new data available by 2016. Another initiative is through the Integrated Trade Intelligence Portal (I-TIP) of the WTO, which provides improved information on members' notifications of NTMs and other sources of WTO-specific information on non-tariff measures. Yet another initiative is called PRONTO, which brings together a number of academic and policy institutions with the goal of improving data availability and methodologies to assess the trade impact of NTMs.

2.2.2 Some stylized facts on NTMs

⁸ The ITC database on NTM business surveys is accessible at <http://ntmsurvey.intracen.org/ntm-survey-data/>. The European Commission's database on trade barriers faced by exporters from the European Union is accessible at <http://madb.europa.eu/madb/indexPubli.htm>.

Two standard indicators to gauge the overall use of NTMs across countries are the coverage ratio and the frequency index. The first captures the percentage of trade subject to non-tariff measures, while the latter shows the percentage of products to which one or more NTMs apply.⁹ While the use of non-tariff measures tends to vary considerably across countries, these simple inventory indexes show the importance of NTMs in terms of trade and sectors affected, justifying the growing interest of economists in this area. Based on NTM data from TRAINS, coverage ratios for the countries in the sample vary between 30 and 100 percent, with the median country (Brazil) having 71.7 percent of trade covered by NTMs. Frequency indexes have a higher variability (between 5 and 100 percent), while the share of products subject to at least one NTM is 66.9 percent for the median country (China).¹⁰

Key questions on NTMs are: what countries are more likely to use them, in what sectors are they employed more frequently, what specific NTMs are more common, and how have they behaved over time. In what follows, we use the different sets of data discussed above to shed some light on these issues.

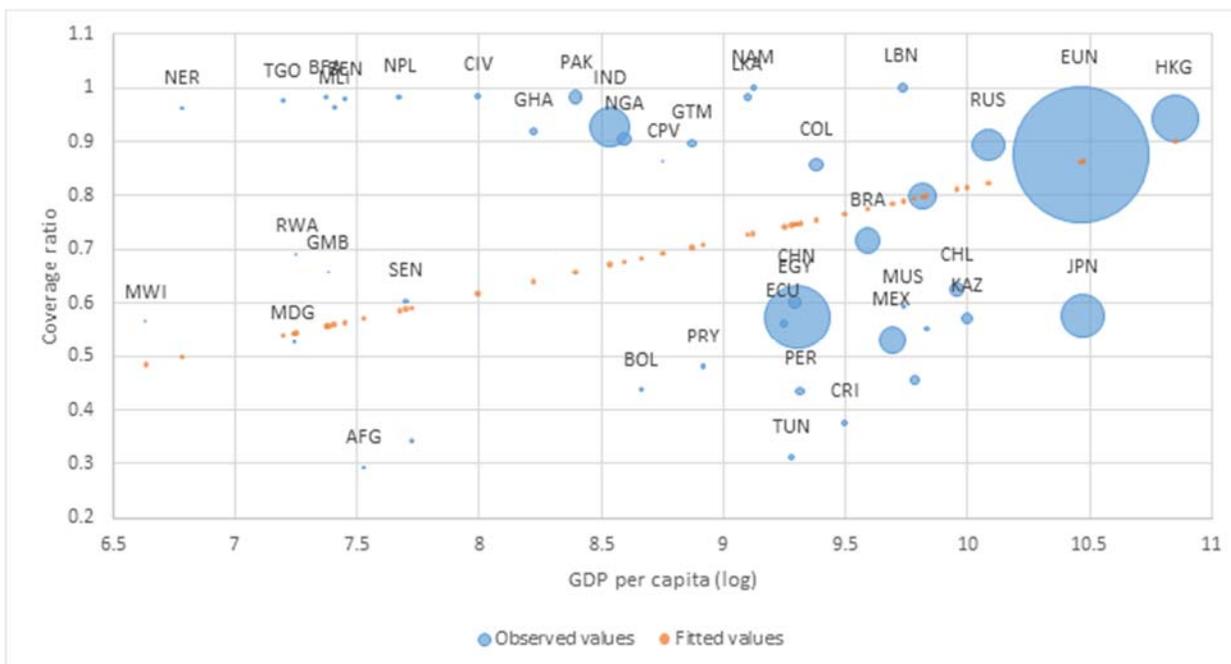
First, we look at the question of what countries are the larger users of non-tariff measures. In Figure 2a, we plot the coverage ratio calculated using TRAINS data against the log of GDP per capita. The size of the bubble represents the percent of imports under NTMs of the country. The regression line shows a positive correlation between the level of development and the use of NTMs, suggesting that developed countries tend to be larger users of NTMs relative to developing countries. This evidence is consistent with the findings in WTO (2012) based on specific trade concerns and the results of business surveys. This finding could be consistent with two types of explanations. One possibility is that more advanced economies have substituted declining tariff

⁹ The frequency index for country i is calculated as $F_i = \left[\frac{\sum D_j M_j}{\sum M_j} \right] \cdot 100$, where D_j and M_j are respectively dummy variables capturing the presence of one or more NTM and the presence of imports in product j . Similarly, the coverage ratio for a country is calculated as $C_i = \left[\frac{\sum D_j M_j V_j}{\sum V_j} \right] \cdot 100$, where V_j is the value of imports of product j . To partially offset the endogeneity problem implicit in the coverage ratio (the value of imports is lower for goods that are subject to NTMs), we use import values for three years. Beyond these simple measures, Bown (2011) presents alternative approaches to construct coverage ratios that capture both the stocks and flows of imported products covered by TTBs and calculates them for the countries covered in the TTB database. These approaches could be usefully applied to the broader set of NTMs as more data become available.

¹⁰ The two inventory measures are highly correlated, but the coverage ratio is generally higher than the frequency index. This shows that NTMs tend to be concentrated in highly traded products.

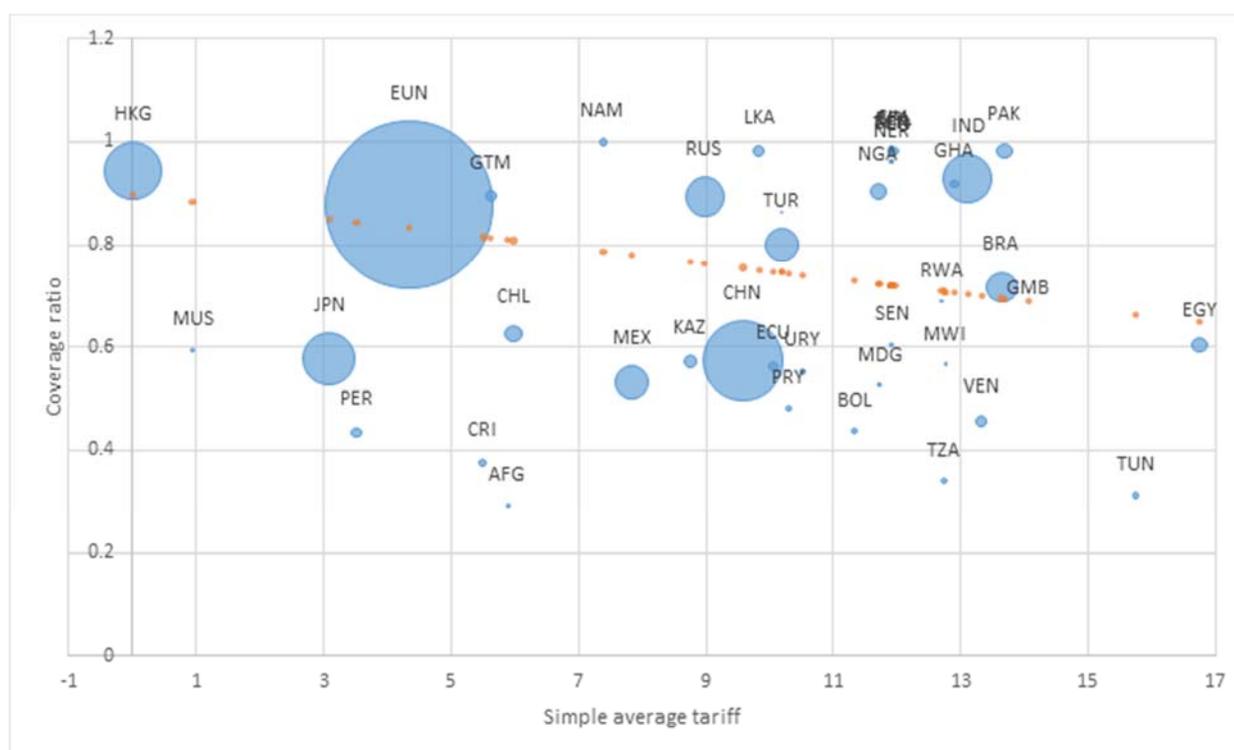
barriers with more stringent NTMs. Figure 2b indeed shows a negative correlation between average tariffs and coverage ratios by country. A more benign explanation, however, is that the use of regulations for public policy purposes is positively correlated with the level of development, rather than reflecting policy substitution. We will come back to these questions below.

Figure 2a: NTMs coverage ratios and per-capita income, by country



Source: Authors' calculation based on data from TRAINS and WDI.

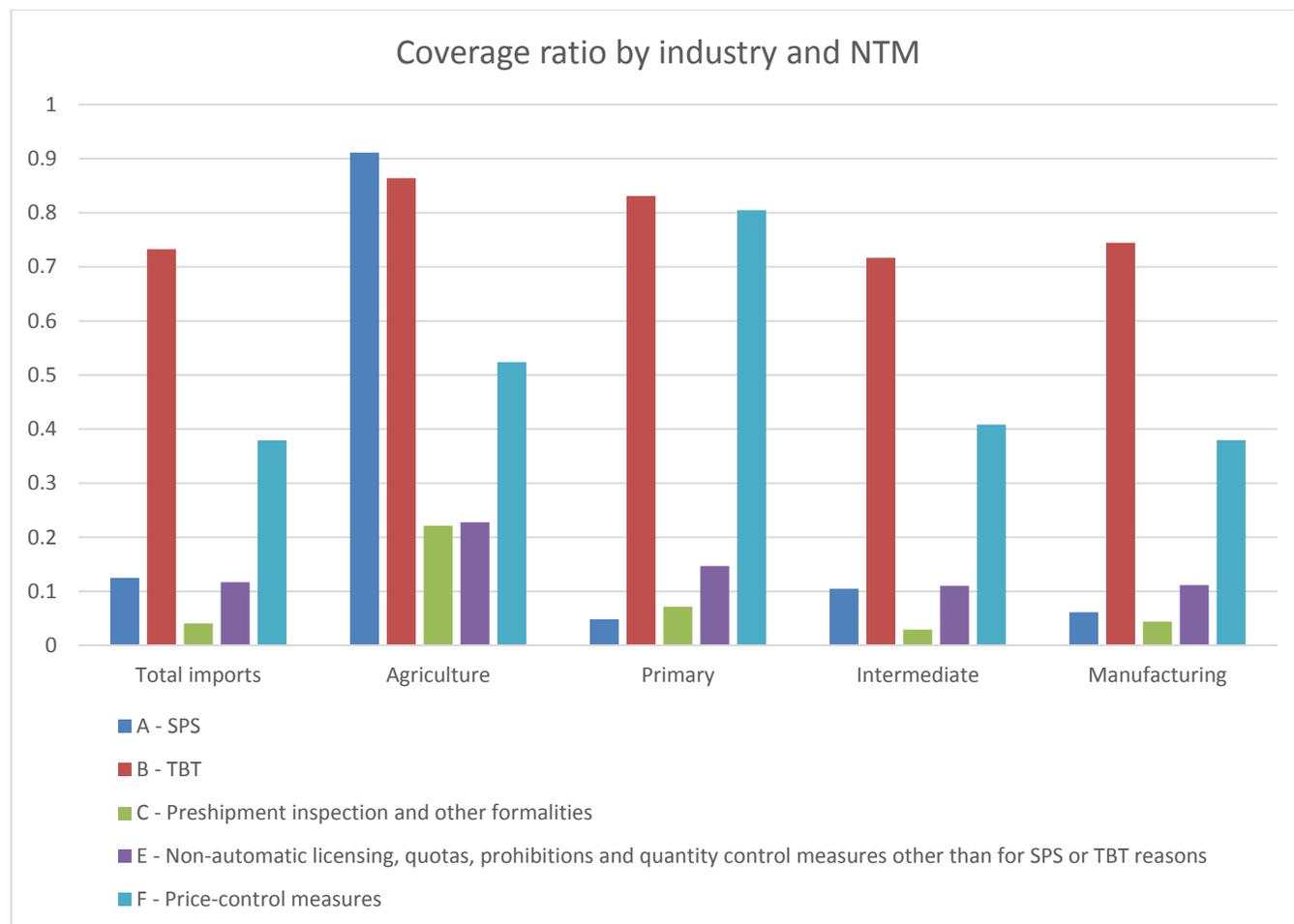
Figure 2b: NTMs coverage ratios and average tariffs, by country



Source: Authors' calculation based on data from TRAINS and WDI.

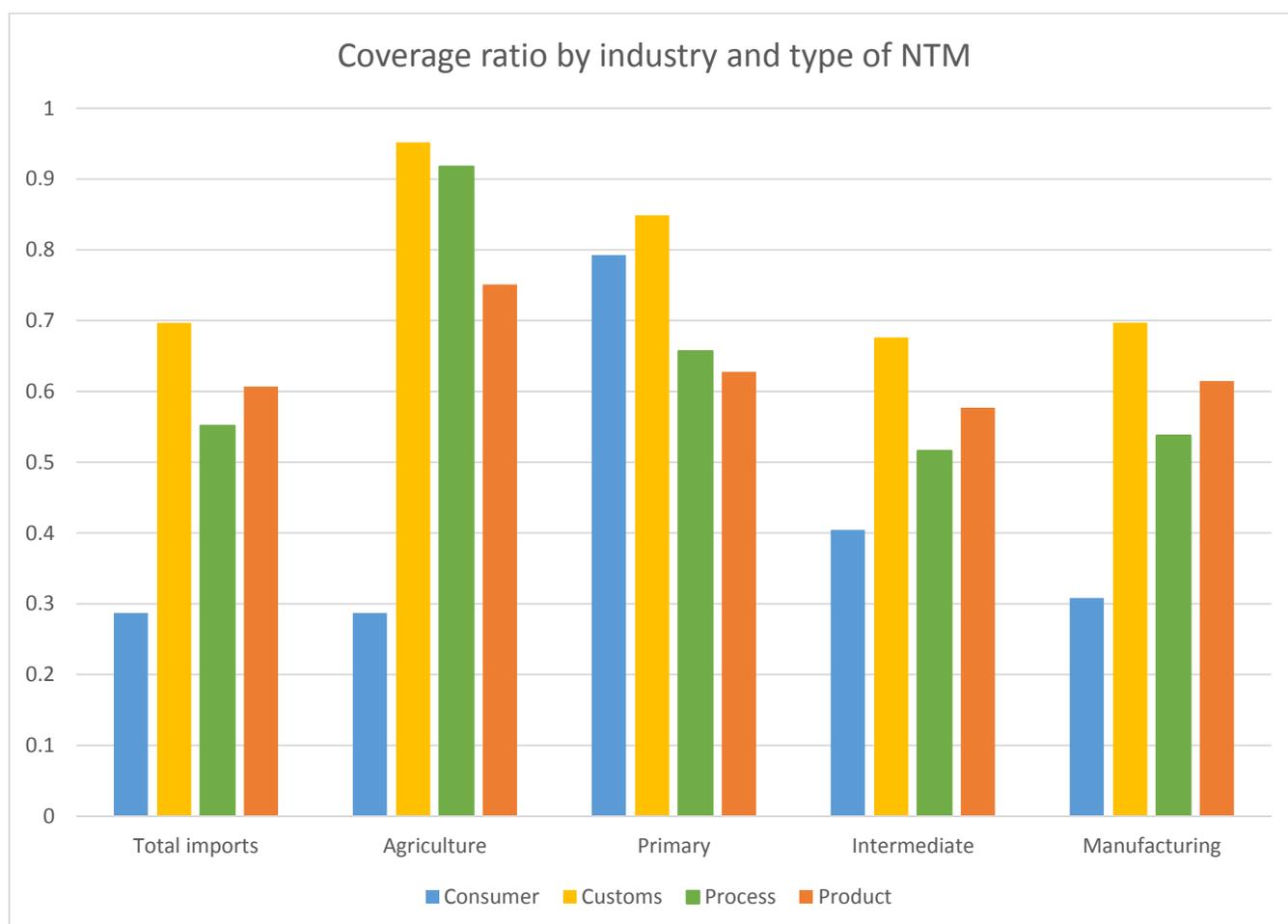
Figures 3a and 3b look at the incidence of NTMs by selected industries. The numbers in the figures represent the share of imports (of the available countries in the TRAINS database) in an industry that is subject to any NTM. Figure 3a uses the classification by UNCTAD (2013). It appears that while all sectors are affected by NTMs, the type of measure used varies widely by sector. For agriculture, the most relevant non-tariff measures are sanitary standards, while for all the other industries/sectors the most relevant NTMs are TBT followed closely by price controls. Figure 3b uses the same data from TRAINS and sectoral breakdown as figure 3a, but divides NTMs according to the theory-based classification presented in Section 2.1. The figure shows that customs regulations tend to be higher across sectors. Agriculture also has a high incidence of product and especially process regulations, while consumer regulations tend to be concentrated in primary products. Manufacturing and intermediate sectors have slightly lower coverage ratios, with a combination of custom, product and process regulations.

Figures 3a: NTMs coverage ratios by selected industry, collecting agencies' classification



Source: Authors' calculation based on data from COMTRADE and UNCTAD NTMs database.

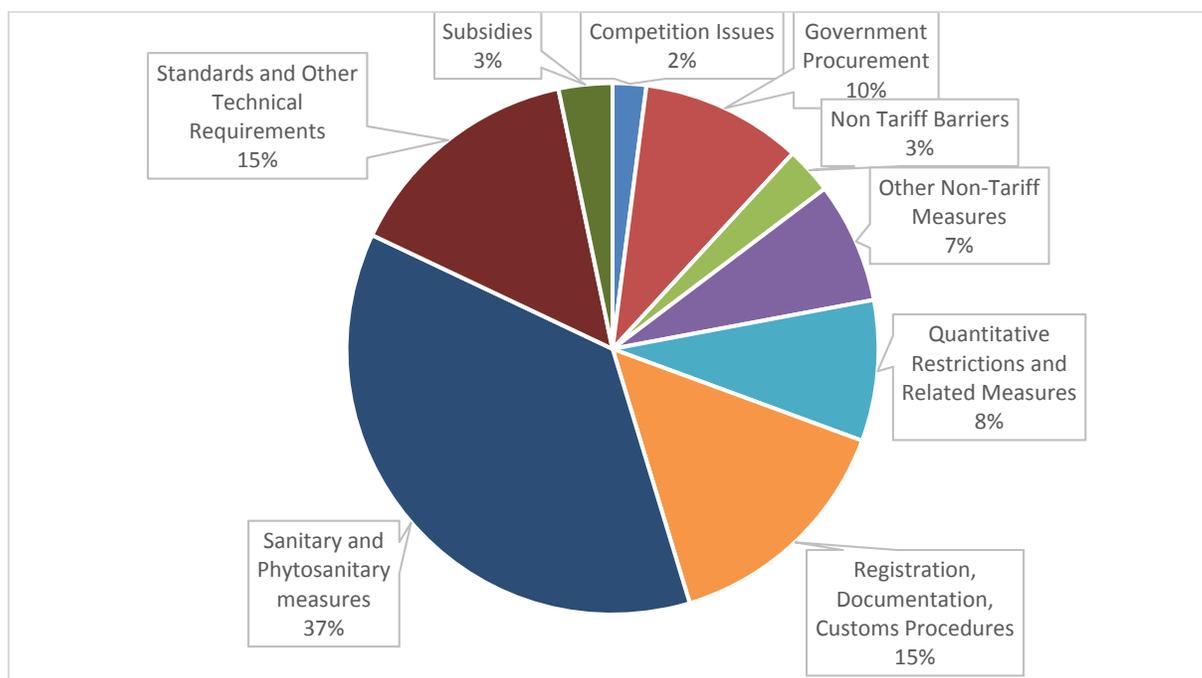
Figure 3b: NTMs coverage ratios by selected industry, theory-based classification



Source: Authors' calculation based on data from COMTRADE and UNCTAD NTMs database.

While TRAINS has actual information on a more limited set of policy measures, business surveys may provide a more complete picture (although subject to biases discussed earlier). Figure 4 shows the trade barriers that have been reported to the EU Commission between 1996 and 2015 by type of measure. Approximately, 50 percent of the trade obstacles faced by European exporters have to do with domestic regulation in foreign markets, such as TBT/SPS measures. Once we further disaggregate the analysis, we find that the most affected sector is agriculture, where concerns are mainly related to SPS measures. Among manufacturing, the most affected industry is pharmaceuticals.

Figure 4: Trade restrictive NTMs faced by EU exporters, by type of measure

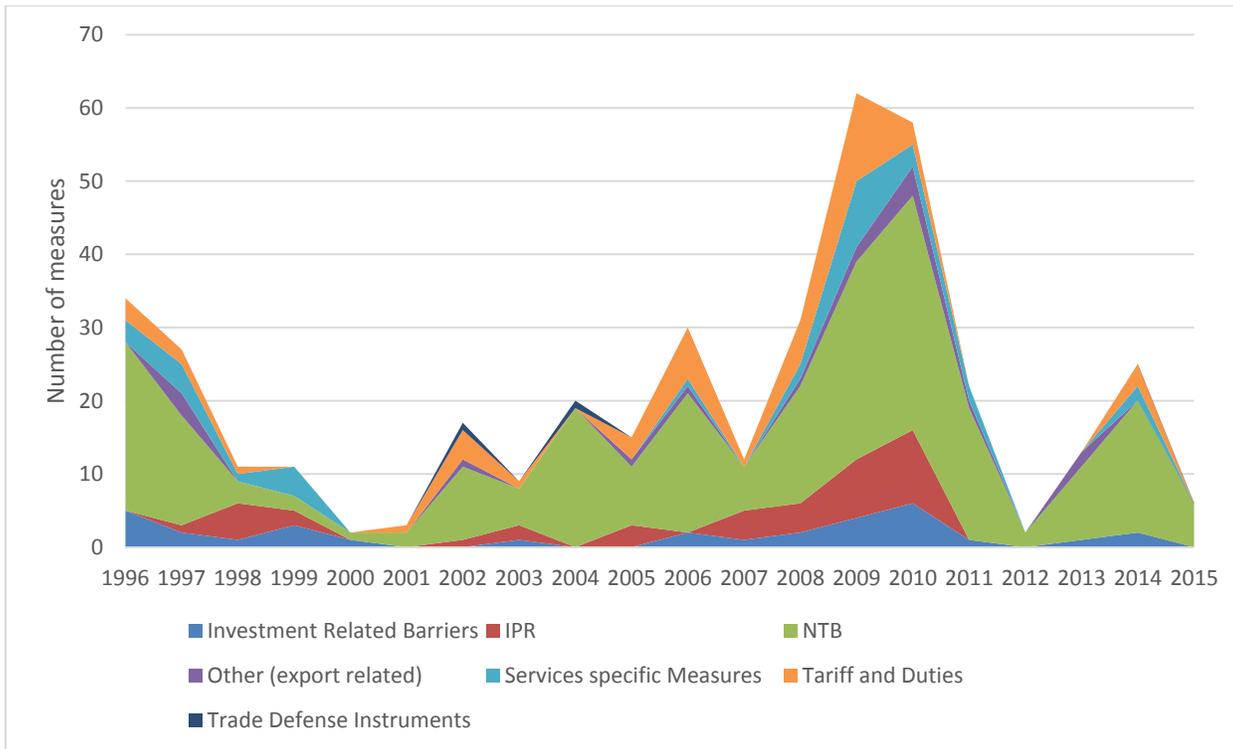


Source: Authors's calculations based on EU Market Access database.

A difficult question to answer concerns the supposed proliferation over time of NTMs. There is little doubt that from the perspective of exporters, non-tariff measures are an increasing concern, particularly at times of economic crisis. Figure 5, which again is based on barriers reported to the EU Commission, shows this increase over time, with a peak around the global financial crisis. Official data, however, are not sufficiently detailed to subject this question to a systematic investigation. For instance, SPS and TBT notifications at the WTO show an increase up to the early 2000s and a flattening of the number of notifications afterwards (Figure 6, left panels). One suspects that these data may reflect lack of reporting rather than the absence of new measures, as governments may face incentives to under-report NTMs at times of economic crisis. Data on specific trade concerns partially address this problem, but still the evidence concerning a surge in NTMs is weak. The right panels in Figure 6 show a marked increase in new and cumulative (i.e. new minus resolved) concerns for technical barriers, however the number of new and cumulative SPS concerns appear relatively stable in recent years and do not show a change in

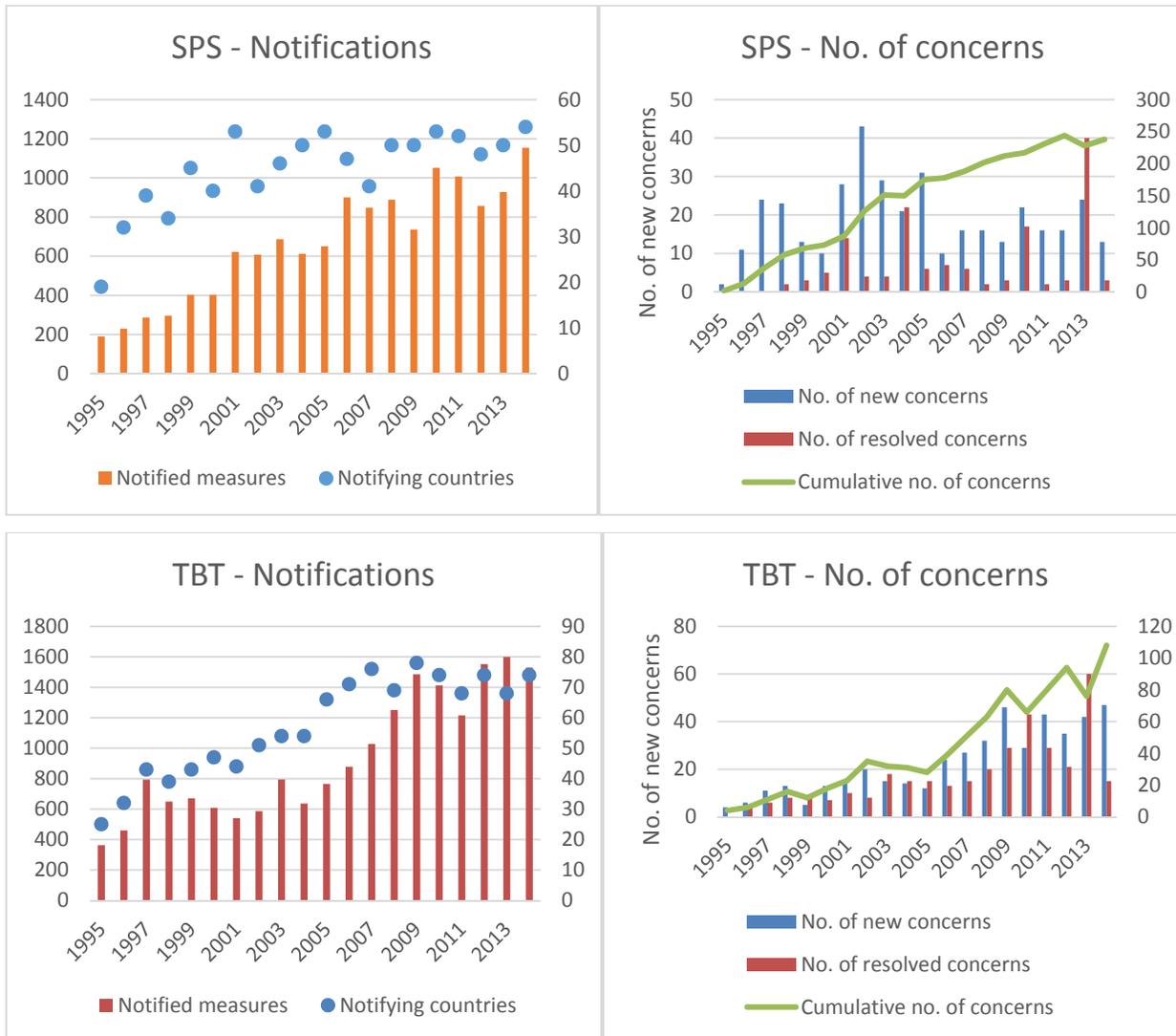
behavior in the aftermath of the financial crisis.

Figure 5: Measures facing EU exporters by group, 1996-2015



Source: Authors's calculations based on EU Market Access database.

Figure 6: SPS and TBT notifications and specific trade concerns, 1995-2014

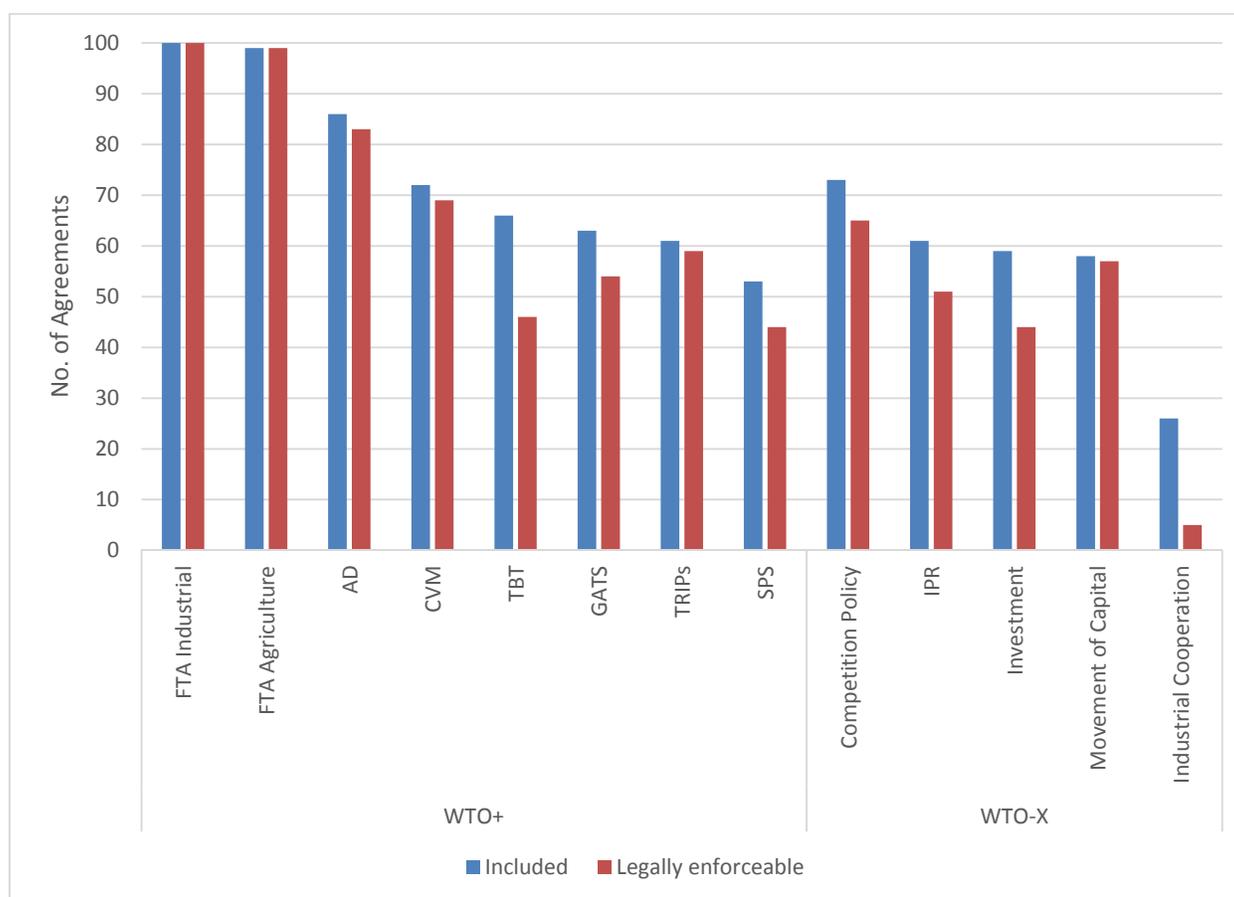


Source: Authors' calculations based on WTO I-TIP database

Non-tariff measures are increasingly regulated by international trade agreements. As we will further discuss below, WTO rules cover NTMs in multiple agreements. The GATT contains general principles on non-tariff measures, while a number of other agreements cover specific issues, including subsidy rules in the Agreement on Subsidies and Countervailing Measures (SCM), government procurement in the Agreement on Government Procurement (GPA), intellectual

property rights in the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs), and standards in the TBT and the SPS agreements. Preferential Trade Agreements (PTAs), which have proliferated in recent years particularly as multilateral negotiations stagnate, increasingly cover non-tariff measures in addition to provide preferential market access. Horn, Mavroidis and Sapir (2010) divide PTA provisions in “WTO +”, those that relate to areas covered by the WTO agreements but where PTAs contain more stringent commitments, and “WTO extra” or “WTO x”, those that are covered by PTA rules but not by the WTO. They also identify those provisions that are legally enforceable based on the language used in the agreement. Following this classification, WTO (2011) surveys 100 PTAs signed between 1958 and 2011 by a group of countries broadly representative of WTO membership and that collectively cover over 90 percent of world trade. As shown in Figure 7, many NTMs that are regulated by the WTO are also regulated by PTAs, with more stringent provision that are generally legally enforceable. Areas include standards (TBT and SPS), anti-dumping and countervailing duties and intellectual property rights. In addition, a majority of PTAs cover several WTO-X areas, such as investment and competition policy.

Figure 7: “WTO +” and “WTO x” provisions in PTAs



Source: WTO dataset on content of PTAs.

While the above summary statistics, which use coverage and/or frequency ratios, are helpful in understanding the incidence of NTMs, it should be noted that they need to be treated with caution. In addition to the data collection limitations discussed above, the analysis of NTMs faces a number of conceptual problems related to the nature of NTMs themselves.

First, *imprecision*: as discussed in the introduction NTMs are often qualitative in nature which complicates measuring the severity of a regulation. In rare cases an individual NTM may provide an exact measure of stringency, say the maximum level of a certain chemical in a product. However, in general data on non-tariff measures are bound to be simply summary indicators, such as a dummy indicating the presence of a regulation, or an imprecise measure of trade restrictiveness

of a certain policy, as in the case of a specific trade concern. In empirical models where the information on NTMs is included as an explanatory variable to assess the trade impact of the non-tariff measure (see below for further discussion), data imprecision can lead to measurement error and biased estimates.

Second, *dimensionality*: NTMs take multiple forms, ranging from quotas to taxes to customs licensing to technical regulations, and cannot easily be captured by a single measure. Thus, any attempt to provide summary measures of NTM incidence requires aggregating over vastly different policies and the econometric analysis may not be able to disentangle the impact of one NTM from the impact of several NTMs. This problem is exacerbated by the fact that NTMs can be set at the tariff line level and there are more than 5,000 tariff lines in a typical tariff schedule. Of course, the flip side to this is that any attempt to focus on a single NTM often involves ignoring the universe of alternate policies that also impact trade.

Third, *composition*: different sectors require different policy intervention (e.g., chemicals and agriculture are likely to be more heavily regulated as these sectors have a larger impact on health). Therefore the mix of industries in a country is likely to affect coverage or frequency measures of the stringency of NTMs relative to other countries, even when they apply exactly the same policy. For instance, Figures 3a and 3b show that SPS and TBT are especially prevalent in Agriculture and thus (by the way the coverage/frequency ratios are calculated), countries that import agriculture are going to appear to have high NTMs. Similarly, the composition of exports of a country will affect measures of the stringency of NTMs faced by its exporters.¹¹

Fourth, *endogeneity*: the concern about NTMs with respect to international trade reflects their ability to distort and restrict trade flows. However, if the higher prevalence of NTMs in an industry results in lower trade flows, than summary measures of NTM incidence which also use trade volume (such as a coverage ratio) might understate NTM prevalence. Alternatively, a political

¹¹ This suggests that disentangling the protectionist intent of non-tariff measures from their public policy purpose can be econometrically challenging. Foletti (2014) finds evidence that non-tariff measures aimed at protecting health such as maximum amounts of pesticides allowed in a product are more stringent on products that present a higher health hazard. This finding is consistent with the view that non-tariff measures do not have a protectionist intent, even if they may restrict trade. Bown and Crowley (2013a) and Grundke and Moser (2014) find evidence that the use of NTMs (TBTs and customs enforcement of product standards, respectively) tends to be counter-cyclical, which is suggestive of a protectionist motive at least for some non-tariff measures.

economy story might suggest that NTMs are endogenously more prevalent in industries where trade is more important (i.e., trade volume is higher or has recently increased) if they are intended to protect domestic producers from foreign competition. In this case, empirical studies using industry panel data might understate the trade impact of NTMs (for an application see Ederington and Minier, 2003).¹² Thus, researchers must take into account that NTMs and trade flows are both endogenously determined in calculating the incidence and trade impact of NTMs.

Some of these problems are dealt with in the empirical studies discussed below. However, it is in general not possible to address all these issues at the same time. For this reason, any review of the landscape of non-tariff measures as well as the analysis of their impact on international trade is likely to be incomplete.

2.3 The trade impact of NTMs

While governments impose non-tariff measures for a variety of reasons that may have nothing to do with international trade, NTMs may still have an impact on trade flows. The quantification of these effects is the subject of a large literature that is briefly reviewed below.¹³ While frequency and coverage ratios are helpful in providing insight into the incidence of non-tariff measures (e.g., in which industries they are most common), they provide little guidance as to their trade restrictiveness. Thus, in the following subsection (2.3.1) we provide some general discussion of the main methodologies behind calculating the trade impact of NTMs. Obviously a significant issue in measuring the trade impact of NTMs is going to be *dimensionality*: that NTMs can take many disparate forms that can have very different effects on trade flows. In light of this, one approach to measuring the trade impact of NTMs is to focus on a single type of NTM (e.g., TBT or SPS measures). The first subsection (2.3.2) provides an overview of empirical literature that investigates the trade impacts of particular NTMs. However, in many cases it is helpful to have an aggregate (country-wide) measure of NTM trade restrictiveness and, indeed, a large body of

¹² Trefler (1993) first made this point showing that when trade protection is modeled endogenously, the impact of lowering non-tariff barriers such as quotas and antidumping duties is ten times the size from treating protection exogenously.

¹³ In addition to the aforementioned studies by the WTO and UNCTAD, there are a number of papers that provide in depth overviews of the methodologies used to assess the trade impact of non-tariff measures (Deardorff and Stern, 1998; Ferrantino, 2006) or of a specific methodological approach (e.g. Novy and Chen, 2012). A useful practical guide on how to measure the effect on NTMs is in UNCTAD and WTO (2012).

empirical work has focused on the investigation of the *overall* effect of non-tariff measures on trade. We review this literature and the empirical methodology behind constructing aggregate measures in the second subsection (2.3.3).

2.3.1 Methodology

There are two main methodologies used in estimating the trade impact of NTMs. The first and most common, which Chen and Novy (2012) refer to as the “direct approach”, involves collecting observable data on the incidence of NTMs and then estimating their impact on the market. Such data can be the frequency or coverage data referred to in the previous section (which simply measures the presence of an NTM) or, in the case of case studies on particular policies, more detailed data which provides information on the stringency of the regulation as well. Thus, in this case the researcher uses information on the incidence of NTMs to econometrically estimate their effect on either price-gaps or trade flows across countries.

The second approach, which Chen and Novy (2012) refer to as the “indirect approach” involves estimating the existence of NTMs from market anomalies (e.g., unexplained price gaps or smaller than expected trade flows). Thus, the indirect approach typically involves estimating hypothetical trade flows (or prices) in the absence of NTMs and then inferring the size of NTM barriers from the deviation between the hypothetical and actual trade.

It should be apparent that both approaches have their advantages and disadvantages. While the direct approach allows for a direct calculation of the trade effects of known policies, observable data on NTMs often suffers from transparency problems –and, more broadly, the precision problem discussed earlier. Thus, dummy or count variables which measure the presence of an NTM, often contain little information about stringency. On the other hand, while the indirect approach does not require data on NTM incidence (and may uncover the existence of NTMs that are otherwise hidden), it is often difficult to disentangle the effects of such NTMs from other forces.

2.3.2 NTM trade restrictiveness: Specific measures

Notwithstanding their benefits, aggregate measures of NTMs have the obvious limitation that the trade impact of non-tariff measures will largely depend on their specific details. In this

respect, one possibility is a measure-by-measure analysis. Unfortunately, given the dimensionality of NTMs (any government policy other than tariffs), it is virtually impossible to review the wide body of literature aiming at assessing the trade impact of individual non-tariff measures. However, Appendix Table 2 offers a categorization of some studies focusing on the trade impact of different non-tariff measures and their key findings.

A large body of the literature has dealt with the trade effects of behind-the-border measures, notably standards such as TBT and SPS measures or a combination of both. This is reasonable, as unlike import and export measures that are by definition discriminatory and hence are designed to affect international trade, behind-the-border policies can have a positive, negative or neutral impact on commercial flows and their ultimate effect is an empirical question. As we will further discuss later, product standards are also fundamentally different from other policies as it is as much their diversity across countries as their level that can be a concern. For example, while typically more sophisticated environmental or safety standards will increase production costs and reduce trade, adopting a set of homogenous international standards -even when more stringent- may well reduce information or production costs for exporters, leading to the opposite effect on commercial flows. In fact, a growing debate in the literature concerns the trade impact of the harmonization and mutual recognition, which have precisely the goal to reduce diversity on standards. We will come back to this point in Section 5.3.

The empirical literature on standards generally adopts the direct approach. In most cases, it assesses the trade impact of specific regulatory measures using a gravity model of the following type, where information on NTMs is introduced as an explanatory variable:

$$\ln m_{sij,t} = \theta_s \ln(1 + t_{sij,t}) + \gamma_s NTM_{sij,t} + \sum_z \delta_z X_{ij,z} + \varepsilon_{sij,t},$$

where $m_{sij,t}$ is the import of good s of country i from country j at time t , $t_{sij,t}$ is the bilateral tariff, $X_{ij,z}$ is the set of bilateral gravity controls and $NTM_{sij,t}$ the information on the incidence of the non-tariff measure (such as a frequency index, WTO notification or specific trade concern).

The literature finds that their trade impact depends on sector, level of development, type of firms and margin of trade. Specifically, several studies find that standards have a more significant

impact on trade in agriculture relative to manufacturing (Fontagné et al., 2005), on developing countries' exports relative to developed countries' (Ederington et al., 2005, Disdier et al., 2008), on small relative to large exporting firms (Reyes, 2011, Fontagné et al., 2015) and on the extensive margin of trade relative to the intensive margin (Fontagné et al., 2015). Intuitively, many of these findings can be reduced to the nature of standards, particularly the fact that (unlike tariffs) their diversity may create a fixed entry cost—once the initial investment for a firm to comply with the different standard is made, there are no additional variable costs.

The rest of the literature (summarized in Appendix Table 2) is divided into import and export measures. In the first category we include papers that deal with import bans, pre-shipment inspections, and rules of origin. The second category encompasses studies on export restrictions and state trading enterprises. The list of papers and topics is clearly partial and is mostly for illustrative purposes. Given their discriminatory nature, the direction of the trade effects of these measures is often obvious (e.g. an import ban will reduce imports, while an export tax will lower exports). Studies generally aim at quantifying the trade effects of certain measures, which can be relevant from a policy perspective. For instance, quantifying the impact of restrictive rules of origin (e.g. Cadot and De Melo, 2008) or of border inspections (e.g. Fernandes et al. 2015, Volpe Martincus et al. 2015) or export restrictions (e.g. Giordani et al., 2014) may be relevant to assess the benefits of reforms of rules of origin, trade facilitation, or multilateral export rules, respectively.

2.3.3 NTM trade restrictiveness: Aggregate measures

A problem with the measure-by-measure approach can also be seen in Appendix Table 2: given the sheer number of different NTMs (and thus number of empirical studies) it becomes difficult to see the big picture. Market participants as well as trade negotiators may be interested in assessing the overall level of restrictiveness of NTMs of a country or for a specific sector in a country. Unfortunately, creating an aggregate measure often compounds the conceptual problems discussed above: imprecision (summary statistics are less precise), dimensionality (need to aggregate across different policies) and composition (need to aggregate across different industries). The standard approach to aggregation typically involves calculating a common metric: the ad valorem equivalent of NTMs, which is the ad valorem tariff rate that would induce the same

level of imports as the NTM in place, and use this as the basis of aggregation. Measurement methods of the trade impact of NTMs generally use a partial equilibrium approach and, in addition to utilizing either the direct or indirect approach (see Section 2.3.1), rely on either price or trade volume data.¹⁴

Examples of the indirect approach using price data involve some of the first attempts to assess the trade impact of NTMs by comparing the domestic price of a good with its international price to obtain an estimate of the price gap (Andriamananjara et al., 2004 or Bradford, 2003). The underlying idea is that non-tariff measures, just like tariffs, drive a wedge between the two prices. A simple expression of the tariff equivalent (TE) of NTMs calculated through the price gap approach is:

$$TE = (p_d/p_w) - (1 + t + c),$$

where p_d is the domestic price, p_w is the world price (both net of wholesale and retail margins), t is the ad valorem tariff and c is the international transport margin also expressed in ad valorem terms. Thus, the severity of NTMs as barriers to trade is inferred from any remaining price gap (after controlling for direct trade barriers). In contrast, Dean et al. (2009), while also using data on international price gaps, utilizes the direct approach which requires observable data on NTM incidence. This paper estimates the impact of observable NTMs on price gaps (controlling for a number of factors, including observed differences in local markups, tariffs and transport costs). Obviously a key issue in these approaches involves obtaining the relevant price information.

An application of the indirect approach which uses information on trade volume is undertaken by Chen and Novy (2012). This paper uses a gravity model to infer bilateral trade frictions from observable trade data by comparing actual trade flows and predicted trade flows in the absence of non-tariff measures. They then show that NTMs such as product standards are highly correlated with these inferred trade frictions.

Finally, the most common approach is to estimate directly the impact of non-tariff

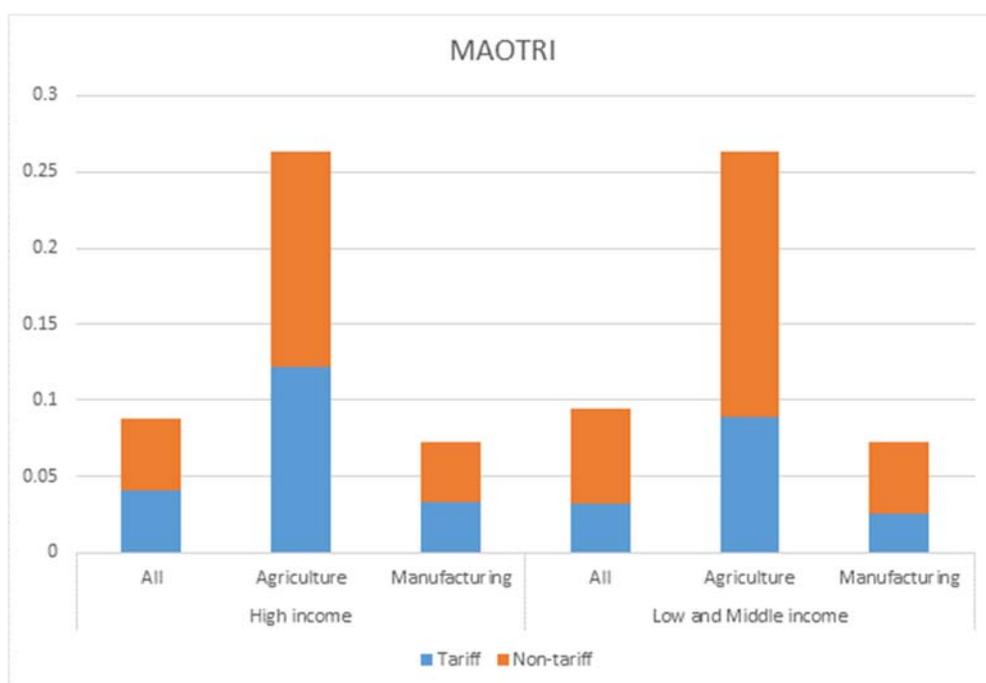
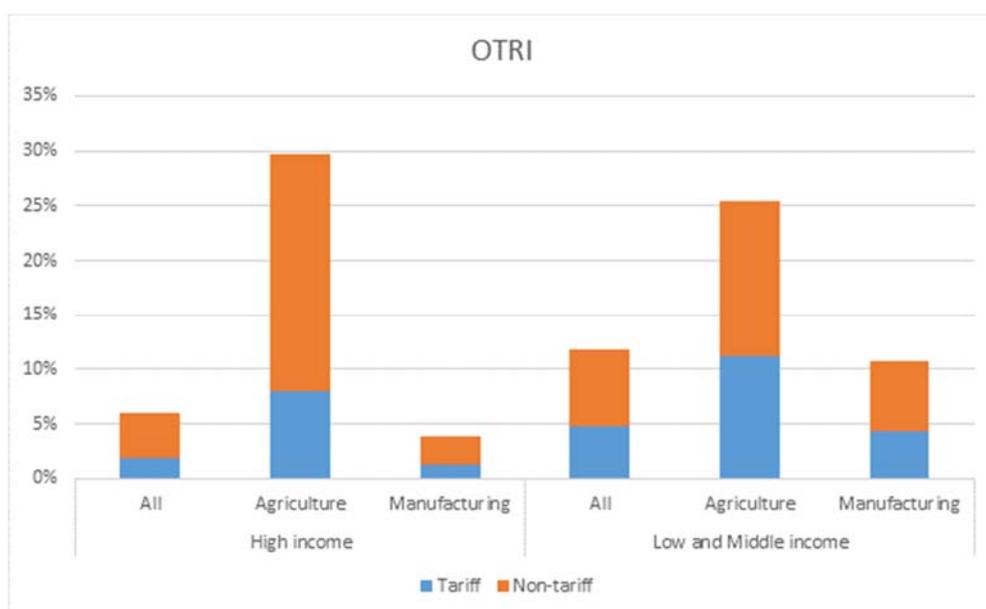
¹⁴ Computable General Equilibrium (CGE) models, such as the Global Trade Analysis Project (GTAP), can in principle be used to assess the impact of non-tariff measures. However, the various treatments of NTMs in CGE models present a series of problems that have limited their use in the literature. See Fugazza and Maur (2008) for an overview.

measures on trade flows where the state-of-the art is Kee et al. (2009). First, they estimate the quantity impact of NTMs on imports by using the following regression equation for a sample of 78 developed and developing countries at the tariff line level:

$$\ln m_{s,j} = \alpha_s + \sum_k \beta_{s,k} C_{j,k} + \gamma_{s,j} NTM_{s,j} + \sum_k \delta_{s,k} C_{j,k} NTM_{s,j} + \theta_{s,j} \ln(1 + t_{s,j}) + \varepsilon_{s,j},$$

where $m_{s,j}$ is the value of imports of good s in country j , $C_{j,k}$ is the set of variables that control for the k factor endowments, $NTM_{s,j}$ is a dummy variable capturing the presence of one or more non-tariff measures and $t_{s,j}$ is the tariff on good s in country j . Following the theoretical work of Anderson and Neary (1994, 1996, 2003, and 2005), Kee et al. (2009) then use import demand elasticities provided in Kee et al. (2008) to aggregate and obtain ad valorem tariff equivalents. They obtain two measures of NTM restrictiveness at the country level which are reported in Figure 8: the Overall Trade Restrictiveness Index (OTRI), which measures the “uniform tariff that if imposed on home imports instead of the existing structure of protection would leave aggregate imports at their current level”, and its mirror image the Market Access OTRI (MA-OTRI), which is the “uniform tariff that if imposed by all trading partners on exports of a country instead of their current structure of protection would leave exports of that country at their current level” (Kee et al, 2009 page 174).

Figure 8: OTRI and MAOTRI, by country group and by sector



Source: Authors' calculations based on Kee et al. (2008, 2009).

An investigation of the OTRI and the MA-OTRI indexes in Figure 8 shows some interesting facts. First, non-tariff measures restrict international trade flows more than tariffs.¹⁵ Second, the trade restrictiveness of NTMs as opposed to tariffs is particularly pronounced for developed relative to developing countries (although this finding may be a result of a different composition of industries in developed countries). Third, non-tariff measures have a larger impact on agriculture relative to manufacturing trade flows. Manufacturing in developing countries faces more restrictive NTMs relative to developed countries, while the opposite is true for agriculture. On aggregate, NTMs double or more than double the overall level of restrictiveness faced by traders, in some cases completely changing our perception of the impact of trade policy. For instance, developing country exporters face higher restrictions than developed country exporters even if they benefit from a number of non-reciprocal market access schemes for tariffs (e.g. the Generalized System of Preferences), because their exports are relatively more concentrated in the agricultural sector where NTMs are more frequently used.¹⁶

Going forward, it is apparent that any attempt (either direct or indirect) to calculate an aggregate measure of NTM trade restrictiveness will entail specifying a theoretical framework (to allow for aggregation over multiple industries/policies) in order to calculate some type of ad-valorem tariff equivalent. However, this suggests the need for future research to examine the robustness of these calculations to alternative theoretical frameworks. The theoretical foundation of Kee et al (2009) is the standard neoclassical perfect competition model. However, other theoretical frameworks might involve Ricardian technology differences (Eaton and Kortum, 2002), firm heterogeneity (Melitz, 2003) or non-homotheticity of preferences (Fieler, 2011). Finally, while this literature has concentrated on calculating NTMs as ad-valorem tariff equivalents (and treated them as such), it seems logical that many non-tariff measures would have more of a fixed cost component with respect to trade flows. This is the case, for instance, whenever a

¹⁵ A number of other studies, based on different methodologies or data, corroborate these findings and suggest that the trade impact of NTMs can be substantial. While not discussed, a partial list of these papers is included in Appendix Table 2.

¹⁶ Accounting for NTMs, therefore, provides a novel interpretation to the well-known finding that GATT/WTO membership is associated with a smaller impact on trade volumes for developing relative to developed countries (Subramanian and Wei, 2009). For a discussion of alternative explanations of this finding, see Bagwell, Bown and Staiger (2015).

regulatory measure requires that firms change their production process to comply. Thus, in calculating the trade impact of NTMs, future research might also consider modeling non-tariff measures as fixed cost distortions rather than simply tariff substitutes.¹⁷

3 Treatment of NTMs in trade agreements: Theory

In the theoretical literature, the distinction between different types of NTMs revolves around their different implications for domestic and international prices. As a means of clarification, assume a good (X) which is traded by two countries, a home and foreign country (denoted by *). Let good X be the natural import good of the home country. In this case, there are four prices of interest in this model: the “world” untaxed price of good X (denoted p_w); the “domestic” price (p_d); the local consumer price (p_c); and the local producer price (p_s).

One set of policies we can refer to as *customs regulations* (alternatively border management policies). This includes the traditional quantitative restrictions (import and export quotas) but also NTMs such as licensing, processing and inspection on both the import and export side. The world price of the good (p_w) represents the international trading price outside of the country’s borders (namely the free on board -f.o.b.- price after any foreign export taxes or subsidies have been applied). Thus, customs regulations will act similarly to a transport cost or tariff and drive a wedge between world prices and domestic prices $p_d = (1 + b)p_w$ where b is the home country ad valorem cost of its customs regulations.¹⁸ This domestic price represents the tradeable price of the good right inside the country’s borders and, as will shortly become clear, is somewhat of a fiction as no one necessarily pays p_d , but it is a useful concept for purposes of exposition.

We can refer to a second set of NTMs as *process regulations*. Process regulations refer to domestic policies which regulate the method by which a good is manufactured or processed, or a natural resource is extracted. In addition to standard production taxes, process regulations include labor standards and environmental regulations (e.g., restrictions on smokestack emissions). As can be seen (Figure 1) process regulations are especially prevalent among the Sanitary and

¹⁷ Indeed, Gulotty (2014) argues that the fact that many NTMs raise fixed costs is a reason why they may be more difficult to lower relative to tariffs.

¹⁸ Note that one could also model these NTMs as having either a fixed or specific cost component and that we are ignoring explicit trade policies (e.g., tariffs or quotas) in this analysis.

Phytosanitary Standards (SBS) where they include regulations on the handling, processing and packaging of goods. In addition, Figure 3b suggests they are relatively more likely to apply to agricultural and primary goods. Since process regulations will typically increase the costs of production, assume that profits for a firms in the home country are given by

$$\pi = p_d y - c(y) - s \cdot p_d y$$

where y is output, $c(y)$ are firm costs and s represents the ad-valorem cost of the process regulation. Note there is an implicit assumption that consumers do not differentiate between goods based on the method of production, and thus the price the home firm can charge is fixed to the domestic price of the good. Thus, one can define the supply price (the price received by domestic producers after taxes and regulations), as:

$$p_s = (1 - s)p_d$$

Thus, while customs regulations drive a wedge between the domestic price and world price, process regulations drive a wedge between the domestic price and the local supply price of the good. An important question is whether domestic country process regulations also apply to foreign production of the good. We will discuss this issue after introducing product regulations as the WTO draws at interesting product/process distinction in the application of international trade law.

A third set of NTMs can be referred to as *consumer regulations*. These are primarily taxes tied to the consumption of the good (e.g., sales and excise taxes) and Figure 3b suggests they are most prominent with respect to primary goods. One can define the consumer price (the price paid by domestic consumers of the good) as $p_c = (1 + t)p_d$ where t is the ad valorem consumption tax. Note that domestic regulations (consumer and process) are imperfect substitutes for customs regulations as customs regulations drive a wedge between the world price and domestic prices, while domestic regulations drive a wedge between domestic producer and consumer prices:

$$p_s = (1 - s)(1 + b)p_w$$

$$p_d = (1 + t)(1 + b)p_w$$

Also be aware that, in contrast to closed economy models, consumer regulations are going to be imperfect substitutes for process regulations as (given the presence of a fixed world price) the economic incidence of the tax will depend strongly on the legal incidence: whether it is applied to the producer or consumer of the good (for applications see McAusland (2008) and Gulati (2008)).

A final set of NTMs we will refer to as *product regulations*. Product regulations are standards and policies related to the characteristics of the product itself. Examples would include emission standards for vehicles, safety standards for child products and general restrictions on hazardous materials. Thus, if a domestic regulation required the installation of a filter on a factory smokestack this would be a process regulation, while the requirement that filters be installed on the tailpipes of all vehicles would be a product regulation. In many cases, the distinction between product and process regulations can be vague, as a process regulation (e.g., restrictions on pesticide use) can also effect the characteristics of the product (e.g., pesticide residue) and thus also serve as a product regulation. However, these distinctions are important, as WTO rules distinguish between product and process regulations with respect to the degree they can be imposed on foreign production.

As can be seen (Figure 1), relative to process regulations, product regulations are more prevalent in the technical barriers to trade (TBT) category and (relatively) more likely to be found among the intermediate and manufacturing industries (see Figure 3b). Once again, meeting the standard will have a cost and thus, similar to a process regulations, a product regulation will generate a wedge between the supply price and domestic price of the good:

$$p_s = (1 - r)p_d$$

where r represents the ad-valorem cost of the process regulations. However, given national treatment rules (see section 4.3.1) product regulations also apply to foreign production (i.e., goods produced by foreign firms for sale in the home market). Indeed, product standards for home goods must be the same as that applied to foreign goods and, thus, one can define foreign firm profits as:

$$\pi^* = p_d^* y^* - c^*(y^*) - r \cdot p_d^* y^*$$

and:

$$p_s^* = (1 - r)p_d^* = (1 - r)(1 + b^*)p_w$$

Note that it is important to differentiate between process and product regulations as product regulations create price wedges (between producer and consumer prices) in both the home and foreign country.

This naturally leads to the question of the conditions under which process regulations also apply to foreign production of the good. Importantly, under current interpretation of international trade law, the WTO makes a process/product distinction in which domestic regulations that attempt

to distinguish between goods based purely on a production methods (process regulations) as opposed to physical good characteristics (product regulations) are considered GATT-illegal if they impede trade. In practice this means that domestic process regulations cannot be applied to foreign production (or used to restrict trade) unless one can show that the process regulation has changed the underlying characteristics of end product (e.g., pesticide residue) or is covered by an Article XX “exception” (for more discussion of the process/product distinction see Howse and Regan, 2000 or Kysar, 2004).¹⁹ Indeed, even the ability to label goods based on differences in production methods across countries is considered an open question in international trade law. What will also be an area of contention in the future is the extent to which WTO rules preclude countries from using border policies to offset differences in process regulations across countries (e.g., there are multiple proposals for the introduction of carbon border taxes or adjustments).

Finally, note that the above analysis does not include discussion of foreign product standards (r^*). This is where the modeling of the fixed costs to meeting product standards will be crucial. In the absence of such fixed costs, foreign firms will simply produce two separate goods: one set for export to the home country that meets r standards, and the other for foreign consumer consumption that meets r^* standards. However, if there are fixed costs to complying with such regulatory product standards, then not only will differential standards across jurisdictions ($r \neq r^*$) create additional compliance costs, but if such fixed costs are sufficiently high then one might get a corner solution where the firm produces only a single good that meets only one country’s standards. As we argue later, such modeling assumptions can have important implications for the efficient design of international trade agreements.

3.1 Policy substitution and shallow integration

While the goal of World Trade Organization (WTO) negotiations has traditionally been the reciprocal reduction in conventional tariff barriers, the WTO agreement also covers a host of non-

¹⁹ Kysar (2004) discusses three main cases. The 1991 *Tuna/Dolphin* dispute which articulates the product/process distinction in arguing that the U.S. cannot restrict imports of tuna based on underlying production methods since they did not effect the underlying characteristics of the product. The 1998 and 2001 *Shrimp/Turtle* rulings which discussed the conditions under which process-based trade regulations might still qualify for exceptions under Article XX. And the *EU/US GMO* (genetically modified organisms) which focuses on the degree of scientific evidence necessary to demonstrate that the underlying process by which a product is made (e.g., genetic modification) might result in health or environmental concerns with respect to the end product.

tariff measures (both border and behind-the-border measures). The GATT agreement contains an interesting asymmetry in the treatment of traditional border-measures (i.e., tariffs, quotas, export-subsidies) and behind-the-border measures (e.g., import licensing, health and safety standards, etc.). With respect to the border measures the GATT is an *instrument-based* agreement, in that WTO negotiations directly constrain members in setting policy – either through establishing binding ceilings (tariffs) or through explicitly outlawing (quantitative restrictions). In contrast, with respect to most non-tariff measures, the GATT is a *rules-based* agreement, in that WTO members are allowed a fair degree of discretion with the exception that the resulting standards must adhere to certain GATT rules. As discussed by Hudec (1990), the main concern of the original drafters was the potential for *policy substitution*: that countries will undo the effects of any negotiated tariff concession by utilizing alternate policies as a secondary trade barrier. As a result, the WTO has taken an approach towards NTMs often referred to as *shallow integration*: allowing countries discretion in setting domestic policy with the exception of the establishing of rules to attempt to prevent policy substitution.²⁰ As we argue below, the justification for this approach is somewhat dependent on the rationale for international cooperation in the first place.

The principal argument in the economic literature for why international agreements can be mutually beneficial is to internalize an international pecuniary externality created by market power in international markets (i.e., the terms-of-trade approach). As we discuss in this section, this approach provides a rationale for shallow integration as it suggests that the main inefficiency in the non-cooperative Nash equilibrium is distorted trade policy due to a terms-of-trade externality, and thus the main goal of international coordination is to bind trade policy and then prevent policy substitution towards alternate NTMs. To clarify this story assume once again two countries, home and foreign (denoted by *), which produce and trade the two goods (X,Y) where X is the natural import good of the home country. Technology in both countries is described by production possibility loci [$Y=F(X)$ and $Y^*=F^*(X^*)$] which are strictly concave to the origin. Since domestic NTMs (e.g., environmental regulations) are commonly justified as correcting for domestic distortions (e.g., pollution), assume the presence of a negative externality that arises

²⁰ As we discuss in Section 5, the WTO has started to adopt a more “deep integration” approach to product standards in the WTO Agreement on Sanitary and Physo-sanitary Measures (SPS) and the WTO Agreement on Technical Barriers to Trade (TBT) which covers all other technical regulations and standards.

from both home and foreign country production of good X. Let $E(X)$ denote the external cost to production of good X (for ease of analysis, the externality does not affect the production functions and enters separably into the welfare functions). We assume citizens are identical within each country and that the government in each country maximizes this (aggregated) representative citizen's quasi-linear utility function:

$$W = C_Y + U(C_X, E(X)) \text{ and } W^* = C_Y^* + U^*(C_X^*, E^*(X^*))$$

where C_i denotes consumption of good i . Importantly, note the absence of any international “spillovers” associated with the production externality (i.e., production of good X in the home country does not enter directly into the welfare function of the foreign country).

We assume that each country pursues trade policy through the use of trade taxes, so that $p_c = (1 + \tau)p_w$ and $p_c^* = p_w/(1 + \tau^*)$ where τ is the ad valorem import tariff, p_w is the “world” relative price of good X (in terms of good Y), and p_c and p_c^* , respectively, are the local home and foreign consumer price ratios. Domestic policy is carried out through the use of process regulations akin to taxes on the production of good X, so that $p_s = (1 - s)p_c$ and $p_s^* = (1 - s^*)p_c^*$ where s and s^* are the respective home and foreign ad-valorem tax rate and p_s p_s^* are the corresponding local producer price ratios. Profit-maximizing producers choose production levels to equate the marginal rate of transformation between the two goods with the local producer price ratio. Meanwhile, utility-maximizing consumers choose consumption levels to equate the marginal rate of substitution between the two goods with the consumer price ratio. Thus, consumption will be a function of local prices (p_c and p_s which determine the budgetary trade-off between the two goods and the level of factor income in the economy) and tariff revenue ($R(p_s, p_c, p_w)$) which is distributed lump sum to consumers. The home country's net exports of good i (denoted by T_i) are given by:

$$T_X = X(p_s) - C_X(p_c) \text{ and } T_Y = F(X(p_s)) - C_Y(p_c, p_s, p_w)$$

The world price, p_w , is determined by the market-clearing condition that net exports of the home country of each good are equal to foreign net exports:

$$T_i = T_i^*$$

Assuming that direct lump-sum transfers (in terms of the numeraire good) are available, the balance of payments constraint requires that for any world price:

$$T_Y + p_w T_X + m = 0 \text{ and } T_Y^* + p_w T_X^* - m = 0$$

where m represents any lump-sum transfers. Thus welfare for the home and foreign country can be rewritten as:

$$W = F(X) + p_w T_X + m + U(X - T_X, E(X)) \text{ and}$$

$$W^* = F^*(X^*) - p_w T_X - m + U(X^* + T_X, E^*(X^*))$$

In the absence of an international agreement, each country sets trade taxes and production taxes to maximize national welfare, taking the policy choices of its trading partner as given. Taking derivatives of the above welfare functions, the unilaterally optimal trade and domestic policies for the home country satisfy the following first order conditions:²¹

$$\left(\frac{1}{\epsilon} - \tau\right) p_w \frac{\partial T_X}{\partial \tau} + (s \cdot p_c - \varphi) \frac{\partial X}{\partial \tau} = 0$$

$$\left(\frac{1}{\epsilon} - \tau\right) p_w \frac{\partial T_X}{\partial s} + (s \cdot p_c - \varphi) \frac{\partial X}{\partial s} = 0$$

where

$$\epsilon = \frac{p_w \left(\frac{\partial T_X^*}{\partial \tau}\right)}{T_X^* \left(\frac{\partial p_w}{\partial \tau}\right)} \text{ and } \varphi = -\frac{\partial W}{\partial E} \left(\frac{\partial E}{\partial X}\right)$$

When viewed from a single country's perspective, there are two basic distortions in this model: a local production distortion (φ) and an international terms-of-trade distortions (ϵ). First, the reduction in the world price that accompanies a slight increase in tariffs redistributes income to the importing country and thus $1/\epsilon$ is the reciprocal of the elasticity of the foreign country's supply of net exports (the usual optimal tariff formula). Second, φ reflects the (purely local) external cost of production in the home country and $s = \varphi/p_c$ reflects they typical optimal Pigouvian tax. Note, that if countries were allowed to set policy unconstrained they would set $\tau = 1/\epsilon$ to exploit any international market power and $s = \varphi/p_c$ to counter the domestic production distortion (first-best policies). Intuitively, since trade policy is the most efficient means of exploiting international market power, it is typically only trade policy that is distorted in the non-cooperative Nash equilibrium due to trade concerns.

²¹ First-order conditions for the foreign country are defined analogously. The derivation of these first order conditions follows that provided in Ederington (2001).

However, suppose the home country were constrained by an international agreement to set tariffs below the unilaterally optimal level ($\tau < 1/\epsilon$). Then note from the first-order conditions, that there will be an incentive to distort domestic process standards on the good as well: $s < \varphi/p_c$. Intuitively, since domestic regulations raise the world price of the good (by reducing domestic production), the terms of trade for importing countries are diminished and therefore the home government faces more than the full costs of its domestic policy. As a result, when trade policy is constrained, a government would have an incentive to under-regulate the domestic distortion associated with import-competing production. This is the concern about *policy substitution* that the GATT/WTO agreement is designed to avoid: as countries are restricted in the setting of their trade policy by a trade agreement they will have an incentive to distort alternate policies as a secondary trade barrier (see Ederington, 2001 and Bagwell and Staiger, 2001). Indeed, the terms-of-trade literature on trade agreements suggests that it is the very success of GATT/WTO negotiations in reducing trade barriers that has created an emphasis on NTMs in trade negotiations (since NTMs are only distorted when countries are constrained in the setting of the more efficient tariff barriers). Consistent with this view, the empirical literature has found that after controlling for country and product fixed effects, tariffs and NTMs are substitutes to each other (Kee et al., 2009, Beverelli, Boffa and Keck, 2014 and Orefice, 2015).

As the above calculations show, when setting policy unilaterally, countries will have an incentive to place restrictions on trade since the resulting change in the world price shifts some of the cost of the policy to the country's trading partners. However, while it is rational for each country to erect trade barriers unilaterally, these cost-shifting incentives lead countries to place greater restrictions on trade than is efficient for world welfare. Indeed, globally efficient trade and domestic policies (which maximize the sum of joint welfare: $W + W^*$) will satisfy the following first-order conditions (conditions for foreign country policies are symmetrically defined):

$$-\left(\tau + \frac{\tau^*}{1 + \tau^*}\right)p_w \frac{\partial T_X}{\partial \tau} + (s \cdot p_c - \varphi) \frac{\partial X}{\partial \tau} + (s^* \cdot p_c^* - \varphi^*) \frac{\partial X^*}{\partial \tau} = 0$$

$$-\left(\tau + \frac{\tau^*}{1 + \tau^*}\right)p_w \frac{\partial T_X}{\partial s} + (s \cdot p_c - \varphi) \frac{\partial X}{\partial s} + (s^* \cdot p_c^* - \varphi^*) \frac{\partial X^*}{\partial s} = 0$$

Notice that unilaterally optimal policies are not globally optimal, and that the difference is the elimination of the terms-of-trade incentive ($1/\epsilon$) from the first-order conditions. Intuitively,

there is no reason for policy intervention driven by “beggar-thy-neighbor” trade-restricting motivations in an efficient cooperative arrangement. In the globally optimal first-order conditions $\tau + \frac{\tau^*}{1+\tau^*}$ represents the net trade barrier (the wedge between the relative (consumer) price of good X in each country caused by the imposition of trade taxes).²² As discussed by Mayer (1981), an entire locus of efficient (Pareto optimal) trade tax combinations can be obtained by imposing import tariffs and symmetric export subsidies. Altering the level of these symmetric policies keeps local prices equalized (ensuring efficiency) while changing the world price (thus redistributing income between the two countries). Thus, the globally optimal solution is to lower the net trade barrier to zero ($\tau + \tau^*/(1+\tau^*)=0$) while retaining domestic policies at their non-distortionary level ($s = \varphi/p_c$ and $s^* = \varphi^*/p_c$) in order to counter the domestic distortions.

This reflects the standard rationale for international negotiations over trade policy: to mitigate the unilateral incentives for countries with some degree of market power to pursue beggar-thy-neighbor trade policies (see e.g., Johnson (1953-54) and Bagwell and Staiger (1999)). Import tariffs, which lower the world price of the good, pass a portion of the cost of the tariff on to foreign exporting firms. When setting policy unilaterally, the domestic government does not take into account this cost and thus tends to set tariffs above the level that would be efficient from a global perspective. Given this tendency for unilateral tariffs to be higher than is globally optimal, international negotiations to reciprocally reduce trade barriers are mutually beneficial.²³ Thus, the main emphasis of international trade agreements has traditionally focused on trade policies (i.e., binding tariffs and eliminating quotas). However, note that even though the terms for the globally and unilaterally optimal domestic policies are the same ($s = \varphi/p_c$), achieving the globally optimal policies will require cooperation over both trade *and* domestic policy, as with $\tau < 1/\epsilon$ countries will face a unilateral incentive to use their domestic policies as a secondary trade barrier.

The question then becomes the depth of integration required: should countries directly negotiate over and bind domestic policies (deep integration) or should countries be allowed more latitude in setting domestic policy only subject to some overriding rules (shallow integration). This

²² Note that $\tau = -\tau^*/(1+\tau^*)$ implies that the relative (consumer) price of X is equal in the two countries (i.e., $p_c = p_c^*$).

²³ While most papers utilize perfect competition, similar results in which the non-cooperative Nash equilibrium of trade policy is not globally efficient and thus international cooperation can be mutually beneficial can be found in models of imperfect competition as well (e.g., see Ossa, 2011 and Mrazova, 2011).

is the question addressed by a sequence of papers (Bagwell and Staiger, 2001 and Staiger and Sykes, 2011) which argue that efficient cooperation can be achieved through shallow integration. Note that the above classical model of trade has two main characteristics. First, the sole mechanism by which one country's policies effect the other country is through the market-clearing world price (i.e., there is no secondary transboundary externality). Thus, with respect to international negotiations, all the foreign (exporting) country cares about is the level of market access (the world price) and the policy mix the importing countries uses to achieve that world price is irrelevant. Second, the non-cooperative set of domestic polices is globally optimal and thus the main goal of international trade cooperation over NTMs is to prevent policy substitution. What Bagwell and Staiger (2001) shows is that global efficiency can be achieved by simply negotiating over bound tariffs to achieve a globally efficient level of market access and then preventing countries from using NTMs as a secondary means of eroding these market access commitments.²⁴ Indeed, it is apparent from the first-order conditions that if the level of market access is fixed ($\frac{\partial T_x}{\partial s} = 0$) then countries will set globally optimal domestic policies ($s = \varphi/p_c$). Hence, importing (and exporting) countries can be allowed a degree of latitude in setting domestic policy provided they meet their market access commitments. Bagwell and Staiger (2001) and Staiger and Sykes (2011) then discuss how various features of the GATT/WTO can be interpreted as providing this market access commitment device. As a result, the terms-of-trade approach to international trade agreements provides both a justification for the GATT/WTO's long-standing concerns about policy substitution with respect to NTMs as well as support for the shallow integration approach to dealing with them in trade agreements.

3.2 Deep integration

As discussed, the GATT/WTO takes a shallow integration approach to NTMs in which countries directly negotiate over and bind trade policies (i.e., tariffs and quotas) while providing countries discretion in setting domestic (behind-the-border) policies with the exception that such policies accord to rules designed to prevent policy substitution. It should be noted that the exact

²⁴ DeRemer (2013) shows that similar results (and thus support for the shallow intergration approach) hold for standard models of trade under imperfect compeititon.

definition of “shallow” and “deep” integration is somewhat vague, however deep integration is typically interpreted as involving (1) more precise rules and (2) greater obligations. Thus, a *deep integration* approach may involve introducing direct negotiations over domestic policy or simply greater adoption of more restrictive rules (e.g., harmonization or mutual recognition). As discussed previously, the theoretical justification for shallow integration rests on two characteristics of classical models of trade: (1) the sole international externality is the pecuniary world price externality and (2) non-cooperative domestic policy is globally optimal and thus the main goal of international trade cooperation over NTMs is to prevent policy substitution. As we discuss below, some new models of international cooperation which do not share these features provide more justification for the deep integration approach.

3.2.1 Political economy: Commitment

While the main justification for international negotiations is to prevent countries from pursuing beggar-thy-neighbor policies, a secondary economic argument in support of international trade agreements is that such agreements help governments maintain commitments to the private sector (see Staiger and Tabellini (1987) and Maggi and Rodriguez-Clare (1998, 2007)). That is, a trade agreement that binds trade policies allows member governments to “lock in” preferred policies, enabling these governments to tell interest groups seeking policy changes that such changes would violate international commitments and possibly trigger foreign retaliation. Such a commitment device is especially valuable when optimal policy is “time-inconsistent” (i.e., the government has an incentive to surprise the private sector with unexpected policy changes). Although the literature typically focuses on government commitment with respect to domestic sectors of the economy, one can tell a similar story about international trade agreements assisting governments in making credible policy commitments to foreign exporters/investors as well (e.g., see Buthe and Milner, 2008).

Once again however, an agreement that only binds tariffs and leaves other NTMs unconstrained will fail to be globally efficient as policy-makers can simply use NTMs as an alternate policy once trade policy is bound (see Brou and Ruta, 2013). Thus, the potential for policy substitution prevents agreements that simply constrain trade policy to serve as an effective commitment device. However, in contrast to the terms-of-trade literature, in the policy

commitment literature it is not clear that a shallow integration approach is sufficient to deal with these distortions. Most directly, if trade agreements are motivated by concerns about time-inconsistent policy, it is no longer obvious that tariffs are the only policy being distorted in the non-cooperative equilibrium. For example, it is well-known that in many political economy models a domestic production subsidy is a more efficient instrument for reallocating income across interest groups (see Rodrik, 1995) and thus such process regulations are potentially distorted due to time inconsistency issues. However, if it is domestic policy (and not trade policy) that is likely to be distorted in the non-cooperative equilibrium, then the rationale for the differential treatment of trade policy (deep integration) and domestic policy (shallow integration) is lost.²⁵ Indeed, the globally efficient outcome in Brou and Ruta (2013) involves deep integration with respect to both trade and domestic policy.

3.2.2 Offshoring: Bilateral bargaining over prices

In the terms-of-trade approach, prices are determined in world markets, however in a sequence of papers Antras and Staiger (2012a, 2012b) consider the case of offshoring where prices between upstream and downstream firms often involve bilateral bargaining (as well as a classic hold-up problem since the upstream supplier must customize the input for consumers). Thus, they consider a model of competition where international prices are no longer the result of market-clearing conditions, but rather a function of bargaining. They show that, in such an environment, there exist two international externalities: both the standard terms-of-trade externality and a trade volume externality (where trade volume also impacts the severity of the hold-up problem). In addition, Antras and Staiger show that, with bilateral bargaining over prices, a country's domestic policies will also be distorted in the Nash equilibrium and thus deeper integration will be required. Hence, Antras and Staiger's results suggest that changes in the international organization of production and market structure (shifting from prices being determined by market clearing to prices being determined by bilateral bargaining) can also influence the desirability of a deep versus shallow integration approach.

²⁵ For example, there is an extensive literature on time-inconsistency in the setting of environmental policy (e.g., Marsiliani and Renstrom (2000) and Gersbach and Glazer (1999)). However, if environmental policy is actually distorted in the non-cooperative equilibrium than an efficient agreement would entail actual negotiation and binding of such policies (deep integration) as opposed to simply attempting to prevent policy substitution.

Indeed, the empirical literature has shown a complementarity between deep provisions in preferential trade agreements and offshoring. Specifically, Orefice and Rocha (2011) find that a larger share of parts and components between two countries relative to their total trade increases the probability that the two countries will sign a preferential trade agreement covering deep provisions. This finding is consistent with the view that offshoring creates new forms of cross-border externalities that are not adequately addressed within the shallow approach of the WTO to NTMs and require deeper provisions that may more easily be negotiated in the narrower setting of preferential agreements.

3.2.3 Coordination externalities

Finally, while the inefficiency of policy (from a global standpoint) is the typical justification for international coordination over trade and domestic policy, with respect to many NTMs (e.g. product standards) the very multiplicity of standards in different regulatory jurisdictions can create barriers to trade and thus global inefficiencies. Heterogeneous consumer protection rules can create informational costs for both consumers and producers. Incompatible technical standards across different markets can increase compliance costs for firms (e.g., by making the exploitation of economies of scale difficult in producing for multiple markets) and reduce the efficiency of global supply chains. It is well known in the trade literature that sharing a common language can increase trade between two regions and likewise the law literature has documented the costs benefits of homogenous (or at least compatible) laws (e.g., see Marciano and Josselin, 2002). Indeed Rodrik (2004) estimates transaction costs of around 40 percent between advanced countries with only 5 percent due to border measures (tariffs) and the remaining 35 percent due to diversity of institutions (i.e., different currencies, legal systems, product standards, etc.).²⁶ In the public economics literature, while spillovers driven by the level of a region's policies are referred to as fiscal externalities, the inefficiencies or spillovers driven by heterogeneity (or incompatibility) of policy across regions are referred to as *coordination externalities* (see Loeper 2011). Once again, this would imply the existence of a second

²⁶ It should be noted that while Rodrik (2004) explicitly states that “institutional discontinuities” are the greatest current barrier to globalization, he also argues that allowing for institutional discretion is of greater importance than attempting to increase trade through reducing institutional diversity.

transboundary externality (in addition to the standard terms-of-trade), and that the non-cooperative setting of domestic policy is unlikely to be globally efficient. Thus, coordination externalities in a trade agreement would require a more deep-integration approach as it would involve direct negotiation over the policies themselves.²⁷

The concept of “coordination externalities” appears in several contexts in the trade literature, especially with regards to product standards. For example, several papers note that differences in product specifications or standards across countries can serve as a barrier to trade as it requires firms to incur additional costs in both learning and complying with the differing standards (referred to as “conversion costs” in Gandal and Shy (2001) and “adaption costs” in Toulemonde (2013)). In addition, Gandal and Shy (2001), Costinot (2008) and Klimenko (2009) also consider the potential for “network effects” where the utility of consuming a good is increasing in the number of other consumers that use compatible products (e.g., consider compact disc players and compact discs). In industries where network effects are important (e.g., the information and communication technology industry) standardization which leads to greater compatibility of foreign and domestic products can have large consumer benefits. Finally, Toulemonde (2013) notes that quality standards on products are often a response to asymmetric information problems in markets and, thus, that having multiple standards across countries can reduce consumer utility as they are likely to be less informed about foreign standards (and it may be costly to acquire that information). Similar to the firm “adaption costs” discussed earlier, Toulemonde (2013) refers to the consumer costs that arise from the existence of multiple product standards as the “consumer adaptation discount”. In all these cases, international cooperation entails a more deep-integration approach as countries directly negotiate over product standards in an attempt to reduce these coordination externalities.

4. Treatment of NTMs in the World Trade Organization

As mentioned previously, the traditional concern of the WTO with respect to non-tariff measures is the potential for *policy substitution*: that countries will undo the effects of any negotiated tariff concession by utilizing alternate policies as a secondary trade barrier. Indeed, a

²⁷ Alternatively, agreements addressing coordination externalities would require less enforcement than traditional trade agreements as countries would have little incentive to deviate from cooperatively setting uniform standards.

common feature of the theoretical literature on trade negotiations over multiple policy instruments is the tendency for countries, on entering into a trade agreements which binds conventional tariff policy, to have an incentive to distort alternate non-tariff policies in pursuit of their goals (e.g., Copeland (1990) and Ederington (2001)). Thus, in its attempt to constrain policy substitution, the GATT/WTO framework has several notable features which we discuss below.

4.1 Customs regulations: Import

Within the regulatory framework of the WTO, tariffs are explicitly legal but bound at levels established by international negotiations. In contrast, quantitative trade restrictions, on both the import and export side, are illegal by Article XI. The theoretical literature on quotas has mostly concentrated on the relative efficiency of tariff versus quota protection. This literature demonstrates that, while tariffs and quotas are equivalent under conditions of perfect competition, they can have differing impacts when the market is characterized by imperfect competition (see Bhagwati, 1965, and Bhagwati, 1968) or demand uncertainty (see Dasgupta and Stiglitz, 1977). More recent contributions have investigated tariff/quota equivalence under different forms of competition (e.g., Jorgensen (2005) as well as various market frictions (e.g., Matshcke (2003)).

There is, to our knowledge, not much of a literature on the WTO's dislike for quantitative restrictions. However, it can be presumed to arise from the more distortionary nature of quantitative restrictions as a trade barrier. While in special circumstances, a tariff and quota are equivalent, in most situations it will be more efficient to employ tariffs as opposed to quotas as a means of protection (see Helpman and Krugman, 1989).²⁸ And, while not explicitly addressing the quota ban, Ederington (2001) provides a justification for relaxed cooperation over less-distortionary instruments in international agreements. Specifically, it considers the standard terms-of-trade case for cooperation in which large countries have access to multiple policy instruments (i.e., tariffs and NTMs) but limited enforcement power prevents an international agreement from achieving the globally efficient equilibrium in both policy instruments. Since tariffs are the most efficient means of exploiting international market power, Ederington (2001)

²⁸ For example, Ederington and McCalman (2013) demonstrates how quotas can have a negative impact of foreign technology adoption and thus tariffication (the conversion of quotas to equivalent tariff restrictions) can increase the rate of technology adoption worldwide. However, it is also well-known since Weitzman (1974) that the relative efficiency of price versus quantity regulations depends largely on the type of shocks being faced.

demonstrates that relaxing cooperation in only trade policy (while cooperating fully over NTMs) will be the most efficient (i.e., least distortionary) means of ensuring that the agreement is self-enforcing. Thus, to the extent that quotas are more distortionary than tariffs, then the prohibition on quantitative trade restrictions (and the movement towards tariffication) can be justified.

4.2 Customs regulations: Export

Another interesting feature of the WTO is that, while export subsidies are banned by the WTO Agreement on Subsidies and Countervailing Measures (SCM), export taxes are treated symmetrically to import tariffs in Article II and Article XXVII of the GATT framework. This implies that export taxes are explicitly legal in the WTO agreement and, while they can be negotiated over and bound like tariffs, in practice this does not typically occur. As export subsidies are considered in a separate chapter of this Handbook, in this chapter we will focus on the WTO's treatment of export taxes. As noted by Ethier (2004) this treatment of export taxes does not appear consistent with the terms-of-trade approach to trade agreements. Specifically, Lerner symmetry suggests that, in a general equilibrium environment, an export tax has the same effects on the economy and welfare as an equivalent import tariff. Thus, by the same logic as in Bagwell and Staiger (1999) it would seem the export taxes would be over-utilized in the Nash equilibrium and that negotiating over (and binding) export taxes would be mutually beneficial.

The lack of explicit negotiation over export taxes is most likely due to their infrequent use in practice. The fact that WTO members largely refrain from using export taxes is probably due to undesirable political economy effects such as redistributing income away from politically organized producers. For example, even in a terms-of-trade model like Grossman and Helpman (1995), export taxes do not occur in equilibrium if the weight on political interests is sufficiently strong. That said, there are sectors where export taxes are indeed quite frequent. For instance, governments have used export taxes, and export restrictions more generally, on food products as a means to insulate the domestic market from high and rising world food prices (Anderson and Martin, 2009, and Giordani et al., 2014). Another sector is natural resources, where export taxes and restrictions are often used to lower the domestic price of the resource as a form of subsidy to the downstream sector (Latina et al., 2011). In these sectors, the lack of agreed rules at the WTO is problematic, as these policies of exporters contribute to the volatility of food and natural

resource prices in international markets and trigger policy responses by trading partners (Ruta and Venables, 2012, and Giordani et al., 2014).

A related area where there is potentially more policy relevance, and thus discussion, is in the WTO's treatment of export cartels. Similar to the WTO's prohibition on import quotas, Article XI also bans the use of quantitative restrictions on the export side (i.e., export quotas). Thus, Article XI can and has been used to regulate export cartels that are proactively maintained and/or facilitated by government.²⁹ However, private export cartels that are maintained by colluding firms are, in practice, legal under WTO rules (note that WTO rules only constrain governmental actions). In addition, many WTO members have explicit competition policies that exempt export cartels from anti-trust legislation. For example, while the United States prohibits collusion (by either foreign or domestic firms) which harms *domestic* consumers, it explicitly exempts from such legislation collusion among exporters with respect to foreign markets even when such collusion may harm *foreign* consumers (the Webb-Pomerene Act). The standard rationale for such exemptions is that collusion may facilitate companies in undertaking (foreign) joint ventures which both reduces the fixed costs of exporting (both informational and administrative) as well as diversifying the risk associated with entering new international markets. However, consistent with the terms-of-trade motivation for trade agreements it is also possible that allowing collusive behavior in export markets could result in higher prices in foreign countries.

The treatment of export cartels in the WTO (or lack thereof) is somewhat controversial as it often reflects a power imbalance between developed and developing countries. Specifically, while WTO rules potentially allow for the formation of private export cartels which could raise prices in foreign markets, these rules also allow those foreign countries to use their own antitrust laws to deter any such anti-competitive behavior. However it is well recognized that many developing countries lack the capabilities to breakup foreign cartels and thus expanding the WTO agreement to constrain developed-country firms from colluding to raise prices in foreign markets is often seen as a development strategy for poorer countries (see Hoekman and Mavroidis (2003)). Given the difficulty in convincing developed countries to adopt such policies unilaterally, later papers (e.g., Hoekman and Saggi (2007)) have suggested using market-access concessions and

²⁹ Although even here government-organized export cartels on commodities, such as OPEC, can often be justified by exemptions for "natural resource conservation".

income transfers to induce developed countries into curtailing export cartel activities. However, despite their policy relevance, export cartels have not received much attention in the trade literature. Thus, information on the severity of this problem and thus the costs and benefits of curtailing export cartel activity is somewhat limited.³⁰

4.3 Behind-the-border measures: Consumer, product and process regulations

Given the vast number of products, countries and policy instruments involved, designing an international agreement that can specify, in advance, how member countries should behave in every conceivable contingency (a “complete” contract) is simply not economical. Thus, the costs of designing and implementing a viable agreement are likely to shape the nature of the agreement. In this respect, behind-the-border measures are especially problematic as internal policies and regulation are decidedly less transparent than conventional border measures (e.g., tariffs and quotas). Indeed, one can view one of the earliest papers on the theory of trade agreements (Copeland, 1990) as simply treating contracting constraints as exogenous and thus assuming that behind-the-border policies are simply non-negotiable. What Copeland (1990) shows is that, if some domestic policies are non-negotiable, it is still efficient to bind the more negotiable trade barriers as policy-substitution towards less-efficient policies is still globally efficient (since the less-efficient instrument is used less in equilibrium).

In a more recent paper, Horn, Maggi and Staiger (2010), actually endogenize these contracting costs and provide a justification for the differential treatment on NTMs. Specifically, to the extent that internal, or domestic, measures are more costly to contract over (due to being less transparent) than border measures (i.e., trade policies), the benefits of domestic policy cooperation may not outweigh the extensive costs of contracting. However, even if contracting costs are assumed to be symmetric across domestic and trade policy instruments, an optimal agreement may still allow discretion over domestic policies. This is because the underlying rationale for the international agreement is trade-related (the terms-of-trade externality). Thus, while governments may use a domestic policy as a secondary trade barrier when their trade

³⁰ For example, while some countries like the US maintain some data on export cartels (see Dick, 1992) many countries do not even track the number of export cartels operating in or from their region.

policy is constrained, such domestic policies are inherently imperfect substitutes. That is, they are a less efficient means of pursuing a country's trade objectives. This means that when contracting is costly, contractual completeness will vary across policy instruments, with the "most important" policies (border measures) being contracted over first, and the "less important" policies (domestic measures) being contracted over only as contracting costs fall.

Given that the WTO primarily takes a rules-based approach towards NTMs (shallow integration), in the following sections we consider the main rules that constrain the setting of NTMs and the economic literature about them.

4.3.1 National treatment

With respect to any behind-the-border policy, the most relevant rule is the National Treatment (NT) clause in Article III of the GATT which requires that imported products should be treated no less favorably than "like domestic products". In other words regulations or taxes should not discriminate between domestic and foreign products and thus afford disguised protection to the domestic industry.

One of the first formal treatments of the NT rule is Horn (2006). That paper notes that, to the extent that countries can directly discriminate against foreign products, they can use behind-the-border internal policies as basically a perfect substitute for border measures (i.e., tariffs). However this implies that, by imposing differential taxes/standards on imported goods, countries can render the tariffs commitments made in trade agreements effectively meaningless. Horn (2006) shows that, given the problems of contracting over all the myriad internal policies and contingencies (i.e., assuming exogenously incomplete contracts) adopting an NT rule may be an alternative way to reciprocally constrain governments in their protectionist impulses. Indeed, he shows that the adoption of an NT rule can always improve welfare even in cases where differential treatment of foreign products is socially optimal. Similarly, other papers have investigated NT rules in the presence of country and product heterogeneity (Saggi and Sara, 2008), endogenous incomplete contracting (Horn et al., 2010) and regulatory standards (Costinot, 2008).

It should be noted that, typically, while NT rules can constrain governments in attempting to substitute internal (behind-the-border) policies for tariffs, they are not sufficient, by themselves, to achieve global efficiency. As noted by Staiger and Sykes (2011) even when

constrained by NT rules, countries might still have an incentive to distort behind-the-border policies as a substitute form of protection. For example, given terms-of-trade considerations, countries might have an incentive to relax (in a non-discriminatory fashion) regulations on import-competing goods in order to reduce prices and thus shift costs onto foreign exporters.³¹ Thus, some papers consider the efficiency of combining NT rules with other constraints on internal policies such as non-violation complaints (the subject of the next section).

4.3.2 Non-violation complaints

A second feature of the GATT/WTO agreement is that policy substitution concerns can be addressed through “non-violation” complaints provided in Article XXIII of the GATT. Specifically, if a WTO member can show that the market access commitments which it had previously negotiated are being offset by an unanticipated change in the domestic policy of another member country, it has a right to seek redress even if the policy change was non-discriminatory and thus broke no explicit WTO rule.

This feature of the WTO is formalized in Bagwell and Staiger (2001) who demonstrate how the existence of the non-violation rule discourages policy substitution since governments are aware that any attempt to undo market access commitments by using NTMs as a secondary trade barrier can trigger a non-violation complaint. Thus, they show how non-violation complaints can allow NTMs to be addressed through the current GATT/WTO framework, even in the absence of explicit negotiations over the setting of domestic policy. The intuition is identical to that discussed in section 3.1.2 in that, within a perfect competition framework, exporting countries care only about market prices in the foreign market (not the policy mix) and thus countries can be afforded discretion in setting domestic policy provided policy changes do not reduce “market access” (the terms-of-trade). Indeed, the subtext of both Bagwell and Staiger (2001) and Staiger and Sykes (2011) is whether the non-violation doctrine should be strengthened or even extended (e.g., allowing countries to raise tariff barriers in the event that a change in domestic policy allows foreign exporters greater market access).³² While non-violation complaints are rarely observed

³¹ For empirical evidence on these issues with respect to environmental regulations see Ederington and Minier (2003).

³² A similar argument is made in Lee (2007) in which governments privately observe the level of a production

in WTO disputes, Staiger and Sykes (2016) discuss how this can still be consistent with non-violation rules playing an important off-equilibrium role.

It should be noted that the sufficiency of non-violation complaints as a means of addressing policy substitution rests on the assumption that cross-country externalities travel solely through the terms-of-trade. Thus, as discussed in section 3.2.2, the Bagwell and Staiger (2001) results might not extend to other forms of competition or cases where the foreign country cares directly about the importing countries policy mix. For example, in a recent paper Saure (2014) considers the case where (1) trade agreement must be self-enforcing and (2) economic conditions are intertemporally linked. Self-enforcement requires that the agreement be designed so that, for each country, the incentive to cooperate outweighs the discounted gain to deviating from the agreement. As shown in Bajona and Ederington (2008), introducing a self-enforcement constraint does not change the results of Bagwell and Staiger (2001) by itself. However, Saure shows that, to the extent that the policy mix can affect future deviation incentives (holding constant the current degree of market access), then a shallow integration agreement that relies on non-violation complaints might be more difficult to enforce.

4.3.3. Transparency

It should be apparent that the trade literature typically treats behind-the-border policies as simply imperfect (and, specifically, less-efficient) substitutes for conventional tariff barriers. However, a second way in which many internal policies differ is that they are decidedly less transparent than tariffs. As discussed in Section 2, given the myriad number of different internal policies that can influence trade, as well as sometimes vague nature of many legal and regulatory statutes, even the measurement of NTM's is problematic. In addition, even when domestic policy statutes are transparent, the actual use and enforcement of such statutes may be decidedly less so making it difficult to determine whether a reduction in foreign market access is due simply to random shocks or to the use of behind-the-border policies as hidden trade barriers.

There is of course a long literature on the design of trade agreements in the presence of

externality (which they counter with Pigouvian taxation). Lee (2007) shows that an efficient incentive-compatible agreement will allow the high-externality country to raise its tariff to counter its higher production tax (since otherwise it will have an incentive to pretend to be a low-externality country so as to set a lower tax as a form of disguised protection). Thus, efficient agreement might entail setting tariffs conditional on domestic policy choices.

asymmetric information. However, in the context of tariff agreements, the imperfect information is typically with respect to some privately observed random variable (e.g., a shock to the payoff function) which makes enforcing the agreement problematic. With respect to behind-the-border policies, the imperfect information is more likely to be about the government's actions itself (i.e., the foreign country's domestic policies are only imperfectly observed). Thus, there exists a small literature looking at the design of trade agreements when policy is private information. Not surprisingly, this literature typically focuses on the problems of enforcement with some of the earliest papers (Riezman, 1991, and Hungerford, 1991) focusing on the use of trigger strategies (e.g., conditioning punishment on trade volume) as a means of enforcing the agreement. However, some more recent papers have begun to focus on the WTO's role as a transmitter of information. For example, in Park (2011), governments privately observe a noisy signal about their trading partner's policies. This paper shows that a procedure (such as the WTO dispute settlement mechanism) that can transfer this information into public signals can help facilitate cooperation. Indeed, with respect to behind-the-border policies, a lot of WTO effort is simply put into cataloguing and measuring them.

For another example of this literature, see Bajona and Ederington (2008) which assumes both that domestic policy is unobservable (which means that a reduction in market access could be due to either unobserved trade shocks or the use of domestic policy for protection) and that the enforcement power of the international agreements is limited. With limited enforcement, the agreement must now be structured so that no country has an incentive to deviate from the agreement. Bajona and Ederington (2008) show that, under conditions of imperfect information, allowing countries full sovereignty in choosing *both* trade and domestic policy levels (subject to a negotiated level of market access) actually makes the agreement more difficult to enforce and thus limits the amount of cooperation that can be sustained. Thus, while the non-violation complaint system holds the promise of addressing race-to-the-bottom concerns while allowing countries greater sovereignty in the setting of policy, some important qualifications have been shown to arise when asymmetric or imperfect information is present and more research is needed in this area.

5. Other approaches to international coordination over NTMs

While most NTMs are dealt with using the rules-based procedures outlined in the previous section, the Uruguay round of WTO negotiations went further and established two additional agreements aimed at product standards: the WTO Agreement on Sanitary and Physo-sanitary Measures (SPS) which attempts to protect humans and the environment from pests and contaminants contained in food products and the WTO Agreement on Technical Barriers to Trade (TBT) which covers all other technical regulations and standards. Similarly, as seen in section 2, a growing number of PTAs include deep provisions. In particular, around 60 percent of enforced preferential agreements contains provisions on TBT/SPS measures (WTO, 2011). As discussed in Section 3.2.3, what makes product standards somewhat unique is that learning and adapting to the different standards of an export market is costly and thus the very multiplicity of product standards (and not just their level) can be a significant barrier to trade (coordination externalities). For example, a recent paper by Miravete et al. (2015) argues that different vehicle emissions policies in the U.S. and Europe led to drastically different adoption of diesel cars in the two regions. Specifically, U.S. emissions policy, which concentrated on combating acid rain, had very stringent nitrogen oxide (NO_x) standards which are difficult for diesel cars to meet, thus leading many European manufacturers to stop selling diesel cars in the U.S. market. In contrast, emissions policy in Europe primarily targets global warming and carbon dioxide emissions (CO₂) and the less stringent NO_x standards allowed for the proliferation of diesel varieties in the European market. Indeed, Miravete et al. (2015) estimate that the more lenient emission standards in Europe had results similar to an ad-valorem tariff of 20 percent in protecting the domestic market share of European (diesel) manufacturers. Thus, we can see how differential standards across regions can lead to vastly different patterns of both consumption and production of goods, thus potentially creating large impediments to trade. Typically, in dealing with such coordination externalities, two approaches are discussed: mutual recognition and harmonization.

5.1 Mutual recognition

As discussed previously, the WTO takes a shallow integration approach to product standards characterized primarily by the national treatment principle. In contrast, the European Union has taken a new (deeper integration) approach characterized by the Mutual Recognition

principle: that countries must agree to accept goods that lawfully meet the standards applied by other (member) countries. Obviously, this reduces firm adaption costs (since firms only have to meet the standard of their domestic country to have their product accepted in the export market), while also respecting heterogeneity of preferences (since each country has discretion in setting local standards and norms). In Costinot (2008) the existence of product standards is explained by either the existence of negative consumption externalities (e.g., pollution) or positive network externalities (where consumer utility is increasing in the compatibility of products). In either case, he shows that mutual recognition agreements could result in “under standardization” as governments do not take into account the benefits of product standards on foreign consumers. Thus, Costinot (2008) finds (somewhat paradoxically) that the deeper integration approach of mutual recognition will only be preferred to national treatment when these local externalities are small.

5.2 Harmonization

While mutual recognition has received a lot of attention as a deep integration approach that still respects country sovereignty, it should be apparent that it can result in an equilibrium involving a multiplicity of standards. Given high fixed costs to meeting product standards (i.e., the “conversion costs” of Gandal and Shy, 2001), the heterogeneity of product standards across countries can result in increased production costs for exporting firms. Likewise, in Toulemonde (2013) the multiplicity of standards allowed in mutual recognition agreements imposes costs on consumers as they are less informed about the characteristics of foreign products. Obviously, if learning and adapting to heterogeneous standards is costly, then an alternative (even deeper integration) approach of adopting a common standard (harmonization) can reduce costs and may increase trade between regions. Interestingly, despite extensive discussion of the potential trade benefits of harmonization in international law and policy, there is more discussion of harmonization in the public economics literature (i.e., the literature on fiscal federalism or centralization) than the trade literature. Based on the work of Oates (1972), the fiscal federalism literature argues that optimal amount of decentralization usually involves a trade-off between the severity of cross-border externalities and benefits of respecting heterogeneous local preferences. Indeed, while in the presence of coordination externalities, harmonization may significantly

reduce trade barriers, it obviously comes at the cost of reducing the ability of individual countries to establish their own standards and norms. Indeed, in an interesting recent paper Loeper (2011) argues that coordination to harmonize policy actually becomes less valuable as the severity of the *coordination* externalities increases. Intuitively, this is because local jurisdictions will unilaterally pursue policy harmonization, even in the absence of federalism or cooperation, if coordination externalities are sufficiently important. Thus, it seems potentially beneficial for future research on international cooperation to analyze such coordination externalities as distinguished from the pecuniary externalities that are typically addressed in the literature.

5.3 Empirics

It should be apparent from the previous discussion that, with respect to product standards, harmonization and mutual recognition agreements are primarily intended to facilitate trade between member countries. Indeed, several recent empirical papers have found this to be the case. This literature generally uses a gravity model to isolate the impact harmonization and mutual recognition on trade. Moenius (2004) finds that common standards have a positive impact on bilateral trade flows while Shepherd (2007) and Reyes (2011) show that harmonization increases both the extensive and intensive margins of trade. Similarly, Chen and Mattoo (2008) and WTO (2012) provide evidence in favor of both the trade-creating effect of harmonization and mutual recognition.

However, this raises the empirical question of whether international coordination on standards among some countries comes at the expenses of trade with others. In an interesting recent paper, Chen and Mattoo (2008) document the trade diverting effect of preferential cooperation on standards and find the effect to be somewhat asymmetric. Specifically, while harmonization agreements tend to reduce exports from non-participating countries, mutual recognition agreements increase trade for both members and non-members (unless, that is, they have stringent rules of origin criteria).

6. Conclusion

As suggested by the quote of Pascal Lamy at the outset of this paper, we may be moving from an old world of tariffs and protection of domestic producers to a new world of non-tariff measures

and protection of consumers. From a world of shallow trade agreements, designed to deal with terms of trade externalities, to a world of deeper agreements involving coordination over behind-the-border policies. However, more work remains to be done on the implications of global supply chains, imperfect information and commitment problems for the desirability of deeper agreements. In addition, international cooperation in the presence of coordination externalities and the potential benefits (and costs) of regulatory harmonization are an obvious area of importance for future research. Developing new and better data on NTMs appears as an essential step to further improve our understanding of the trade impact of non-tariff measures and, hence, how changing rules overseeing NTMs eventually affect social welfare.

Finally, while no formal model has so far shown this, one could conjecture, as Bagwell et al. (2015, fn 119) do, that the two worlds in Lamy's quote could be linked. The need for deep integration is likely the optimal development after terms-of-trade considerations have been removed from tariff choices (i.e., deep PTAs are the byproduct of GATT-like shallow integration). Indeed, Bagwell et al. (2015) note that, while the multilateral (single-undertaking) approach of the WTO was optimal for standard trade coordination involving terms-of-trade externalities, deeper international agreements aimed at commitment problems or coordination externalities might be better handled at a more disaggregate level under either a system of preferential or plurilateral trade agreements. While the world trading system appears to be moving already in this direction (e.g. Trans-Pacific Partnership, Transatlantic Trade and Investment Partnership), economic research is lagging behind. Addressing these questions will entail integrating the research on non-tariff measures (discussed in the chapter) with the literature on preferential trade agreements (discussed in chapter 14 of this handbook), particularly as little work has been done on the third-country effects of deep integration.

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Appendix Table 1: Table of conversion between the NTM classification used by data collecting agencies (UNCTAD, 2013) and the theory-based classification

Chapter	Chapter description	NTM code	NTM description	Classification
A	SPS measures	A000	Sanitary and phytosanitary measures	-
A	SPS measures	A100	Prohibitions/restrictions of imports for SPS reasons	-
A	SPS measures	A110	Temporary geographic prohibitions for SPS reasons	Product
A	SPS measures	A120	Geographical restrictions on eligibility	Product
A	SPS measures	A130	Systems Approach	Process
A	SPS measures	A140	Special Authorization requirement for SPS reasons	Customs
A	SPS measures	A150	Registration requirements for importers	Customs
A	SPS measures	A190	Prohibitions/restrictions of imports for SPS reasons n.e.s.	-
A	SPS measures	A200	Tolerance limits for residues and restricted use of substances	Process
A	SPS measures	A210	Tolerance limits for residues of or contamination by certain (non-microbiological) substances	Process

A	SPS measures	A220	Restricted use of certain substances in foods and feeds and their contact materials	Process
A	SPS measures	A300	Labelling, Marking and Packaging requirements	Process
A	SPS measures	A310	Labelling requirements	Process
A	SPS measures	A320	Marking requirements	Process
A	SPS measures	A330	Packaging requirements	Process
A	SPS measures	A400	Hygienic requirements	Process
A	SPS measures	A410	Microbiological criteria of the final product	Process
A	SPS measures	A420	Hygienic practices during production	Process
A	SPS measures	A490	Hygienic requirements n.e.s.	Process
A	SPS measures	A500	Treatment for elimination of plant and animal pests and disease-causing organisms in the final product (e.g. Post-harvest treatment)	Process
A	SPS measures	A510	Cold/heat treatment	Process
A	SPS measures	A520	Irradiation	Process
A	SPS measures	A530	Fumigation	Process
A	SPS measures	A590	Treatment for elimination of plant and animal pests and disease-causing organisms in the final product, n.e.s.	Process
A	SPS measures	A600	Other requirements on production or post-production processes	Process

A	SPS measures	A610	Plant growth processes	Process
A	SPS measures	A620	Animal raising or catching processes	Process
A	SPS measures	A630	Food and feed processing	Process
A	SPS measures	A640	Storage and transport conditions	Process
A	SPS measures	A690	Other requirements on production or post-production processes, n.e.s	Process
A	SPS measures	A800	Conformity assessment related to SPS	-
A	SPS measures	A810	Product registration requirement	Customs
A	SPS measures	A820	Testing requirement	Process
A	SPS measures	A830	Certification requirement	Customs
A	SPS measures	A840	Inspection requirement	Customs
A	SPS measures	A850	Traceability requirements	Customs
A	SPS measures	A851	Origin of materials and parts	Customs
A	SPS measures	A852	Processing history	Customs
A	SPS measures	A853	Distribution and location of products after delivery	Customs
A	SPS measures	A859	Traceability requirements, n.e.s.	Customs
A	SPS measures	A860	Quarantine requirement	Customs
A	SPS measures	A890	Conformity assessment related to SPS n.e.s.	Customs
A	SPS measures	A900	SPS measures n.e.s.	-

B	TBT	B000	Technical barriers to trade	-
B	TBT	B100	Prohibitions/restrictions of imports for objectives set out in the TBT agreement	-
B	TBT	B110	Prohibition for TBT reasons	Product
B	TBT	B140	Authorization requirement for TBT reasons	Customs
B	TBT	B150	Registration requirement for importers for TBT reasons	Customs
B	TBT	B190	Prohibitions/restrictions of imports for objectives set out in the TBT agreement, n.e.s.	-
B	TBT	B200	Tolerance limits for residues and restricted use of substances	Process
B	TBT	B210	Tolerance limits for residues of or contamination by certain substances	Process
B	TBT	B220	Restricted use of certain substances	Process
B	TBT	B300	Labelling, Marking and Packaging requirements	Process
B	TBT	B310	Labelling requirements	Process
B	TBT	B320	Marking requirements	Process
B	TBT	B330	Packaging requirements	Process
B	TBT	B400	Production or Post-Production requirements	Process
B	TBT	B410	TBT regulations on production processes	Process

B	TBT	B420	TBT regulations on transport and storage	Process
B	TBT	B490	Production or Post-Production requirements n.e.s.	Process
B	TBT	B600	Product identity requirement	Product
B	TBT	B700	Product quality or performance requirement	Product
B	TBT	B800	Conformity assessment related to TBT	-
B	TBT	B810	Product registration requirement	Customs
B	TBT	B820	Testing requirement	Process
B	TBT	B830	Certification requirement	Customs
B	TBT	B840	Inspection requirement	Customs
B	TBT	B850	Traceability information requirements	Customs
B	TBT	B851	Origin of materials and parts	Customs
B	TBT	B852	Processing history	Customs
B	TBT	B853	Distribution and location of products after delivery	Customs
B	TBT	B859	Traceability requirements, n.e.s.	Customs
B	TBT	B890	Conformity assessment related to TBT n.e.s.	Customs
B	TBT	B900	TBT Measures n.e.s.	-

C	Pre-shipment inspections and other formalities	C000	Pre-shipment inspection and other formalities	Customs
C	Pre-shipment inspections and other formalities	C100	Pre-shipment inspection	Customs
C	Pre-shipment inspections and other formalities	C200	Direct consignment requirement	Customs
C	Pre-shipment inspections and other formalities	C300	Requirement to pass through specified port of customs	Customs
C	Pre-shipment inspections and other formalities	C400	Import monitoring and surveillance requirements and other automatic licensing measures	Customs
C	Pre-shipment inspections and other formalities	C900	Other formalities, n.e.s.	Customs
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E000	Non-automatic licensing, quotas, prohibitions and quantity control measures other than for SPS or TBT reasons	-
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E100	Non-automatic import licensing procedures other than authorizations for SPS or TBT reasons	Customs

E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E110	Licensing for economic reasons	Customs
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E111	Licensing procedure with no specific ex-ante criteria	Customs
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E112	Licensing for specified use	Customs
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E113	Licensing linked with local production	Customs
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E119	Licensing for economic reasons n.e.s.	Customs

E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E120	Licensing for non-economic reasons	Customs
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E121	Licensing for religious, moral or cultural reasons	Customs
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E122	Licensing for political reasons	Customs
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E129	Licensing for non-economic reasons n.e.s.	Customs
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E210	Permanent	Product

E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E211	Global allocation	Product
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E212	Country allocation	Product
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E232	Country allocation	Product
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E300	Prohibitions other than for SPS and TBT reasons	Product
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E311	Full prohibition (import ban)	Product

E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E312	Seasonal prohibition	Product
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E313	Temporary prohibition, including suspension of issuance of licenses	Product
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E315	Prohibition of products infringing patents or other intellectual property rights	Product
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E316	Prohibition of used, repaired or remanufactured goods	Product
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E319	Prohibition for economic reasons, n.e.s.	Product

E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E320	Prohibition for non-economic reasons	Product
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E321	Prohibition for religious, moral or cultural reasons	Product
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E322	Prohibition for political reasons (embargo)	Product
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E329	Prohibition for non-economic reasons, n.e.s.	Product
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E600	Tariff Rate Quotas	-

E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E611	Global allocation	Consumer
E	Non-automatic licensing, quotas, prohibitions and quantity control measures other than SPS or TBT reasons	E900	Quantity control measures n.e.s.	Product
F	Price-control measures, including additional taxes and charges	F100	Administrative measures affecting customs value	-
F	Price-control measures, including additional taxes and charges	F110	Minimum import prices	Consumer
F	Price-control measures, including additional taxes and charges	F120	Reference prices	Consumer
F	Price-control measures, including additional taxes and charges	F190	Other administrative measures affecting the customs value, n.e.s.	-

F	Price-control measures, including additional taxes and charges	F300	Variable charges	Consumer
F	Price-control measures, including additional taxes and charges	F310	Variable levies	Consumer
F	Price-control measures, including additional taxes and charges	F400	Customs Surcharges	Customs
F	Price-control measures, including additional taxes and charges	F500	Seasonal duties	Consumer
F	Price-control measures, including additional taxes and charges	F600	Additional taxes and charges levied in connection to services provided by the Government	Customs
F	Price-control measures, including additional taxes and charges	F610	Custom inspection, processing and servicing fees	Customs
F	Price-control measures, including	F620	Merchandise handling or storing fees	Customs

	additional taxes and charges			
F	Price-control measures, including additional taxes and charges	F630	Tax on foreign exchange transactions	Customs
F	Price-control measures, including additional taxes and charges	F640	Stamp tax	Customs
F	Price-control measures, including additional taxes and charges	F650	Import license fee	Customs
F	Price-control measures, including additional taxes and charges	F670	Statistical tax	Customs
F	Price-control measures, including additional taxes and charges	F690	Additional charges n.e.s.	-
F	Price-control measures, including additional taxes and charges	F700	Internal taxes and charges levied on imports	Consumer
F	Price-control measures,	F710	Consumption taxes	Consumer

	including additional taxes and charges			
F	Price-control measures, including additional taxes and charges	F720	Excise taxes	Consumer
F	Price-control measures, including additional taxes and charges	F730	Taxes and charges for sensitive product categories	Consumer
F	Price-control measures, including additional taxes and charges	F790	Internal taxes and charges levied on imports n.e.s.	Consumer
F	Price-control measures, including additional taxes and charges	F800	Decreed Customs Valuations	Customs
F	Price-control measures, including additional taxes and charges	F900	Prince control measures n.e.s	-

Appendix Table 2: Trade effect of NTMs

<i>NTMs in General</i>		
Paper	Sector	Effect
Kee et al. (2009)	all	ad-valorem tariff equivalent (AVE) of 12 percent
Hoekman and Zarrouk (2009)		AVE of 6 percent
Hoekman and Nicita (2011)		reducing AVE of NTMs increases trade
Andriamananjara et al (2004)	apparel, leather shoes	different AVE of NTMS depending on countries and industries
Hoekman and Nicita (2008)	all	AVE of NTMS is higher than existing tariffs
Henn and McDonald (2011)	all	behind the border measures decreased trade more than border measures in the aftermath of the crisis
Carrere and De Melo (2011)	all	NTMs are more restrictive than corresponding tariffs, most of the AVE are between 25 and 50 percent, restrictiveness of technical regulations increases in income per capita
Ferrantino (2012)		NTMs are more relevant for goods with long supply chains
Bradford (2003)		AVE range between 12 and 57 percent
Essaji (2008)	agriculture, mining, manufacturing	technical regulations substantially impinge on poor countries' exports because of high costs of compliance
Francois et al. (2013)		comprehensive (i.e. including tariffs, procurement, NTBs) agreements bring significantly greater benefits to both economies
Li and Beghin (2012)	meta-analysis	effects TBT and SPS on agriculture and food are less likely to be positive than other sectors

Behind-the-Border NTMs

SPS		
Paper	Sector	Effect
Otsuki et al (2001)	food	negative effect of EU standards on aflatoxin on African exports

Wilson and Otsuki (2004)	bananas	negative effect of EU standards on chlorpyrifos on Latin America, Asia and Africa exports to OECD
Chen et al. (2008)	vegetables and fish	negative effect of regulation on pesticides on Chinese exports
Anders and Caswell (2009)	seafood	negative for developing, positive for developed
Schlueter et al. (2009)	meat	some SPS increase trade, some restrict trade
Crivelli and Groschl (2012)	all	SPS specific trade concerns have negative impact on probability to export, but positive on value
Gebrehiwet et al. (2007)	food	stringent SPS limit trade
Xiong and Beghin (2010)	groundnuts	change in maximum residues limit does not affect trade
Chen et al. (2008)	agriculture	food safety standards have negative effects on trade
Wilson et al. (2003)	beef	imports are lower in countries with more stringent standards
van Tongeren et al. (2010)	raw milk cheese, shrimps and flowers	less strict regulation creates gains for consumers, tighter inspections have negative effect
Melo et al. (2014)	fresh fruits	increase in stringency of SPS decreases export volumes
Wei et al. (2012)	tea	negative effects of Maximum Residual Limit on exports

TBT

Paper	Sector	Effect
Chen and Novy (2011)	all	TBT are the most relevant trade barrier among NTMs
Sithamparam and Devadason (2011)	all	negative for agricultural products, positive for industrial products
Chen (2004)		negative effect of TBT
Maskus et al. (2005)		standards increase short-run production costs by requiring additional inputs of labor and capital
Bao and Qiu (2012)		negative effect on extensive margin, positive effect on intensive margin

Bao and Chen (2013)	all	negative effect on the probability of trade, positive effect on volume and duration of trade
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Standards

Paper	Sector	Effect
Swann et al. (1996)	all	standards promote trade
Temple and Urga (1997)	all	effect of standards on trade is non-significant
Moenius (2004)	all	negative effect for non-manufacturing products, positive effect for manufacturing products
Blind (2001)	instruments for measurements and testing	positive effects of standards
Moenius (2006)	electrical products	positive effects of standards
Disdier et al. (2008b)	agriculture	negative effects of standards on agricultural products
Li and Beghin (2012)	all	negative effect on agriculture and food products
Disdier et al. (2008a)	all	negative effect on exports
Shepherd (2007)	all	increase of EU TBT/SPS measures is associated to decrease in product variety of export to EU
Chen et al. (2006)		negative effect on exports of developing countries to developed countries Senegal's exports increase after increase in sanitary requirements, shift from small to large-scale production
Maertens and Swinnen (2009)	vegetables	
Fassarella et al. (2011)	poultry	non-significant impact of TBT and SPS on exports
Fontagné et al. (2015)	all	SPS discourage exports both intensive and extensive, effect is reduced for big firms
Czubala et a./ (2009)	textiles and clothing	EU-specific standards damage African exports while international standards are less restrictive
Wong (2007)	bananas and pineapples	negative effect of TBT and SPS for small firms
Herzfeld et al. (2011)	agriculture	third-party certification for export purposes seems to reinforce already existing trade relations, potentially hampering new entrants

Beghin et al. (2012)	shrimp	negative effect on trade, positive effect on welfare
Mangelsdorf et al. (2012)	food	standards have a positive effect on export because they signal conformity to quality measures

Environmental standards

Paper	Sector	Effect
Fontagné et al(2005)	all	positive effect on manufacturing, negative for food products
Jaffe et al. (1995)	manufacturing	no evidence of effect of differences in environmental regulations
Ederington et al. (2005)		stronger effect on trade between developed and developing than among developed
van Beers and van den Bergh (1997)		negative effect for pollution-intensive sectors that are resource-based

Harmonization / Mutual Recognition

Paper	Sector	Effect
Reyes (2011)	electronics	harmonization of standards to international norms increases firm entry
Moenius (2004)	all	common standards increase bilateral trade
Clougherty and Grajek (2008)	all	conformity of standard to international norms increase exports of developing to developed countries
Grajek (2004)	all	non-significant trade effect of conformity of standard to international norms
Vancauteran and Weiserbs (2005)	all	harmonization has positive effects on exports
Shepherd (2007)	textiles, clothing and footwear	harmonization positive effects on the extensive margin
Chen and Mattoo (2008)		harmonization increases exports from developed countries but decreases exports from developing countries, mutual recognition increases trade within region but diverts trade in presence of severe rules of origin

Dissanayaka et al. (2001)		common standards lower information costs mutual recognition increases extensive and intensive margin of trade but harmonization has ambiguous trade effects
Baller (2007)		
De Frahan and Vancauteran (2006)	food	harmonization has positive effect on exports
Disdier et al. (2014)	all	positive trade effect of harmonization but negative impact on third parties
Gervais et al. (2011)	pork and beef	differences in standards have negative effect on trade
Portugal-Perez et al. (2010)	electronics	standards harmonized to international standards have a positive net effect on trade

State Trading Enterprises (STEs)

Paper	Sector	Effect
McCorrison and MacLaren (2005a)		STEs can distort trade
McCorrison and MacLaren (2005b)	wheat	effects of STEs can be equivalent to export subsidy or export tax
McCorrison and MacLaren (2007)	wheat and cereals, oils and food	Canadian wheat board is equivalent to an implicit export subsidy
Cadot et al. (2009)	vanilla	elimination of Marketing Board induce increase in income for producers and decrease in poverty

NTMs Targeting Imports

Import ban

Paper	Sector	Effect
James and Anderson (1998)	bananas	removal of ban on imports increases benefit of consumers
Leroux and Maclaren (2011)	bananas	delaying the lift of import ban can be beneficial
Peterson et al. (2004)	avocados	removing ban decreases local production and price but increases imports
Felt et al. (2010)	pork	ban on Taiwan, China's exports made the U.S. demand more inelastic and reinforced its market power

Nicita (2008)	poultry	ban accelerated transition to production and export of higher value added products
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Pre-shipment inspections

Paper	Sector	Effect
Anson et al. (2006)	all	inspections do not necessarily increase tariff revenue collection or reduce fraud
Yeats (1991)	all	inspections fail to reduce excessive import price customs delays have a significant negative impact on firms' exports
Volpe Martincus et al. (2015)	all	lower probability of inspection increases imports
Fernandes et al. (2015)	all	

Rules of origin (RoO)

Paper	Sector	Effect
Cadot and De Melo (2008)	all	rules of origin induce inefficient sources of intermediate goods, they reduce preferential market access margins
Brenton and Ozden (2005)	textile and apparel	different rules of origin segment export markets strict RoO reduce extensive and intensive margin of exports
De Melo and Portugal-Perez (2008)	apparel	documentation processes, registration and controls at customs are reported to constrain exports and increase costs
Khanal (2011)	carpets, pashmina, handicrafts and tea	

NTMs Targeting Exports

Export restrictions

Paper	Sector	Effect
Piermartini (2004)	all	export taxes encourage inefficient allocation of resources, production, consumption

Korinek and Kim (2010)	molybdenum, chromite, rare earths	no evidence that export restrictions reduce production of molybdenum, export tax on chromite diverted imports to countries not subject to tax
Nogues (2008)	agriculture	elimination of export barriers increase GDP and employment
Deese and Reeder (2008)	soybean	burden of export tax paid by local and foreign consumers
Martin and Anderson (2011)	rice and wheat	export restrictions in rice and wheat increase world prices of these commodities, contributing to volatility
Giordani et al. (2014)	food	export restrictions in food markets interact with import promotion, contributing to world price volatility
