Non-tariff Measures: What's Tariffs Got to Do with It?

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Abstract

After successive rounds of tariff reductions by GATT/WTO members, non-tariff measures (NTMs) have increasingly become the focal point of multilateral trade negotiations. It remains an open question whether the liberalization in tariff rates has subsequently been weakened or even erased by increases in NTMs. Using a product-level global panel of WTO members over the period 1996-2019, this paper systematically examines the empirical link between various tariff measures and the imposition of NTMs. I find that bound or applied tariff reductions do not correlate much on their own with NTM incidence. The relevant trade policy margin for detecting a tariff-NTM nexus is instead tariff overhangs, the difference between WTO members' bound and applied tariff rates. Countries impose more NTMs when their sectoral applied tariffs are close to their respective bound rates, indicating that small tariff overhangs signal limited legal trade policy flexibility.

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1 Introduction

Tariff reductions of GATT/WTO members over the years have made non-tariff measures (NTMs) increasingly the main focus of multilateral trade negotiations. The question remains to what extent countries' tendency towards lower tariffs truly reflects a general liberalization motive. It is a common notion in policy circles and the trade policy literature that negotiated tariff reductions might subsequently be weakened or even erased by increases in NTMs. However, existing studies on this question offer ambiguous results.[1] Due to data constraints, most analyses consider a small number of countries and/or have no panel dimension, which limits the ability to control for confounding factors. Moreover, the theoretical literature offers no clear guidance on the relevant trade policy margin for which a tariff-NTM nexus should be observed.

This paper examines the empirical relevance of various tariff measures for the imposition of NTMs. My analysis uncovers that sectoral tariff overhangs, the difference between WTO members' bound and applied tariff rates, is the relevant margin to detect a NTM-tariff tradeoff. At the same time, there is little evidence that reductions in applied or bound tariffs are significantly linked on their own to NTM actions. Instead, I find that countries tend to impose more NTMs when their sectoral applied tariffs are close to their respective bound rates. A country's tariff overhang is an indicator of a country's legal trade policy flexibility. If NTMs are primarily used to substitute for tariff protection, then WTO members with small tariff overhangs will feel a stronger urge to use alternative instruments to inhibit imports from abroad. Focusing on WTO-notified sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBT) as NTM activity proxy, Figure 1 offers preliminary (and unconditional) evidence for this channel. Panel a) shows that HS 4-digit products with a zero tariff overhang are about twice as likely to witness NTM actions in the subsequent year than products with a tariff overhang of 10 percent or more. Panel b) presents a similar pattern when considering the average count of new NTM measures across products.

Theoretical backing for the observed link between tariff overhangs and NTM actions is provided by Beshkar and Bond (2017) who show that higher tariff bindings and contingent protection measures, such as antidumping tariffs, are both means to provide WTO members with desired trade policy flexibility. A similar argument applies to non-tariff measures.[2] Constraining WTO members' trade policy flexibility through tighter tariff overhangs implies that they will explore

[1] Section 2 reviews this literature in detail.

[2] In Appendix A, I provide a modified version of the cap-and-escape framework in Beshkar and Bond (2017) to theoretically motivate the inverse relationship between tariff overhangs and NTMs.

alternative avenues like NTMs to protect sensitive sectors. In Beshkar and Bond (2017), variations in tariff overhangs naturally emerge across sectors due to the presence of non-observable time-varying political pressure that countries face. To the extent that NTMs are more difficult to regulate than tariffs, my paper strongly suggests that tariff overhangs and alternative protection measures are indeed substitutes to exploit flexibility in trade agreements.

A major hurdle to examining the nexus between tariffs and NTMs is the lack of detailed and complete sectoral NTM data for many countries and years.[3] I therefore focus in this study on the specific NTM category of SPS and TBT regulations that has been tracked by the WTO since its founding in 1995.[4] A couple of existing studies use portions of this data to examine the relation between tariffs and NTMs. Beverelli et al. (2019) focus on the subset of TBT notifications at the HS 4-digit level that subsequently are subject to recorded concerns by other WTO member countries. They find that TBT concerns are more frequent after applied tariff reductions, in particular in OECD countries. Considering products at the HS 2-digit level, Aisbett and Silberberger (2021) argue instead that bound tariff reductions lead to more SPS notifications of members to the relevant WTO committees, independent of any subsequent concerns by other countries. However, these papers make no attempt to distinguish theoretically or empirically between tariffs and tariff overhangs, and why this issue could be important. Moreover, the literature has yet to use the full available sample of SPS/TBT activity in searching for a link between tariffs and NTMs.

My paper fills these gaps. First, using a sample of 65 WTO members over the period 1996-2019 at the 4-digit HS level (about 1,200 products), I systematically examine and contrast the interlinkages of different tariff measures with NTM incidence. My baseline sample exceeds those in previous studies of SPS/TBT determinants by a factor of 20 to 50 times. Second, by focusing simultaneously on SPS and TBT activity, I analyze the tariff-NTM nexus using both (i) self-reported notifications by WTO members and (ii) the subsequently recorded concerns by other countries. I find a negative correlation between NTM notifications and tariff overhangs, which is robust to alternative empirical approaches, different subsamples, various NTM determinants suggested in the literature, and extensive fixed effects controls for unobservables.

[3] A notable exception is the NTM Hub created by UNCTAD, which collects and disseminates data on various trade-inhibiting measures besides tariffs. However, this data is not available at an annual frequency for most countries and does not go back as far as the WTO data sources I rely on. For more details, see https://unctad.org/en/Pages/DITC/Trade-Analysis/Non-Tariff-Measures.aspx.

[4] Grübler and Reiter (2020) compile an NTM dataset that combines SPS/TBT notifications to the WTO with information on temporary trade barriers from Bown (2016). I control for the effects of temporary trade barriers below.

More broadly, my paper adds to the literature on the determinants of NTM incidence, which emphasizes mostly import competition and political economy factors. Focusing on the US, Ray (1981) presents evidence that NTMs are concentrated in sectors with a comparative disadvantage and away from products with large potential welfare losses for consumers. Trefler (1993) similarly finds that increases in import penetration and private influence groups, in particular businesses, are critical drivers of sectoral NTMs in the US. Bagwell and Staiger (1990) note that countries have a greater incentive to implement special protection when import volumes surge, a prediction that is empirically confirmed for the US by Bown and Crowley (2013a). Goldberg and Maggi (1999) emphasize that the positive correlation between import penetration and NTMs is driven by unorganized sectors, whereas the opposite holds for politically organized industries. In the cross-country context, Lee and Swagel (1997) observe NTMs to be more frequent in sectors deemed to be politically important or subject to foreign competition. Mansfield and Busch (1995) in their analysis of cross-national NTM determinants emphasize the importance of political economy factors as well, in particular in the form of economic size and domestic institutions.

The results in my paper have important policy implications. New tariff liberalization commitments at the WTO are likely to be associated with protectionist backsliding by increasing the usage of other policy instruments, such as NTMs, but only when they reduce tariff overhangs.[5] Hence, in order to evaluate the WTO's actual success in removing trade barriers over time, a more holistic approach is needed than a sole focus on tariff reductions. The negative correlation between tariff overhangs and NTMs that I document suggests policy makers choose from a menu of trade policies to achieve their desired level of import barriers. To limit hidden protection through NTMs, WTO members can take two immediate steps. First, to more accurately evaluate the state of trade protection, member countries need to report NTMs fully and in a more timely fashion. Second, to incentivize reporting and discourage illegal measures, the WTO's dispute settlement mechanism needs to return to full working order, including its appeal and implementation stages.

The next section examines the theoretical linkages between NTMs and tariffs suggested in the literature and the associated empirical evidence. Section 3 discusses the empirical model and the necessary data. Section 4 presents the empirical evidence linking countries' self-reported NTM notifications to different tariff measures, and section 5 considers extensions to the baseline framework. Section 6 focuses on NTM concerns reported by other WTO members. Section 7 concludes.

[5] More specifically, only when a product's bound tariff is cut more than its applied tariff, the overhang will shrink and incentivize the usage of more NTMs.

2 Non-tariff Measures as Trade Policy Instrument

Overall, there are two major takeaways from the existing literature. First, from a theoretical perspective tariffs and NTMs can be either substitutes or complements. We are therefore dealing with an inherently empirical question. Second, identifying any association between regular tariff instruments and NTMs might depend crucially on the exact measurement of the relevant tariff margin.

Baldwin (1984) in his review of the early work on the topic argues that the application of NTMs has risen over time as countries have successfully negotiated down tariff rates in successive multilateral trade negotiations. A number of subsequent theoretical papers attempt to explain this phenomenon. Copeland (1990) shows that governments will gravitate towards the usage of NTMs due to loopholes in trade agreements that mostly focus on tariff instruments. These loopholes can arise, for instance, due to uncertainty and asymmetric information (Hungerford 1991). Governments might be particularly inclined to use NTMs after agreeing to multilateral tariff reductions if special interest groups hold some sway over them (Yu 2000 and Limão and Tovar 2011).

Since then, a number of empirical studies have offered support for this substitution effect between tariffs and NTMs. Focusing on NTM coverage ratios, i.e., the share of products by industry that are protected by an NTM, Broda et al. (2008) note that the US implements greater protection, in the form of higher tariffs or more NTMs, in sectors in which it has more market power.[6] Looking beyond the US and other advanced economies, Kee et al. (2009) estimate ad-valorem equivalents of NTMs for 78 countries at the tariff line level using data available in TRAINS and other sources from the early 2000s. When regressing product-line tariffs on their NTM tariff equivalents, Kee et al. find somewhat mixed results. Whereas tariffs and agricultural support measures are used in a complementary fashion, other NTMs seem to substitute for border taxes. Their estimates also indicate a stronger substitution effect for developed economies who tend to apply more restrictive NTMs while having lower tariffs.[7]

There is, however, also a large strand of the theoretical trade policy literature that argues tariffs and NTMs are, at best, imperfect substitutes or even complementary policy tools. For instance,

[6] Broda et al. (2008) find the same to be true when using instead the ad valorem equivalents of NTMs compiled by Kee et al. (2009).

[7] Niu et al. (2020) apply Kee et al.'s approach in a panel context for 3-year averages between 2003 and 2015. They find a substitution effect between NTMs and tariffs but do not differentiate between agricultural support measures and other NTMs. More broadly, Niu et al.'s approach differs from the present paper as they do not consider actual SPS/TBT measures and focus purely on applied tariffs.

Maggi and Rodríguez-Clare (2000) show that whether a tariff or a quota is the optimal protection instrument for a given sector depends to a large extent on political economy considerations. Anderson and Schmitt (2003) emphasize instead the role of trade costs and the shape of the government's welfare function in determining the optimal trade policy tool.[8] In practice, the choice of the means of import protection is, of course, often not as clean-cut as tariffs and NTMs are frequently applied in tandem. Focusing on a more specific kind of NTM, Falvey and Reed (2002) show that rules of origin can be applied in a complementary fashion to tariffs to raise the importing country's welfare. Specifically, rules of origin allow importers to actively target the input composition of domestic production to improve their terms of trade.

In line with this argument, several empirical papers highlight the possibility that countries have an incentive to implement NTMs along with tariffs. Focusing on the trade impacts of US NTMs in manufacturing in 1983, Trefler (1993) notes that tariffs and sectoral NTM coverage ratios are positively correlated across industries. Using data on NTM coverage ratios for 41 advanced and developing countries in 1988, Lee and Swagel (1997) similarly find that NTMs are used in combination with tariffs rather than as substitutes. Focusing on the Colombian trade reforms from 1985 to 1994, Goldberg and Pavcnik (2005) show that tariff reductions went hand in hand with decreases in NTMs. Analyzing the effects of NTMs for 60 countries and 4 sectors, Dean et al. (2009) also find a complementary effect as NTMs are more likely to be applied when tariffs are higher. In the context of China's WTO accession, Imbruno (2016) as well provides evidence that NTMs in the form of import licenses were applied in combination with tariff protection.

A growing part of the literature focuses on the relationship between MFN tariffs and temporary protection tools in the form of antidumping (AD) measures, safeguard (SG) tariffs, and countervailing duties (CVD). Although these instruments constitute additional import duties, their application differs substantially from regular MFN tariffs as their level is usually much greater. Moreover, AD, SG, and CVD measures can target specific countries and products. Focusing on WTO bound tariffs after the Uruguay Round, Feinberg and Reynolds (2007) find that AD activity increases for products with greater tariff cuts, but only in developing economies. Moore and Zanardi (2011) instead consider changes in MFN applied tariffs over the same period and report a substitution effect between AD measures and tariff reductions, but only for the small subset of emerging economies that most frequently use them. Focusing on product level data for India and the EU, respectively, Bown

[8] Additional papers considering this question are Cassing and Hillman (1985), Mayer and Riezman (1987), Hillman and Ursprung (1988), Rosendorff (1996a,b), and Feenstra and Lewis (1991).

and Tovar (2011) and Ketterer (2016) also estimate a positive effect of tariff cuts on subsequent AD, SG and CVD activity.

Interestingly, the recent temporary protection literature points out that tariff cuts alone are not necessarily the relevant margin for countries to implement AD, SG and CVD measures. Focusing on the country level in 13 developing economies, Bown and Crowley (2014) note that a country's share of product with MFN applied tariffs close to their WTO-imposed tariff bounds is positively associated with the application of more AD, SG and CVD measures.[9] Beshkar and Bond (2016) also provide evidence that safeguard actions are more common in countries with lower tariff overhangs. However, these papers do not provide product level evidence on the link between tariff overhangs and the application of temporary protection. Focusing on HS 6-digit products in a sample of 30 WTO member countries over the period 1996-2014, Kuenzel (2020) finds strong support for a substitution effect between tariff overhangs and the application of AD, SG and CVD instruments, but no effect of tariff cuts (applied or bound) on their own. Importantly, none of these papers considers the link between tariff overhangs and SPS/TBT measures.

3 Data and Empirical Model

Non-tariff measures can take many forms and shapes. For the purposes of the empirical analysis in this paper, I focus on countries' imposition of sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBT).[10] Given the existing NTM data constraints, many of the studies cited in section 2 use cross-section data, which limit the extent of controls that can be included compared to a panel context. Some headway has recently been made to capture a broader set of NTMs over the years, but the country and time coverage of SPS and TBT measures is unrivaled. SPS measures capture regulations related to food safety, territorial and human protection against pests and diseases, animal health, and plant protection. TBT rules focus instead on technical regulations and standards that products have to meet. Apart from their advantage in terms of data availability, SPS and TBT measures deserve particular attention on their own as these regulations can substantially affect public welfare. At the same time, they are prone to be misused for protectionist purposes. Identifying a substitution effect between tariff instruments and SPS/TBT measures would

[9] The same measure is not significant in a sample of five advanced economies; see Bown and Crowley (2013b).

[10] Note that based on the WTO's National Treatment principle, domestic products have to be subject to exactly the same regulations. However, governments can design these rules in such a way that they favor domestic industries' current production practices.

suggest that current WTO rules are not effective in preventing the latter.

3.1 Data

To examine the relationship between non-tariff measures and tariffs, I combine information from three different data sources. Data on non-tariff measures comes from two WTO databases, the SPS and TBT Information Managements Systems (IMS). These WTO databases provide detailed country- and sector-specific information on new regulations (and changes thereof) that exporters have to fulfill in order to move their goods into the country in question. The content in these databases relies on self-reported information by each WTO member as required by the WTO agreements on SPS and TBT measures. One concern for the empirical analysis might be that WTO members underreport the extent of their own regulations. The estimates reported below should therefore be interpreted as a lower bound of the link between tariffs and NTMs. However, to incentivize the self-notification of regulations, the WTO allows its members to officially register concerns regarding other countries' SPS and TBT measures in the relevant WTO committees if they run counter to an importer's commitments or have not been officially notified. Section 6 below provides more details on these NTM concerns and how they relate to the frequency of NTM notifications and tariffs.

WTO members can choose at which level of detail they report their NTM notifications. In the raw data, the most common reporting level is HS 4-digit, followed by HS 6-digit and HS 2-digit.[11] The empirical analysis below therefore focuses on the HS 4-digit level, by aggregating the 6-digit notifications to the 4-digit level and distributing the 2-digit notifications across all affected 4-digit sectors. Appendix B provides a detailed discussion about the construction of the dataset and the sources of all key variables. Note that the baseline results below are similar when excluding notifications at the HS 2-digit level (see Table C1 in Appendix C). The third data source is the World Banks' TRAINS database, which provides average MFN bound and applied tariff data at the HS 4-digit level. I use this tariff data to construct both the tariff overhang variable and various measures of tariff changes, which will be at the core of the empirical analysis below.

The final sample constitutes the overlap between the NTM notification and tariff data. The dataset includes 65 countries and 919,622 observations at the importer-HS4-year level over the period 1996-2019. The left panel of Table 1 provides an overview of NTM notification counts by country in the full sample, which are further broken down into their respective SPS and TBT

[11] Over the sample period, 1996-2019, the detailed reporting level breakdown in the raw combined SPS and TBT data is: 2-digit – 11.2%, 4-digit – 48.9%, 6-digit – 40.0%.

composition. NTM activity varies widely across WTO members. The US, Brazil, the EU, Japan and China are the most frequent users of SPS and TBT measures with more than 4,000 NTM notifications each. The least active countries in terms of NTM usage in the sample are Tanzania, Burundi, Belize, Trinidad and Tobago, Mongolia and Barbados with fewer than 50 NTMs each.[12] In the full sample, there are 72,515 NTM notifications at the HS 4-digit level, which are distributed across 50,930 observations, indicating that countries frequently notify multiple NTMs in the same 4-digit HS sector and year. Table 2 provides an overview of the distribution of the non-zero NTM counts. Although the majority of HS 4-digit sectors with a positive NTM count in the sample is subject to only a single new notification in a given year, about a quarter (25.6%) witnesses two or more new non-tariff measures. The maximum number of NTMs imposed by an importer for a given HS 4-digit sector and year is 26.[13] For 21 countries in the sample, TBT notifications account for the majority of their NTMs, whereas SPS notifications take the lead for the other 44 countries.

The right panel in Table 1 shows the distribution of sectoral tariff overhangs for all 65 countries. The tariff overhang categories were chosen to provide an approximately even four-way split of the sample. Similar to the distribution of NTMs, there is substantial variation in terms of tariff overhang space across the 65 countries. Six countries (China, EU, Hong Kong, Japan, Switzerland, US) have mostly low tariff overhangs, with over 80 percent of their HS 4-digit sectors featuring applied tariff rates at or above the respective bound rate. Note that applied tariffs can exceed bound tariffs for at least three reasons: 1. No bindings are set for certain sub-sectors (which can bias the 4-digit average bound rate), 2. phase-in periods after newly negotiated bound tariff rates, and 3. the presence of non-tariff barriers in the tariff averaging procedure in TRAINS. I show below that the results are robust to controlling for these issues. 21 out of 65 countries in the sample have tariff overhangs that exceed 25 percent for over half of their products, among them Colombia, India and Indonesia. Half of the countries in the sample fall between these two extremes, with more than 50 percent of their import sectors featuring tariff overhangs between 0 and 25 percent. The mean sectoral tariff overhang in the sample is 15.12 percent.

In addition to tariff overhangs, the analysis below examines the relationship between tariff levels (bound and applied) as well as their changes with NTMs, which are again obtained and computed using the TRAINS data. Most specifications also include different sectoral import and PTA controls.

[12] Table C2 in Appendix C shows that the results below are robust to excluding a wide range of countries from the sample based on their NTM counts.

[13] The results below are similar when excluding high-count sectors. Detailed estimates are available upon request.

HS 4-digit trade data is sourced from UN Comtrade, whereas information on bilateral PTAs over time comes from the updated datasets of de Sousa (2012) and Egger and Larch (2008). Table 3 provides detailed summary statistics, definitions and data sources for all variables used in the analysis.

3.2 Empirical Model

The variable of interest, NTM notification counts, varies by importer, year and sector, and the empirical analysis therefore focuses on this level. As the dependent variable is a count measure, see Table 2, the primary estimation approach will rely on Poisson pseudo maximum likelihood (PPML) regressions. Due to the non-linear nature of PPML, the presence of many fixed effects might subject the estimation to the incidental parameters problem (Cameron and Trivedi 2005).[14] To rule out this possibility, I also report in Appendix C and briefly discuss below the estimates from a linear fixed effects model.

To test whether tariff overhangs are related to the implementation of NTM measures, I estimate the following baseline model:

$$NTM_{ict} = \beta Overhang_{ic,t-1} + \gamma Z_{ic,t-1} + \eta_s + \omega_{ct} + \epsilon_{ict} \quad (1)$$

where NTM_{ict} is a count variable that indicates how many non-tariff measures country c notifies to the relevant WTO committees in the HS 4-digit sector i in year t. The NTM count variable is comprised of the sum of both SPS and TBT measures. The sectoral tariff overhang variable in specification (1) is the difference between the MFN bound and applied tariffs at the 4-digit HS level:

$$Overhang_{ic,t-1} = BoundTariff_{ic,t-1} - AppliedTariff_{ic,t-1} \quad . \quad (2)$$

If a lower tariff overhang is associated with more protectionist NTM actions, we should observe $\beta < 0$. In this case, a low tariff overhang constraints a country's options to satisfy protectionist pressures by raising its applied tariff. SPS and TBT measures can then offer an escape valve to implement the desired protection level. Conversely, if tariff and non-tariff measures work as complements rather than substitutes, β will be positive or statistically not different from zero.[15]

[14] Fernández-Val and Weidner (2016) and Weidner and Zylkin (2020) examine the properties of the PPML estimator in settings with many fixed effects. While PPML estimates are consistent even in the small T context, asymptotic confidence intervals might not be correctly centered at the true point estimates.

[15] I use a continuous tariff overhang measure in equation (1) to examine the relation between the magnitude of trade

The empirical model in equation (1) includes one-year lagged values of all independent variables to account for potential information delays.[16] In addition, one might be concerned about potential reverse causality issues when focusing on tariffs and NTM notifications from the same period as countries might be more inclined to lower tariffs during periods of increased NTM activity. The vector $Z_{ic,t-1}$ accounts for a number of control variables that could drive NTM incidence and might be correlated with a country's tariff overhang, most importantly applied and bound tariff changes. Vector Z also captures several trade-related measures that are considered to be determinants of tariff overhangs (Beshkar et al. 2015) and/or NTMs themselves. First, countries with more market power have an incentive to implement more trade-inhibiting NTMs and set higher tariffs. To rule out that the tariff overhang coefficient is actually driven by market power considerations, I include in the model a country's sectoral imports in a given year (in logs), $\log(\text{Imports})_{ict}$, and the sectoral share in world imports (in logs), $\log(\text{WorldImportShare})_{ict}$. Moreover, as emphasized by Beshkar et al. (2015), countries that receive a greater share of their imports from PTA partners might be less willing to grant multilateral tariff concessions, which could induce a tighter tariff overhang, and apply additional protection through NTMs. To avoid overstating the empirical link between overhangs and NTMs, I account for the sectoral share of imports from a country's preferential trade agreement partners, $\text{PTAImportShare}_{ict}$. Additional variables that will be included in vector Z are discussed in passing below.

Finally, the empirical model in (1) includes HS 2-digit level fixed effects, η_s, to account for industry-specific regulation patterns. For instance, as I will discuss in more detail below, food items are much more likely to be subject to SPS measures but less so to TBT regulations. Including HS 2-digit fixed effects ensures that the estimation does not assign any effect to tariff overhangs that is actually driven by product characteristics. All specifications also include country-year fixed effects, ω_{ct}, to control for country-level NTM patterns. For instance, certain governments could be willing to introduce more NTMs because their domestic firms face lower compliance costs than foreign firms. At the same time, business cycles might play a more important role for NTM decisions in some countries but less so in others. I also explore below how sensitive the results are to the inclusion of a more restrictive HS 4-digit x country and year fixed effects structure, which purely exploits within-country-product variation over time to identify the estimates.

policy space and the usage of non-tariff measures. Table C3 in Online Appendix C reports results when using instead two binary variables capturing the tariff overhang magnitude: (i) 0% tariff overhang or less, and (ii) 0 to 25% tariff overhang. The results are qualitatively similar.

[16] The estimates are similar when using a contemporaneous specification. Detailed results are available upon request.

4 Results

In this section, I present the baseline estimates of the empirical model in equation (1). Due to the count data nature of SPS and TBT notifications, I report panel PPML estimates throughout. In Appendix C, I also provide OLS results to examine the robustness of the PPML findings.

4.1 Baseline Results

Table 4 shows average marginal effect estimates from PPML regressions of the NTM count measure, which is the sum of SPS and TBT notifications, on the sectoral tariff overhang and additional control variables. Other tariff measures, in particular bound and applied tariff levels as well as changes thereof, are added subsequently. Standard errors are clustered throughout at the country/2-digit HS level and are reported in parentheses, which accounts for NTM and tariff choices that are correlated over time within country x 2-digit HS level product groups.[17]

Column (1) in Table 4 regresses the HS 4-digit NTM count on the sectoral tariff overhang as well as a comprehensive set of country-year and HS 2-digit industry fixed effects. The average marginal effect of the tariff overhang is negative and statistically significant at the one percent level, implying that a greater tariff overhang is associated with fewer notified NTMs to the WTO. Hence, tariff overhangs and NTMs appear to be substitutes. The estimated marginal effect of -.0400 indicates that, on average, an increase in the sectoral tariff overhang from 0 to 25 percentage points, which corresponds to a switch from the 25th to the 75th percentile in the data, is linked to a decrease in the sectoral NTM count of .01 ($= .25 \times .04$). Given that the mean of the NTM count variable is 0.0789 in the specification (1) sample, this effect is not only statistically but also economically very significant. Put differently, we can expect a country with a 25 percentage point tariff overhang across all of its 1,200 HS 4-digit sectors to notify 12 fewer ($= .01 \times 1,200$) NTMs in a given year compared to a country with zero percentage point tariff overhangs across all its product lines. To the extent that SPS and TBT measures are trade facilitating instead of inhibiting, these estimate provide a floor for the impact of tariff overhangs on NTM usage. However, a large literature shows that SPS and TBT measures have mostly trade-hindering effects, which supports the notion that these regulations are barriers to trade rather than facilitators of additional imports.[18]

[17] I also estimated the model using clustering at the country x 4-digit HS level. The general results pattern prevails in that case as the estimates become more precise. Detailed results are available on request.

[18] Disdier et al. (2012) find that SPS and TBT measures significantly reduce developing countries' agricultural exports to European countries, whereas Bao and Qiu (2012) note a negative impact of TBT notifications on the extensive margin of trade.

Column (2) in Table 4 accounts for the additional trade controls discussed above: log(Imports), PTAImportShare, and log(WorldImportShare). Three results emerge. First, the negative correlation between tariff overhangs and NTM notifications remains stable and statistically significant at the one percent level. Second, a greater amount of sectoral imports, log(Imports), has a significant positive effect (at the one percent level) on a country's NTM notifications. This finding indicates that governments tend to implement more import protection when domestic firms face increased competition from abroad. Lastly, the log(WorldImportShare) is linked negatively to the NTM incidence count, an effect that is statistically significant at the one percent level. This result might seem puzzling at first as trade theory predicts an inverse relation between the sectoral world import share and the foreign export supply elasticity that a country faces. We should then expect a country's protection level, e.g., via NTMs, to increase with the world import share. However, part of this market power effect is already picked up by the log(Imports) measure. When excluding the sectoral import variable in specification (3), the log(WorldImportShare) coefficient indeed turns positive, an effect that is again statistically significant at the one percent level.

In specifications (2) and (3), the PTAImportShare variable on its own has no statistically significant link with NTM notifications. Column (4) in Table 4 examines the impact of the PTA import share further by introducing an interaction of this measure with the tariff overhang. On the one hand, the tariff overhang channel could be less relevant when most imports are sourced from PTA partners for which MFN tariffs do not apply. On the other hand, due to the lack of legal alternative policy options, NTM measures might be even more attractive when a country faces both a low tariff overhang and substantial imports from PTA partners in a given sector. The interaction coefficient turns out to be negative and significant at the one percent level, indicating that the latter channel dominates. Countries are more likely to impose NTMs when they both have a lower tariff overhang and a higher PTA import share. Note that column (4) reports composite effects for both the Overhang and PTAImportShare variables, evaluated at the respective sample mean of the other variable. The tariff overhang effect remains negative and significant at the one percent level, even when accounting for its potential dependence on trade shares of preferential partner countries.

Specifications (5) and (6) in Table 4 examine to what extent the tariff overhang estimate differs by SPS and TBT measures. Column (5) focuses on the sectoral count of TBT notifications, whereas specification (6) considers the number of SPS notifications. Note that the sample shrinks in both cases compared to the NTM count specifications in columns (1) to (4) because the PPML estimator requires to drop all observations that are perfectly predicted by the included fixed effects.

Specifically, the SPS and TBT specifications will omit observations from the full sample in case there is no variation in the dependent variable at the country-year or HS 2-digit fixed effects levels. For instance, if a WTO member in a given year only notified TBT but no SPS measures, then the SPS specification in column (6) will drop all observations of that country for the year in question. Two results emerge from the SPS and TBT regressions. First, as in the NTM sample, the overhang coefficient is negative in both cases. Second, the negative effect is only statistically significant (at the five percent level) when focusing on the TBT sample. Hence, TBT notifications are mostly responsible for the earlier detected substitution effect between tariff overhangs and NTM measures.[19]

Finally, column (7) in Table 4 investigates the relationship between NTM notifications and tariff overhangs at the more aggregate HS 2-digit level. The 2-digit codes aggregate the 4-digit information from around 1,200 sectors to 97 industries. Specifically, in the 2-digit specification, the NTM count measure adds up all SPS and TBT notifications that a country submitted to the WTO within a HS 2-digit industry, independent of whether it refers to the 2-digit sector or a 4-digit subsector. Appendix B provides more details on the NTM count variable construction for this case. In column (7), the link between tariff overhangs and NTM notifications is again negative and statistically significant (at the one percent level). Thus, even at a more aggregate level, tariff overhangs and NTM measures remain substitutes. The magnitude of the tariff overhang coefficient is larger than in the prior specifications due to the fact that the sectoral prevalence of NTM notifications rises in the 2-digit compared to the 4-digit specifications. Specifically, the mean of the dependent variable is .4330 in the 2-digit sample compared to .0789 in the baseline 4-digit specification in column (2). As before, the log(Import) variable has a significant positive effect on NTM notifications. However, in contrast to the 4-digit specifications, the log(WorldImportShare) measure is not statistically significant anymore.

To examine the robustness of the PPML fixed effects estimates in Table 4, I consider (i) a model with a more restrictive fixed effects structure and (ii) results from a linear fixed effects approach. Table 5 provides the corresponding results when estimating the model with HS 4-digit x country and year fixed effects. The advantage of the estimates in Table 5 is that they are purely based on within-country-product variation and limit the possibility that omitted variables drive the inverse

[19] This pattern is confirmed when separately estimating Tables 6 through 8 below for SPS and TBT notifications, respectively. I also examined whether the general applicability of SPS and TBT regulations for a HS 4-digit product affects the overhang-NTM nexus. It turns out that whether a product has ever been subject to a SPS or a TBT measure, respectively, is not a significant driver of the tariff overhang effect. The inverse overhang-NTM link seems instead to be driven by more heavily regulated products, i.e., goods that register both SPS and TBT rules. These results are available upon request.

overhang-NTM link. The signs and statistical significance for all variables are remarkably similar in Table 5 compared to the baseline specifications in Table 4. Even with a more rigid fixed effects structure we observe a statistically significant negative link between tariff overhangs and NTM notifications. In fact, the magnitude of the tariff overhang estimates is about three to five times greater in Table 5 compared to Table 4.

However, introducing a more rigid fixed effects structure also comes at a substantial cost. The non-linear nature of the PPML estimator requires dropping all NTM observations that are perfectly explained by the fixed effects. With the HS 4-digit x country fixed effects structure that means dropping all country-product observations for which no NTM notification was registered during the sample period. As a result, the number of observations in Table 5 drops by 609,597, or about 66 percent, compared to Table 4. The products remaining in the sample have by definition higher NTM counts and, as the results suggest, lower tariff overhangs. Hence, we should expect that the sample reduction induced by the fixed effects structure in Table 5 will result mechanically in a higher overhang coefficient compared to Table 4, which is consistent with the observed estimate pattern. The results in Table 5 are therefore likely to overstate the inverse link between overhangs and NTMs.

In a second robustness check, I re-estimate the specifications in Table 4 and Table 5 using the corresponding linear fixed effects models. The first seven columns in both Table C4 and Table C5 in Appendix C replicate the specifications in Table 4 and Table 5, respectively. The signs and magnitudes of the marginal effects from the linear models are remarkably similar to their PPML equivalents. Hence, the linear fixed effects models confirm that countries' tendency to impose more NTMs is inversely correlated with the tariff overhang.

Using the linear models, one can also examine to what extent the aforementioned sample reduction due to the fixed effects structure in the PPML estimation is problematic as the linear estimations are not subject to this caveat. When estimating the linear equivalent of specification (9) in Table 5 with all available observations (see column (C37) in Table C5), the Overhang coefficient continues to be negative and statistically significant at the one percent level. However, the magnitude of the overhang estimate is much lower than in Table 5 and closer to Table 4. This pattern supports the earlier suspicion that the sample reduction due to the HS 4-digit x country and year fixed effects in Table 5 likely overstates the inverse overhang-NTM link. Going forward, I therefore focus on PPML specifications using HS 2-digit and country-year fixed effects as in Table 4. The corresponding linear estimates paint a similar picture and are available upon request.

4.2 Tariffs versus Tariff Overhangs

As reviewed above, there is an extensive literature that examines the linkages between tariffs and the incidence of NTMs. In the light of the previous results, it is particularly relevant to know if other tariff measures affect the estimated link between tariff overhangs and NTM notifications. Table 6 therefore examines the effect of various tariff measures on NTM incidence, individually and in combination with tariff overhangs.

In place of the tariff overhang variable, specifications (15) and (16) in Table 6 start out by accounting for the contemporaneous levels of the applied and bound tariffs themselves (at the HS 4-digit level), respectively.[20] Only the applied tariff level shows a weakly statistically significant link (at the 10 percent level) with NTM notifications. However, the positive coefficient actually indicates that applied tariff levels and NTMs are complements. Note that all specifications in Table 6 include as controls the same three import measures from before: log(Imports), PTAImportShare, and log(WorldImportShare). Their estimated effects are similar to the earlier results in Table 4.

Specification (17) and (18) proceed by focusing instead on the impact of tariff changes on NTMs. Column (17) accounts for the lagged three-year change in the applied MFN tariff rate (at the HS 4-digit level). As indicated by the summary statistics in Table 3, the average change in the three-year applied tariff is close to zero but there is substantial variation in the sample as indicated by the standard deviation of 6.66 percentage points. A similar pattern also holds for the three-year change in the bound MFN tariff. While the coefficient of the three-year applied tariff change is negative in specification (17), the correlation with NTM notifications is not statistically significant. Column (18) replaces the change in the applied tariff with its MFN bound tariff equivalent, but the same results pattern prevails. Applied and bound tariff changes are not significantly linked to NTM notifications.[21]

Columns (19) to (22) in Table 6 examine whether the tariff overhang retains its effect when introducing the four different tariff level and change measures alongside it. Three results emerge. First, in all cases, the marginal effect of the tariff overhang variable remains statistically significant at the one percent level and is comparable to the earlier baseline results in column (2) of Table 4. Second, when controlling for tariff overhangs, both the applied and bound tariff levels correlate

[20] Including lagged tariff levels would prevent identification of the Overhang coefficients in columns (19) and (20) in Table 6.

[21] The results are virtually identical when focusing on 1-year changes in applied and bound tariffs. These results are available upon request.

significantly with NTMs. Importantly, however, the overhang coefficient is about 10 times larger (in absolute terms) than the respective applied and bound tariff estimates, indicating that the economic relevance of the applied and bound tariff levels by themselves for NTMs is close to zero. I want to highlight in this context that an alternative specification where bound and applied tariffs enter simultaneously, i.e., $NTM_{ict} = \beta_1 BoundTariff_{ic,t-1} + \beta_2 AppliedTariff_{ic,t-1} + \eta_s + \omega_{ct} + \epsilon_{ict}$, results in $\beta_1 = -.0397$ and $\beta_2 = .0418$, with both coefficients being statistically significant at the one percent level.[22] In addition, the hypothesis that both the applied and bound tariffs have effects of equal magnitude, $\beta_1 = -\beta_2$, cannot be rejected. Hence, it is truly the combination of both bound and applied tariffs in the form of the tariff overhang that establishes a significant correlation with NTMs and not one of the two tariff levels on its own.

Third, neither applied nor bound tariff changes have a statistically significant impact on NTMs, even after accounting for tariff overhangs. Taken together, the horse race between different tariff measures in Table 6 shows that a substitution effect exists between tariffs and NTMs, but the relevant trade policy margin is tariff overhangs and not tariff levels on their own or tariff changes.

5 Extensions

The above results provide evidence that tariff overhangs are inversely linked to the imposition of NTMs. This part implements three extensions of the baseline model. First, I will examine the robustness of this result when controlling for additional determinants of NTMs that could be correlated with tariff overhangs. Second, I examine if specific parts of the sample are driving the negative overhang-NTM nexus. Finally, I also consider estimates that disentangle the overhang effect by industries and SPS/TBT measures.

5.1 Additional NTM Determinants

The theoretical model in Appendix A predicts that countries impose more NTMs during times of high political pressure from import-competing industries as governments set in turn higher applied tariffs, which result in lower tariff overhangs. One likely determinant of political pressure is the actual amount of imports that domestic firms face in their home markets. Hence, the inverse overhang-NTM link should increase with imports. In specification (23) in Table 7, I therefore add

[22] The coefficient estimates are similar throughout when replicating Table 4 with separate bound and applied tariff terms, except in the SPS specification. These results are available upon request.

the interaction of the log(Import) variable with the tariff overhang to the baseline specification in Table 4, column (2). In line with the theoretical prediction, the estimate for the interaction term is negative and significant at the one percent level. Hence, greater exposure to imports increases the number of NTMs countries notify to the WTO except when they have a lot of overhang.[23] At the same time, the overhang and import level variables retain their respective signs and statistical significance levels.[24] Another potential determinant of political pressure on governments is the growth rate of imports instead of the level. Column (24) therefore considers instead the lagged three-year growth rate of imports, 'Δlog(Imports), 3 years,' and its interaction with the tariff overhang. Neither the growth rate of imports itself nor its interaction with the overhang variable shows a statistically significant correlation with NTMs. However, this result could capture the fact that a high import growth rate by itself might not constitute much of a threat for domestic producers when the actual import level is low.

One of the most steadfast predictions of the trade policy literature is that countries tend to implement more protection in sectors featuring relatively inelastic import demand and export supply (e.g., Johnson 1953–1954 and Bagwell and Staiger 1990). When these elasticities are low, an increase in trade protection is more likely to improve the terms of trade of the importing country. Bagwell and Staiger (1990) point out that the incentive to impose additional protection, e.g., via NTMs, is particularly high during periods with import surges. Importantly, these elasticity considerations could also affect the tariff overhang choices of countries. For instance, when faced with low import demand and export supply elasticities, countries are incentivized to set higher applied tariffs. To rule out that the negative overhang-NTM link is actually driven by this elasticity channel, specification (25) in Table 7 introduces as additional NTM determinant the inverse of the sum of the sectoral import and export supply elasticities, '1/[IM + EX Elasticities].' Country-specific import demand and export supply elasticities at the HS 4-digit level come from Nicita et al. (2018). Since low import and export elasticities should reinforce the impact of import growth pressures, I also include the three-year growth rate of sectoral imports and its interaction with the inverse elasticity measure. This setup mirrors closely the approach of Bown and Crowley (2013a) who provide evidence in the US context for the 'managed trade' theory by Bagwell and Staiger (1990). Two results emerge from

[23] Note that a similar result emerges when using the applied tariff rate as dependent variable. In that case, the overhang-import interaction becomes positive, indicating that countries increase their applied tariffs when facing more imports but only when they have sufficient overhang. These results are available upon request.

[24] Note that throughout Table 7 I report the composite estimates for the variables involved in interactions, which are evaluated at the respective mean of the other variable.

the modified model in column (25).[25] First, the import growth and the inverse elasticity measures as well as their interaction show no significant link with NTM notifications. One reason for this finding could be that many countries included in the sample are not large enough to consider terms-of-trade motives when implementing NTMs. Second, the tariff overhang coefficient increases in magnitude relative to the baseline model in column (2) of Table 4 and remains statistically significant at the one percent level.

As indicated in section 2, there is substantial evidence at the country and product level that temporary protection in the form of AD, SG and CVD measures are used to implement trade protection when countries have little maneuvering space to adjust their applied MFN tariffs (Bown and Crowley 2014, Beshkar and Bond 2016, and Kuenzel 2020). Given that these instruments are substitutes for regular tariff protection, we would expect that sectors which are more frequently subject to AD, SG or CVD actions are also more likely to be the target for increased NTM activity.[26] Not controlling for the presence of these measures could therefore inflate the tariff overhang coefficient in the NTM regressions. Specification (26) in Table 7 examines this possibility by introducing the binary variable 'PastTP, 3 year,' which takes the value one if at least one temporary protection investigation (AD, SG or CVD) was initiated by the respective importer in the previous three years involving the HS 4-digit product at hand, and zero otherwise. Data on AD, SG and CVD investigations come from Bown (2016) and its recent update by the World Bank (2021). The positive and statistically significant (at the five percent level) estimate of the 'PastTP, 3 year' variable confirms the hypothesis. Products that are more likely to receive protection from AD, SG or CVD measures are also more likely to witness more NTM notifications. Importantly, the tariff overhang coefficient remains negative, statistically significant at the one percent level and similar in magnitude relative to the baseline estimate in column (2) of Table 4.[27]

Finally, specification (27) in Table 7 simultaneously includes all previously introduced NTM determinants. The estimates are in line with the prior results in Table 7. Of the additional variables, the overhang/import level and growth interactions as well as 'PastTP, 3 years' show a statistically significant correlation with the incidence of NTMs. At the same time, the highly significant inverse

[25] The tariff overhang results are nearly identical when allowing for a separate impact of the import demand and export supply elasticities. Detailed estimates are available upon request.

[26] The literature has not empirically explored why countries would prefer the application of NTMs to temporary protection instruments, and vice versa. While this question is of interest, it is beyond the scope of this paper.

[27] The tariff overhang results are virtually identical when adding the number of initiated temporary protection investigations in the previous three years, or when including separate AD, CVD and SG controls. Detailed estimates are available upon request.

link between tariff overhangs and NTM notifications prevails. Importantly, the persistence of the tariff overhang effect when accounting for additional NTM determinants substantially alleviates concerns that the estimated relationship between tariff overhangs and NTMs is based on a spurious correlation.

5.2 Examining the Drivers of the Overhang-NTM Relationship

This part examines if there are subsets of observations that ultimately drive the inverse link between tariff overhangs and NTM notifications. One the one hand, measuring tariff overhangs at the HS 4-digit level can lead to some imprecisions as countries' actual bound tariff commitments and applied tariff choices are made at the HS 8-digit level. Aggregating the tariff data up to the 4-digit level could cause more potential measurement issues for some observations than others, e.g., agricultural products due to presence of specific tariffs. On the other hand, independent of potential overhang measurement concerns, certain country groups could be driving the inverse overhang-NTM link, e.g., advanced economies or large countries. Examining these possibilities is crucial in interpreting the above results.

Before discussing the different groups of observations that will be examined, I discuss the general empirical setup that I employ in this part. Specifically, I identify a particular group k of observations using a binary indicator variable D_k, which takes the value one in that case and zero otherwise. I then interact these respective dummy variables with the tariff overhang variable:

$$NTM_{ict} = \beta Overhang_{ic,t-1} + \sum_{k}^{K} \gamma_k Overhang_{ic,t-1} \times D_k + \sum_{k}^{K} \delta_k D_k + \gamma Z_{ic,t-1} + \eta_s + \omega_{ct} + \epsilon_{ict} \quad , \quad (3)$$

where β captures the overhang-NTM nexus for observations without any potential restrictions and γ_k summarizes how the effect differs for observation group k. For instance, $\gamma_k < 0$ would indicate that the group of observations in question experiences a stronger inverse overhang-NTM relationship compared to the baseline effect β.[28]

As laid out in more detail in Appendix B, I obtain tariff overhangs at the HS 4-digit level by using the respective simple averages of applied and bound tariffs at that level. These measures

[28] Alternatively, one could also exclude these observation groups one-by-one and re-estimate the baseline specification in equation (1) for each case. When doing so for all observation groups discussed below, the tariff overhang variable retains its statistically significant inverse relationship with NTM notifications in all cases. However, the advantage of the interaction specification in equation (3) is that it can account for observations that are subject to multiple restrictions, e.g., an agricultural product during a phase-in period in an OECD country.

are provided in the TRAINS database and are based on underlying 8-digit tariff line data. When averaging the 8-digit tariffs, the procedures employed in TRAINS could potentially introduce measurement issues for the tariff overhang variable. I consider five product groups that might be particularly vulnerable to this issue: (i) agricultural products, (ii) products with ad valorem equivalents, (iii) products with less than 100 percent binding coverage, (iv) products with negative tariff overhangs, and (v) tariffs during phase-in periods.

Agricultural products are more likely to be subject to specific and/or compound tariffs, which could either lead to their omission from the tariff averaging in TRAINS or the imputation of ad valorem equivalents. I therefore introduce a binary variable 'Agriculture' that takes the value one for 4-digit products in HS sectors 1 to 15, which applies to about 9.9 percent of observations in the sample. To specifically target products with underlying tariff lines that include ad valorem equivalents, I create the binary variable 'AVE', which takes the value one for 6.1 percent of the sample. In a next step, I control for HS 4-digit products with less than 100 percent binding coverage among its underlying 8-digit tariff lines by creating the binary indicator 'Coverage', which takes the value one for 3.4 percent of observations in the sample. As mentioned earlier in section 3.1, HS 4-digit tariff overhangs based on averaging of underlying tariff lines can be negative due to phase-in periods of WTO commitments, agreement violations, missing bindings at the 8-digit level, or the conversion of import restrictions to ad valorem equivalents. I identify these observations with the binary variable 'Neg. TO', which account for 7.0 percent of the sample. Lastly, phase-in periods could be another contributor to mismeasured tariff overhangs. After successful negotiation rounds or entering the organization WTO members have up to 10 years to bring their applied tariffs in line with their bound tariff commitments. I account for this possibility with the binary variable 'Phase-in', which takes the value one for the tariff years 1995 to 2004 for countries that were members of the WTO in 1995, or if they accessed the WTO at a later date, for the first 10 years of their membership. Based on this definition, 38.7 percent of the sample are part of a phase-in period.

In addition, I define two binary indicators that identify large economies and advanced countries. Large economies are among the most frequent users of NTMs and might therefore account completely for the inverse overhang-NTM link. The binary indicator variable 'Large' takes the value one for observations from China, the EU, Japan, and the US. These countries make up 11.4 percent of the sample. Advanced countries could be more likely to design NTMs that favor their domestic over foreign firms. I therefore define the binary indicator 'OECD,' which takes the value one if a country is a member of the OECD, which applies to 28.9 percent of observations in the sample. To sum up, the complete set of binary indicator variables and their respective interactions with tariff overhangs included in equation (3) are $K = \{$Agriculture, AVE, Coverage, Neg. TO, Phase-in, Large, OECD$\}$.

Table 8 presents the PPML estimates of the baseline overhang coefficient (β) and the composite overhang effects for the seven respective binary indicators ($\beta + \gamma_k$). Note that the regression in Table 8 also includes the binary indicators themselves, except for 'Agriculture', 'Phase-in', 'Large' and 'OECD' as they are captured by the included fixed effects, and the standard trade controls: log(Imports), PTAImportShare, and log(WorldImportShare). The complete results for these variables are available on request. Three results emerge from Table 8. First, and most importantly, the baseline tariff overhang coefficient (β) is negative, of similar magnitude as in Table 4, and statistically significant at the one percent level. That is, observations that are not subject to any of the restrictions discussed above still witness the inverse overhang-NTM nexus. Second, for three of the seven interactions the composite tariff overhang effect is not significantly different from zero. Agricultural products ('Agriculture'), products with ad valorem equivalents ('AVE') and negative tariff overhangs ('Neg. To') are not driving the aggregate negative overhang-NTM link. Third, observations with less than 100 percent binding coverage ('Coverage'), phase-in periods ('Phase-in'), large countries ('Large') and OECD members ('OECD') experience a magnified negative correlation between overhangs and NTMs.[29] However, only for large countries the composite overhang impact is substantially greater in magnitude than the baseline, but the effect is also imprecisely estimated.

5.3 Industry-specific Estimates

The above analysis averages the tariff overhang estimate across all HS 4-digits sectors, independent of the fact that certain products might be more likely to be subject to NTMs than others. For instance, by their nature, SPS regulations are much more likely to be imposed on agricultural and food products than manufactures. To examine the sectoral sensitivity of the tariff overhang effect, I divide the sample into seven products groups: 1. animal products (HS 1-5), 2. chemicals (HS 27-40), 3. clothing (HS 41-43, 50-67), 4. foodstuffs (HS 15-24), 5. manufactures (HS 84-97), 6. materials (HS 25-26, 44-49, 68-71, 72-83), and 7. vegetable products (HS 6-14).

The animals, vegetables and foodstuffs categories account for 27,654 of the 50,930 HS 4-digit sectors with NTM notifications in the sample, with respective counts of 8,780, 6,248 and 12,626.

[29] Estimating equation (3) without the 'OECD' and 'Large' binary indicators results in nearly identical results for the remaining five variables.

That is, agricultural and food related products are responsible for 54.3 percent of all HS 4-digit sectors with NTM measures. The vast majority of these sectors witness new SPS rules (24,074) and a much smaller number are subject to new TBT regulations (5,217).[30] Manufacturing products account for 17.6 percent (or 8,961) of all HS 4-digit sectors with NTM notifications, which are mostly due to products becoming subject to new TBT measures (8,295), whereas SPS notifications (685) only play a small role. The picture is similar for chemicals, which witness 7,999 HS 4-digit sectors with NTM notifications, or 15.7 percent out of the total. We observe again more TBT regulations (5,427) than SPS rules (3,060), but the imbalance is less extreme than in the case of manufacturing industries. A much smaller number of HS 4-digit sectors with NTM notifications are observed for clothing (3,232) and materials (3,084).

To estimate industry-specific tariff overhang effects on NTM notifications, I add to the empirical model in (1) the interactions of the tariff overhang variable with seven industry dummies, D_k:

$$NTM_{ict} = \sum_{k}^{K} \beta_k Overhang_{ic,t-1} \times D_k + \gamma Z_{ic,t-1} + \eta_s + \omega_{ct} + \epsilon_{ict} \qquad (4)$$

where β_k captures the effect of tariff overhangs on NTMs in industry k out of the above specified industry set K. Note that the inclusion of the dummies themselves is not necessary as they are captured by the fixed effects.

The upper three panels in Table 9 present the industry-specific tariff overhang estimates for three samples of countries: A. all countries, B. OECD countries, and C. non-OECD countries. Note that all specifications account for log(Imports), PTAImportShare and log(WorldImportShare) as well as country-year and HS 2-digit fixed effects. Focusing first on the full-sample results in panel A., two results emerge. First, the industry-specific tariff overhang estimates are negative for all industries. Second, the tariff overhang effect is statistically different from zero at least at the 10 percent level for four out of the seven industries.[31] Most prominently, manufacturing products show the strongest inverse link between tariff overhangs and NTMs. This result is intriguing as, particular in advanced economies, tariff protection is considered to be much lower for manufacturing sectors than agricultural and food related products. The estimated coefficient for manufacturing is about 5-times as large as in the baseline specification in column (2) of Table 4. The statistically

[30] Note that the SPS and TBT notifications do not add up to the total number of sectors with new NTMs as a given HS 4-digit sector can witness both during a given year.

[31] Note that I am not testing to what extent the different industry-specific estimates are statistically different from each other.

significant effects for the animals, foodstuffs and vegetables industries are closer to the aggregate tariff overhang estimate.

Panels B. and C. in Table 9 dissect the industry-specific tariff overhang estimates by OECD and non-OECD countries. In OECD countries, the significant substitution effects between NTMs and tariff overhangs are concentrated in agricultural and food related products. This result is in line with the general account in the literature that advanced economies disproportionately shield these sectors from foreign competition while materials and manufactures enjoy much lower protection levels. The opposite picture emerges for non-OECD countries in panel C. Agricultural and food related industries show no statistically significant link between tariff overhangs and NTMs. However, clothing, manufactures and materials industries witness substantial substitution effects between NTM notifications and tariff overhangs. Hence, although we observe an inverse link between tariff overhangs and NTMs in the aggregate, the effect varies substantially by countries' income levels and industries.

In panels D. and E. in Table 9, I break down the NTM notification variable into its respective TBT and SPS counterparts to estimate the industry-specific impact of tariff overhangs on TBT and SPS notifications for all countries. Panel D. shows that narrow tariff overhangs in manufacturing are highly negatively correlated with NTMs in the form of TBTs. That is, the significant inverse link between tariff overhangs and TBT notifications in the aggregate sample (column (5) in Table 4) is driven by regulations in the manufacturing sector. Finally, panel E. shows statistically significant links with SPS notifications in two industries: clothing (positive) and foodstuffs (negative). These offsetting effects could explain why there is no significant overhang-SPS nexus in the aggregate sample (column (6) in Table 4).

6 Non-tariff Measure Concerns

The analysis above focuses on the determinants of NTM notifications by member countries to the relevant WTO committees. However, one could argue that not all NTM notifications are necessarily of a protectionist nature (Beverelli et al. 2019), which could understate the magnitude of any potential substitution effect between tariffs and NTMs. To complement my prior focus on NTM notifications, I therefore consider in this section NTM concerns, which I compile based on the WTO's SPS and TBT committees that allow member countries to register their misgivings about other members' NTMs. Following the same empirical approach as in equation (1), I swap out the dependent variable to 'NTMconcern$_{ict}$,' which captures the sum of SPS and TBT concerns for HS 4-digit product i in a given year t that have been received by WTO member c. One major difference to the empirical model in equation (1) is that the number of current NTM concerns received by a country are likely to be correlated with the number of its recent NTM notifications as other WTO members can gather information through the notification process. As tariff overhangs are significantly linked with NTM notifications, their omission could potentially bias the estimated impact of the various tariff measures on NTM concerns. I therefore include a control for recent NTM notifications throughout.[32] Equation (5) below summarizes these changes:

$$NTMConcern_{ict} = \alpha PastNTMCount_{ict-1} + \beta Overhang_{ic,t-1} + \gamma Z_{ic,t-1} + \eta_s + \omega_{ct} + \epsilon_{ict} \quad , (5)$$

where 'PastNTMCount' captures the frequency of NTM notifications in the previous three years for the HS 4-digit product i by country c and year t.

Column (34) in Table 10 presents the results of a PPML regression of the NTM concern count variable on the number of past NTM notifications (and fixed effects). As expected, past NTM notifications show a positive and statistically significant (at the one percent level) link with NTM concerns. If a WTO member notifies more NTMs to the SPS and TBT committees, it will be on the receiving end of more NTM concerns in the future. Importantly, however, although recent NTM notifications are an important contributor to NTM concerns, there are also plenty of NTM concerns in sectors that were not subject to any NTM notification in the recent past. Specifically, only 37.6 percent of HS 4-digit sectors with positive NTM concern counts had received at least one NTM notification in the previous three years. This fact highlights a major issue with the NTM concern data with regard to the exact timing of NTM concerns. WTO members can register concerns about NTM notifications independent of when they went into force. Hence, a raised concern could refer to NTMs from several years past, which complicates the interpretation of the NTM concern regressions results. Finally, note that relative to Table 4 the size of the sample shrinks considerably when focusing on NTM concern counts. The reduction in the number of observations to about one third of the earlier analysis is due to the fact that NTM concerns are much rarer than NTM notifications. Therefore, the outcome of a larger number of observations in the PPML regressions is perfectly explained by the included country-year and HS 2-digit fixed effects, which leads to more

[32] The results for the remaining variables are nearly unchanged when omitting the recent NTM notification variable. Detailed results are available upon request.

observations being dropped in Table 10.

Specification (35) in Table 10 adds the tariff overhang variable as regressor and the three trade controls from earlier that are potentially correlated with tariff overhangs and NTMs: log(Imports), PTAImportShare, and log(WorldImportShare). Importantly, whereas the estimate for the 'Past-NTMCount' remains positive and statistically significant at the one percent level, the tariff overhang does not correlate with the reporting frequency of NTM concerns. In the remainder of Table 10, I follow the general approach from Table 6 and regress NTM concerns on different tariff measures as well as the Overhang and 'PastNTMCount' variables. In columns (36) and (37), I add the contemporaneous applied and bound tariff levels, respectively. Neither the applied nor the bound tariff levels show any significant link with NTM concerns. A similar result emerges in specification (38), which adds to the tariff overhang measure the three-year change in the applied MFN tariff. There is no significant correlation between applied tariff changes and NTM concerns. The picture changes somewhat in column (39) when the applied tariff change is swapped out for its bound tariff counterpart. Larger reductions in the bound tariff are linked with more registered NTM concerns, an effect that is statistically significant at the 10 percent level. Note that the results are similar when 1-year instead of 3-year changes are considered for the applied and bound tariff rates. These results are available upon request.

More broadly, the picture that emerges in Table 10 indicates that past NTM notifications are the most important driver of NTM concerns. Whereas tariff overhangs are not directly correlated with the number of reported NTM concerns, the measure has at least an indirect impact through its highly significant inverse link with NTM notifications. With regard to the other tariff measures, only bound tariff changes can be linked with NTM concerns, but the respective statistical significance is only at the 10 percent level. Moreover, bound tariff changes are very small in the sample. On average, the three-year change in the bound tariff is about -.2% (see Table 3). The economic significance of this result is therefore not as relevant as one might think at first. Hence, tariff overhangs through their link with NTM notifications appear as a more important, although indirect, correlate with NTM concerns.

7 Concluding Remarks

Non-tariff measures have increasingly become the major focus of multilateral trade negotiations. It remains a crucial question whether and how the existing tariff structure in countries affects their tendency to implement NTMs. The theoretical literature lays out different channels suggesting that NTMs can either be applied in tandem with or in place of tariffs. Determining the relation between tariffs and NTMs is therefore an inherently empirical question. However, existing empirical studies offer mixed results, which are often based on cross-sectional data and limited country coverage due to the lack of comprehensive NTM data. Importantly, there is also no consensus on the relevant trade policy margin for which a tariff-NTM nexus should be detected.

In this paper, I examine the empirical significance of various tariff measures for the incidence of NTMs. The main part of my analysis focuses on SPS and TBT notifications of WTO members, which have the advantage of being available at the product-year level for a wide range of countries over a long time frame. Whereas applied and bound tariff reductions have previously been emphasized as NTM determinants, I find little support for this notion. Instead, I identify sectoral tariff overhangs, the difference between WTO bound and applied tariff rates, as the key trade policy measure for detecting a significant tradeoff between tariffs and NTMs. Smaller tariff overhangs constrain the trade policy flexibility of WTO members and therefore increase NTM actions. This finding is consistent with the theoretical framework of Beshkar and Bond (2017) who emphasize tariff overhangs as the key driver of a country's likelihood to use alternative protection instruments.

More broadly, the results in this paper suggest that focusing on reductions in bound or applied tariffs might overstate the actually realized trade liberalization of past GATT/WTO negotiation rounds. If tariff liberalizations induce lower tariff overhangs, an increased usage of other protectionist instruments, such as NTMs, is likely to follow. To avoid this protectionist backsliding, there are several countermeasures that could be taken. First, in order to distinguish between legitimate and illicit uses of NTMs, every GATT/WTO member needs to transparently report all domestic rules and regulations that could affect trade. Official WTO trade policy reviews frequently point out deficits to that effect. Second, while member countries can report SPS/TBT concerns to the relevant WTO committees, only the dispute settlement mechanism can adjudicate disagreements between members countries. Returning the WTO's dispute settlement body to full working order should therefore top the agenda for member countries in the near future.

Failure to make progress along these lines will contribute to a further shift away from a global rules-based trading system to a muddled mesh of preferential trade deals. Although recent evidence shows that increasing import shares from preferential trade agreement partners reduce MFN tariffs due to trade diversion concerns (Kuenzel and Sharma 2021), the long-run implications of higher red tape costs associated with bilateral agreements are usually just an afterthought. Acknowledging the link between tariff setting flexibility and NTMs is a first step for policymakers to avoid a costly disintegration of the WTO's principles.

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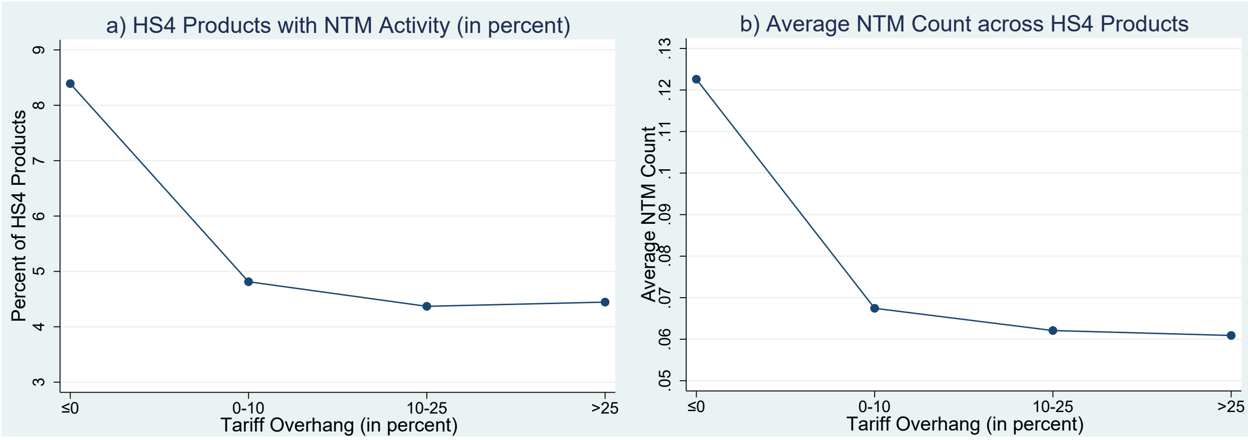
Figure 1: NTM Incidence across 4-digit HS Sectors, by Tariff Overhang



Notes: Author's own calculations based on data for the baseline sample from the SPS/TBT IMS and TRAINS databases. Both panels divide the baseline sample into four tariff overhang bins that contain about the same number of observations. Panel a) shows the share (in percent) of 4-digit HS sectors that are subject to a new NTM in the subsequent year, sorted by tariff overhang categories. Panel b) reports the average of the NTM Count variable in the subsequent year, sorted by tariff overhang categories.

Table 1: Non-tariff Measures and Tariff Overhang Distribution by Country, HS 4-digit, 1996–2019

Country	Observations	NTM Count	TBT Count	SPS Count	Share of Sectors by Tariff Overhang $\leq 0\%$	$0-10\%$	$10-25\%$	$> 25\%$
Albania	13,306	304	39	265	0.410	0.558	0.032	0.000
Argentina	27,856	901	168	733	0.051	0.116	0.616	0.217
Armenia	5,991	354	147	207	0.346	0.410	0.244	0.000
Australia	27,566	1,642	579	1,063	0.262	0.518	0.199	0.021
Bahrain	13,492	461	50	411	0.014	0.008	0.077	0.901
Barbados	988	7	1	6	0.000	0.000	0.000	1.000
Belize	2,928	30	8	22	0.015	0.002	0.011	0.972
Bolivia	11,074	233	183	50	0.031	0.001	0.064	0.904
Brazil	27,319	7,200	4,219	2,981	0.057	0.127	0.625	0.191
Burundi	755	32	8	24	0.295	0.101	0.045	0.559
Canada	28,926	1,916	658	1,258	0.467	0.520	0.012	0.001
Chile	27,360	1,671	40	1,631	0.043	0.002	0.944	0.011
China	19,341	4,258	3,125	1,133	0.824	0.172	0.003	0.001
Colombia	24,513	2,746	1,185	1,561	0.016	0.006	0.419	0.559
Costa Rica	20,694	1,952	904	1,048	0.019	0.022	0.069	0.890
Cote d'Ivoire	783	112	16	96	0.575	0.286	0.135	0.004
Dominican Republic	10,362	205	26	179	0.008	0.031	0.422	0.539
Ecuador	15,649	3,773	3,346	427	0.198	0.168	0.624	0.011
Egypt, Arab Rep.	16,584	815	459	356	0.093	0.204	0.438	0.265
El Salvador	25,045	885	222	663	0.019	0.009	0.328	0.644
European Union	28,662	5,194	987	4,207	0.906	0.093	0.000	0.000
Guatemala	19,602	1,196	32	1,164	0.009	0.007	0.179	0.806
Honduras	14,449	339	23	316	0.010	0.036	0.411	0.543
Hong Kong, China	15,005	239	89	150	1.000	0.000	0.000	0.000
India	12,273	692	27	665	0.108	0.081	0.295	0.516

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Country	Observations	NTM Count	TBT Count	SPS Count	Share of Sectors by Tariff Overhang $\leq 0\%$	$0-10\%$	$10-25\%$	$>25\%$
Indonesia	22,187	1,034	548	486	0.024	0.019	0.206	0.751
Israel	15,732	1,909	1,898	11	0.140	0.619	0.136	0.105
Japan	28,883	4,540	2,415	2,125	0.924	0.074	0.003	0.000
Jordan	14,871	147	20	127	0.368	0.439	0.184	0.010
Kenya	2,046	131	97	34	0.009	0.004	0.012	0.975
Korea, Rep.	28,344	2,085	233	1,852	0.363	0.539	0.081	0.018
Kuwait	7,982	240	146	94	0.006	0.001	0.003	0.991
Kyrgyz Republic	1,880	162	132	30	0.481	0.444	0.076	0.000
Malawi	991	79	22	57	0.004	0.003	0.050	0.942
Malaysia	19,045	661	532	129	0.172	0.549	0.238	0.041
Mali	373	195	2	193	0.475	0.110	0.019	0.397
Mexico	25,515	1,841	517	1,324	0.038	0.043	0.541	0.378
Moldova	5,259	358	326	32	0.598	0.327	0.074	0.002
Mongolia	1,887	19	17	2	0.013	0.171	0.816	0.000
Morocco	12,843	603	2	601	0.128	0.081	0.244	0.547
New Zealand	26,027	1,542	270	1,272	0.401	0.290	0.296	0.013
Nicaragua	17,433	582	171	411	0.008	0.003	0.138	0.850
Norway	13,407	94	9	85	0.592	0.380	0.027	0.000
Oman	13,611	338	10	328	0.141	0.288	0.551	0.019
Panama	10,927	253	3	250	0.091	0.215	0.541	0.154
Paraguay	14,415	113	57	56	0.046	0.035	0.572	0.347
Peru	22,393	2,313	1,065	1,248	0.025	0.016	0.682	0.276
Philippines	17,021	1,148	19	1,129	0.057	0.138	0.545	0.260
Qatar	10,180	122	9	113	0.119	0.183	0.692	0.006
Saudi Arabia	6,098	358	62	296	0.064	0.654	0.281	0.001
Singapore	20,219	452	198	254	0.183	0.262	0.555	0.000
South Africa	25,230	1,575	1,340	235	0.277	0.269	0.375	0.079
Sri Lanka	5,366	149	5	144	0.064	0.262	0.419	0.255
Switzerland	6,204	268	46	222	1.000	0.000	0.000	0.000
Tanzania	692	37	35	2	0.000	0.000	0.000	1.000
Thailand	12,265	1,131	793	338	0.221	0.109	0.503	0.167
Trinidad and Tobago	5,479	20	5	15	0.018	0.011	0.057	0.913
Turkey	7,806	440	121	319	0.180	0.349	0.294	0.177
Uganda	910	316	301	15	0.010	0.001	0.047	0.942
Ukraine	12,793	1,140	344	796	0.609	0.371	0.020	0.000
United Arab Emirates	10,747	384	9	375	0.123	0.195	0.679	0.004
United States	28,262	7,620	3,921	3,699	0.941	0.058	0.001	0.000
Uruguay	16,346	81	6	75	0.047	0.100	0.595	0.258
Venezuela	4,710	238	130	108	0.001	0.020	0.631	0.348
Vietnam	12,720	640	63	577	0.568	0.403	0.026	0.004

Table 2: Non-zero Non-tariff Measure Count Distribution

NTM Count	1	2	3	4	5	6-10	11-26	Total
Observations	37,902	9,193	2,006	881	334	527	87	50,930

Table 3: Summary Statistics

Variable	Mean	Std. Dev.	Obs.	Definition	Data Source
AppliedTariff	0.0807	0.2210	858,025	Current year HS 4-digit applied tariff (in ad valorem terms)	WITS database
ΔAppliedTariff, 3 years	-0.0041	0.0666	815,368	3-year change in HS 4-digit applied tariff (in ad valorem terms)	WITS database
BoundTariff	0.2195	0.2788	858,295	Current year HS 4-digit applied tariff (in ad valorem terms)	WITS database
ΔBoundTariff, 3 years	-0.0020	0.0220	777,073	3-year change in HS 4-digit bound tariff (in ad valorem terms)	WITS database
1/[IM + EX Elasticities]	0.1626	0.2176	627,140	HS 4-digit level inverse of sum of import demand and export supply elasticities	Nicita et al. (2018)
log(Imports)	8.2608	3.2329	919,622	log of sectoral imports (in $1,000s)	UN Comtrade
Δlog(Imports), 3 years	0.1926	1.0793	871,535	3-year change in log(Imports)	UN Comtrade
log(WorldImportShare)	-10.2318	2.6452	919,622	Log of sectoral world import share	UN Comtrade
NTMConcern	0.0388	0.2698	319,886	Number of submitted concerns regarding SPS and TBT measures in HS 4-digit sector	TTBD database
NTM	0.0789	0.4127	919,622	Number of SPS and TBT notifications in HS 4-digit sector	WTO SPS & TBT IMS databases
Overhang	0.1512	0.1784	919,622	MFN bound tariff − MFN applied tariff (in ad valorem terms)	WITS database
PastNTMCount, 3 years	0.2940	1.0821	319,886	Number of SPS and TBT notifications in HS 4-digit sector in previous 3 years	WTO SPS and TBT IMS databases
PastTP, 3 years	0.0103	0.1010	919,622	Temporary protection investigation (AD, CVD, SG, CSG) in HS 4-digit sector in previous 3 years: 1 (yes), 0 (no)	TTBD database
PTAImportShare	0.3127	0.3573	919,622	Share of sectoral imports from PTA partners	UN Comtrade, de Sousa (2012) & Larch and Egger (2008)
SPS	0.0596	0.3356	672,926	Number of SPS notifications in HS 4-digit sector	WTO SPS IMS database
TBT	0.0605	0.3693	536,146	Number of TBT notifications in HS 4-digit sector	WTO TBT IMS database

Table 4: Non-tariff Measures and Tariff Overhangs – PPML Results (Average Marginal Effects)

Dependent Variable: Non-tariff Measure Notification Count	4-digit (1) NTM	4-digit (2) NTM	4-digit (3) NTM	4-digit (4) NTM	4-digit (5) TBT	4-digit (6) SPS	2-digit (7) NTM
Overhang_{t-1}	-0.0400***	-0.0386***	-0.0399***	-0.0365***	-0.0270**	-0.0135	-0.3218***
	(0.0132)	(0.0130)	(0.0131)	(0.0127)	(0.0125)	(0.0092)	(0.1168)
$\log(\text{Imports})_{t-1}$		0.0108***		0.0108***	0.0104***	0.0063***	0.1354**
		(0.0006)		(0.0006)	(0.0007)	(0.0004)	(0.0584)
$\text{PTAImportShare}_{t-1}$		0.0027	0.0051	0.0041	0.0087*	-0.0012	0.0278
		(0.0037)	(0.0036)	(0.0037)	(0.0047)	(0.0024)	(0.0525)
$\log(\text{WorldImportShare})_{t-1}$		-0.0074***	0.0036***	-0.0074***	-0.0075***	-0.0044***	-0.0906
		(0.0008)	(0.0005)	(0.0008)	(0.0010)	(0.0005)	(0.0585)
Overhang_{t-1} $\times\text{PTAImportShare}_{t-1}$				-0.0388***			
				(0.0145)			
Observations	919,622	919,622	919,622	919,622	536,146	672,926	79,369
Pseudo R2	0.361	0.367	0.362	0.367	0.299	0.473	0.479
Country-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2-digit HS FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table presents average marginal effects from PPML regressions. Clustered standard errors at the country/2-digit HS level are in parentheses. ***, ** and * indicate 1 percent, 5 percent and 10 percent significance levels, respectively. Specification (4) reports the respective composite effects for Overhang_{t-1} and $\text{PTAImportShare}_{t-1}$, taking into account the interaction between both variables.

Table 5: Non-tariff Measures and Tariff Overhangs – PPML Results with HS4 x c FEs (Average Marginal Effects)

Dependent Variable: Non-tariff Measure Notification Count	4-digit (8) NTM	4-digit (9) NTM	4-digit (10) NTM	4-digit (11) NTM	4-digit (12) TBT	4-digit (13) SPS	2-digit (14) NTM
Overhang_{t-1}	-0.2014***	-0.2011***	-0.2006***	-0.2102***	-0.2201***	-0.0059	-0.9407*
	(0.0649)	(0.0651)	(0.0651)	(0.0650)	(0.0718)	(0.0637)	(0.5296)
$\log(\text{Imports})_{t-1}$		0.0304***		0.0304***	0.0351***	0.0175*	0.3153***
		(0.0090)		(0.0090)	(0.0105)	(0.0102)	(0.1193)
$\text{PTAImportShare}_{t-1}$		-0.0178	-0.0180	-0.0124	-0.0611***	0.0072	-0.2917***
		(0.0159)	(0.0159)	(0.0162)	(0.0229)	(0.0151)	(0.0942)
$\log(\text{WorldImportShare})_{t-1}$		-0.0236***	0.0057**	-0.0236***	-0.0219**	-0.0174*	-0.1513
		(0.0088)	(0.0026)	(0.0088)	(0.0103)	(0.0101)	(0.1150)
Overhang_{t-1} $\times\text{PTAImportShare}_{t-1}$				-0.1020*			
				(0.0607)			
Observations	310,025	310,025	310,025	310,025	204,673	166,293	43,292
Pseudo R2	0.228	0.229	0.229	0.229	0.195	0.241	0.419
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4-digit HS x country FE	Yes	Yes	Yes	Yes	Yes	Yes	No
2-digit HS x country FE	No	No	No	No	No	No	Yes

Notes: The table presents average marginal effects from PPML regressions. Clustered standard errors at the country/2-digit HS level are in parentheses. ***, ** and * indicate 1 percent, 5 percent and 10 percent significance levels, respectively. Specification (11) reports the respective composite effects for Overhang_{t-1} and $\text{PTAImportShare}_{t-1}$, taking into account the interaction between both variables.

Table 6: Non-tariff Measures, Tariffs, and Tariff Changes – PPML Results (Average Marginal Effects)

Dependent Variable: Non-tariff Measure Notification Count	4-digit (15) NTM	4-digit (16) NTM	4-digit (17) NTM	4-digit (18) NTM	4-digit (19) NTM	4-digit (20) NTM	4-digit (21) NTM	4-digit (22) NTM
Overhang_{t-1}					-0.0392***	-0.0431***	-0.0424***	-0.0420***
					(0.0129)	(0.0130)	(0.0139)	(0.0138)
AppliedTariff_{t}	0.0040*				0.0041**			
	(0.0021)				(0.0021)			
BoundTariff_{t}		-0.0009				0.0034*		
		(0.0037)				(0.0019)		
$\Delta\text{AppliedTariff}_{t-1}$, 3 years			-0.0007				-0.0045	
			(0.0065)				(0.0099)	
$\Delta\text{BoundTariff}_{t-1}$, 3 years				-0.0118				0.0016
				(0.0281)				(0.0281)
$\log(\text{Imports})_{t-1}$	0.0109***	0.0109***	0.0114***	0.0114***	0.0109***	0.0109***	0.0114***	0.0114***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
$\text{PTAImportShare}_{t-1}$	0.0023	0.0023	0.0016	0.0005	0.0023	0.0024	0.0016	0.0005
	(0.0040)	(0.0040)	(0.0042)	(0.0042)	(0.0039)	(0.0039)	(0.0041)	(0.0041)
$\log(\text{WorldImportShare})_{t-1}$	-0.0073***	-0.0074***	-0.0077***	-0.0077***	-0.0073***	-0.0073***	-0.0077***	-0.0077***
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Observations	858,025	858,295	815,368	777,073	858,025	858,295	815,368	777,073
R2	0.366	0.366	0.364	0.365	0.367	0.367	0.364	0.366
Country-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2-digit HS FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table presents average marginal effects from PPML regressions. Clustered standard errors at the country/2-digit HS level are in parentheses. ***, ** and * indicate 1 percent, 5 percent and 10 percent significance levels, respectively.

Table 7: Non-tariff Measures and Tariff Overhangs – Additional Determinants (PPML Results – Average Marginal Effects)

Dependent Variable: Non-tariff Measure Notification Count	4-digit (23) NTM	4-digit (24) NTM	4-digit (25) NTM	4-digit (26) NTM	4-digit (27) NTM
Overhang_{t-1}	-0.0498***	-0.0413***	-0.0537***	-0.0385***	-0.0622***
	(0.0136)	(0.0134)	(0.0162)	(0.0130)	(0.0171)
Overhang_{t-1}	-0.0068***				-0.0057**
$\times\log(\text{Imports})_{t-1}$	(0.0017)				(0.0026)
$\Delta\log(\text{Imports})_{t-1}$, 3 years		-0.0010	0.0001		-0.0002
		(0.0007)	(0.0011)		(0.0011)
Overhang_{t-1}		0.0030			0.0076*
$\times\Delta\log(\text{Imports})_{t-1}$, 3 years		(0.0026)			(0.0041)
1/[IM + EX Elasticities]			0.0033		0.0035
			(0.0029)		(0.0029)
1/[IM + EX Elasticities]			-0.0060		-0.0054
$\times\Delta\log(\text{Imports})_{t-1}$, 3 years			(0.0036)		(0.0036)
PastTP_{t-1}, 3 years				0.0163**	0.0177**
				(0.0067)	(0.0073)
$\log(\text{Imports})_{t-1}$	0.0108***	0.0113***	0.0122***	0.0107***	0.0120***
	(0.0006)	(0.0006)	(0.0007)	(0.0006)	(0.0007)
$\text{PTAImportShare}_{t-1}$	0.0030	0.0019	0.0016	0.0027	0.0017
	(0.0037)	(0.0039)	(0.0050)	(0.0037)	(0.0050)
$\log(\text{WorldImportShare})_{t-1}$	-0.0071***	-0.0075***	-0.0086***	-0.0073***	-0.0084***
	(0.0007)	(0.0008)	(0.0011)	(0.0008)	(0.0011)
Observations	919,622	871,535	627,140	919,622	627,140
Pseudo R2	0.367	0.363	0.358	0.367	0.358
Country-year FE	Yes	Yes	Yes	Yes	Yes
2-digit HS FE	Yes	Yes	Yes	Yes	Yes

Notes: The table presents average marginal effects from PPML regressions. Clustered standard errors at the country/2-digit HS level are in parentheses. ***, ** and * indicate 1 percent, 5 percent and 10 percent significance levels, respectively. Specifications (23) and (27) report the respective composite effects for $\log(\text{Imports})_{t-1}$, 3 years and Overhang_{t-1}, taking into account the interaction between both variables. Specifications (24) and (27) report the respective composite effects for $\Delta\log(\text{Imports})_{t-1}$, 3 years and Overhang_{t-1}, taking into account the interaction between both variables. Specifications (25) and (27) report the respective composite effects for $\Delta\log(\text{Imports})_{t-1}$, 3 years and 1/[IM + EX Elasticities], taking into account the interaction between both variables.

Table 8: Non-tariff Measures and Tariff Overhangs – PPML Estimate Heterogeneity

Dependent Variable: NTM Notifications	Overhang	Sum of Overhang and respective binary indicator interaction coefficient ($\beta+\gamma_k$): Agriculture	AVE	Coverage	Neg. TO	Phase-in	Large	OECD
Effect on NTM_{ict}	-0.0522***	-0.0102	0.0114	-0.1111***	0.0017	-0.0645***	-0.2701**	-0.1182***
	(0.0184)	(-0.0154)	(0.0265)	(0.0430)	(0.0582)	(0.0211)	(0.1126)	(0.0334)

Notes: The table presents average marginal effects (and combinations thereof) from a PPML model regression of equation (3). The estimation accounts for country-year fixed effects, 2-digit HS fixed effects, $\log(\text{Imports})_{t-1}$, $\text{PTAImportShare}_{t-1}$ and $\log(\text{WorldImportShare})_{t-1}$. In addition, the regression includes the binary indicators AVE, Coverage, and Neg. TO, whereas Agriculture, Phase-in, Large, and OECD are captured by the fixed effects structure. Clustered standard errors at the country/2-digit HS level are in parentheses. ***, ** and * indicate 1 percent, 5 percent and 10 percent significance levels, respectively.

Table 9: Non-tariff Measures and Tariff Overhangs – PPML Estimates by Industry and NTM Types

Dependent Variable: Non-tariff Measure Notification Count	Industry						
	Animals	Chemicals	Clothing	Foodstuffs	Manufactures	Materials	Vegetables
A. All Countries							
Overhang	-0.0272*	-0.0226	-0.0801	-0.0359**	-0.1986***	-0.0503	-0.0299*
	(0.0158)	(0.0334)	(0.0502)	(0.0174)	(0.0481)	(0.0489)	(0.0167)
B. OECD Countries							
Overhang	-0.1098**	-0.0223	-0.0723	-0.1096*	-0.2198	-0.1557	-0.1647***
	(0.0547)	(0.1214)	(0.1831)	(0.0631)	(0.1457)	(0.1742)	(0.0567)
C. Non-OECD Countries							
Overhang	-0.0081	0.0253	-0.1538***	-0.0238	-0.1847***	-0.0960**	0.0121
	(0.0140)	(0.0274)	(0.0462)	(0.0151)	(0.0473)	(0.0429)	(0.0145)
D. TBT Notification Count – All Countries							
Overhang	-0.0269	0.0007	-0.0513	-0.0059	-0.0960***	-0.0070	-0.0266
	(0.0243)	(0.0299)	(0.0410)	(0.0148)	(0.0323)	(0.0405)	(0.0190)
E. SPS Notification Count - All Countries							
Overhang	-0.0118	0.0121	0.1116***	-0.0421**	-0.1352	0.0045	-0.0091
	(0.0105)	(0.0355)	(0.0340)	(0.0188)	(0.1072)	(0.0565)	(0.0117)

Notes: The table presents average marginal effects from a PPML model regressions of equation (4). Each specification includes country-year fixed effects, 2-digit HS fixed effects, $\log(\text{Imports})_{t-1}$, $\text{PTAImportShare}_{t-1}$ and $\log(\text{WorldImportShare})_{t-1}$. Clustered standard errors at the country/2-digit HS level are in parentheses. ***, ** and * indicate 1 percent, 5 percent and 10 percent significance levels, respectively.

Table 10: Non-tariff Measure Concerns and Tariff Overhangs – PPML Results

Dependent Variable: Non-tariff Measure Concern Count	4-digit (34) NTM	4-digit (35) NTM	4-digit (36) NTM	4-digit (37) NTM	4-digit (38) NTM	4-digit (39) NTM
$\text{PastNTMCount}_{t-1}$, 3 years	0.0026***	0.0024***	0.0024***	0.0024***	0.0017**	0.0018***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Overhang_{t-1}		0.0011	-0.0012	0.0011	0.0004	0.0031
		(0.0069)	(0.0072)	(0.0071)	(0.0095)	(0.0096)
AppliedTariff_t			-0.0025			
			(0.0020)			
BoundTariff_t				-0.0026		
				(0.0019)		
$\Delta\text{AppliedTariff}_{t-1}$, 3 years					0.0052	
					(0.0215)	
$\Delta\text{BoundTariff}_{t-1}$, 3 years						-0.0506*
						(0.0261)
$\log(\text{Imports})_{t-1}$		0.0033***	0.0034***	0.0034***	0.0034***	0.0035***
		(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0005)
$\text{PTAImportShare}_{t-1}$		0.0025	0.0026	0.0025	0.0034	0.0059**
		(0.0025)	(0.0025)	(0.0025)	(0.0027)	(0.0028)
$\log(\text{WorldImportShare})_{t-1}$		-0.0028***	-0.0031***	-0.0030***	-0.0025***	-0.0027***
		(0.0006)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Observations	319,886	319,886	304,859	305,891	276,970	252,947
R2	0.360	0.362	0.361	0.362	0.352	0.351
Country-year FE	Yes	Yes	Yes	Yes	Yes	Yes
2-digit HS FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table presents average marginal effects from PPML regressions. Clustered standard errors at the country/2-digit HS level are in parentheses. ***, ** and * indicate 1 percent, 5 percent and 10 percent significance levels, respectively.

Appendix A: Theory

To explain the inverse link between tariff overhangs and NTMs, I follow the setup of the two-country/many-goods model in Beshkar and Bond (2017). I first layout the basic model, derive the equilibrium bound tariff agreement, and then allow for the presence of NTMs.

A.1 Basic Setup

There are two countries, Home (no *) and Foreign (*), of potentially different size. There are $I+1$ products with good 0 being a freely trade numeraire good. Home's demand and supply relationships for the non-numeraire goods $i = 1, ..., I$ are $d_i = \lambda(1-p_i)$ and $x_i = \lambda b_i p_i$, where b_i is a measure of Home's productivity and λ indicates the relative size of Home compared to Foreign. The corresponding expressions in Foreign are $d_i^* = (1-\lambda)(1-p_i^*)$ and $x_i^* = (1-\lambda)b_i^* p_i^*$. Below I consider a representative import sector i with $b = 1 < b^* = \beta$. Dropping goods subscripts going forward, the world price is $p = (1+t)p^* = (1+t)/[2\lambda(1+t) + (1+\beta)(1-\lambda)]$, where t is the ad valorem tariff charged by Home.

Government welfare in Home, $V(t,\theta)$, is the sum of consumer surplus, firm profits and tariff revenue, while government welfare in Foreign, $V^*(t)$, is the sum of foreign firm profits and foreign consumer surplus:

$$V(t,\theta) = S(t) + (1+\theta)\pi(t) + tp^*(t)m(t) \tag{A.1}$$

$$V^*(t) = S^*(t) + \pi^*(t) \quad , \tag{A.2}$$

where $\theta \geq 0$ is the political pressure exerted by import-competing firms in Home. Crucially, the level of political pressure is private information of the Home government. The individual terms are $S(t) = \lambda(1-p(t))^2/2$, $\pi(t) = \lambda p(t)^2/2$, $tp^*(t)m(t) = tp^*(t)\lambda(1-2p(t))$, $S^*(t) = (1-\lambda)(1-p^*(t))^2/2$, and $\pi^*(t) = (1-\lambda)\phi^* p^*(t)^2/2$.

Home's Nash tariff rate, t^N, is found by maximizing domestic welfare (A.1) with respect to t, whereas the efficient tariff, t^E, maximizes joint welfare in Home and Foreign, $W = V + V^*$:

$$t^N(\theta) = \frac{\theta(1+\beta) + 2(\beta-1)\lambda}{(2-\theta)(1+\beta) + 4\lambda} \tag{A.3}$$

$$t^E = \frac{\theta}{2-\theta} \quad , \tag{A.4}$$

with $t^E < t^N$. Without a trade agreement Home always sets t^N, although the efficient tariff t^E is preferable from a global welfare perspective.

A.2 Optimal Trade Agreement

Private information about political pressure from import-competing firms implies that an incentive-compatible trade agreement between Home and Foreign must focus on negotiating bound tariffs. This feature does not only ensure truthfulness but is also preferred from a welfare perspective by either country to a fixed applied tariff rate (Bagwell and Staiger, 2005). The incentive-compatible tariff schedule for Home in the agreement is therefore

$$t = min\left[t^N(\theta), t^B\right] \quad , \tag{A.5}$$

where $t^N(\theta)$ is given by (A.3) and t^B is the negotiated bound tariff. Home's Nash tariff exceeds the bound tariff above the following level of political pressure:

$$\theta^B(t^B) = \frac{t^B\left[2(1+\beta) + 4\lambda\right] - 2(\beta-1)\lambda}{(1+\beta)(1+t^B)} \quad . \tag{A.6}$$

When international transfer payments are feasible, the optimal agreement in the presence of uncertainty maximizes expected world welfare. The optimal bound tariff then solves the following problem:

$$\max_{t^B} \quad E[W] = \int_0^{\theta^B(t^B)} W(t^N(\theta),\theta) f(\theta) d\theta + \int_{\theta^B(t^B)}^{\bar{\theta}} W(t^B,\theta) f(\theta) d\theta \quad , \tag{A.7}$$

where the first term captures the situation when $\theta \leq \theta^B$ and Home can set its Nash tariff. The second term accounts for the situation where $\theta > \theta^B$ and Home's applied tariff equals the negotiated bound tariff. To simplify the analysis going forward, I follow Kuenzel (2017) and assume that political pressure in Home is distributed uniform with support $[0,\overline{\theta}]$, where $\overline{\theta} < 2(\beta-1)/(1+\beta)$ to ensure positive trade flows: $f(\theta) = 1/\overline{\theta}$.

Solving (A.7) then results in

$$t^B = \begin{cases} \frac{\bar{\theta}}{4-\bar{\theta}} & \text{if} \quad t^B \leq t^N(0) \\ \frac{\bar{\theta}(1+\beta)-2\lambda(\beta-1)}{(2-\bar{\theta})(1+\beta)-4\lambda} & \text{if} \quad t^N(0) < t^B \leq t^N(\bar{\theta}) \end{cases} \tag{A.8}$$

where Home always has a tariff overhang, $t^B - t$, of zero when the first line applies. On the second line, both the realizations of a positive and a zero tariff overhang are possible, depending on the exact political pressure draw. In general, the tariff binding on the first (second) line applies if $\lambda \geq (<) \ \tilde{\lambda} \equiv \overline{\theta}(1+\beta)/[(4-\theta)(\beta-1)-2\overline{\theta}]$. That is, if a country is sufficiently large, its tariff overhang is always zero.

A.3 Optimal Trade Agreement with NTMs

One limitation of the above agreement is that countries have little trade policy flexibility when faced with high political pressure, θ, as they are likely to be constrained by the bound tariff. One way to introduce additional flexibility into the agreement is to allow countries the imposition of protectionist NTMs in addition to tariffs. However, in order for countries not to exploit this feature, i.e., imposing an NTM in times of low political pressure, the introduction of an NTM needs to be associated with a certain cost, c. In practice, the WTO requires that NTMs adhere to scientific standards and do not impose a burden on exporters more than necessary. Hence, writing agreement-conforming NTMs is costly in itself. In addition, NTMs impose additional efficiency losses compared to using tariffs and introduce additional compliance costs even for domestic firms. Hence, the NTM cost c includes both actual administrative costs and indirect costs from efficiency losses and compliance burdens.

To ensure that the NTM is increasing global welfare, I assume that countries have to impose an NTM that raises the amount of import protection to the equivalent of the efficient tariff, t^E. This protection level is attractive for countries only at high levels of political pressure as only then the efficient tariff level exceeds the bound tariff. Defining θ^M as the threshold above which world welfare from imposing an NTM exceeds the cost c, the optimal bound tariff agreement with NTMs then solves

$$\begin{aligned} \max_{t^B} \quad E[W] = & \int_0^{\theta^B(t^B)} W(t^N(\theta),\theta) f(\theta) d\theta + \int_{\theta^B(t^B)}^{\theta^M(t^B,c)} W(t^B,\theta) f(\theta) d\theta \\ & + \int_{\theta^M(t^B,c)}^{\bar{\theta}} \Big(W(t^E(\theta),\theta) - c \Big) f(\theta) d\theta \quad . \end{aligned} \tag{A.9}$$

Note that θ^M depends positively on the cost of the NTM, c, and the level of the bound tariff itself.

To understand the overhang-NTM relationship, it is sufficient to focus on the impact of the NTM cost c on the negotiated bound tariff t^B. As noted by Beshkar and Bond (2017), the expected welfare expression in (A.9) is supermodular in (t, c) and therefore not easily solvable. However, Proposition 2 in Beshkar and Bond (2017) shows that the optimal bound tariff is nondecreasing in the level of the cost c. That is, if the cost of imposing an NTM is low, Home's negotiated bound tariff decreases and the tariff overhang drops. Vice versa, if the NTM cost is high, Home will negotiate a higher bound tariff and therefore has a higher tariff overhang. Hence, a trade agreement can provide trade policy flexibility in two ways: tariff overhangs or the ease of imposing protectionist NTMs. If it is very costly to impose new NTMs, a country negotiates a greater tariff overhang. In case new NTMs are easily introduced, a country will in turn accept a lower tariff overhang. The model therefore predicts a negative relationship between tariff overhangs and NTM activity.

Appendix B: Data

Sample Composition: The baseline sample consists of the overlap between the tariff information in the World Bank's TRAINS database and the WTO's SPS and TBT Information Managements Systems (IMS) at the HS 4-digit level. The former can be accessed through the WITS system: http://wits.worldbank.org/wits/. The SPS and TBT data is available at http://spsims.wto.org/ and http://tbtims.wto.org/, respectively. When their MFN tariff data is available, WTO members are included in the sample if they notified at least one SPS and TBT notification during the period 1996-2019. The start of the sample period is determined by the fact that consistent bound and applied MFN tariff data at the HS 4-digit level are not available before 1995. The baseline specification in Table 4 also requires import data (in logs) at the HS 4-digit level. Hence, sectors with missing or zero imports are dropped from the analysis. The sample also excludes the two percent of sectors with the largest tariff overhangs to minimize the impact of outliers, which limits the data to HS 4-digit sectors with tariff overhangs of 120 percent or less.

NTM Notification Count: The NTM variable, NTM_{ict} in equation (1), is a count measure that adds up the number of SPS and TBT notifications to the WTO by member country c in HS 4-digit sector i and year t. WTO members can choose to report their SPS/TBT notifications at any HS level. As indicated in footnote 12, the most frequent notification level is HS 4-digit. The empirical analysis is therefore conducted at this level, implying that HS 6-digit notifications are aggregated up to the HS 4-digit level. For instance, if in a given year a country notifies one SPS measure in HS040610 (fresh cheese) and one TBT measure in HS040610 (grated or powdered cheese), the NTM_{ict} measure takes the value two in the HS 4-digit sector 0406 (cheese and curd). HS 2-digit notifications are instead distributed among the underlying HS 4-digit sectors. For instance, if a country notifies an SPS measure for HS01 (live animals), NTM_{ict} increases its count by one for all HS 4-digit sectors within HS01. Notifications without HS information, e.g., because they apply at a more general level, are not considered in the analysis.

In specification (7) in Table 4, I compile the NTM count variable instead at the HS 2-digit level. For instance, if in a given year a country notifies one SPS measure in HS040610 (fresh cheese), one TBT measure in HS040610 (grated or powdered cheese) and one SPS measure pertaining to HS04 (dairy produce), the NTM_{ict} measure at the HS 2-digit level (HS04) takes the value three.

NTM Concern Count: The NTM concern measure, $NTMconcern_{ict}$ in equation (5), is a count variable that adds up the number of concerns that countries submit to the WTO pertaining to member c's SPS and TBT measures in HS 4-digit sector i and year t. Following the procedure for the NTM notification variable described above, HS 6-digit concerns are aggregated up to the HS 4-digit level and HS 2-digit concerns are distributed among the underlying HS 4-digit sectors.

Tariff Overhangs: To obtain the baseline HS 4-digit tariff overhang measure, $Overhang_{ic,t-1}$ in equation (1), I proceed in two steps. I first obtain from the TRAINS database for each WTO member (if available) the simple averaged bound and MFN applied tariff data at the HS 4-digit level (based on the combined HS nomenclature), which TRAINS compiles based on underlying HS 8-digit data. The tariff data excludes non-tariff measures. I then construct the sectoral tariff overhangs by subtracting the MFN applied tariff from the bound tariff. The corresponding tariff overhang measures at the HS 2-digit level are calculated using simple averages of the bound and applied MFN tariff rates at this aggregation level instead.

Appendix C: Additional Results

Table C1: Non-tariff Measures and Tariff Overhangs – Without HS 2-digit NTM Notifications (PPML Results – Average Marginal Effects)

Dependent Variable: Non-tariff Measure Notification Count	4-digit (C1) NTM	4-digit (C2) NTM	4-digit (C3) NTM	4-digit (C4) NTM	4-digit (C5) TBT	4-digit (C6) SPS
Overhang_{t-1}	-0.0320***	-0.0291***	-0.0322***	-0.0279***	-0.0270**	-0.0135
	(0.0077)	(0.0073)	(0.0077)	(0.0071)	(0.0125)	(0.0092)
$\log(\text{Imports})_{t-1}$		0.0119***		0.0119***	0.0104***	0.0063***
		(0.0006)		(0.0006)	(0.0007)	(0.0004)
$\text{PTAImportShare}_{t-1}$		0.0055**	0.0082***	0.0063***	0.0087*	-0.0012
		(0.0024)	(0.0022)	(0.0024)	(0.0047)	(0.0024)
$\log(\text{WorldImportShare})_{t-1}$		-0.0084***	0.0035***	-0.0084***	-0.0075***	-0.0044***
		(0.0007)	(0.0004)	(0.0007)	(0.0010)	(0.0005)
Overhang_{t-1}				-0.0188**		
$\times\text{PTAImportShare}_{t-1}$				(0.0093)		
Observations	887,418	887,418	887,418	887,418	536,146	672,926
Pseudo R2	0.306	0.332	0.309	0.332	0.299	0.473
Country-year FE	Yes	Yes	Yes	Yes	Yes	Yes
2-digit HS FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table presents average marginal effects from PPML regressions. Clustered standard errors at the country/2-digit HS level are in parentheses. ***, ** and * indicate 1 percent, 5 percent and 10 percent significance levels, respectively. Specification (C4) reports the respective composite effects for Overhang_{t-1} and $\text{PTAImportShare}_{t-1}$, taking into account the interaction between both variables.

Table C2: Non-tariff Measures and Outlier Sensitivity – PPML and Linear Fixed Effects Model Results

	PPML Model				Linear Fixed Effects Model			
Sample Restriction	NTM>250	NTM>500	NTM>1000	NTM<2000	NTM>250	NTM>500	NTM>1000	NTM<2000
Dependent Variable:	4-digit	4-digit	4-digit	4-digit	4-digit	4-digit	4-digit	4-digit
Non-tariff Measure	(C7)	(C8)	(C9)	(C10)	(C11)	(C12)	(C13)	(C14)
Notification Count	NTM	NTM	NTM	NTM	NTM	NTM	NTM	NTM
Overhang_{t-1}	-0.0477***	-0.0578***	-0.0929***	-0.0203**	-0.0373**	-0.0567***	-0.1258***	-0.0294**
	(0.0157)	(0.0185)	(0.0243)	(0.0098)	(0.0185)	(0.0212)	(0.0300)	(0.0143)
$\log(\text{Imports})_{t-1}$	0.0121***	0.0136***	0.0164***	0.0063***	0.0113***	0.0125***	0.0152***	0.0056***
	(0.0006)	(0.0008)	(0.0010)	(0.0004)	(0.0007)	(0.0008)	(0.0010)	(0.0004)
$\text{PTAImportShare}_{t-1}$	0.0032	0.0033	0.0049	0.0072***	0.0151**	0.0159**	0.0255***	0.0028
	(0.0043)	(0.0051)	(0.0065)	(0.0026)	(0.0061)	(0.0070)	(0.0091)	(0.0033)
$\log(\text{WorldImportShare})_{t-1}$	-0.0084***	-0.0102***	-0.0119***	-0.0040***	-0.0080***	-0.0082***	-0.0094***	-0.0036***
	(0.0009)	(0.0010)	(0.0013)	(0.0005)	(0.0009)	(0.0011)	(0.0014)	(0.0005)
Observations	777,102	648,083	504,284	679,748	777,102	648,083	504,284	679,748
R2 (Pseudo R2)	0.355	0.344	0.329	0.356	0.1647	0.1695	0.1740	0.1313
Country-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2-digit HS FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table presents average marginal effects from PPML and linear fixed effects model regressions. Clustered standard errors at the country/2-digit HS level are in parentheses. ***, ** and * indicate 1 percent, 5 percent and 10 percent significance levels, respectively.

Table C3: Tariff Overhang Bins – PPML Results (Average Marginal Effects)

Dependent Variable: Non-tariff Measure Notification Count	4-digit (C15) NTM	4-digit (C16) NTM	4-digit (C17) NTM	4-digit (C18) NTM	4-digit (C19) TBT	4-digit (C20) SPS	2-digit (C21) NTM
Overhang_{t-1}: $\leq 0\%$ (1:Yes, 0:No)	0.0110**	0.0134**	0.0126**	0.0128**	0.0133**	0.0031	0.1355***
	(0.0054)	(0.0053)	(0.0054)	(0.0053)	(0.0067)	(0.0031)	(0.0497)
Overhang_{t-1}: 0%to25% (1:Yes, 0:No)	0.0110**	0.0104**	0.0111**	0.0097**	0.0117**	-0.0022	0.1332***
	(0.0043)	(0.0043)	(0.0043)	(0.0043)	(0.0058)	(0.0026)	(0.0396)
$\log(\text{Imports})_{t-1}$		0.0108***		0.0108***	0.0104***	0.0063***	0.1331**
		(0.0006)		(0.0006)	(0.0007)	(0.0004)	(0.0583)
$\text{PTAImportShare}_{t-1}$		0.0028	0.0053	0.0037	0.0091*	-0.0014	0.0400
		(0.0037)	(0.0036)	(0.0037)	(0.0047)	(0.0024)	(0.0516)
$\log(\text{WorldImportShare})_{t-1}$		-0.0073***	0.0036***	-0.0073***	-0.0075***	-0.0043***	-0.0887
		(0.0007)	(0.0005)	(0.0007)	(0.0009)	(0.0006)	(0.0585)
Overhang_{t-1}: ≤ 0 $\times\text{PTAImportShare}_{t-1}$				0.0130*			
				(0.0068)			
Overhang_{t-1}: 0%to25% $\times\text{PTAImportShare}_{t-1}$				0.0060			
				(0.0061)			
Observations	919,622	919,622	919,622	919,622	536,146	672,926	79,369
Pseudo R2	0.361	0.366	0.362	0.366	0.299	0.473	0.479
Country-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2-digit HS FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table presents average marginal effects from PPML regressions. Clustered standard errors at the country/2-digit HS level are in parentheses. ***, ** and * indicate 1 percent, 5 percent and 10 percent significance levels, respectively. Specification (C18) reports the respective composite effects for Overhang_{t-1}: $\leq 0\%$, Overhang_{t-1}: 0%to25% and $\text{PTAImportShare}_{t-1}$, taking into account the interactions between the former two variables and $\text{PTAImportShare}_{t-1}$.

Table C4: Non-tariff Measures and Tariff Overhangs – Linear Fixed Effects Model Results for Table 4

Dependent Variable: Non-tariff Measure Notification Count	4-digit (C22) NTM	4-digit (C23) NTM	4-digit (C24) NTM	4-digit (C25) NTM	4-digit (C26) TBT	4-digit (C27) SPS	2-digit (C28) NTM	4-digit (C29) NTM
Overhang_{t-1}	-0.0411***	-0.0367**	-0.0406***	-0.0355**	-0.0313**	-0.0061	-0.2890**	-0.0506***
	(0.0154)	(0.0154)	(0.0154)	(0.0153)	(0.0141)	(0.0142)	(0.1327)	(0.0116)
$\log(\text{Imports})_{t-1}$		0.0101***		0.0101***	0.0100***	0.0054***	0.1514***	0.0079***
		(0.0006)		(0.0006)	(0.0008)	(0.0004)	(0.0329)	(0.0005)
$\text{PTAImportShare}_{t-1}$		0.0122**	0.0139***	0.0140**	0.0089**	0.0061	0.0359	0.0089**
		(0.0052)	(0.0053)	(0.0056)	(0.0039)	(0.0056)	(0.0732)	(0.0043)
$\log(\text{WorldImportShare})_{t-1}$		-0.0076***	0.0025***	-0.0076***	-0.0081***	-0.0033***	-0.1466***	-0.0062***
		(0.0008)	(0.0006)	(0.0008)	(0.0009)	(0.0007)	(0.0329)	(0.0006)
Overhang_{t-1} $\times\text{PTAImportShare}_{t-1}$				-0.0745***				
				(0.0253)				
Observations	919,622	919,622	919,622	919,622	536,146	672,926	79,369	1,186,912
R2	0.1539	0.1555	0.1541	0.1556	0.0930	0.2065	0.1784	0.1423
Country-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2-digit HS FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table presents linear fixed effects model regression results. Clustered standard errors at the country/2-digit HS level are in parentheses. ***, ** and * indicate 1 percent, 5 percent and 10 percent significance levels, respectively. Specification (C25) reports the respective composite effects for Overhang_{t-1} and $\text{PTAImportShare}_{t-1}$, taking into account the interaction between both variables.

Table C5: Non-tariff Measures and Tariff Overhangs – Linear Fixed Effects Model Results for Table 5

Dependent Variable: Non-tariff Measure Notification Count	4-digit (C30) NTM	4-digit (C31) NTM	4-digit (C32) NTM	4-digit (C33) NTM	4-digit (C34) TBT	4-digit (C35) SPS	2-digit (C36) NTM	4-digit (C37) NTM
Overhang_{t-1}	-0.2730***	-0.2712***	-0.2713***	-0.2770***	-0.4554***	-0.0337	-0.8496**	-0.0791***
	(0.0834)	(0.0834)	(0.0834)	(0.0833)	(0.1211)	(0.0699)	(0.3871)	(0.0275)
$\log(\text{Imports})_{t-1}$		0.0425***		0.0425***	0.0409***	0.0201**	0.2895***	0.0142***
		(0.0082)		(0.0082)	(0.0090)	(0.0098)	(0.0934)	(0.0018)
$\text{PTAImportShare}_{t-1}$		-0.0264*	-0.0265*	-0.0231	-0.0474**	0.0017	-0.3113***	-0.0071*
		(0.0152)	(0.0152)	(0.0154)	(0.0207)	(0.0147)	(0.0936)	(0.0038)
$\log(\text{WorldImportShare})_{t-1}$		-0.0371***	0.0041	-0.0371***	-0.0276***	-0.0218**	-0.2402***	-0.0125***
		(0.0083)	(0.0025)	(0.0083)	(0.0088)	(0.0101)	(0.0910)	(0.0018)
Overhang_{t-1} $\times\text{PTAImportShare}_{t-1}$				-0.0836				
				(0.0583)				
Observations	310,025	310,025	310,025	310,025	204,673	166,293	43,292	1,186,912
R2	0.2334	0.2338	0.2335	0.2338	0.1416	0.2938	0.3212	0.2820
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4-digit HS x country FE	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
2-digit HS x country FE	No	No	No	No	No	No	Yes	No

Notes: The table presents linear fixed effects model regression results. Clustered standard errors at the country/2-digit HS level are in parentheses. ***, ** and * indicate 1 percent, 5 percent and 10 percent significance levels, respectively. Specification (C33) reports the respective composite effects for Overhang_{t-1} and $\text{PTAImportShare}_{t-1}$, taking into account the interaction between both variables.