Environmental and Health Protections, or new Protectionism? Determinants of SPS Notifications by WTO Members*

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Abstract

The drastic reductions in bound tariffs agreed by WTO members over the past half century have been accompanied by a substantial rise in non-tariff barriers to trade. Many commentators have drawn a causal link between these two phenomena, but there have been few attempts to empirically test this claim. This lack is particularly apparent with regard to Sanitary and Phytosanitary (SPS) measures, despite their increasing prevalence both in the media and in WTO disputes. SPS measures, like other health and environment regulations, ostensibly serve legitimate national policy objectives and cannot be labeled as "green" protectionism merely by considering posterior trade impacts. The determinants of these regulations matter. This paper uses members' SPS notifications to the WTO at the product level to test the importance of negotiated tariff reductions as a driver for additional SPS regulations. Using an error correction model specification, we confirm that smaller tariff binding overhang leads to increases in the probability of new SPS measures. However, we also find that environmental and governance variables are more important determinants of SPS notifications.

Keywords: SPS, Standards, WTO, Green Protectionism, Non-Tariff Barriers

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1 INTRODUCTION

Through successive rounds of trade negotiations, bound tariffs have fallen and limitations have been placed on traditional trade barriers among WTO members. From very early in the evolution of the General Agreement on Tariffs and Trade (GATT), however, there have been concerns that negotiated reductions in tariffs may lead to a rise in Non-Tariff Barriers (NTBs)[1,2] (Wilson, 1969). Some authors even argue that for certain sectors—mainly those industries which are competitive and have low barriers to entry—there has ironically been a net increase in protection due to NTB substitution after tariff reduction (Ray, 1981, 1987; Marvel and Ray, 1983). Concern about the potential for NTBs to offset gains from liberalization led to the inclusion of agreements intended to curtail non-tariff protectionism in the Uruguay Round of trade negotiations (Green, 1981; Laird and Yeats, 1990; Page, 1987; Ray and Marvel, 1984). Despite this, non-tariff measures—particularly in the form of technical and sanitary standards—continue to proliferate, and disputes before WTO panels are increasingly related to this clash between domestic policy space and commitments to market access.

The incentives for governments to raise NTBs in response to negotiated decreases in bound tariffs have been illustrated in numerous political economy models. Some refer to the political advantages of NTBs' complexity and/or financial benefits from lobbying contributions (Kono, 2006; Yu, 2000; Rosendorff, 1996), while others focus on specific substitution of one type of NTB for another (Rosendorff, 1996).[3] The underlying intuition of all these models is that trade agreements lower the rate of protection, but do not reduce the underlying domestic political economy pressure for protectionism. Jagdish Bhagwati (1988) labeled this phenomena the "Law of Constant Protection".

In contrast to the theoretical literature, the empirical literature testing the relation between tariff liberalization and countries' use of non-tariff measures is relatively undeveloped. Earlier studies only looked over a few sample years and focused on broadly defined NTB coverage ratios (Laird and Yeats, 1990). The connection at a more detailed level on specific NTB measures has been investigated almost solely for anti-dumping (Moore and Zanardi, 2011; Vandenbussche and Zanardi, 2010; Anderson et al., 2000). Feinberg and Reynolds (2007), for example, find that tariff reductions increased both the likelihood and number of AD petitions, especially for developing countries . However, the positive correlation found in this and similar studies has generally been between *levels* of tariffs and *changes* in NTBs, with little or no apology for the mismatch. The current paper examines the relationship between NTBs and tariffs in a properly-specified

[1] Also called non-tariff measures (NTM) in the literature

[2] Although the NTB concerns in the early years of GATT were largely around quotas and voluntary export restraints (VERs), today technical standards and anti-dumping (AD) measures are of increasing importance.

[3] See Mansfield and Busch (1995) for further discussion.

error correction model.

The specific non-tariff measures studied in the current paper are Sanitary and Phytosanitary (SPS) measures. SPS are particularly interesting because ostensibly their objectives of protecting human, plant and animal health are quite laudable and generally claim to serve legitimate policy objectives. However, the decades of tariff reductions have also seen a steady rise in SPS measures. Thus concerns about protectionist abuse of SPS and other technical barriers are common both in the academic literature(Runge, 1990; Charlier and Rainelli, 2002; Peterson and Orden, 2008; Mahé, 1997; Otsuki et al., 2001; Kastner and Pawsey, 2002; Götz et al., 2010) and the broader media. According to Baldwin et al. (2000), the complicated nature of these measures and the impact they can have on trade, make them more important than ever for the world trading system.

Concerns about the use of SPS as hidden trade barriers have prompted a number of quantitative studies into their trade impacts. Chen et al. (2008) find that trade impacts from standards can be more significant for certain products than import tariffs. Qualitative, survey evidence as well indicates that SPS measures can form some of the strongest barriers to trade (Henson and Loader, 2001). Other studies on SPS measures have focused on developing techniques to find tariff equivalents (J.C. and Bureau, 2001; Maskus et al., 2000). These methods have then been applied, often in gravity models, in studies of specific countries and/or specific products to capture the trade effects of SPS measures, usually based on an SPS coverage ratio for a product line. They also tend to conclude that SPS have a trade depressing effect (Liu and Yue, 2009; Otsuki et al., 2001; Calvin et al., 2008; Jongwanich, 2009; Chen et al., 2008). In our view, while these findings are important, they do not address the issue of protectionism per se. Though reduced trade is a protectionist effect, it does not necessarily imply protectionist intent.

Protectionism has been variously defined throughout the literature with regards to NTBs. Broad definitions such as Walter (1972) define any measure which impacts the direction, composition, or volume of trade as a protectionist barrier (Chambers and Pick, 1994). Others have taken a narrower view and considered the data from specific trade concerns; when there is a high ratio of trade concerns to new trade policy notifications at the product level, this could indicate protectionist intent by a country (Disdier and van Tongeren, 2010). Disdier et al. (2008) look for protectionism in the frequency of standards on products across countries; when only a few countries have issued a regulation on a specific HS code, the regulation may be potentially protectionist. Complementing these approaches, in this paper we look for signs of protectionist intent by connecting the decline in bound tariffs on a product with the issuance of new SPS regulations on that product.

We believe our approach to be the first in connecting the decline of tariff protection to the issuance of new

SPS measures. SPS regulations are an interesting case study since environment and health are normal goods with a high income elasticity of demand—meaning that rising incomes provide a highly plausible alternative explanation for the trend toward more stringent SPS policy that we observe over time. Furthermore, since environment and health are highly emotive topics, WTO attempts to curtail countries' rights to apply SPS measures are often highly controversial.

2 Data and Variables

Our empirical analyses utilize panel data of all countries (98) which have reported SPS notifications (regular and emergency) in 69 product types (at 2-digit, chapter level HS codes) to the WTO over the period from 1996 to 2010. It was necessary to do the analysis at the aggregated HS 2-digit level due to constraints in the SPS notification data set; many countries only report at this high level. The data on notifications from each country per product, per year were then merged with relevant economic factors, environmental metrics, and governance controls to form a panel.

The European Union created a dilemma. The EU reports some SPS notifications as community-wide policy, but also individual members are able to report new SPS policy as well. We created two databases. One is an EU aggregate where EU notifications and member states notifications are compiled into a large, aggregate EU "country" (as per Fontagné et al., 2005). The second, perhaps more realistic data set, applies EU-wide notifications to each member state and drops the EU as an independent "country" in the data set. This disaggregated version will account for intra-EU trade and slight differences between the standards in each country. The main conclusions of the paper are robust to either treatment of Europe (see Table 10 in Appendix). We report results for the EU-disaggregated version of the data set unless otherwise specified.

2.1 SPS Notifications

Each WTO member is required to have both a National Notification Authority and an official Enquiry Point for Sanitary Phytosanitary (SPS) regulations. Countries are required to report new or changed sanitary and phytosanitary (SPS) regulations to the WTO when the standard is different from international standards and will "have a significant impact on trade". To increase transparency, these notifications are compiled by the WTO and available through the SPS Information Management System[4] (SPS - IMS). Member countries report both "regular" notifications which reflect new or changed permanent regulatory measures and "emergency" measures which are meant to be temporary restrictions.

[4]http://spsims.wto.org

Table 1: Top Ten HS Codes (1996-2010)

HScode	Description	Regular	Emergency	Both	AgProd
1	Live animals	678	686	1,364	Yes
2	Meat and edible meat offal	712	699	1,411	Yes
3	Fish & crustacean, mollusc & other aquatic invert	272	24	296	
4	Dairy prod; birds' eggs; natural honey; edible pr	520	369	889	Yes
5	Products of animal origin, nes or included.	255	290	545	Yes
6	Live tree & other plant; bulb, root; cut flowers	271	26	297	Yes
7	Edible vegetables and certain roots and tubers.	328	37	365	Yes
8	Edible fruit and nuts; peel of citrus fruit or me	501	41	542	Yes
12	Oil seed, oleagi fruits; miscell grain, seed, fru	299	9	308	Yes
23	Residues & waste from the food indust; prepr ani	240	205	445	Yes
	TOP TEN TOTAL	4,076	2,386	6,462	
	ALL TOTAL	5,928	2,559	8,487	

Although the SPS-IMS system represents a significant improvement in the compilation of SPS data, there is still likely to be some under-reporting by countries. Not all WTO members have appointed a National Notification Authority and some have not issued any SPS notifications in the 1996 to 2010 period. The other major limitation of the SPS-IMS data is that members do not always give complete information about the restrictiveness of the measure, the reasoning behind it, and the specific products (by Harmonized System codes) it applies to. As a result, an inventory approach at the HS 2-digit chapter level was used in this paper as this was the most disaggregated level possible, while still utilizing the vast majority of observations from the database.[5]

Table 1 contains the number of emergency and regular notifications for the top ten most notified products from all countries. In sum there are 8,487 notifications in all categories, but the number of notifications is heavily skewed towards a few product types. The top ten chapter level product codes account for over 75% of the total number of either type of SPS notification (termed "Both" in the table). For the emergency notifications, over half occur just in HS-1 and HS-2, which are live animals and meat respectively. SPS notifications are almost exclusively in agricultural products (as defined by the Agreement on Agriculture), though the SPS agreement is not legally limited to these products alone.

There are several developing countries which are in the top ten users of SPS notifications of both types (see Table 2). Some countries use almost exclusively regular notifications (e.g. Japan), others nearly ex-

[5] There are around 2,000 notifications without HS categorization, but comparing analysis on country/year aggregated levels, our results are not biased by the missing uncategorized data.

Table 2: Top Ten SPS using Countries (1996-2010)

Country	Regular	% All Reg.	Emergency	% All Emer.	Both	% All Both
European Union	771	13.01%	311	12.15%	1,082	12.75%
Japan	530	8.94%	23	0.90%	553	6.52%
United States	446	7.52%	92	3.60%	538	6.34%
Peru	329	5.55%	149	5.82%	478	5.63%
Philippines	114	1.92%	362	14.15%	476	5.61%
Brazil	396	6.68%	12	0.47%	408	4.81%
Albania	13	0.22%	380	14.85%	393	4.63%
New Zealand	274	4.62%	86	3.36%	360	4.24%
China,P.R.: Mainland	286	4.82%	36	1.41%	322	3.79%
Chile	261	4.40%	35	1.37%	296	3.49%
TOP TEN TOTAL	3,420	57.69%	1,486	58.07%	4,906	57.81%

clusively emergency (e.g. Albania), others more balanced (e.g. European Union). It could be interesting to look at the political economy or reasons driving the divergent use patterns between the two notification types across countries, but this will not be explored at present. The econometrics analysis that follows is robust to using either regular notifications or both notifications as the metric for the use of SPS policy.

2.2 Tariffs and Trade Variables

Tariff data (AHS/Applied, BND/Bound, and MFN rate) at the chapter level in the harmonized system (HS) were downloaded from the World Integrated Trade System (WITS) for all countries for the years 1996 to 2010. Tariff Binding Overhang was calculated by taking the difference between the bound and applied tariff for each country/year/product observation. Trade data for imports and exports was taken from UN COMTRADE for each country as a reporter and the world as partner.

The trend between the increased use of SPS with falling applied tariffs is shown in Figure 1. The total number of SPS notifications from every country are plotted in the bars for each year, while the median applied tariff for all countries in the data set is plotted in the line. At this aggregated level, few definitive conclusions can be drawn. The SPS system only started in 1995 and one would expect use to increase as countries become more familiar with the system. This figure cannot show if on specific products, declines on tariffs were concurrent or related to issuing of new SPS measures.

Figure 2 makes the relation a bit more clear. Notifications by HS code for every country and year are grouped into into three categories based on the size of tariff binding overhang: small flex (mean binding

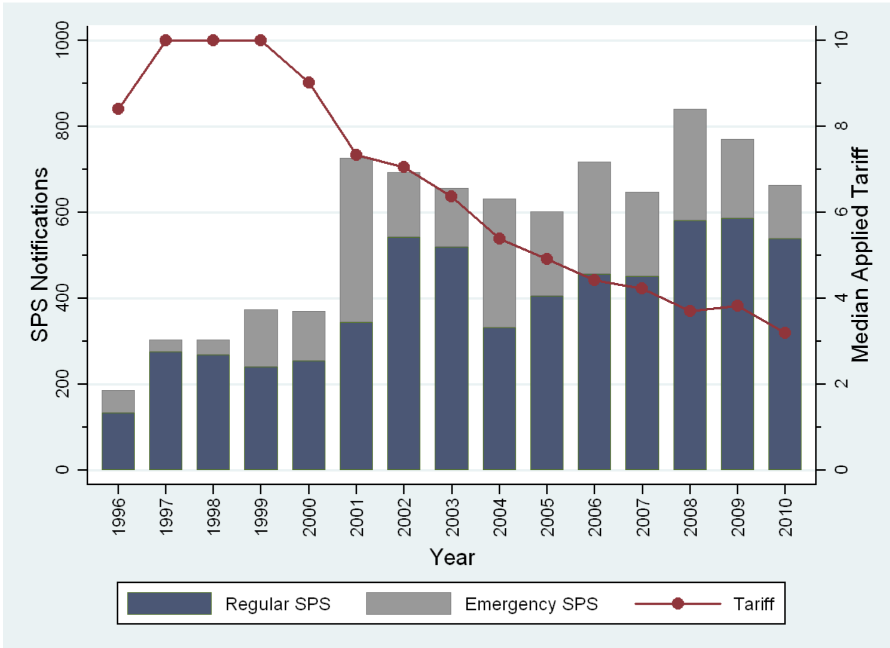


Figure 1: Global SPS Notifications and Median Applied Tariffs

overhang <5%), medium flex (>5%, <30%), and large flex (>30%). The mean number of SPS notifications per year per HS code for each group is plotted against the group's mean binding overhang rate. The figure suggests that SPS notification increases with declining ability to raise tariffs due to binding constraints. However, this could be driven by many other factors from a country's wealth (i.e. in general developing countries have larger binding overhang) to environmental governance which could be associated with the observed pattern. The subsequent analysis controls for these other factors, however, these simplistic figures demonstrate the motivation behind many comments made in the policy sphere and political perception of "green protectionism" (Costinot, 2008; Yu, 1994; Campbell and Coombes, 1999).

2.3 Governance and Environmental measures

The most credible source of environmental metrics and governance data comes from a joint project of Yale University and Columbia University through the outcome-oriented Environmental Performance Index (EPI) and their previous work on the Environmental Sustainability Index (ESI). These indexes have been widely used in the environmental economics and policy literature (Fredriksson and Wollscheid, 2007; Whitford and Wong, 2009; Morse and Fraser, 2005; Mukherjee and Chakraborty, 2010). Each index produces an overall score for each country based on many metrics and sub-metrics (see websites[6] for more information). From

[6]EPI: http://epi.yale.edu/ ; ESI: http://www.yale.edu/esi/

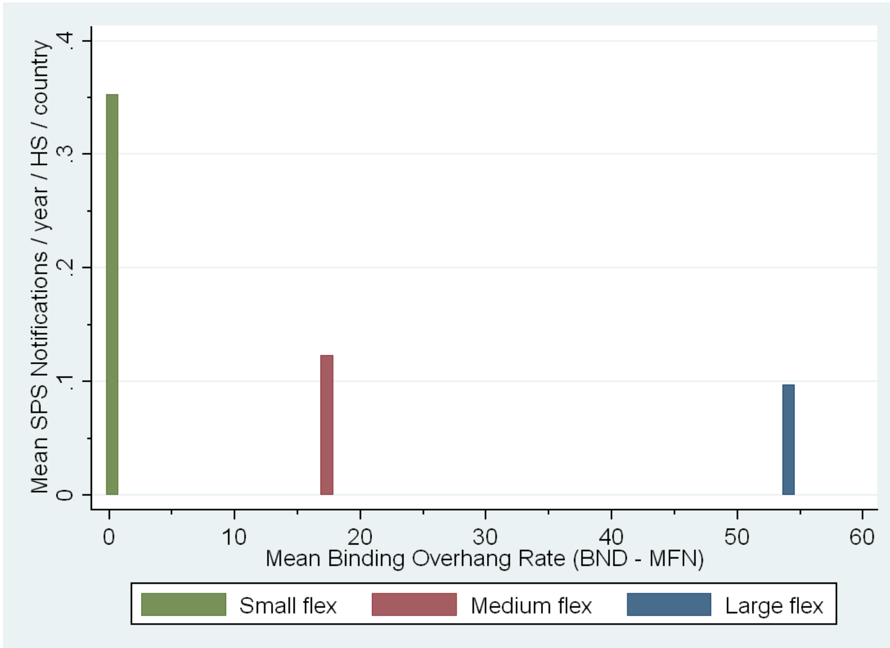


Figure 2: SPS Notifications by Flexibility of Binding Overhang

the ESI, data was missing for 11 member countries who reported a total of 851 notifications in the time period. From the EPI, data was missing for 3 members (Taiwan, Macao, and Hong Kong).

Under the EPI there are two components: "environmental health" and "ecosystem". We use environmental health as a whole and then relevant components of the "ecosystem" metric (further explained in: section 3.2). From the ESI, we use the component "environmental governance" which measures each countries' institutional strength in this specific area. The general trend between environmental governance and SPS notifications is shown below in Figure 3. Countries are grouped in three categories (analogous to Figure 2) roughly separating the data into thirds: low performers (score < 0), best performers (score >1), and those in between. The general trend that countries with greater environmental governance tend to issue more SPS notifications is clear.

Governance indicators are taken from the World Bank from the most recent data release of Sept. 2010.[7] The data covers the period 1996 to 2010, however data for 1997, 1999, 2001 are missing. For these missing years, a simple average of data from adjacent available years were used. Indicators for the European Union as a block were created by taking a simple average of the data for all 27 members.

Data for level of democracy was taken from the Polity IV project.[8] The Polity Project measure of governance is widely used in the literature to analyze the impact of democracy and autocracy on environmental

[7]http://data.worldbank.org/data-catalog/worldwide-governance-indicators
[8]http://www.systemicpeace.org/polity/polity4.htm

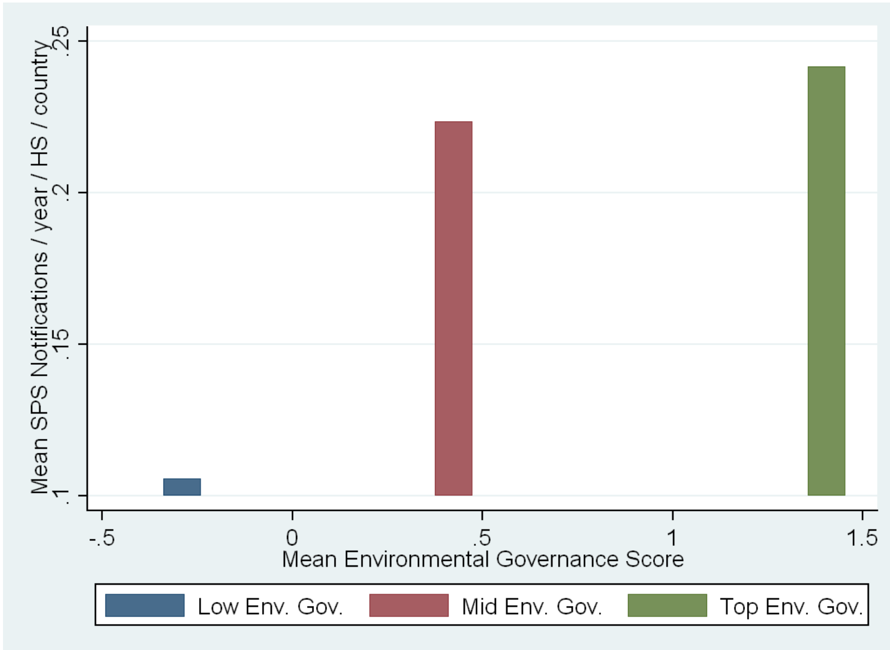


Figure 3: SPS Notifications by Mean Environmental Governance

performance (Pellegrini and Gerlagh, 2006; Li and Reuveny, 2006; Farzin and Bond, 2006; Asiedu and Lien, 2010; Neumayer, 2002; Fredriksson and Wollscheid, 2007; Bhattacharyya and Hodler, 2010). The polity2 index was used as a measure of political competition and democracy from 1996 to 2010. Data is available for most countries, but seven members were missing (accounting for 107 total notifications). Like before, a simple average was taken for the EU-27 as a single entity.

Stringency of a country's environmental regulations is taken from the World Economic Forum for the year 2010 for which 25 countries are not present (together accounting for 2,373 notifications). A simple average was taken for the EU-27 as a block with four members missing.

2.4 Other Variables

Macro-economic indicators (GDP per capita, Current Account, and Exchange Rate) were take from the World Bank's World Development Indicators (WDI). The same data for Taiwan was acquired from the IMF World Economic Outlook (WEO) and conversions to constant $US2000 dollars to match World Bank data were done based on the suggested method by the World Bank. [9] Population for each country was taken from the World Population Prospects 2010 revision provided by the UN DESA Population Division. [10]

[9] http://data.worldbank.org/about/faq/specific-data-series

[10] http://esa.un.org/unpd/wpp/Excel-Data/population.htm

Table 3: Summary Stats and Data Sources

VARIABLE	UNITS	MEAN	SD	RANGE	N	Source
Ag. Subsidies	See Source	0.090	0.190	1.2	101,430	Yale EPI 2010
AHSWeightAve	%	8.671	22.816	2,645.0	64,486	WITS / TRAINS
biodiversity	See Source	58.538	26.093	100	101,430	Yale EPI 2010
BNDWeightAve	%	27.869	38.387	2,776.00	59,998	WITS / TRAINS
BothNotes	Notifications	0.19	1.05	65	101,430	SPS - IMS
CurrentOverGDP	% of GDP	-1.001	9.215	77.5	95,496	World Bank WDI (Taiwan: IMF WEO)
EmerNotes	Notifications	0.037	0.495	43	101,430	SPS - IMS
Enviro. Health	See Source	70.919	18.818	73.5	98,325	Yale EPI 2010
Enviro. Gov.	See Source	0.287	0.617	2.4	87,975	Yale ESI 2005
Enviro. Reg. Strin.	See Source	4.27	1.087	4.5	75,555	WEF Exec. Opin. Survey 2010
Exchange Rate Index	$\frac{ExRate}{ExRate_{96}}$	1.757	1.971	18.4	91,356	World Bank WDI (authors' calc.)
Export Value	Constant 2000 US$	1.13E+09	7.51E+09	3.96E+11	84,042	UN COMTRADE
GDP per capita	Constant 2000 US$/person	9,356.55	10,701.77	41,758.40	99,981	World Bank WDI (Taiwan: IMF WEO)
Import Value	Constant 2000 US$	1.18E+09	8.03E+09	6.15E+11	84,111	UN COMTRADE
isBothNote	(dummy)	0.073	0.26	1	101,430	Authors' own, based on SPS-IMS
MFNWeightAve	%	10.495	23.366	2,645.00	64,459	WITS / TRAINS
Pesticide Reg.	See Source	15.582	7.877	22.0	101,430	Yale EPI 2010
Polity	See Source	5.455	6.133	20	94,185	Polity IV Project 2010
Population	1,000s people	5.14E+04	1.73E+05	1.34E+06	101,430	UN DESA Pop. Div.
RegNotes	Notifications	0.153	0.849	65	101,430	SPS - IMS
Tariff BO	%	17.475	31.177	3,960.80	59,751	WITS / TRAINS (authors' calc.)
WGI_CC	See Source	0.309	0.995	4	101,430	World Bank WGI
WGI_GE	See Source	0.381	0.895	3.5	101,430	World Bank WGI
WGI_PV	See Source	0.131	0.834	4.4	101,430	World Bank WGI
WGI_RL	See Source	0.284	0.899	3.7	101,430	World Bank WGI
WGI_RQ	See Source	0.418	0.79	3.8	101,430	World Bank WGI
WGI_VA	See Source	0.238	0.85	3.7	101,430	World Bank WGI

3 Empirical Approach

Development of SPS policy, particularly SPS measures sufficiently matured to be notified to the WTO takes time and involves institutional capacity building and learning. For this reason, current levels of SPS protection in a country are likely to depend on previous notification experience, as well as, both current and previous levels of other explanatory variables — including tariff rates and environmental health preferences. We therefore base our analysis on an auto-regressive distributed lag (ARDL) model. Since our measure of the level of SPS protection has a unit root, we apply the ARDL in error correction form. While error correction models are most often associated with models of co-integration, the unrestricted ECM may be derived in a straight-forward manner from any ARDL model (Wickens and Breusch, 1988). The only complication, in our case, is that the unit root in the level of SPS (i.e. cumulative number of notifications) does not allow us to model a stable relationship between the *level* of SPS protection and the explanatory variables. However, the unrestricted error correction model (ECM) is a stable model of *new* SPS notifications. Since our data set consists only of new notifications since WTO formation (or membership), this restriction on what can be econometrically modeled is not binding for us. The ECM form also allows us to easily test the significance of the lagged levels of explanatory variables, and thus whether the ARDL model is appropriate.

The summary statistics in Table 3 show that almost 93% of the (country-year-HS2 code) observations in our data set report zero new SPS notifications. For this reason our analysis focuses on the determinants of having a non-zero number of notifications in a year (using a logit model).

3.1 Testing for Protectionist Drivers of SPS

Our base specification for examining protectionist drivers of SPS notifications has the form:

$$\triangle SPS_{iht} = \alpha \triangle X_{iht-1} + \beta X_{iht-2} + \gamma \triangle Z_{it} + \delta Z_{it-1} + \lambda_i + \mu_h + \nu_t + \varepsilon_{iht} \tag{3.1}$$

The vector of controls, X_{iht} in equation 3.1 includes trade-related variables which vary by country (i), year (t), and HS2 code (h). All the variables in X_{iht} are lagged once more than in the standard error correction model to reduce simultaneity bias. To test whether negotiated tariff reductions are a driver for increased SPS notifications, our variable of interest is the weighted average MFN binding tariff overhang.[11] We expect decreases in binding overhang (or slack) to be associated with increases in SPS use. The other components of X_{iht} are log imports and log exports. Protectionist motives for SPS notifications would predict a rise in SPS

[11] See Section 2.2 for a detailed explanation of the tariff variables. Robustness checks using a range of other tariff measures are included in the Appendix.

notifications when imports rise or exports fall. There are, however, legitimate, non-protectionist, motives for SPS notifications which may predict a different relationship between SPS notifications and imports/exports, especially in the long-term. For example, a fall in imports and rise in exports may be driven by growth in the domestic industry. A larger and more valuable domestic industry raises the expected cost of a biosecurity incursion, thus driving up the need for enhanced SPS protections to mitigate the risk of negative economic impact. Alternatively, a rise in imports may prompt an increase in SPS standards simply because increased volumes means increased risk of a biosecurity breach (Waage and Mumford, 2008; Mumford, 2002).

The vector Z_{it} in equation 3.1 contains country-year level controls. These include other trade-related variables: whether the current account is positive and the exchange rate (relative to the US dollar). Protectionist motives for SPS notifications would predict a rise in SPS notifications when the current account turns negative or the exchange rate falls (i.e. the currency appreciates). Log population is also included since the fixed cost component of issuing SPS notifications means we expect larger countries to make more notifications. Log GDP per capita is included as we expect notifications to be increasing in both environmental and health preferences and in institutional capacity, both of which are increasing in income. In the next section we explicitly include national-level measures of environmental and health preferences, agricultural support and institutional capacity.[12] They are not included in the base regression as many of the measures are only available for a single year and thus preclude the inclusion of country dummies.

As is prudent in cross-country regressions of any type, we consider the inclusion of a country "fixed-effect". A robust Hausman test supports the inclusion of country dummies in the specification, although their inclusion has no significant impact on the estimates of the coefficients on the tariff measures themselves. HS2 code dummies are also included in equation 3.1 due to the heterogeneity of SPS notifications by HS2 code which we observed in Section 2.1. Finally, our base specification includes year dummies to capture global shocks and trends, including biosecurity threats (such as avian influenza) and economic shocks (such as the global financial crisis).

Finally, we note that the simple inclusion of country, HScode and year dummies (or "fixed effects") could potentially cause bias. We nevertheless use this as our main approach as it allows better estimation of predicted probabilities. Given the number of time periods our dataset covers, previous work indicates the bias should be small (Katz, 2001). Additionally, we show robustness checks using alternative conditioning techniques which suggest bias is not a cause for concern in our case.

[12] See Section 5 for results tables where these measures are included.

3.2 Governance, Health and Environmental Determinants of SPS

Although protectionist pressures may be one of the drivers of SPS regulations, it would be quite wrong to assume that they were the only factors. SPS standards have a legitimate role in protection of human, plant and animal health. Furthermore, it is possible that much of the trend toward increased SPS standards is a result of this legitimate policy objective. For example, rising incomes are known to lead to demands for higher environmental and health standards (Gangadharan and Valenzuela, 2001; McConnell, 1997). Rising incomes and institutional development are also likely to lower the cost of developing and implementing higher standards. Using a number of leading political, governance and environmental policy measures from the economic literature, we examine the importance of these drivers on SPS notifications. We conduct this part of the analysis using a modified version of equation 3.1 which excludes country dummies but includes all other controls. The country effects are excluded in this section as a number of the important environmental and governance variables were only available for a single year.

Every nation can set its own allowable level of risk in the conduct of its setting of SPS policy and standards. Countries with higher environmental standards or more sensitive environments would be expected to issue more SPS notifications as they have a greater real or perceived threat from the import pathway. We use components of the Environmental Performance Index (EPI) as a measure for environmental quality as has been common in the environmental policy literature (Fredriksson and Wollscheid, 2007; Whitford and Wong, 2009). EPI is made up of two aggregated measures: "environmental health" and "ecosystem". We expect environmental health (Enviro. Health) to have a positive coefficient in the regressions as increased environmental quality should lead to increased need for protection against harm via SPS policy. The other main component, ecosystem, is composed of many metrics, but only some are appropriate to this analysis (e.g. we exclude factors like climate change which *a priori* have unclear and indirect impacts at best on SPS regulatory needs). The ecosystem sub-metrics of biodiversity, agriculture subsidies, and pesticide regulation are used. We expect higher biodiversity and more stringent pesticide regulation to be common to countries with greater use of SPS policy. As well, if it is less protection of domestic producers that leads to SPS policy as a protection alternative, we would expect smaller agriculture subsidies to increase the use of SPS policy (controlling for development level and other economic factors).

Aggregated metrics for environmental governance were used from the Environmental Sustainability Index (ESI). We expect that higher levels of environmental governance will lead to greater use of SPS notifications. Since environmental governance might be just be a proxy of general governance, we also include the six components of governance from the World Bank in some of the analysis. Since it is not clear how Political Stability, Voice and Accountability, and other components of the World Bank metrics could directly influence SPS policy, we include them as controls, but do not report the results.

Lastly we control for democracy and perceptions of the stringency of a nation's environmental regulations. The impact of democracy on environmental policy is highly debated, but several papers find generally that more democratic countries tend to have higher environmental protection (Midlarsky, 1998; Driesen, 2006; Fredriksson and Wollscheid, 2007). Similarly, we expect countries that are more democratic as well as countries that have more stringent environmental policy to also have more aggressive use of SPS policy on products they import.

4 PROTECTIONIST DRIVERS OF SPS NOTIFICATIONS

Table 4 reports our main results for our analysis of the trade-related determinants of SPS notifications. The results in column 1 appear to provide support for the claim that protectionist motives are one of the drivers of SPS measures. In particular, we see that larger tariff binding overhang (BO), positive current account balance and a lower valued exchange rate are all statistically significantly associated with lower probability of SPS notification. As predicted, countries with greater value imports and exports are more likely to notify an SPS measure. However, as discussed in Section 3.1, this does not necessarily imply "protectionist" intent.

Also as predicted, larger population and higher income is significantly positively associated with SPS notifications. Perhaps the most surprising result in Table 4 is the strong negative association of SPS notification with population growth rate. We postulate that this effect may be being driven by demographic changes. Specifically, low population growth rate leads to aging societies, where environmental and health concerns are likely to be greater. We leave testing this proposition to further research.

Column 2 in Table 4 presents an attempt to understand the economic significance of the effects in column 1. It presents the percent difference in probability of notification predicted by varying the explanatory variable from its 1st to 99th percentile value. Thus we see that these coefficients imply that variation in the level of tariff BO in our sample from the top percentile down to the bottom one is associated with an increase in the probability of notification of roughly 1%. This is reasonably substantial given that the average probability of notification in our sample is only around 3%.

By far the most important variables indicated in column 2 of Table 4 are export value and population growth rate, whose variation in our sample could cause changes in the probability of notification of around 3% and around 2.5% respectively. These are followed by population, income, import value, exchange rate changes and current account fluctuations — all of which appear to be more important determinants of SPS

Table 4: Logit model of at least one SPS notification by country, year and HS2 code. △ Probability indicates the % change in predicted probability of notification as the explanatory variable changes from is 1st to 99th percentile in the sample. Year and HS2-code effects included but not reported.

	Odds Ratio	Δ Probability (%)
L.D. Tariff BO	0.995**	-0.267
	(0.00161)	
L2. Tariff BO	0.993**	-1.089
	(0.00123)	
L.D. Log Imports	1.009	0.036
	(0.0544)	
L2. Log Imports	1.077**	1.365
	(0.0308)	
L.D. Log Exports	0.996	-0.055
	(0.0331)	
L2. Log Exports	1.131**	3.169
	(0.0165)	
D. Positive Current Account	0.633**	-1.326
	(0.0839)	
L. Positive Current Account	0.780**	-0.343
	(0.0424)	
D. Exchange Rate Index	0.513**	-1.190
	(0.0679)	
L. Exchange Rate Index	0.998	-0.021
	(0.0157)	
D. Log GDP per capita	0.594	-0.133
	(0.676)	
L. Log GDP per capita	1.229**	1.318
	(0.0483)	
D. Log Population	4.19e-14**	-2.623
	(3.23e-13)	
L. Log Population	1.138**	1.644
	(0.0345)	
Constant	0.00222**	
	(0.000868)	
Observations	28583	28583

Standard errors (in parentheses) are clustered by HScode-Year. * $p < 0.05$, ** $p < 0.01$

Tariff Binding Overhang (BO) calculated from MFN weighted average tariff. "L." indicates 1-year lag. "D." indicates first difference.

notifications than tariff BO. Thus, although there is a story to tell about the impact of tariff reductions on SPS notifications, it may not be the most important story. We return to this question of how tariff BO compares to other determinants of notifications in Section 5.

The remainder of this section addresses the question of how robust and universal is our finding that protectionist variables are statistically significantly associated with increased probability of SPS notifications. We begin in Table 5 by examining the robustness to changing the way we address country-, HScode-, and year-level heterogeneity. Column 1 reproduces our logit regression with HScode and year effects from Table 4. Column 2 simply adds a set of country dummies. Column 3 is much more sophisticated, conditioning on HScode-Year groups and including a set of country dummies. Column 4 is an alternative to column 3, conditioning on Country-HScode and including a set of year dummies.

The magnitude of the odds ratios for the tariff BO variables are fairly consistent across the columns in Table 5, though the statistical significance varies. The more traditional "fixed effect" regression in column 4 shows the least significance for tariff BO — but this may be due to the smaller sample with identifying variation.[13] The most robust "protectionist" determinants of SPS notification — once we control for country heterogeneity in columns 2-4 — are decreases in export value and exchange rate appreciation.

Table 6 shows that the negative relationship between tariff reductions and SPS notifications is not driven primarily by recent WTO accessions. It also suggests - consistent with the study by Feinberg and Reynolds (2007)- that developing countries are at least as likely to use SPS in a protectionist response as developed countries are.

5 Environment, Health, Governance and SPS

As in the previous analysis (see Table 4), Table 7 confirms that tighter tariff binding overhang increases the likelihood of issuing new or changed SPS regulations when including environmental governance factors as well. Measures of environmental health and governance are also signficant. We find that higher environmental metrics also lead to more heavy use of SPS policy. This is the expected outcome when SPS regulations are used for their intended objectives and match a countries' individually set level of risk tolerance.

In column 1, the results of Table 7 show that the metrics of interest from the Environmental Performance Index have significant effect on the probability of submitting a changed or new SPS regulation in a given year. Countries with greater environmental health and biodiversity metrics are more likely to use SPS

[13]Observations are dropped from the regressions if there is no within-group variation.

Table 5: Conditional and unconditional logit models of at least one SPS notification by country, year and HS2 code; odds ratios reported. Levels and changes of log per capita GDP and population included but not reported. Other controls vary by column as indicated in the table.

	(1)	(2)	(3)	(4)
L.D. Tariff BO	0.995**	0.996	0.994**	0.994*
	(0.00161)	(0.00204)	(0.00242)	(0.00261)
L2. Tariff BO	0.993**	0.996**	0.996*	0.997
	(0.00123)	(0.00136)	(0.00165)	(0.00545)
L.D. Log Exports	0.996	0.898*	0.899**	0.884**
	(0.0331)	(0.0385)	(0.0355)	(0.0405)
L2. Log Exports	1.131**	1.008	1.008	0.988
	(0.0165)	(0.0194)	(0.0194)	(0.0676)
L.D. Log Imports	1.009	0.974	0.976	0.972
	(0.0544)	(0.0306)	(0.0285)	(0.0535)
L2. Log Imports	1.077**	0.986	0.967	1.012
	(0.0308)	(0.0304)	(0.0295)	(0.0818)
D. Positive Current Account	0.633**	0.922	0.960	0.939
	(0.0839)	(0.145)	(0.149)	(0.147)
L. Positive Current Account	0.780**	1.170	1.183	1.248
	(0.0424)	(0.184)	(0.185)	(0.220)
D. Exchange Rate Index	0.513**	0.786	0.743	0.709
	(0.0679)	(0.148)	(0.144)	(0.147)
L. Exchange Rate Index	0.998	0.627**	0.606**	0.552**
	(0.0157)	(0.0876)	(0.0893)	(0.0878)
Observations	28583	24841	14887	6201
Dummies	Year, HScode	Country, Year, HScode	Country	Year
Conditioning Group	None	None	HScode-Year	Country-HScode

Standard errors (in parentheses) clustered by HScode-Year in columns 1,2,3 and Country-HScode in column 4. * $p < 0.05$, ** $p < 0.01$

Table 6: Logit model of SPS notification by country, year and HS2 code, odds ratios for binding overhang reported for different country sub-samples across columns. Other controls as per Table 4 included but not reported. Note that observation counts do not add to the full sample as observations are dropped when there is no variation across country and HS code in the sub-sample.

	(1)	(2)	(3)	(4)
	WTO Found	WTO Join	Developing	Developed
L.D. Tariff BO	0.996	0.946	0.992*	0.997
	(0.00199)	(0.0338)	(0.00325)	(0.00239)
L2. Tariff BO	0.996**	1.003	0.995*	0.996
	(0.00135)	(0.0133)	(0.00210)	(0.00198)
Observations	22543	1152	12451	7701

Standard errors (in parentheses) clustered by HScode-Year

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

policy, even when controlling for wealth and other economic factors. As well, countries that have done more to liberalize the agriculture market through removal of subsidies, also are more likely to submit new SPS notifications. In column 2, adding in the Environmental Governance metric from the ESI 2005, it confirms that environmental policy strength affects SPS use. A similar result is confirmed in the last two columns using the World Economic Forum's metric of environmental regulatory stringency as an indicator of environmental policy strength of a country. As expected from previous studies on environmental policy, increased levels of democracy (reflected in the Polity2 variable) have a significant effect on SPS use with more democratic countries being more likely to use SPS policy.

Figure 4 demonstrates the impact that the environmental health of a country has on its utilization of SPS regulations. Holding other variables at their mean values in the model, an increase in environmental health of a given country from the 25th percentile to the 75th percentile nearly doubles the probability of issuing an SPS notification. Figure 5 shows the equivalent figure for the variation of tariff binding overhang over its range in our dataset.

Varying environmental health from the 5th percentile to the 95th percentile in our sample causes an increase in the probability of SPS notification which is twice as large as the increase in probability associated with the analogous decrease in tariff binding overhang. This is made more explicit in Figure 6. Environmental health has the largest impact on the probability of issuing a regulation under the SPS system in any given year. A country with environmental metrics at the 99th percentile (holding other variables at their means) has an increase in probability of notifying of nearly 40% more as compared to an otherwise equivalent country with 99th percentile exports, imports, agricultural pest regulation, or 1st percentile tariff binding overhang

Table 7: Logit model of at least one SPS notification by country, year and HS2 code; odds ratio reported. Year and HS2-code dummies included but not reported. Macro Economic and wealth indicators as per Table 4 included, but not shown. World Bank governance indicators included in columns 2 and 4, but not shown.

	(1)	(2)	(3)	(4)
	isBothNote	isBothNote	isBothNote	isBothNote
L.D. Tariff BO	0.995**	0.996*	0.996*	0.996*
	(0.00151)	(0.00165)	(0.00150)	(0.00172)
L2. Tariff BO	0.994**	0.996**	0.995**	0.994**
	(0.00116)	(0.00105)	(0.00114)	(0.00130)
Enviro. Health	1.028**	1.035**	1.028**	1.023**
	(0.00472)	(0.00551)	(0.00525)	(0.00563)
Biodiversity	1.001	0.991**	0.997	0.997
	(0.00161)	(0.00165)	(0.00161)	(0.00164)
Ag. Subsidies	0.585**	0.315**	0.349**	0.704
	(0.111)	(0.0751)	(0.0742)	(0.164)
Pesticide Reg.	1.039**	1.027**	1.051**	1.036**
	(0.00723)	(0.00782)	(0.00830)	(0.00793)
Enviro. Gov.		6.783**		
		(1.238)		
Polity		1.003	1.110**	1.046*
		(0.0223)	(0.0138)	(0.0239)
Enviro. Reg. Strin.			1.328**	1.127
			(0.0646)	(0.0862)
Constant	0.00273**	0.189	0.0677**	0.251
	(0.00148)	(0.187)	(0.0451)	(0.256)
Observations	28538	26438	25799	25799

Exponentiated coefficients; Standard errors in parentheses

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

Figure 4: Predicted probability of SPS notification in a given year from logit model column 1 of Table 7 over range of Enviro. Health, while other variables held at means. Vertical line at median and points at 1st, 5th, 10th, 25th, 50th, 75th, 90th, 95th, 99th percentile of observed data. 95% confidence interval plotted from model.

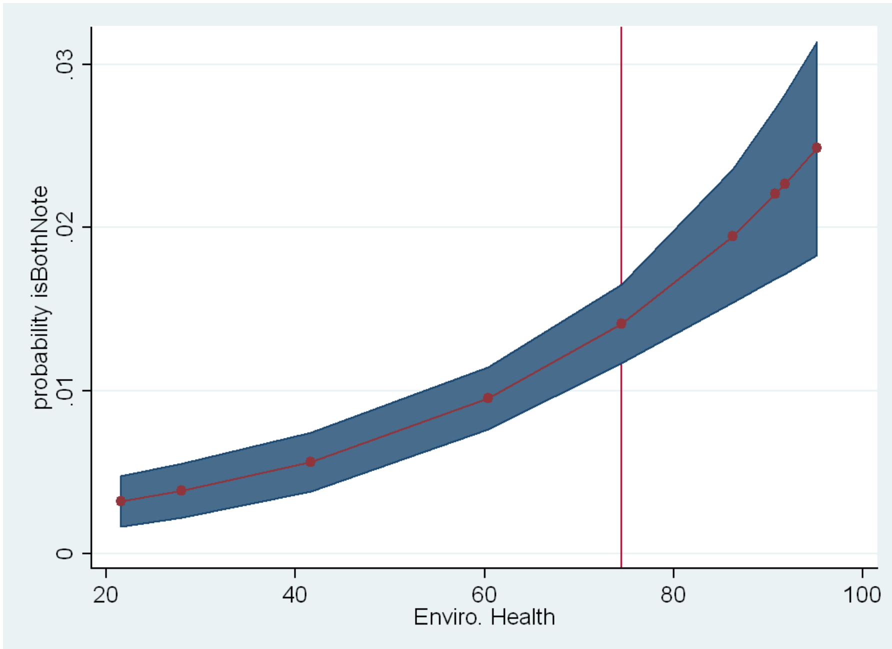


Figure 5: Predicted probability of SPS notification in a given year from logit model column 1 of Table 7 over range of Tariff Binding Overhang, while other variables held at means. Vertical line at median and points at 1st, 5th, 10th, 25th, 50th, 75th, 90th, 95th, 99th percentile of observed data. 95% confidence interval plotted from model.

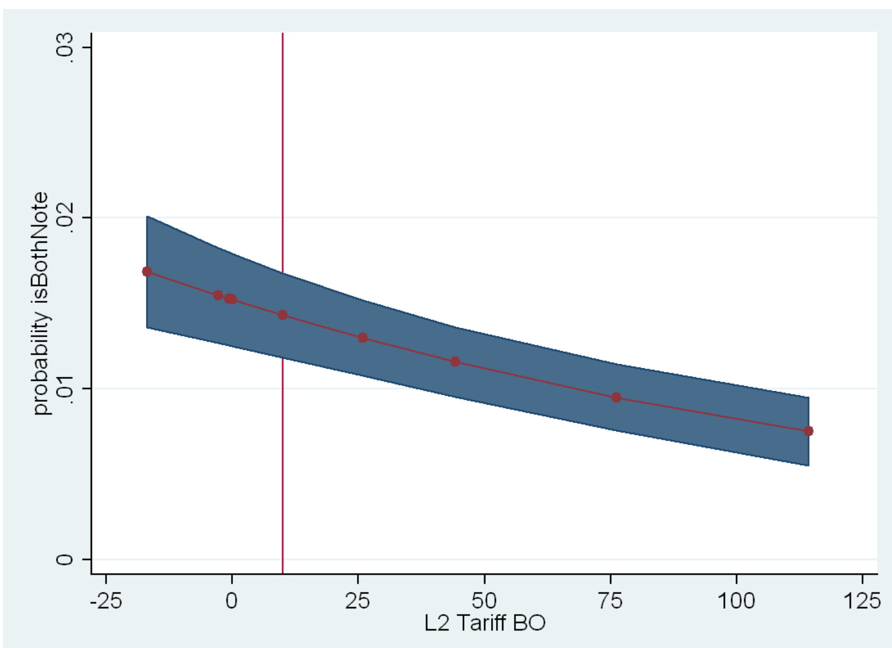
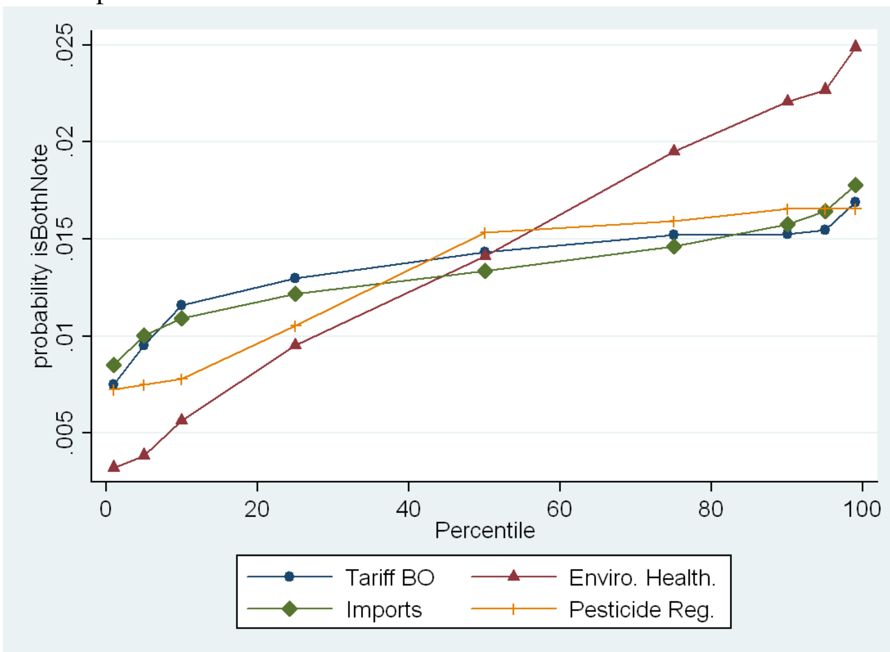


Figure 6: Predicted probability of SPS notification in a given year from logit model column 1 of Table 7for changes over range of five variables. Tariff Binding Overhang plotted from 99th to 1st percentile (reverse of others) for ease of comparison.



(holding other variables at their means). Similarly, a country with among the poorest environmental health will be far less likely to notify new regulations than a country with outstandingly low exports, imports, pest regulations, or outstandingly large tariff binding overhang. Thus our results suggest that desire for high environmental health standards is a substantially more important driver of SPS notifications than protectionist responses to tighter tariff binding overhang.

6 Conclusion

In this paper we have attempted to refocus the discussion of NTBs and protectionism from one of protectionist effect—which we believe has been amply demonstrated in the literature—to one of protectionist intent. If economists are to have an influence on public debate, they need to have a better understanding of the motivations behind NTMs such as SPS measures. Furthermore, institutions such as the WTO risk undermining their own legitimacy if they continue to find against domestic policy measures on the basis that they are trade distorting, without accounting for the fact that they were enacted in good faith, or understanding the strength of public opinion which supported them.

Our results provide a measure of support for both sides of the NTB debate. One the one hand we do find evidence consistent with protectionist motives for SPS notifications. The effect of tariff constraint—

as measured by low binding overhang—is economically quite small, but statistically robust. Traditional, mercantilist concerns of decreased export value and exchange rate appreciation appear to be even more significant protectionist drivers. Somewhat surprisingly, import values had no explanatory power once we accounted for country heterogeneity.

Protectionism is, however, far from being the only motivation for SPS measures. Indeed, our results suggest that it is unlikely to even be the primary motive. Cross-country variation in the environmental health component of Yale's environmental performance index had twice as much impact on the predicted probability of notification as any of the protectionist measures.

Methodologically, our paper has shown that the common, ad hoc, practice of regressing changes in non-tariff barriers against levels of tariffs can be justified within the framework of a generalized error correction model, derived from an auto-regressive-distributed lag model. However, our properly specified model—in contrast to previous models in this literature—includes both levels and changes of all time-varying explanatory variables.

Finally, our paper has provided hints about a couple of drivers of SPS notifications which we believe are worthy of further investigation. The first is the significant role of low population growth rate, which we can thus far only surmise to be capturing the effects of aging populations and their heightened environmental and health concerns. The other is the relationship between agricultural subsidies and SPS notifications. Our results are suggestive of such a relationship, but proper examination of the issue would require time-varying measures of agricultural subsidy levels. This research would be of particular interest as it speaks to the question of substitution between alternative means of protecting and supporting agricultural industries.

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APPENDIX

Table 8: Logit models of at least one Both, Regular, or Emergency SPS notification by country, year and HS2 code; odds ratio reported. Other controls as per column 2 of Table 5 included but not reported.

	(1)	(2)	(3)
	Both	Regular	Emergency
L.D. Tariff BO	0.996	0.996*	0.996
	(0.00204)	(0.00177)	(0.00352)
L2. Tariff BO	0.996**	0.996**	1.001
	(0.00136)	(0.00146)	(0.00219)
Observations	24841	23889	8944

Exponentiated coefficients; Standard errors in parentheses

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

Table 9: Logit model of SPS notification by country, year and HS2 code; odds ratio for different tariff measures reported. All other controls as per Column 2 of Table 5 included but not reported.

	(1)	(2)	(3)	(4)	(5)
L.D. Tariff BO (AHS wgt.)	0.997				
	(0.00158)				
L2. Tariff BO (AHS wgt.)	0.995**				
	(0.00137)				
L.D. Tariff BO (MFN simp.)		0.996*			
		(0.00210)			
L2. Tariff BO (MFN simp.)		0.997			
		(0.00184)			
L.D. Tariff BO (AHS simp.)			0.995*		
			(0.00213)		
L2. Tariff BO (AHS simp.)			0.995*		
			(0.00185)		
L.D. BND Tariff (wgt. av.)				0.996	0.996
				(0.00355)	(0.00367)
L2. BND Tariff (wgt. av.)				0.995**	0.994**
				(0.00180)	(0.00177)
L.D. MFN Tariff (wgt. av.)				1.004	
				(0.00286)	
L2. MFN Tariff (wgt. av.)				1.002	
				(0.00202)	
L.D. AHS Tariff (wgt. av.)					1.003
					(0.00179)
L2. AHS Tariff (wgt. av.)					1.004**
					(0.00155)
Observations	24843	24841	24843	24841	24843

Exponentiated coefficients; Standard errors in parentheses

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

Table 10: Logit model of Both, Regular, and Emergency SPS notification by country, year and HS2 code; odds ratio reported. Other controls as per column 1 of Table 7 included but not reported.

	EU Disaggregate			EU Aggregate		
	(1)	(2)	(3)	(4)	(5)	(6)
	Both	Regular	Emergency	Both	Regular	Emergency
L.D. Tariff BO	0.995**	0.996**	0.995	0.997*	0.997**	1.000
	(0.00151)	(0.00144)	(0.00308)	(0.00110)	(0.00114)	(0.00273)
L2. Tariff BO	0.994**	0.994**	0.996*	0.996**	0.996**	0.999
	(0.00116)	(0.00116)	(0.00184)	(0.000805)	(0.000833)	(0.00166)
Enviro. Health	1.028**	1.032**	1.028**	1.044**	1.054**	1.035**
	(0.00472)	(0.00497)	(0.00727)	(0.00537)	(0.00591)	(0.00796)
Biodiversity	1.001	0.998	1.015**	0.996**	0.992**	1.013**
	(0.00161)	(0.00170)	(0.00230)	(0.00143)	(0.00160)	(0.00249)
Ag. Subsidies	0.585**	0.733	0.184**	0.914	1.217	0.196**
	(0.111)	(0.148)	(0.0682)	(0.162)	(0.225)	(0.0808)
Pesticide Reg.	1.039**	1.041**	1.048**	1.036**	1.035**	1.050**
	(0.00723)	(0.00899)	(0.00895)	(0.00747)	(0.00897)	(0.00970)
Observations	28538	28538	12179	25460	25460	10516

Exponentiated coefficients; Standard errors in parentheses

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

Table 11: Logit model of SPS notification by country, year and HS2 code; odds ratio for different tariff measures reported. All other controls as per Column 1 of Table 7 included but not reported.

	(1)	(2)	(3)	(4)
L.D. Tariff BO (AHS wgt.)	0.997*			
	(0.00134)			
L2. Tariff BO (AHS wgt.)	0.994**			
	(0.00104)			
Enviro. Health	1.029**	1.028**	1.029**	1.029**
	(0.00473)	(0.00470)	(0.00474)	(0.00475)
Biodiversity	1.001	1.001	1.001	1.001
	(0.00162)	(0.00163)	(0.00162)	(0.00163)
Ag. Subsidies	0.581**	0.602**	0.623*	0.620*
	(0.111)	(0.116)	(0.119)	(0.119)
Pesticide Reg.	1.039**	1.039**	1.039**	1.039**
	(0.00724)	(0.00721)	(0.00726)	(0.00726)
L.D. Tariff BO (AHS simp.)		0.996**		
		(0.00145)		
L2. Tariff BO (AHS simp.)		0.994**		
		(0.00100)		
L.D. BND Tariff (wgt. av.)			0.997	0.997
			(0.00253)	(0.00252)
L2. BND Tariff (wgt. av.)			0.993**	0.993**
			(0.00105)	(0.000982)
L.D. MFN Tariff (wgt. av.)			1.004*	
			(0.00179)	
L2. MFN Tariff (wgt. av.)			1.004**	
			(0.00149)	
L.D. AHS Tariff (wgt. av.)				1.002
				(0.00138)
L2. AHS Tariff (wgt. av.)				1.004**
				(0.00126)
Constant	0.00273**	0.00284**	0.00334**	0.00337**
	(0.00148)	(0.00154)	(0.00180)	(0.00181)
Observations	28540	28540	28538	28540

Exponentiated coefficients; Standard errors in parentheses

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