The Impact of Sanitary and Phytosanitary Measures on Market Entry and Trade Flows*

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Abstract

In an attempt to disentangle the impact of sanitary and phytosanitary (SPS) measures on trade patterns, we use the database on specific trade concerns on SPS measures of the WTO. Estimating various gravity model specifications at the HS4 disaggregated level of trade, we find that aggregated SPS measures constitute obstacles to agricultural and food trade consistently to all exporters. But conditional on market entry, trade flows are positively affected by SPS measures. In addition, we find that SPS measures related to conformity assessment hamper market entry, while SPS measures related to product characteristics increase bilateral trade flows conditional on meeting the standard.

Keywords: International Trade, Sanitary and Phytosanitary Measures, Conformity Assessment, Agriculture, Gravity Model
JEL-Classification: C23, F14, Q17

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In the light of decreasing tariffs, quotas and prohibitions due to multilateral and bilateral agreements over the last decades, non-tariff measures (NTMs), such as sanitary and phytosanitary (SPS) measures[1], are on the rise (WTO, 2012). Countries seek alternatives to protect what was previously carried out by classical trade policy instruments (Roberts, Josling and Orden, 1999; Li and Beghin, 2012*a*; Winchester et al., 2012). SPS measures pose methods partly regulated under the SPS Agreement of the World Trade Organization (WTO), but their design and use are less restricted and rather flexible (compared to other NTMs such as quotas or prohibitions). In principle, SPS measures are meant to provide countries with a possibility to protect the health of animals, humans and plants. Due to their design, SPS measures may also be used as instruments to achieve certain policy objectives, such as protecting domestic producers.

Limited knowledge on the particular trade effects of SPS measures exists. Economic theory does not provide a clear cut prediction on the impact of standards on trade. Instead, theory suggests that the impact of SPS measures on agriculture and food trade may be diverse and need not always be negative. While increased production costs that may arise in order to meet higher SPS standards reduce trade, information on food safety and product quality may lead to increased consumer confidence and trust in foreign products, reduced transaction costs and thus foster trade. Further, trade may also rise due to increased producer efficiency, as quality signals help to promote the competitiveness of foreign producers who meet stringent standards. This suggests that the implied trade effect of standards depends on the relative costs of domestic and foreign production and the willingness of consumers to pay a higher price for safer products (WTO, 2012). To achieve a certain health safety objective, policy makers can choose from a range of different SPS measures. These measures entail diverse effects on trade as some affect fixed costs and thus market entry, while others affect post-entry activities, hence, variable trade costs. Further, differences in standards between both importer and exporter countries also af-

[1]This paper focuses on SPS measures, most prevalent in agricultural and food trade.

fect trade flows. While countries with already high standards easily export to second countries with lower standards, this is hardly possible the other way round. Depending on differences in regulatory heterogeneity between countries, trade flows may thus increase or decrease. Assessing the effects of SPS measures on the intensive and extensive margins of trade is thus an empirical issue.

This paper contributes by using only restrictive product standards to (i) assess the SPS impact on the extensive and the intensive margin of trade aggregate over all agricultural and food sectors, (ii) differentiate the impact of bilateral from multilateral SPS measures, and (iii) identify specific channels such concerns related to conformity assessment versus concerns related to product characteristics. More specifically, we assess the impact of SPS measures on the probability to enter a destination market and on the amount of trade. To control for zero trade flows and a potential sample selection bias, we use a Heckman selection model.[2] The key findings of the study are that concerns over SPS measures pose a negative impact on the probability to export to a concerned market. Although, conditional on market entry, the amount of exports to markets with SPS measures in place tends to be higher. A possible explanation of the positive effect relates to the fact that information provision to the consumer may be relatively stronger than the costs of the producer. By enhancing consumer trust in foreign products, SPS measures increase trade for foreign exporters that manage to overcome the fixed cost of entering a market.

We further differentiate the impact of bilateral from multilateral SPS measures by assessing the impact of a SPS concern on the market entry and trade flows of all potential trade partners of a protected market. Our results suggest that SPS measures deter market entry uniformly across all trading partners, whereas SPS measures positively affect bilateral exports, namely of the country raising the concern. Besides, SPS measures have a negative impact on the

[2]For robustness reasons, we also estimate a probit model and fixed-effects, instrumental variable, generalized negative binomial specifications, and a zero-inflated negative binomial model. Results confirm our findings.

trade values of other exporters.

In an attempt to identify the channels that lead to our results, we systematically assess the relevance of different SPS measures applied for various safety purposes on trade in agriculture and food. The analysis distinguishes concerns related to conformity assessment (i.e., certificate requirements, testing, inspection and approval procedures) and concerns related to the characteristics of a product (i.e., requirements on quarantine treatment, pesticide residue levels, labeling or packaging). In particular, we show that conformity assessment-related SPS measures constitute a market entry barrier, as such measures might be particularly burdensome and costly, while SPS measures related to product characteristics explain most of the increase in the amount of trade. The latter suggests that SPS product characteristic measures sufficiently enhance consumer trust such as to foster trade. This contribution is particularly interesting for policy makers as they often have to choose from a range of measures that are assumed to equivalently reduce health risks but entail diverse trade costs. Depending on a policy maker's choice of SPS measures, the implied impact on trade varies strongly. In addition, we show that conformity assessment-related SPS measures constitute a market entry barrier to all potential trade partners, whereas product characteristic measures positively affect the trade value of the country raising a concern at the SPS committee of WTO.

Recent empirical research on the nexus between NTMs and trade has mostly been focusing on the forgone trade via the gravity equation. They provide evidence that NTMs hamper trade (Gebrehiwet, Ngqangweni and Kirsten, 2007; Disdier, Fontagné and Mimouni, 2008; Anders and Caswell, 2009), while harmonization of regulation fosters trade (De Frahan and Vancauteren, 2006). But, when looking at various sectors, Fontagné, Mimouni and Pasteels (2005) and Disdier, Fontagné and Mimouni (2008) find positive and negative NTM effects. These approaches focus on aggregate NTMs rather than on the trade effect of diverse regulations that equivalently reduce risk with respect to health safety. Evidence on product-specific regulations, such as maximum residue levels (MRLs), suggests that such measures hamper trade (Otsuki, Wilson and Sewadeh, 2001*a*,*b*; Wilson and Otsuki, 2004; Disdier and Marette, 2010; Jayasinghe, Beghin and Moschini, 2010). However, as product-specific measures are not exhaustive and may not be representative, recent papers discuss and apply different types of indexes to measure aggregate levels of protection (Drogue and DeMaria, 2012; Winchester et al., 2012; Li and Beghin, 2012*b*).[3]

Three main issues arise within the literature. First, most of the previous studies assess the impact of either a global or a specific SPS measure on the amount of trade at the aggregate or sectoral level. But, they rarely provide evidence regarding potential selection effects caused by regulations[4]. To our knowledge, only three studies identifying the impact of SPS measures on the intensive and extensive margins. Using a Heckman selection model, Disdier and Marette (2010) find an insignificant effect of maximum residue levels (MRLs)[5] on market entry but a negative significant impact on the import volume of crustaceans. Jayasinghe, Beghin and Moschini (2010) show that the probability to trade and the trade volume of US corn seeds are both negatively affected by MRLs. Xiong and Beghin (2012) analyze the effect of EU aflatoxin standards on trade in groundnuts between the EU15 and nine African countries from 1989 to 2006. They find no significant impact of the MRL set by the EU on trade in groundnuts. Contrasting results may arise from sector or country specific factors or from different definitions of SPS measures. While Disdier and Marette (2010) define SPS measures using country specific MRLs, Jayasinghe, Beghin and Moschini (2010) use SPS regulations based on EXCERPT (Export Certification Project Demonstration), and Xiong and Beghin (2012) use data from the

[3]Drogue and DeMaria (2012) approach the quantification of the potential protectionism of NTMs by summarizing the entire list of pesticides which appear in various regulations into an index of aggregate regulations and standards. Winchester et al. (2012) propose heterogeneity indexes that aggregate diverse NTMs. And Li and Beghin (2012*b*) propose yet another formal aggregation of NTMs into an index that measures the potential protectionism of maximum residue limit standards.

[4]SPS measures may actually select firms that can or cannot comply with the regulations.

[5]MRLs are standards imposed by countries on maximum pesticide levels or toxic compounds in food or agricultural products. Disdier and Marette (2010) use limits on chloramphenicol in crustacean imports.

Food and Agricultural Organization (FAO) on global regulations and from the European Communities on aflatoxin contaminants. Thus, the current paper contributes by providing solid evidence on the impact of SPS measures on both market entry and trade values in agricultural and food products.

Second, most studies focus on a specific measure, such as MRLs, and can thus not compare the impact of *various SPS instruments* on trade, even though policy makers may choose from a range of possible measures to achieve equivalent health safety objectives. Heterogeneity across countries in implementing diverse SPS requirements may cause ambiguous trade outcomes. To our knowledge, the only two studies that deal with the impact of different regulatory measures on trade are Schlueter, Wieck and Heckelei (2009) and Fassarella, Pinto de Souza and Burnquist (2011). Both studies look specifically at the meat sector. Schlueter, Wieck and Heckelei (2009) estimate the impact of various types of SPS measures on trade in meat products. The authors estimate a Poisson pseudo maximum likelihood (PPML) gravity model on trade flows of meat on the HS4 digit level. Aggregated over all regulatory instruments, they find a positive effect of SPS on trade flows in meat products. Disaggregated results show diverse effects. In particular, conformity assessment promotes trade in the meat sector. In a similar manner, Fassarella, Pinto de Souza and Burnquist (2011) analyze the effect of SPS and TBT measures on Brazilian exports of poultry meat. Deploying a PPML model, they find an insignificant impact of aggregated measures on Brazilian exports of poultry meat. On the disaggregated level, the authors find that conformity assessment-related measures decrease the volume of poultry meat exports from Brazil to its major trade partners, while requirements on quarantine treatment and labeling increase the amount of poultry trade. As results on SPS measures on the aggregated and on the disaggregated level are only available for the meat sector and are ambiguous across studies, even contradict each other, the current paper provides more insight and investigation.

Third, previous studies often use *notification-based data*. Contrasting this, our paper deploys the more sophisticated *specific trade concerns database* of the WTO.[6] The trade concerns database overcomes limitations of notification-based data[7] because government incentives to report a concern increase if a SPS measure potentially affects their trade. In addition, the database allows us to consistently differentiate SPS measures and to perform bilateral estimations.

Using trade concerns data of the WTO, we are able to focus on restrictive product standards only that are perceived as sizable export trade barriers[8]. To the best of our knowledge, the only other two studies using SPS concerns data on an aggregated level are Disdier and van Tongeren (2010) and a current paper by Fontagné et al. (2013). The latter uses SPS trade concerns data and firm-level data, while this paper uses country-level data and has a focus on the intensive and the extensive margin of trade, including *zero trade flows*, as well as the *identification of channels*, such as concerns related to conformity assessment versus concerns related to the characteristics of a product.

The remainder of the paper is structured as follows. Section I. provides detailed information on data and describes the empirical strategy. In section II., we provide benchmark results on the Heckman selection model using the aggregate SPS measure and a sensitivity analysis of results. Section III. distinguishes by type of concern (conformity assessment versus product-related concerns). The last section concludes.

I. Data and Empirical Strategy

A. Data Sources and Sample

The SPS Information Management System (SPS IMS) of the WTO contains information on specific SPS concerns reported to the WTO by a raising country

[6]With this approach, we follow Disdier and van Tongeren (2010), who have been the first to use the data on SPS concerns.

[7]WTO members have usually no incentives to notify their own SPS measures.

[8]We deal with the potential drawback of endogeneity in the paper using lagged variables or an IV strategy.

towards a maintaining country for 1995 to 2010, respectively.[9] For each single concern, we have information on the raising and maintaining country, the HS4 product code concerned, the year in which the concern was reported to the WTO, and whether it has been resolved. To measure SPS restrictions, we generate a simple dummy variable on SPS concerns that is equal to one when a concern is reported to the WTO and shifts to zero whenever the concern is resolved. Alternatively, we also calculate a normalized frequency measure, which counts the number of SPS measures in place on HS4 product lines within an HS2 sector and divides them by the number of products within an HS2 sector. Similar 'normalized' frequency measures on various levels of disaggregation have also been used by Fontagné, Mimouni and Pasteels (2005); Disdier, Fontagné and Mimouni (2008); Fontagné et al. (2013). If HS4 product codes are not available, but instead the HS2 sector is listed in the concern, we assume that all HS4 product lines under the HS2 sector are affected. The database reports the HS2002 classification, which are converted to the HS1992 classification to be able to merge them to the trade data of agricultural and food products.

SPS specific trade concerns reveal particular restrictive product standards that exporters from countries raising a concern face in a given export market. Concerns over SPS measures thus provide potentially interesting information on the economic implications of NTMs. Figure 1 shows that over time the number of countries raising a SPS concern or maintaining a measure has increased. In Figure 2, the right axis denotes the number of SPS concerns initiated and resolved per year, while the left axis shows the total number of SPS concerns. Between 1995 and 2010, both, the number of concerns raised and the number of concerns resolved vary widely, but the total number of SPS concerns has increased as well. We depict the coverage ratio with respect to trade flows in agricultural and food trade, as well as the frequency index [10] in Figure 3. Both,

[9]The SPS Information Management System is available under http://spsims.wto.org.

[10]The coverage ratio represents the import share under a complaint over total imports whereas the frequency index is the share of the number of imported goods covered by a SPS concern over the total number of imported products. Both measures focus on existing trade. Concerns over prohibited goods or other non-traded goods are excluded.

FIGURE 1. Maintaining and Raising Countries of SPS Specific Trade Concerns, 1995-2010

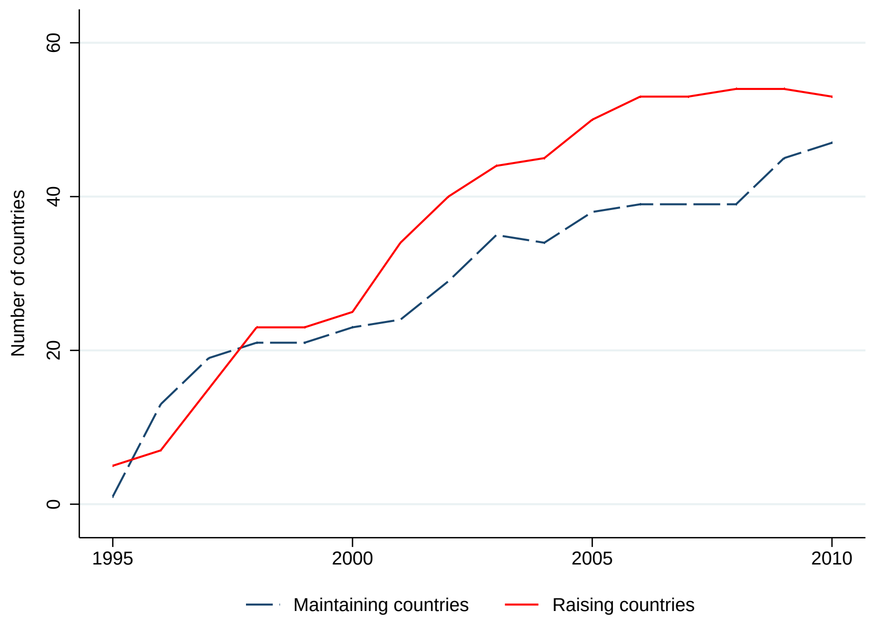


FIGURE 2. New and Resolved SPS Specific Trade Concerns, 1995-2010

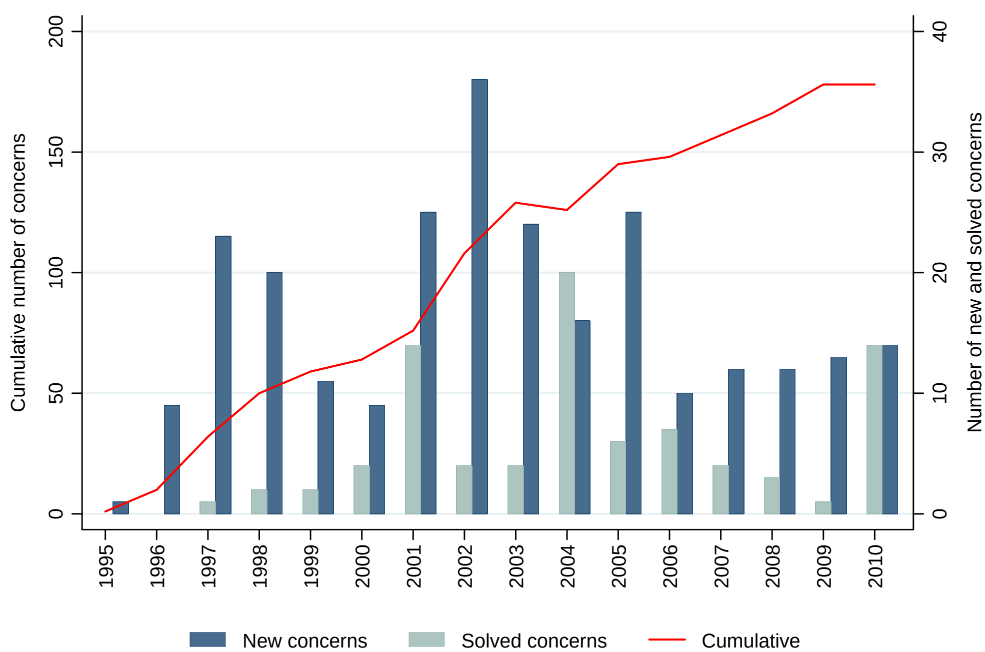
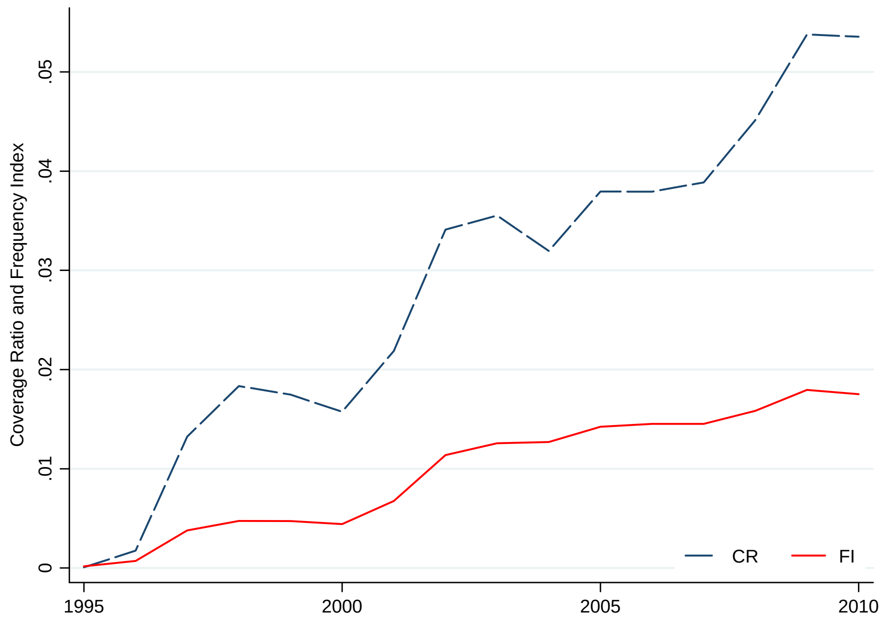


FIGURE 3. Frequency Index (FI) and Coverage Ratio (CR) aggregated by year, 1995-2010



the coverage ratio and the frequency index increase over time. This indicates that specific trade concerns over SPS measures affect an increasing number of agricultural and food products and trade flows in agricultural and food trade.

Further, to consider the possible diversity of various SPS measures, we divide concerns into two categories in accordance to the specific description of concerns contained in the SPS database, referenced documents, or occasionally national documents, if the database and referenced documents were too vague about a certain concern. We create two dummy variables indicating whether a specific concern relates to conformity assessment or product characteristics. Conformity assessment-related measures refer to Annex C of the SPS Agreement and include concerns about certification requirements, testing, inspection and approval procedures. Annex C was understood broadly. Hence, conformity assessment-related measures also include concerns on delays, unrevoked suspensions, or administrative procedure problems. Measures related to product characteristics refer to concerns regarding the requirements on process and production methods, transport, packaging, and labeling that are directly related to food safety, concerns on the requirements of pesticide residue levels and quarantine or cold treatments, as well as concerns over strict bans, regional division, or protected zones. Concerns depicted in the WTO database may relate to one, or both issues at the same time. Out of the 312 trade concerns raised by one or several countries against a specific importing country, 57 percent are associated with conformity assessment-related measures, while 78 percent relate to concerns over product characteristics.

Data on bilateral trade come from the United Nations Commodity Trade Statistics Database (Comtrade) and are obtained in the HS1992 classification. The European Union is considered as a single country, hence, trade data is summed up over all EU member states. Total population and nominal GDP in US dollars provide a proxy for market size. Data stem from the World Bank's World Development Indicator (WDI) database and enter equations through the log of the product of the GDPs of the importer and the exporter and the log of the product of the total population of the importer and the exporter. Bilateral distance is the geographic distance between capitals.[11] Data is extracted from the CEPII database on distance and geographical variables, as are all other gravity variables contained in the equations, such as adjacency, common language, and variables on colonial heritage. Data on common religion across countries is obtained from Elhanan Helpman's homepage. Helpman, Melitz and Rubinstein (2008) define the index of common religion across countries as (% Protestants in country $i \times$ % Protestants in country j) + (% Catholics in country $i \times$ % Catholics in country j) + (% Muslims in country $i \times$ % Muslims in country j). We use common religion as the selection variable as it strongly affects the export decision and thus the formation of trading relationships, but not the amount of trade once the export decision has been taken.

For robustness checks, we include applied tariff data that are combined from the WTO's Integrated Data Base (IDB) and UNCTAD's Trade Analysis and Infor-

[11]The distance to and from the EU is measured as the distance to and from Brussels.

mation System (TRAINS). As tariff data have little time variation and are missing to a large part, we only include them in a robustness check.[12] IDB tariff data are preferred over TRAINS if both are available, as IDB contains comprehensive information on applied preferential tariffs *and* provides data on general tariff regimes whenever available. Following the literature, we use applied tariff data that is weighted by imports.

In total, our sample consists of 114 importer and 124 exporting countries, and 224 HS4 product categories in 34 HS2 sectors observed over a time period of fifteen years, from 1996 to 2010, due to the lag considered in the SPS measure implemented to circumvent reverse causality[13].

B. Empirical Strategy

In an attempt to disentangle the impact of SPS measures on trade in agricultural and food products, we estimate a Heckman selection model (Heckman, 1979) to control for a possible bias in our results from non-random selection or zero trade flows in the data. Controlling for zero trade flows is important as SPS measures implemented in the wake of a disease outbreak might provoke a complete ban in the trade of some products. An alternative way to control for zeros would be to estimate a Poisson model. In contrast to the Heckman model, the Poisson method assumes that there is nothing special about zero trade and would not allow us to tackle the sample selection issue with respect to reporting. While the Poisson model is able to better control for heterogeneity, it disregards the existence of another data generating process that produces excessive zeros in the trade matrix caused by self-selection into no trade.[14] Hence, we prefer the

[12]Results on the impact of SPS measures on trade do not change qualitatively nor quantitatively by the inclusion of tariffs.

[13]The summary statistics as well as the lists of products (HS2) and countries are reported in appendix in Tables 6, 7 and 8 .

[14]Alternatively estimating zero inflated Poisson or a negative binomial model is not easy either. Due to strong non-linearity, they are difficult to implement (Greene, 2003). However, as a robustness check, we show results for generalized negative binomial models and zero-inflated negative binomial models in Table 14 and Table 20 in the Appendix. We refrain from Poisson models due to overdispersion and convergence problems.

Heckman method. Besides, the Heckman model enables us to distinguish the effect of SPS measures on the extensive margin (the probability to trade) and the intensive margin (the amount of trade conditional on market entry). The latter considers zero trade values by potential censoring. We estimate both, the selection and the outcome equations, simultaneously using the maximum likelihood technique.[15] Both equations include the same independent variables, except for the selection variable, in our case common religion as in Helpman, Melitz and Rubinstein (2008). The selection variable helps to identify the model as it is assumed to have an impact on the fixed costs of trade, but to have a negligible effect on variable trade costs. We estimate a probit binary choice model of the form

$$\begin{aligned}\Pr(M_{ijts} > 0) = \boldsymbol{\Phi}[&\hat{\alpha_1} SPS_{ij(t-1)s} + \hat{\alpha_2}\ln(GDP_{it} \times GDP_{jt}) \\ &+ \hat{\alpha_3}\ln(POP_{it} \times POP_{jt}) + \boldsymbol{\hat{\alpha}_4 X_{ij}} + \boldsymbol{\hat{\alpha}_5 MR_{ijts}} \\ &+ \nu_i + \nu_j + \nu_s + \nu_t + \varepsilon_{ijts}] \qquad (1)\end{aligned}$$

where $\boldsymbol{\Phi}(\cdot)$ is a standard normal distribution function. And an outcome equation of the form

$$\begin{aligned}\ln(M_{ijts} | M_{ijts} > 0) = &\beta_1 SPS_{ij(t-1)s} + \beta_2 \ln(GDP_{it} \times GDP_{jt}) \\ &+ \beta_3 \ln(POP_{it} \times POP_{jt}) + \boldsymbol{\beta_4 X_{ij}} + \boldsymbol{\beta_5 MR_{ijts}} \\ &+ \beta_\lambda \lambda(\boldsymbol{\hat{\alpha}}) + \nu_i + \nu_j + \nu_s + \nu_t + \epsilon_{ijts} \qquad (2)\end{aligned}$$

where M_{ijts} denotes the import values of a specific HS4 product s of country j from country i at time t. $SPS_{ij(t-1)s}$ reports a concern over a SPS measure between the reporting country i and the maintaining country j at time $t-1$ for a specific HS4 product line. $\ln(GDP_{it} \times GDP_{jt})$ depicts the log of the product of GDPs of country i and country j at time t and $\ln(POP_{it} \times POP_{jt})$ de-

[15]Wooldridge (2002, p.566) states that the maximum likelihood method produces more efficient estimates, preferable standard errors, and likelihood ratio statistics compared to the two-step estimation technique.

notes the log of the product of country $i's$ and country $j's$ total population at time t. These variables proxy for the supply capacities and market capacities of the exporting and the importing countries. The vector $\boldsymbol{X_{ij}}$ contains the usual gravity controls, such as the log of distance, measured as the geographical distance between capitals, adjacency, common language and variables of colonial heritage. The vector $\boldsymbol{MR_{ijts}}$ contains multilateral resistance terms based on adjacency, distance, common language and variables of colonial heritage, as well as on the SPS concern. We follow Baier and Bergstrand (2009), who derive theory-consistent MR indexes from a Taylor series expansion of the Anderson and Van Wincoop (2003) gravity equation. We adapt their strategy to the panel environment[16]. Hence, all regressions include multilateral resistance terms for every bilateral dependent variable x_{ij} included in the estimations (gravity controls and SPS concerns), each of them being defined as follows:

$$\mathrm{MRx}_{ijt} = \left(\sum_{i=1}^{N_i} \theta_{it} \ln \mathrm{x}_{ij}\right) + \left(\sum_{j=1}^{N_j} \theta_{jt} \ln \mathrm{x}_{ij}\right) - \left(\sum_{i=1}^{N_i} \sum_{j=1}^{N_j} \theta_{it}\theta_{jt} \ln \mathrm{x}_{ij}\right) \tag{3}$$

where θ_{it} and θ_{jt} denotes the country's share of GDP (Y_{it}, Y_{jt}) over the world GDP (Y_t), ie. Y_{it}/Y_t and Y_{jt}/Y_t.

A popular alternative way to account for multilateral remoteness would be to include the full array of interaction terms between country and year dummies and combined fixed effects. However, due to the large number of observations including additional fixed effects using interacted dummy variables is computationally not possible in our sample. Indeed, even when software would allow for such a specification, estimations cannot be performed because of hardware limitations[17]. In addition, within transformation is unfortunately

[16]Alternatively, we use the remoteness index defined by Head (2003) and applied in several subsequent papers as Soloaga and Winters (2001). The robust results are available upon request.

[17]The hardware limitations result from the large number of observations generating an oversized memory requirement. Indeed, with above five million of observations, the inclusion of interaction terms between country and year dummies together with sector dummies requires about 26 gigabytes (GB) of Random-Access Memory (RAM) to store the dataset. Hence, it be-

not possible with the Heckman specification due to the nonlinearity of the first stage.

To control for any country-specific characteristics, product specifics and time trends, we include full arrays of importer ν_i, exporter ν_j, HS4 product ν_s, and year dummies ν_t separately in the equation. Hence, we control for a wide array of observable and unobservable factors, i.e., geographical variables or global business cycles. Error terms ε_{ijts} are heteroskedasticity-robust and clustered at the country-pair level. $\lambda(\hat{\boldsymbol{\alpha}})$ denotes the inverse mills ratio which is predicted from equation (1).[18]

The focus of this paper is on SPS concerns reported by exporters to the WTO. For the $SPS_{ij(t-1)s}$ measures, we consider two different variables, respectively: (i) a dummy variable equal to one if at least one concern is notified at the 4-digit level of the HS classification, or (ii) a normalized frequency measure $\text{SPSFreq}_{ij(t-1)s}$. The normalized SPS measure is defined as the number of concerns on HS4 products within a HS2 product category and divided by the total number of HS4 product items within the HS2 sector. In a second approach, we dissociate the impact of the measure on the country raising the concern from the impact on all potential exporters. We thus additionally include a *multilateral* variable equal to one if at least one concern regarding a measure maintained by a given importer exists ($\text{SPS}_{j(t-1)s}$ multilateral), and its associated normalized frequency SPS measure ($\text{SPSFreq}_{j(t-1)s}$ multilateral) additionally to the respective bilateral SPS measure.

Endogeneity. To circumvent potential reverse causality between imports and SPS measures, we use the first lag of the variable on SPS concerns. However, our estimation may also be subject to endogeneity of SPS concerns due to omitted variables. The inclusion of a wide range of fixed effects and multilateral resistance terms that control for most of the potentially omitted variables

comes impossible to run the estimations with a 4 processors-server of 32GB of RAM without generating a bug in the system.

[18]The inverse mills ratio is the ratio of the probability density function over the cumulative distribution function of $\hat{M}_{ijts}$ from equation (1).

affecting export strongly reduces endogeneity issues. Using further instrumentation methods is not straightforward in the Heckman model. For robustness reasons, we estimate a probit and a two stage least squares (2SLS) model separately. The two instruments used in the 2SLS model are (i) the sum of SPS concerns of all other partner countries $k \neq i$ against the importer j in sector s and (ii) the sum of SPS concerns raised by country i against the importer j in sectors l different from s but within the same HS2 category. Results in Table 12 Panel A and Panel B confirm our findings. Hence, forward looking actors seem not to be a problem in our framework.

II. SPS Measures and Trade

A. Benchmark Results

The first two columns of Table 1 present results using the SPS dummy variable, while columns (3) and (4) use the normalized SPS frequency measure. All regressions include importer, exporter, and HS4 product fixed effects, a full array of year dummies and multilateral resistance terms. In addition, all columns include gravity controls. These are the log of the product of GDPs, the log of the product of populations, the log of distance, adjacency, common language and colonial heritage. Common religion is the selection variable and thus excluded in column (2) and (4), respectively. All specifications apply the Heckman selection procedure using the maximum likelihood approach and thus account for potential sample selection and zero trade flows.

Overall, gravity variables are in line with the literature. Countries similar in income trade more with another, while countries similar with respect to population size show a higher probability to trade, but no significant effect on the amount of trade conditional on market entry. As expected, distance has a negative impact on trade, and adjacency, common language and common colonial heritage increase trade, while country pairs in a colonial relation after 1945 experience a negative impact on the probability and the amount of trade. Common religion reduces the fixed costs of trade, hence, positively affects the probability of market entry. This result is in line with the findings of Helpman, Melitz and Rubinstein (2008). As in Helpman, Melitz and Rubinstein (2008), we assume that common religion does not affect trade flows once the exporting decision has been made.

TABLE 1. The Impact of SPS on Agricultural and Food Trade (1996 - 2010)

	Heckman Selection Model (maximum likelihood)			
Equation:	Selection	Outcome	Selection	Outcome
Dependent Variable:	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$
	(1)	(2)	(3)	(4)
$\text{SPS}_{ij(t-1)s}$	-0.139**	0.642***		
	(0.06)	(0.14)		
$\text{SPSFreq}_{ij(t-1)s}$			-0.155**	0.625***
			(0.06)	(0.15)
Controls				
$\ln \text{GDP}_{it} \times \text{GDP}_{jt}$	0.220***	0.468***	0.219***	0.471***
	(0.02)	(0.03)	(0.02)	(0.03)
$\ln \text{POP}_{it} \times \text{POP}_{jt}$	0.248***	0.076	0.250***	0.058
	(0.05)	(0.09)	(0.05)	(0.09)
$\ln \text{Distance}_{ij}$	-0.329***	-0.946***	-0.329***	-0.946***
	(0.01)	(0.03)	(0.01)	(0.03)
Adjacency_{ij}	0.123***	0.392***	0.122***	0.392***
	(0.03)	(0.10)	(0.03)	(0.10)
Common Language_{ij}	0.123***	0.265***	0.123***	0.265***
	(0.02)	(0.05)	(0.02)	(0.05)
Ever Colony_{ij}	-0.021	0.055	-0.021	0.056
	(0.05)	(0.15)	(0.05)	(0.15)
Common Colonizer_{ij}	0.081***	0.268***	0.081***	0.268***
	(0.02)	(0.07)	(0.02)	(0.07)
Colonizer post 1945_{ij}	-0.112***	-0.441***	-0.112***	-0.443***
	(0.04)	(0.11)	(0.04)	(0.11)
Common Religion_{ij}	0.150***		0.150***	
	(0.02)		(0.02)	
Estimated correlation (rho)	0.460***		0.461***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.369***		1.371***	
	(0.04)		(0.04)	
Observations	5,452,147		5,452,147	

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Constant, importer, exporter, HS4 product and time fixed effects and MR terms are included but not reported. Common religion is the selection variable and thus excluded in columns (2) and (4). Country clustered robust standard errors reported in parenthesis.

In column (1), we find a significantly lower probability to trade bilaterally in the presence of SPS concerns. Our results suggest that the probability to enter an export market is about 4.3 percent lower in the presence of a SPS measure (compare Table 2 column (1) for marginal effects). This indicates that SPS measures increase fixed costs of trading and thus constitute an effective market entry barrier in agricultural and food sectors. Interestingly, the outcome equation in column (2) indicates that SPS measures significantly increase the amount of trade once a market has been entered. This positive effect can be explained by the fact that SPS measures provide information on product safety to consumers.[19] If SPS measures enhance consumer trust in the quality of imported goods proportionally more than they increase variable trade costs due to product adaption, producers gain market share. This leads to an increase in the amount of trade for exporters that manage to overcome the fixed cost of entering a market. The dummy variable indicates that SPS measures increase the amount of trade in agriculture and food products by 77 percent on average. The marginal effect for the outcome equation[20] is depicted in Table 2 column (2). Results are confirmed when using the SPS frequency measure in Table 1 columns (3) and (4). For both, the frequency and the dummy SPS variable, the estimated correlation coefficient (rho) and the estimated selection coefficient (lambda) are statistically significant and different from zero, confirming that not controlling for selection effects and zero trade flows would generate biased coefficients.

[19]The positive effect may also be explained by the fact that an exporter has higher standards and thus no problem to export to a second country with lower standards.

[20]The estimated coefficient in the Heckman outcome equation does not indicate the marginal effect of SPS measures on the trade flows as the independent variables appear in the selection and the outcome equation and $\rho \neq 0$. Hence, we calculate the marginal effect of the outcome equation according to Greene (2003, p.784). The marginal effect on the amount of trade is composed of the effect on the selection and the outcome equation. If the outcome coefficient is β and the selection coefficient is α, then

$$dE[y|z^* > 0]/dx = \beta - (\alpha^* \rho^* \sigma^* \delta(\alpha)),$$

where $\delta(\alpha)$ = inverse Mills' ratio*(inverse Mill's ratio*selection prediction).

TABLE 2. Marginal Effects from Heckman Selection Model (maximum likelihood)

	Marginal Effects			
Equation:	Selection (1)	Outcome (2)	Selection (3)	Outcome (4)
$\text{SPS}_{ij(t-1)s}$	-0.043**	0.775***		
	(0.02)	(0.00)		
$\text{SPSFreq}_{ij(t-1)s}$			-0.048**	0.774***
			(0.02)	(0.00)

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Marginal Effects of the outcome equations are calculated according to Greene (2003). Country clustered robust standard errors reported in parenthesis.

B. Bilateral versus Multilateral Effects

The specific trade concerns data help to overcome limitations of notification-based data. First, government incentives to report a concern over a SPS measure increase if an implemented measure potentially affects their trade. Second, specific trade concerns allow to account for the bilateral character of SPS measures. This is particularly important as some SPS measures are really bilateral (i.e. due to a disease outbreak in the exporter country), but, even if measures are multilateral in the sense that they apply to all trade partners, they may eventually affect exporters in different ways. In an attempt to differentiate bilateral from multilateral effects, we estimate a gravity model additionally including a variable equal to one if at least one concern has been raised against the importing country j in sector s. This variable aims at capturing the impact of *multilateral* SPS measures affecting simultaneously all exporter of a given product. To be consistent, we also calculate the associated normalized *multilateral* SPS frequency measure.

Results are reported in Table 3. Columns (1) and (3) provide evidence that SPS measures exert a negative impact on the extensive margin of trade for all potential trading partners, including the country raising the concern. Hence, SPS measures constitute a market entry barrier to all exporters and are thus not discriminatory. On the contrary, bilateral SPS measures in columns (2) and (4) indicate that, once exporters meet the stringent standard, the trade flows of countries concerned over a specific SPS measure increase to the detriment of other trade partners (the bilateral coefficient is positive, while the multilateral variable depicts a negative effect).

TABLE 3. The Impact of Bilateral and Multilateral SPS on Agricultural and Food Trade (1996 - 2010)

	Heckman Selection Model (maximum likelihood)			
Equation:	Selection	Outcome	Selection	Outcome
Dependent Variable:	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$
	(1)	(2)	(3)	(4)
$\text{SPS}_{ij(t-1)s}$	-0.027	0.709***		
	(0.05)	(0.14)		
$\text{SPS}_{j(t-1)s}$ multilateral	-0.173***	-0.103**		
	(0.01)	(0.05)		
$\text{SPSFreq}_{ij(t-1)s}$			-0.024	0.697***
			(0.06)	(0.16)
$\text{SPSFreq}_{j(t-1)s}$ multilateral			-0.205***	-0.111*
			(0.02)	(0.06)
Estimated correlation (rho)	0.497***		0.497***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.091***		1.091***	
	(0.01)		(0.01)	
Observations	5,452,147		5,452,147	

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Controls, constant, importer, exporter, HS4 product and time fixed effects and MR terms are included but not reported. Common religion is the selection variable and thus excluded in columns (2) and (4). Country clustered robust standard errors reported in parenthesis.

C. *Sensitivity*

In the sensitivity analysis, we address five concerns. To avoid a potential misspecification, we conduct three robustness checks including further control variables: (i) the bilateral applied tariff protection to be able to differentiate its impact on trade in agricultural and food products from that of SPS interventions (ii) the revealed comparative advantage index as defined by Balassa (1965) to account for the importer and exporter comparative advantage in given production and (iii) interacted country and year dummies to control for country-specific factors varying over time such as business cycles or exchange rate variations. In addition to potential omitted variables, reverse causality might be an issue in our framework. As further instrumentation methods are not straightforward in the Heckman model, we estimate a simple two stage least squares (2SLS) model to give an indication that forward looking actors are not a problem. Finally, to prove that results from the Heckman model and the 2SLS model are stable, we estimate several variants of the negative binomial model.

Bilateral Tariffs. Table 9 in the Appendix includes bilateral applied tariff protection as a further control variable, to avoid a potential misspecification of the model and to be able to distinguish the impact of SPS interventions on trade in agricultural and food products from that of bilateral tariffs.

We include a specific control for bilateral tariffs only in the robustness section for several reasons. First, even though data on bilateral tariffs are provided by IDB and TRAINS, the data pose several limitations with respect to missing values over time. Second, data do not include all specific duties, tariff quotas and anti-dumping duties applied by importers. Third, we cannot distinguish preferential from general tariffs, as data are not always available. Fourth, tariffs may be endogenous and vary very little over time between 1995 and 2010. In the following, we include import weighted bilateral applied tariffs. We provide evidence that our previous results do not suffer from a bias due to the omission of tariff data in the framework.

Table 9 in the Appendix provides the results. Coefficients on gravity controls remain qualitatively and quantitatively similar compared to Table 1. So do our results on the effect of SPS measures on the extensive and the intensive margin of trade. While SPS measures pose an obstacle to market entry, producers who meet the more stringent standard increase their trade flows conditional on market entry (compare Panel A). Results on bilateral versus multilateral effects are robust as well (compare Panel B). SPS measures constitute a market entry barrier against all trade partners, while SPS intervention particularly raises bilateral trade flows conditional on meeting the stringent standard.

Regarding the applied tariffs, we find a slightly positive coefficient on the probability to trade, which suggests only a minor influence of tariffs on market entry fixed costs for agricultural and food trade. The positive minimal effect is in line with findings by Schlueter, Wieck and Heckelei (2009) for the meat sector. One possible explanation of this counterintuitive result is that tariffs are endogenous in our specification. The variable may hence capture effects of all sorts of omitted variables that may in total add up to a positive but very small effect on the extensive margin of trade.

Further, the outcome equations suggest a minimal negative impact of tariffs on trade flows. This negative impact of tariffs on the amount of trade stands in line with findings by Disdier, Fontagné and Mimouni (2008) and Fontagné, Mimouni and Pasteels (2005). Still, our results on the minor impact of tariffs on agricultural and food trade should be read with caution, as discussed in section I.*A*., and tariffs vary very little over time but rather across countries in the time period that we are looking at. Besides, keep in mind that the focus lies on the identification of the impact of SPS on the extensive and the intensive margin of trade. Tariffs are only included as a control variable for robustness reasons. Most importantly, the inclusion of applied tariffs does not alter our results on the impact of SPS measures.

The Revealed Comparative Advantage. The country-sector dimension of trade flows is particularly important as imports may be affected by the comparative advantage of the trading partner in a given sector. We therefore include for both, the importer and the exporter, an additional control variable based on the Revealed Comparative Advantage Index (RCAI) introduced by Balassa (1965) and defined as follows:

$$RCAI_{its} = \frac{X_{its} \Big/ \sum_{s=0}^{S} X_{its}}{\sum_{i=0}^{N_i} X_{its} \Big/ \sum_{i=0}^{N_i} \sum_{s=0}^{S} X_{its}} \tag{4}$$

where X_{its} are the exports[21] of country i at time t in sector s and N_i (respectively S) is the total number of exporting countries (resp. sectors). The Balassa's RCAI is therefore the export share of product s in country i's total exports, divided by the world export share of this product. The results are provided in Appendix Table 10 where RCA is a dummy variable equal to one if the country has a revealed comparative advantage in sector s, ie. if RCAI >1. The coefficients are consistent with theoretical predictions. Indeed, the partner country's comparative advantage implies more imports from that exporter whereas the RCA coefficient for the importing country is significant and negative. Most importantly, our previous results do not suffer from the omission of this control as they all keep the same sign and remain significantly different from zero in both panels A and B, using bilateral variables exclusively or both, bilateral and multilateral SPS measures.

Country-time fixed effects. As described in section I., MR terms have been computed following Baier and Bergstrand (2009) instead of adopting the popular dummy variables approach because of computational limitations. Thanks to a temporary access recently granted to a more powerful server, a robustness check including country-year and sector fixed effects can nevertheless be provided, although not performed with the Heckman selection model. The estimations have been carried out using a standard linear probability model (LPM) in the first stage and a least squares dummy variable (LSDV) model in the second stage with a correction for the selection bias as defined by Olsen (1980) and

[21] Consistently with the bilateral import data, export data come from the United Nations Commodity Trade Statistics Database (Comtrade) and are obtained in the HS1992 classification.

thereafter used in Chen and Mattoo (2008). This adjustment consists in including the inverse mills ratio in the second stage, the latter being defined as the linear prediction of the first stage regression minus one.

Table 11 displays the results. Using only the bilateral measure of SPS concerns, the impact on the extensive margin of trade vanishes following the inclusion of the additional fixed effects and is not significant in column A3. However, the coefficients remain positive and highly significant in the second stage. Estimates reported in panel B are consistent with the baseline results. Indeed, the negative impact of SPS concerns appears to be multilateral in the sense that all potential exporters are affected by the SPS measure(s) against which one or several countries raised a concern. The second stage's results suggest that the positive impact of SPS concerns on import values may not only be bilateral but might also benefit exporters that have not raised or shared the concern. In all specifications, the inverse Mills ratio is positive and significantly different from zero, confirming therefore that the selection bias is an issue that needs to be addressed.

Endogeneity A further concern is that reverse causality might be a problem in our estimated framework if actors are forward looking. However, the use of further instrumentation methods is not straightforward in the Heckman model. To give an indication that forward looking actors are not an issue, we estimate a simple 2SLS model. As instruments for concerns over SPS measures, we use (i) the sum of SPS concerns of all other partner countries $k \neq i$ against the importer j in sector s, and (ii) the sum of SPS concerns raised by exporter i against importer j in sectors $l \neq s$ but $l, s \in$ HS2 sector.

Partner country i is more likely to complain against a SPS measure maintained by country j if most other trading partners have already raised a concern. Indeed, country j may simply share the concern without having prepared a strong advocacy before the SPS Committee. Hence, the sum of SPS concerns of all other partner countries k against an importer is strongly correlated with

SPS concerns of the exporter against the importer. On the other hand, this instrument is exogenous as it is uncorrelated to bilateral trade between i and j[22]. Following similar reason, concerns over SPS measures in other HS4 product categories l within the same HS2 sector are unlikely to affect bilateral trade between the importer and the exporter in a specific HS4 product line s, but the sum of concerns related to other products l is strongly correlated to SPS concerns over a specific HS4 product s.

Table 12 Panel A in the Appendix reports the results for the SPS dummy variable and frequency measure, respectively. For comparison reasons, we first show a probit and an ordinary least squares (OLS) model in columns (A1) to (A2) and (A4) to (A5). Columns (A3) and (A6) then report results for the 2SLS estimation. The probit results confirm our previous findings that SPS measures constitute a market entry barrier to trade. Even though OLS results are potentially biased due to reverse causality, censoring or sample selection, the simple OLS results also support our previous results. Again, we find a positive impact of SPS measures on trade flows. 2SLS results on the impact of SPS measures also confirm our previous findings. Instrumented coefficients are only slightly smaller than the coefficients from the Heckman outcome equation (compare Table 1 columns (2) and (4) in the Appendix). Hence, 2SLS results indicate that forward looking actors are not a problem in our setup. Our instruments are not only reasonable but also valid. The Kleibergen-Paap Wald F test on excluded instruments indicates that our F-Statistics range well above the 10% Stock and Yogo (2005) critical values, so that we can firmly reject the weak instrument hypothesis (Kleibergen and Paap, 2006). Since we have two instruments, we can also compute a test of overidentifying restrictions. The test does not reject the null hypothesis (p-value of 0.80) and thus indicates that the instruments are valid[23].

[22] If all SPS measures have a multilateral impact on trade, the exclusion restriction may be violated. However, this does not seem to be the case as previous results show that the multilateral impact of SPS concerns is significant only on the extensive margin of trade. Also, the Hansen *J* and Kleibergen-Paap LM P-values reported in 12 both confirm the validity of instruments.

[23] Note that our results are robust when we use a just identified model using either of the

When we dissociate the impact of bilateral SPS measures from that of multilateral SPS measures on trade, results remain generally in line. Table 12 Panel B in the Appendix reports the results. In terms of significance and magnitude, the probit models in columns (B1) and (B4) exhibit similar coefficients as those reported in the selection equations of Table 3. The only major change regarding the OLS and 2SLS models in columns (B2) to (B3) and (B5) to (B6), respectively, concerns the loss of significance of the coefficient associated with the multilateral SPS variable. Our results suggest that SPS measures exert a positive and significant effect on the trade flows of the reporting country, but do not affect the trade flows of other partner countries. This implies that the trade enhancing effect of SPS measures is a bilateral matter which could not be handled using notification-based data. In both 2SLS specifications, using either the dummy variable or the frequency index, instruments are valid and feasible with respect to the first stage F-Statistics. The Kleibergen-Paap Wald F Test on the excluded instruments is way above the 10% Stock and Yogo (2005) critical value and the Hansen *J* test does not reject the null hypothesis under which the over-identification restrictions are valid.

Negative Binomial. Even though 2SLS results prove similar to Heckman estimates, the current and unsettled state of how to best estimate gravity equations requires further scrutiny.[24] We provide generalized negative binomial (GNegB) models with overdispersion parameters conditioned on HS4 product fixed effects and zero-inflated negative binomial (ZINegB) estimations in Table 14 in the Appendix. The coefficient on SPS measures remain highly significant and positive (columns (A1) and (A4)), but it is somewhat lower than under Heckman, OLS or 2SLS estimation. A high proportion of zeros in the dependent vari-

two instruments. To further assess the instrumenting strategy, the first stage regressions are reported in Appendix Table 13.

[24]Because of convergence problems experienced when trying to estimate the pseudo-poisson maximum likelihood (PPML) and zero-inflated Poisson (ZIP) estimators recommended by Santos Silva and Tenreyro (2006), we carried out the estimations using generalized and zero-inflated negative binomial models, introducing therefore less restrictive variance assumptions (Burger, Van Oort and Linders (2009)).

able suggests that a zero-inflated model might be more appropriate. Columns (A2) and (A3) and columns (A5) and (A6) display the coefficients associated with the inflated and level equations of a ZINegB model. Columns (A2) and (A5) relate to the probability of zero trade. Results suggest that SPS measures increase the likelihood of no trade, while they have a significant and positive impact on the level of trade (columns (A3) and (A6)).

When the bilateral component of SPS measures is dissociated from the multilateral component, results remain generally in line. Table 14 Panel B in the Appendix reports results. While bilateral concerns over SPS measures increase trade flows, the role of multilateral SPS measures is less clear. In both ZINegB specifications, using either the dummy variable or the frequency index, the likelihood of no trade increases with multilateral measures (columns (B2) and (B5)), while both, bilateral and multilateral components of SPS measures have a significant and positive impact on the level of trade (columns (B3) and (B6)).

III. Diversity in SPS Specific Trade Concerns

A. Benchmark Results

In the previous section, we point out that SPS measures pose a market entry barrier due to increased fixed costs. In addition, we find a positive effect on trade flows conditional on market entry due to the fact that the increase in market share is proportionally larger than the variable trade costs due to product adaption. However, governments may choose from a range of SPS instruments to achieve certain policy goals related to animal, plant or human health. The ensuing diversity in SPS intervention may cause ambiguous outcomes on trade, as different SPS instruments entail diverse costs. Measures related to testing, inspection and approval procedures are particularly costly and burdensome for the exporter proportional to the information they provide to the consumer. Such regulations may thus have a negative impact on market entry *and* the amount of trade. Conformity assessment-related measures entail fixed costs that relate to separate or redundant testing or certification of products for various export markets and to the time required to comply with administrative requirements and inspection by importer authorities. The latter may cause time delays that severely impact the profitability of a specific market. Other SPS measures directly related to product characteristics, such as quarantine requirements, pesticide residue levels, labeling or packaging, may pose a barrier to market entry, but once products meet higher standards, exporters gain market share (possibly even in several export markets) due to an increase in consumer trust through valuable product information. Accordingly, we expect that conformity assessment-related measures explain the negative effect on market entry, while concerns related to product characteristics explain the positive impact on trade flows conditional on entering the market.

TABLE 4. The Impact of SPS on Trade, by Type of Concern (1996 - 2010)

	Heckman Selection Model (maximum likelihood)			
Equation:	Selection	Outcome	Selection	Outcome
Dependent Variable:	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$
	(1)	(2)	(3)	(4)
SPS Conformity$_{ij(t-1)s}$	-0.258***	-0.402*		
	(0.07)	(0.23)		
SPS Characteristic$_{ij(t-1)s}$	0.012	0.943***		
	(0.07)	(0.19)		
SPSFreq Conformity$_{ij(t-1)s}$			-0.290***	-0.461*
			(0.09)	(0.27)
SPSFreq Characteristic$_{ij(t-1)s}$			0.014	0.967***
			(0.07)	(0.22)
Estimated correlation (rho)	0.460***		0.461***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.368***		1.370***	
	(0.04)		(0.04)	
Observations	5,452,147		5,452,147	

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Controls, constant, importer, exporter, HS4 product and time fixed effects and MR terms are included but not reported. Common religion is the selection variable and thus excluded in columns (2) and (4). Country clustered robust standard errors reported in parenthesis.

To systematically compare the implied trade effects of different SPS instruments implemented to achieve a desired level of SPS safety, we distinguish concerns over SPS measure into requirements related to conformity assessment and concerns related to product characteristics. As expected, Table 4 column (1) shows that the extensive margin of trade is significantly negatively affected by conformity assessment-related measures (SPS Conformity$_{ij(t-1)s}$). The probability to trade bilaterally is lower by 8 percent in the presence of a conformity assessment-related measure.[25] SPS concerns related to product characteristics (SPS Characteristic$_{ij(t-1)s}$) have no significant impact on market entry. Hence, only conformity assessment-related measures constitute market entry barriers, probably due to the relatively high costs and burdensome procedures they impose on foreign producers.

In column (2), the intensive margin of trade is negatively and significantly affected by conformity assessment-related measures. This may result either from an increase in marginal costs or from a price effect in the case where producers pass through the costs of conformity assessment to consumers, thereby reducing the demand for their product. In contrast, concerns on product characteristics have a positive and significant impact on trade flows conditional on market entry. This suggests that SPS measures related to product characteristics provide information that enhance consumer trust in the quality of imported goods. The gain in market share is then relatively higher than the loss due to product adaption costs. This leads to enhanced trade flows for exporters that manage to overcome the fixed cost of market entry. The dummy measure indicates that conformity assessment-related factors decrease trade in agriculture and food products by 15.6 percent on average, while SPS measures related to product characteristics increase trade flows by 93 percent conditional on market entry.[26] Estimates suggest qualitatively similar result when we use the normalized frequency index in Table 4 columns (3) and (4). The coefficient on conformity assessment is again negative and significant for the extensive *and* the intensive margin of trade, while the positive and significant impact of SPS concerns

[25]Calculating the marginal effect, we get for SPS Conformity$_{ij(t-1)s}$ a coefficient of -0.080 with a standard error of (0.02).

[26]Calculating marginal effects of the outcome equation according to Greene (2003), we get a coefficient of -0.156 with a standard error of (0.00) for SPS Conformity$_{ij(t-1)s}$ and a coefficient of 0.931 with a standard error of (0.00) for SPS Characteristic$_{ij(t-1)s}$.

related to product characteristics on trade flows prevails.

B. *Bilateral versus Multilateral Effects*

In an attempt to dissociate the bilateral from the multilateral character of SPS measures, we again estimate the gravity model by including additional *multilateral* SPS variables. *Multilateral* variables are equal to one for all potential trading partners if at least one respective concern regarding a conformity assessment or a product characteristics measure has been raised against the importer j in sector s. Results are reported in Table 5.

TABLE 5. The Impact of Bilateral and Multilateral SPS on Trade, by Type of Concern (1996 - 2010)

	Heckman Selection Model (maximum likelihood)			
Equation:	Selection	Outcome	Selection	Outcome
Dependent Variable:	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$
	(1)	(2)	(3)	(4)
SPS Conformity$_{ij(t-1)s}$	-0.188***	-0.348		
	(0.07)	(0.23)		
SPS Conformity$_{j(t-1)s}$ multilateral	-0.107***	-0.090		
	(0.02)	(0.06)		
SPS Characteristic$_{ij(t-1)s}$	0.084	0.952***		
	(0.07)	(0.19)		
SPS Characteristic$_{j(t-1)s}$ multilateral	-0.086***	0.016		
	(0.02)	(0.6)		
SPSFreq Conformity$_{ij(t-1)s}$			-0.222***	-0.435
			(0.08)	(0.28)
SPSFreq Conformity$_{j(t-1)s}$ multilateral			-0.109***	-0.040
			(0.02)	(0.07)
SPSFreq Characteristic$_{ij(t-1)s}$			0.101	0.980***
			(0.07)	(0.23)
SPSFreq Characteristic$_{j(t-1)s}$ multilateral			-0.105***	-0.005
			(0.02)	(0.07)
Estimated correlation (rho)	0.497***		0.497***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.091***		1.091***	
	(0.01)		(0.01)	
Observations	5,452,147		5,452,147	

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Controls, constant, importer, exporter, HS4 product and time fixed effects and MR terms are included but not reported. Common religion is the selection variable and thus excluded in columns (2) and (4). Country clustered robust standard errors reported in parenthesis.

In columns (1) and (3), the negative and significant coefficients on the bilateral and multilateral SPS Conformity variables point out that measures related to conformity assessment reduce the probability of bilateral trade between the country raising the concern and the one maintaining the measure, but also impedes market entry for all other exporters. The negative significant coefficient of the multilateral SPS Characteristic variable indicates that such measures hamper market entry as well. Yet, SPS measures related to product characteristics apply to all exporters similarly and are thus not discriminatory, in contrast to SPS measures related to conformity assessment. Most interesting, our results suggest that it is the bilateral component of SPS measures related to product characteristics that trigger a positive and significant effect on trade flows. Hence, depending on the type of regulatory instrument, policy makers may either discriminate against all potential trade partners or even benefit a specific partner that meets the stringent standard.

C. Sensitivity

We apply the same battery of robustness checks to the disaggregated SPS regulatory instruments than in section II.*C*.. Results remain generally in line.

Bilateral Tariffs. First, Table 15 Panel A in the Appendix provides evidence that our previous results are not affected by the inclusion of bilateral applied tariff protection. All coefficients on the probability and the amount of trade remain qualitatively and quantitatively similar compared to Table 4. Results still show that most of the negative effect on the probability of entering a market is due to conformity assessment-related SPS intervention, while concerns related to product characteristics explain the positive impact on trade flows. This applies to the frequency as well as to the SPS dummy variables. Regarding the effect of applied tariffs on market entry and on trade values, they show a minor impact on bilateral trade and interpretation should again be read with caution similar to results presented in Table 9. Panel B shows that results on bilateral versus multilateral effects are robust as well. Conformity assessment and measures related to product characteristics act as a market entry barrier against all trade partners, while intervention related to product characteristics increases bilateral trade flows conditional on entering the protected market.

The Revealed Comparative Advantage. As compared to Tables 4 and 5, the inclusion of the RCA dummy variables indicating whether the country has a comparative advantage in a given production does not create major changes. Indeed, the coefficients reported in Appendix Table 16 keep the same magnitudes and signs, and the significance levels either remain the same or increase. SPS concerns related to conformity assessment keep acting as a barrier to entry whereas product characteristics-related measures have a positive impact on imports. In addition, the former may also reduce the amount of trade as the coefficients on the SPS conformity variables become significant at the second stage of the Heckman procedure, although only at the 5 percent significance level. As for the signs of the country-sector specific measure of comparative advantage (RCA), they are in line with the literature, namely negative for the importer and positive for the exporter, which means that the partner's comparative advantage induces more imports from this country. Finally, in both panels A and B, the estimated correlation coefficients (rho) and the estimated selection coefficients (lambda) are statistically significant, confirming that controlling for selection effects and zero trade flows is appropriate.

Country-time fixed effects. In the same way as in section II.*C*., a specification including country-time and sector fixed effects is estimated using (i) a standard linear probability model (LPM) to assess the impact of disaggregated SPS regulatory instruments on the probability of trade, and (ii) a least squares dummy variable (LSDV) model in the second stage to evaluate the impact on the level of trade.

Results reported in Table 17 are consistent with those of Tables 4 and 5. Although the magnitude of the coefficients in the first stage regressions is reduced, conformity assessment-related SPS interventions (bilateral and multilateral measures) still negatively affect the extensive margin of trade. In contrast, SPS concerns related to the product characteristics positively impact the import values, not only from the country raising the concern but also from all other trading partners. The inverse Mills ratio calculated following Olsen (1980) and Chen and Mattoo (2008) is positive and significant in all regressions, confirming the need of using a correction procedure for the selection bias.

Endogeneity. Second, we estimate a probit and a 2SLS model separately. For comparison reasons, we again also report the OLS coefficients. In the 2SLS model, we deploy a similar instrumentation method as before.[27]

Table 18 Panel A in the Appendix reports bilateral results. Probit, OLS and 2SLS results on the impact of SPS measures on trade confirm our findings from the Heckman model. Estimates exhibit expected signs, significance levels, and similar magnitudes as those reported in Table 4. Instruments in the 2SLS models are generally valid as the Kleibergen-Paap F-Statistics are way above the 10% Stock and Yogo (2005) critical values. The same applies to bilateral versus multilateral effects of SPS measures. Results hold and are reported in Table 18 Panel B in the Appendix. The positive impact of SPS measures on trade flows can be attributed to SPS measures related to product characteristics which mainly benefit the country raising the concern. But, there is evidence that SPS measures related to product characteristics also promote trade with all partners conditional on entering the market (compare columns (B2) and (B3)). Further, when using instrumentation methods, we find that SPS measures related to conformity assessment significantly reduce the bilateral exports of the country reporting the concern. Instruments are again valid and the first stage F-Tests on the excluded instruments pass the most stringent criterion of the Stock and Yogo

[27]Instruments are (i) the sum of SPS concerns related to conformity assessment or product characteristics of all other countries $k \neq i$ against the importer and (ii) the sum of SPS concerns related to conformity assessment or product characteristics raised by the exporter against the importer in sectors $l \neq s$ but included within the same HS2 category, respectively.

(2005) critical values[28].

Negative Binomial. Panel A in Table 20 in the Appendix provides results on GNegB and ZINegB models. Similar to previous estimations, the coefficient on concerns related to product characteristics remains highly significant and positive in column (A1).[29] Columns (A2) and (A3) and columns (A5) and (A6) display the coefficients associated with the inflated and level equations of a ZINegB model. Columns (A2) and (A5) suggest that conformity assessment-related SPS measures increase the likelihood of no trade, while they have no impact on the level of trade (columns (A3) and (A6)). Contrary to this, product characteristics-related SPS measures have no significant impact on the probability of no trade, but positively affect trade flows.

Panel B in Table 20 in the Appendix reports results on the bilateral and the multilateral component of various types of SPS measures. Results remain generally in line. Bilateral and multilateral product characteristics-related SPS measures increase trade flows, while multilateral conformity assessment-related SPS measures significantly decrease the level of trade in columns (B1) and (B4). In the ZINegB specifications, the likelihood of no trade increases with both, bilateral and multilateral conformity assessment-related SPS measures and with multilateral product characteristics measures (columns (B2) and (B5)), while both, bilateral and multilateral product characteristics measures have a significant and positive impact on the level of trade (columns (B3) and (B6)).

IV. Concluding Remarks

This paper contributes to the literature by investigating the impact of SPS measures on the extensive and the intensive margin of agricultural and food trade using restrictive product standards only that are perceived as sizable barriers to

[28] The first stage regressions are reported in Appendix Table 19.

[29] Using the frequency index, the coefficient is similar in size but loses significance in column (A4).

trade by exporters. Using the database on specific trade concerns on SPS measures of the WTO, we deploy a gravity model at the HS4 disaggregated level of trade that controls for a potential selection bias and zero trade flows using both a dummy variable and a normalized frequency measure on SPS concerns.

We find that aggregate SPS measures pose a negative effect on the probability to export to a protected market, but, conditional on market entry, trade flows to markets with SPS standards in place tend to be higher. This reveals two important issues: First, SPS measures pose a serious barrier to market entry by increasing the fixed costs of trading. Second, SPS standards provide information on product safety to consumers and thus exert a positive impact on the trade flows of those exporters that manage to overcome the fixed cost of entering the market. Hence, foreign producers who meet the stringent standard gain market share. The advantage from gaining market share outweighs the costs of product adaption to meet the standard and leads to a positive effect on trade flows. The results are robust to the inclusion of applied bilateral tariff data, to instrumentation, and to various estimation techniques of gravity models. In addition, we find robust evidence that SPS measures pose market entry barriers to all potential exporters and are thus non-discriminatory. In contrast, conditional on market entry, SPS measures mostly increase trade flows of those countries that raise a concern over an SPS measure at the WTO SPS committee to the detriment of other exporters.

Further, we determine the trade outcomes on agricultural and food products of different SPS regulations implemented by policy makers to achieve certain health safety objectives. We distinguish concerns related to conformity assessment (i.e., certificate requirements, testing, inspection and approval procedures) and concerns related to product characteristics (i.e., requirements on quarantine treatment, pesticide residue levels, or labeling and packaging). Results indicate that conformity assessment-related SPS measures act as a barrier to market entry, while concerns related to product characteristics increase trade once exporters meet the stringent standard. This suggests that conformity assessment-related measures increase fixed costs due to often burdensome and separate certification, testing and inspection procedures in different export markets. In contrast, SPS measures related to product characteristics enhance consumer trust by providing safety information on imported products.

This result is particularly interesting for policy makers who often have to choose from a set of measures that equivalently reduce health risks but entail diverse trade costs. Even though SPS measures cover a relatively narrow area of health and safety measures that are often directly related to consumer protection, policy makers should be aware that policy substitution may be put at some expense. Hence, depending on the policy maker's choice between conformity assessment versus product characteristics measures, the implied impact on trade varies strongly. In particular, conformity assessment-related SPS measures increase the fixed costs of trade in agricultural and food products.

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Appendix

TABLE 6. Summary Table

Variable	Observations	Mean	Std. Dev.	Source
$\ln(\text{import}_{ijts})$	1,960,755	10.440	3.305	Comtrade (2011)
$\Pr(\text{import}_{ijts} > 0)$	5,452,147	0.360	0.480	Comtrade (2011)
$\text{SPS}_{ij(t-1)s}$	5,452,147	0.004	0.067	SPS IMS (2011)
$\text{SPSFreq}_{ij(t-1)s}$	5,452,147	0.004	0.062	SPS IMS (2011)
$\text{SPS}_{j(t-1)s}$ mult.	5,452,147	0.043	0.203	SPS IMS (2011)
$\text{SPSFreq}_{j(t-1)s}$ mult.	5,452,147	0.041	0.188	SPS IMS (2011)
SPS $\text{Conformity}_{ij(t-1)s}$	5,452,147	0.003	0.052	SPS IMS (2011)
SPSFreq $\text{Conformity}_{ij(t-1)s}$	5,452,147	0.003	0.049	SPS IMS (2011)
SPS $\text{Characteristic}_{ij(t-1)s}$	5,452,147	0.004	0.062	SPS IMS (2011)
SPSFreq $\text{Characteristic}_{ij(t-1)s}$	5,452,147	0.004	0.058	SPS IMS (2011)
SPS $\text{Conformity}_{j(t-1)s}$ mult.	5,452,147	0.031	0.174	SPS IMS (2011)
SPS $\text{Characteristic}_{j(t-1)s}$ mult.	5,452,147	0.039	0.193	SPS IMS (2011)
SPSFreq $\text{Conformity}_{j(t-1)s}$ mult.	5,452,147	0.031	0.164	SPS IMS (2011)
SPSFreq $\text{Characteristic}_{j(t-1)s}$ mult.	5,452,147	0.036	0.178	SPS IMS (2011)
$\ln \text{GDP}_{it} \times \text{GDP}_{jt}$	5,452,147	22.928	3.255	WDI (2011)
$\ln \text{POP}_{it} \times \text{POP}_{jt}$	5,452,147	6.210	2.759	WDI (2011)
$\ln \text{Distance}_{ij}$	5,452,147	8.511	0.949	CEPII (2005)
Adjacency_{ij}	5,452,147	0.080	0.271	CEPII (2005)
Common Language_{ij}	5,452,147	0.358	0.480	CEPII (2005)
Ever Colony_{ij}	5,452,147	0.094	0.293	CEPII (2005)
Common Colonizer_{ij}	5,452,147	0.159	0.366	CEPII (2005)
Colonizer post 1945_{ij}	5,452,147	0.061	0.240	CEPII (2005)
Common Religion_{ij}	5,452,147	0.251	0.298	Helpman et al. (2008)
Tariff_{ijts}, weighted average	5,452,147	2.977	15.071	IDB (2011) & TRAINS (2011)
MR Distance_{ijt}	5,452,147	9.512	0.835	own calculation, Baier & Bergstrand (2009)
MR Adjacency_{ijt}	5,452,147	-0.032	0.146	own calculation, Baier & Bergstrand (2009)
MR Common Language_{ijt}	5,452,147	0.297	0.400	own calculation, Baier & Bergstrand (2009)
MR Ever Colony_{ijt}	5,452,147	0.175	0.228	own calculation, Baier & Bergstrand (2009)
MR Common Colonizer_{ijt}	5,452,147	0.119	0.236	own calculation, Baier & Bergstrand (2009)
MR Colonizer post 1945_{ijt}	5,452,147	0.174	0.225	own calculation, Baier & Bergstrand (2009)
MR SPS_{ijts}	5,452,147	-1.779	4.358	own calculation, Baier & Bergstrand (2009)
IV $\text{SPS}_{ij(t-1)s}$	5,452,147	0.212	1.358	own calculation
IV $\text{SPSFreq}_{ij(t-1)s}$	5,452,147	0.200	1.262	own calculation
IV SPS $\text{Conformity}_{ij(t-1)s}$	5,452,147	0.104	0.780	own calculation
IV SPS $\text{Characteristic}_{ij(t-1)s}$	5,452,147	0.192	1.256	own calculation
IV SPSFreq $\text{Conformity}_{ij(t-1)s}$	5,452,147	0.098	0.674	own calculation
IV SPSFreq $\text{Characteristic}_{ij(t-1)s}$	5,452,147	0.182	1.202	own calculation

TABLE 7. List of Agricultural and Food Sectors and Products included in the Data

HS2 Code	Constraint	Specification	Coverage Ratio	Frequency Index
01		Live Animals	0.0677	0.0261
02		Meat and Edible Meat Offal	0.1113	0.0718
03		Fish and Crustaceans	0.0178	0.0056
04		Dairy, Eggs, Honey and Edible Products	0.0495	0.0258
05		Products of Animal Origin	0.0651	0.0209
06		Live Trees and other Plants	0.0400	0.0097
07		Edible Vegetables	0.0327	0.0208
08		Edible Fruits and Nuts, Peel of Citrus and Melons	0.0575	0.0222
09		Coffee, Tea, Mate and Spices	0.0244	0.0075
10		Cereals	0.0319	0.0111
11		Milling Industry Products	0.0001	0.0005
12		Oil Seeds, Miscellaneous Grains, Medical Plants and Straw	0.0254	0.0027
13		Lac, Gums, Resins, Vegetable Saps and Extracts Nes	0.0217	0.0027
14		Vegetable Plaiting Materials	0.0000	0.0000
15		Animal and Vegetable Fats, Oils and Waxes	0.0120	0.0120
16		Edible Preparations of Meat, Fish, Crustaceans	0.0151	0.0047
17		Sugars and Sugar Confectionery	0.0001	0.0007
18		Cocoa and Cocoa Preparations	0.0004	0.0004
19		Preparations of Cereals, Flour, Starch or Milk	0.0000	0.0001
20		Preparations of Vegetables, Fruits and Nuts	0.0221	0.0032
21		Miscellaneous Edible Preparations	0.0355	0.0097
22		Beverages, Spirits and Vinegar	0.0248	0.0025
23		Residues from Food Industries and Animal Feed	0.0456	0.0062
24		Tobacco and Manufacturing Tobacco Substitutes	0.0000	0.0000
29	includes 2905	Organic Chemicals	0.0000	0.0000
33	includes 3301	Essential Oils, Resinoids, Perfumery, Cosmetic or Toilet Preparations	0.0316	0.0035
35	includes 3501 to 3505	Albuminoidal Substances, Starches, Glues, Enzymes	0.0002	0.0001
38	includes 3809 and 3824	Miscellaneous Chemical Products	0.0000	0.0000
41	includes 4101 to 4103	Raw Hides and Skins (other than Furskins) and Leather	0.0009	0.0005
43	includes 4301	Furskins and Artificial Fur, Manufactures thereof	0.0028	0.0028
50	includes 5001 to 5003	Silk	0.0000	0.0000
51	includes 5101 to 5103	Wool, Animal Hair, Horsehair Yarn and Fabric thereof	0.0002	0.0002
52	includes 5201 to 5203	Cotton	0.0000	0.0000
53	includes 5301 and 5302	Vegetable Textile Fibers Nes, Paper Yarn, Woven Fabric	0.0000	0.0000

Note: This list follows the products listed in Annex 1 in the Agricultural Agreement of the WTO, yet, also including fish, fishing and seafood products. All HS4 product codes in an HS2 sector are included if not specified otherwise in the constraints column. A coverage ratio or frequency index of zero indicates either no SPS concern or no trade between the country raising the concern and the one maintaining the measure for the specific HS4 product category of concern.

TABLE 8. List of Countries included in the Data

Importing		Exporting	
Afghanistan	Mali	Afghanistan	Korea, Rep.
Albania	Mauritania	Albania	Kuwait
Algeria	Mauritius	Algeria	Lao PDR
Australia	Mexico	Angola	Lebanon
Bahamas, The	Mongolia	Argentina	Liberia
Bahrain	Morocco	Australia	Libya
Bangladesh	Mozambique	Bahamas, The	Madagascar
Barbados	Nepal	Bahrain	Malawi
Belize	New Caledonia	Bangladesh	Malaysia
Benin	New Zealand	Barbados	Maldives
Bermuda	Nicaragua	Belize	Mali
Bhutan	Niger	Benin	Mauritania
Bolivia	Nigeria	Bermuda	Mauritius
Brazil	Norway	Bhutan	Mexico
Brunei Darussalam	Oman	Bolivia	Mongolia
Burkina Faso	Pakistan	Brazil	Morocco
Burundi	Panama	Brunei Darussalam	Mozambique
Cambodia	Papua New Guinea	Burkina Faso	Nepal
Cameroon	Paraguay	Burundi	New Caledonia
Canada	Peru	Cambodia	New Zealand
Central African Republic	Philippines	Cameroon	Nicaragua
Chile	Qatar	Canada	Niger
China	Rwanda	Cayman Islands	Nigeria
Colombia	Saudi Arabia	Central African Republic	Norway
Comoros	Senegal	Chad	Oman
Costa Rica	Seychelles	Chile	Pakistan
Ivory Coast	Sierra Leone	China	Panama
Cuba	Singapore	Colombia	Papua New Guinea
Djibouti	Solomon Islands	Comoros	Paraguay
Dominican Republic	South Africa	Costa Rica	Peru
Ecuador	Sri Lanka	Ivory Coast	Philippines
Egypt, Arab Rep.	St. Kitts and Nevis	Cuba	Qatar
El Salvador	Sudan	Djibouti	Rwanda
Ethiopia	Suriname	Dominican Republic	Saudi Arabia
Fiji	Switzerland	Ecuador	Senegal
Gabon	Syrian Arab Republic	Egypt, Arab Rep.	Seychelles
Gambia, The	Tanzania	El Salvador	Sierra Leone
Ghana	Thailand	Equatorial Guinea	Singapore
Greenland	Togo	Ethiopia	Solomon Islands
Guatemala	Trinidad and Tobago	Fiji	South Africa
Guinea	Tunisia	Gabon	Sri Lanka
Guinea-Bissau	Turkey	Gambia, The	St. Kitts and Nevis
Guyana	Uganda	Ghana	Sudan
Honduras	United Arab Emirates	Greenland	Suriname
Hong Kong SAR, China	United States	Guatemala	Switzerland
Iceland	Uruguay	Guinea	Syrian Arab Republic
India	Venezuela, RB	Guinea-Bissau	Tanzania
Indonesia	Vietnam	Guyana	Thailand
Iran, Islamic Rep.	Yemen, Rep.	Haiti	Togo
Israel	Zambia	Honduras	Trinidad and Tobago
Jamaica	Zimbabwe	Hong Kong SAR, China	Tunisia
Japan		Iceland	Turkey
Jordan		India	Uganda
Kenya		Indonesia	United Arab Emirates
Kiribati		Iran, Islamic Rep.	United States
Korea, Rep.		Iraq	Uruguay
Kuwait		Israel	Venezuela, RB
Lebanon		Jamaica	Vietnam
Madagascar		Japan	Yemen, Rep.
Malawi		Jordan	Zambia
Malaysia		Kenya	Zimbabwe
Maldives		Kiribati	

TABLE 9. Robustness: SPS, Tariffs and Trade (1996 - 2010)

	Heckman Selection Model (maximum likelihood)			
Equation:	Selection	Outcome	Selection	Outcome
Dependent Variable:	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$
PANEL A: BILATERAL SPS (N = 5,452,147)				
	(A1)	(A2)	(A3)	(A4)
$\text{SPS}_{ij(t-1)s}$	-0.134**	0.641***		
	(0.06)	(0.14)		
$\text{SPSFreq}_{ij(t-1)s}$			-0.149**	0.623***
			(0.06)	(0.15)
Tariff_{ijts}, weighted average	0.001***	-0.001**	0.001***	-0.001**
	(0.00)	(0.00)	(0.00)	(0.00)
Estimated correlation (rho)	0.459***		0.460***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.366***		1.368***	
	(0.04)		(0.04)	
PANEL B: BILATERAL & MULTILATERAL SPS (N = 5,452,147)				
	(B1)	(B2)	(B3)	(B4)
$\text{SPS}_{ij(t-1)s}$	-0.029	0.710***		
	(0.05)	(0.14)		
$\text{SPS}_{ij(t-1)s}$ multilateral	-0.163***	-0.108**		
	(0.01)	(0.05)		
$\text{SPSFreq}_{ij(t-1)s}$			-0.025	0.698***
			(0.06)	(0.16)
$\text{SPSFreq}_{ij(t-1)s}$ multilateral			-0.193***	-0.117*
			(0.02)	(0.06)
Tariff_{ijts}, weighted average	0.001***	-0.001***	0.001***	-0.001**
	(0.00)	(0.00)	(0.00)	(0.00)
Estimated correlation (rho)	0.459***		0.459***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.364***		1.367***	
	(0.04)		(0.04)	

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Controls, constant, importer, exporter, HS4 product and time fixed effects and MR terms are included but not reported. Common religion is the selection variable and thus excluded in the outcome equations. Country clustered robust standard errors reported in parenthesis.

TABLE 10. Robustness: SPS and Trade (1996 - 2010)
The Revealed Comparative Advantage

	Heckman Selection Model (maximum likelihood)			
Equation:	Selection	Outcome	Selection	Outcome
Dependent Variable:	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$
PANEL A: BILATERAL SPS (N = 5,452,147)				
	(A1)	(A2)	(A3)	(A4)
$\text{SPS}_{ij(t-1)s}$	-0.154***	0.560***		
	(0.06)	(0.13)		
$\text{SPSFreq}_{ij(t-1)s}$			-0.168***	0.558***
			(0.06)	(0.15)
RCA Importer_{jst}	-0.181***	-0.306***	-0.181***	-0.306***
	(0.01)	(0.02)	(0.01)	(0.02)
RCA Exporter_{ist}	0.312***	1.763***	0.312***	1.764***
	(0.01)	(0.02)	(0.01)	(0.02)
Estimated correlation (rho)	0.445***		0.446***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.043***		1.043***	
	(0.00)		(0.00)	
PANEL B: BILATERAL & MULTILATERAL SPS (N = 5,452,147)				
	(B1)	(B2)	(B3)	(B4)
$\text{SPS}_{ij(t-1)s}$	-0.042	0.616***		
	(0.06)	(0.14)		
$\text{SPS}_{j(t-1)s}$ mult.	-0.172***	-0.086*		
	(0.01)	(0.05)		
$\text{SPSFreq}_{ij(t-1)s}$			-0.034	0.627***
			(0.06)	(0.15)
$\text{SPSFreq}_{j(t-1)s}$ mult.			-0.208***	-0.107*
			(0.02)	(0.06)
RCA Importer_{jst}	-0.181***	-0.306***	-0.182***	-0.306***
	(0.01)	(0.02)	(0.01)	(0.02)
RCA Exporter_{ist}	0.311***	1.763***	0.311***	1.763***
	(0.01)	(0.02)	(0.01)	(0.02)
Estimated correlation (rho)	0.445***		0.445***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.042***		1.042***	
	(0.00)		(0.00)	

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Controls, constant, importer, exporter, HS4 product, time fixed effects and MR terms included but not reported. Common religion is the selection variable and thus excluded in the outcome equations. Country clustered robust standard errors reported in parenthesis. Following Balassa(1965), the Revealed Comparative Advantage (RCA) is equal to one if the proportion of the country's exports of product *s* divided by the proportion of world exports of that given product is greater than unity, and zero otherwise.

TABLE 11. Robustness: SPS and Trade (1996 - 2010)
Linear Probability Model and Least Squares Dummy Variable

Equation:	1st stage	2nd stage	1st stage	2nd stage
Estimation Method:	LPM	LSDV	LPM	LSDV
Dependent Variable:	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$
	(1)	(2)	(3)	(4)
PANEL A: BILATERAL SPS				
	(A1)	(A2)	(A3)	(A4)
$\text{SPS}_{ij(t-1)s}$	-0.029*	0.899***		
	(0.02)	(0.13)		
$\text{SPSFreq}_{ij(t-1)s}$			-0.031	0.889***
			(0.02)	(0.14)
Inverse Mills ratio_{ijts}		6.114***		6.127***
		(1.56)		(1.56)
Observations	5,452,147	1,960,755	5,452,147	1,960,755
Adjusted R^2	0.236	0.306	0.236	0.306
PANEL B: BILATERAL & MULTILATERAL SPS				
	(B1)	(B2)	(B3)	(B4)
$\text{SPS}_{ij(t-1)s}$	-0.007	0.768***		
	(0.02)	(0.12)		
$\text{SPS}_{j(t-1)s}$ mult.	-0.035***	0.214***		
	(0.00)	(0.07)		
$\text{SPSFreq}_{ij(t-1)s}$			-0.005	0.729***
			(0.02)	(0.14)
$\text{SPSFreq}_{j(t-1)s}$ mult.			-0.043***	0.263***
			(0.01)	(0.08)
Inverse Mills ratio		6.113***		6.129***
		(1.56)		(1.56)
Observations	5,452,147	1,960,755	5,452,147	1,960,755
Adjusted R^2	0.237	0.306	0.237	0.306

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Controls, constant, importer-year, exporter-year, HS4 product fixed effects and MR terms are included but not reported. Common religion is the selection variable and thus excluded in columns (2) and (4). Country clustered robust standard errors reported in parenthesis. The inverse Mills ratio is calculated as described in Olsen (1980) and Chen and Mattoo (2008).

TABLE 12. Robustness: SPS and Trade (1996 - 2010)

Dependent Variable:	$\text{import}_{ijts} > 0$	$\ln(\text{import}_{ijts})$		$\text{import}_{ijts} > 0$	$\ln(\text{import}_{ijts})$	
Method:	Probit	OLS	2SLS	Probit	OLS	2SLS
PANEL A: BILATERAL SPS						
	(A1)	(A2)	(A3)	(A4)	(A5)	(A6)
$\text{SPS}_{ij(t-1)s}$	-0.140***	0.771***	0.598***			
	(0.05)	(0.12)	(0.14)			
$\text{SPSFreq}_{ij(t-1)s}$				-0.155***	0.763***	0.614***
				(0.06)	(0.13)	(0.15)
Observations	5,452,147	1,960,755	1,960,755	5,452,147	1,960,755	1,960,755
Adjusted R^2		0.295	0.295		0.295	0.295
Kleibergen-Paap Wald F stat.			645.57			692.10
Hansen *J* P-value			0.80			0.75
Kleibergen-Paap LM P-value			0.00			0.00
PANEL B: BILATERAL & MULTILATERAL SPS						
	(B1)	(B2)	(B3)	(B4)	(B5)	(B6)
$\text{SPS}_{ij(t-1)s}$	-0.027	0.752***	0.563***			
	(0.05)	(0.12)	(0.15)			
$\text{SPS}_{j(t-1)s}$ multilateral	-0.173***	0.031	0.054			
	(0.01)	(0.04)	(0.05)			
$\text{SPSFreq}_{ij(t-1)s}$				-0.024	0.736***	0.573***
				(0.06)	(0.14)	(0.15)
$\text{SPSFreq}_{j(t-1)s}$ multilateral				-0.205***	0.046	0.066
				(0.02)	(0.05)	(0.05)
Observations	5,452,147	1,960,755	1,960,755	5,452,147	1,960,755	1,960,755
Adjusted R^2		0.295	0.295		0.295	0.295
Kleibergen-Paap Wald F stat.			386.53			416.89
Hansen *J* P-value			0.54			0.52
Kleibergen-Paap LM P-value			0.00			0.00

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Controls, constant, importer, exporter, HS4 product and time fixed effects and MR terms included but not reported. Gravity controls included but not reported. Country clustered robust standard errors reported in parenthesis. The instruments are the sum of concerns of all other countries $k \neq i$ against country j and the sum of bilateral SPS concerns in sectors $l \neq s$ with $s, l \in HS2$.

TABLE 13. 2SLS First Stage Results, Aggregate SPS Measure (1996 - 2010)

Equation	Bilateral		Bilateral and Multilateral	
Endogenous regressor:	SPS$_{ij(t-1)s}$ (1)	SPSFreq$_{ij(t-1)s}$ (2)	SPS$_{ij(t-1)s}$ (3)	SPSFreq$_{ij(t-1)s}$ (4)
IV1 SPS$_{ij(t-1)s}$	0.005***		0.002***	
	(0.00)		(0.00)	
IV2 SPS$_{ij(t-1)s}$	0.075***		0.074***	
	(0.00)		(0.00)	
IV1 SPSFreq$_{ij(t-1)s}$		0.003***		0.001**
		(0.00)		(0.00)
IV2 SPSFreq$_{ij(t-1)s}$		0.077***		0.077***
		(0.00)		(0.00)
SPS$_{j(t-1)s}$ mult.			0.033***	
			(0.01)	
SPSFreq$_{j(t-1)s}$ mult.				0.015***
				(0.00)
Observations	1,960,755	1,960,755	1,960,755	1,960,755
F statistic	1053.35	1146.59	837.06	916.08
Adjusted R^2	0.740	0.871	0.743	0.872

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Controls, constant, importer, exporter, HS4 product and time fixed effects and MR terms included but not reported. Gravity controls included but not reported. Country clustered robust standard errors reported in parenthesis. Instruments are (IV1) the sum of SPS concerns of all other countries $k \neq i$ against the importer and (IV2) the sum of SPS concerns raised by the exporter against the importer in sectors $l \neq s$ with $s, l \in HS2$, respectively.

TABLE 14. Robustness: SPS and Trade, Negative Binomial (1996 - 2010)

Method:	GNegB	ZINegB		GNegB	ZINegB	
		Prob. (Zero Trade)	Trade		Prob. (Zero Trade)	Trade
	PANEL A: BILATERAL SPS (N = 5,452,147)					
	(A1)	(A2)	(A3)	(A4)	(A5)	(A6)
$\text{SPS}_{ij(t-1)s}$	0.498***	0.258***	0.617***			
	(0.12)	(0.09)	(0.11)			
$\text{SPSFreq}_{ij(t-1)s}$				0.460***	0.284***	0.604***
				(0.15)	(0.10)	(0.13)
	PANEL B: BILATERAL & MULTILATERAL SPS (N = 5,452,147)					
	(B1)	(B2)	(B3)	(B4)	(B5)	(B6)
$\text{SPS}_{ij(t-1)s}$	0.536***	0.070	0.554***			
	(0.12)	(0.09)	(0.11)			
$\text{SPS}_{j(t-1)s}$ multilateral	-0.070	0.298***	0.123***			
	(0.05)	(0.02)	(0.05)			
$\text{SPSFreq}_{ij(t-1)s}$				0.504***	0.066	0.522***
				(0.15)	(0.10)	(0.14)
$\text{SPSFreq}_{j(t-1)s}$ multilateral				-0.081	0.349***	0.165***
				(0.05)	(0.03)	(0.05)

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Controls, constant, importer, exporter, HS4 product and time fixed effects and MR terms included but not reported. Gravity controls included but not reported. Country clustered robust standard errors reported in parenthesis. GNegB, generalized negative binomial; ZINegB, zero-inflated negative binomial. For the ZINegB estimation in columns (A2) and (A3), the maximum number of iterations has been fixed to 50 because of convergence problems.

TABLE 15. Robustness: SPS, Tariffs and Trade, by Type of Concern (1996 - 2010)

	Heckman Selection Model (maximum likelihood)			
Equation:	Selection	Outcome	Selection	Outcome
Dependent Variable:	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$
PANEL A: BILATERAL SPS (N = 5,452,147)				
	(A1)	(A2)	(A3)	(A4)
SPS Conformity$_{ij(t-1)s}$	-0.254***	-0.402*		
	(0.07)	(0.23)		
SPS Characteristic$_{ij(t-1)s}$	0.015	0.941***		
	(0.07)	(0.19)		
SPSFreq Conformity$_{ij(t-1)s}$			-0.285***	-0.463*
			(0.09)	(0.27)
SPSFreq Characteristic$_{ij(t-1)s}$			0.017	0.965***
			(0.07)	(0.22)
Tariff$_{ijts}$, weighted average	0.001***	-0.001**	0.001***	-0.001**
	(0.00)	(0.00)	(0.00)	(0.00)
Estimated correlation (rho)	0.459***		0.459***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.365***		1.367***	
	(0.04)		(0.04)	
PANEL B: BILATERAL & MULTILATERAL SPS (N = 5,452,147)				
	(B1)	(B2)	(B3)	(B4)
SPS Conformity$_{ij(t-1)s}$	-0.189***	-0.347		
	(0.07)	(0.23)		
SPS Conformity$_{ij(t-1)s}$ mult.	-0.098***	-0.093		
	(0.02)	(0.06)		
SPS Characteristic$_{ij(t-1)s}$	0.083	0.953***		
	(0.07)	(0.19)		
SPS Characteristic$_{ij(t-1)s}$ mult.	-0.083***	0.013		
	(0.02)	(0.06)		
SPSFreq Conformity$_{ij(t-1)s}$			-0.224***	-0.435
			(0.09)	(0.28)
SPSFreq Conformity$_{ij(t-1)s}$ mult.			-0.098***	-0.044
			(0.02)	(0.07)
SPSFreq Characteristic$_{ij(t-1)s}$			0.100	0.981***
			(0.07)	(0.23)
SPSFreq Characteristic$_{ij(t-1)s}$ mult.			-0.102***	-0.008
			(0.02)	(0.07)
Tariff$_{ijts}$, weighted average	0.001***	-0.001**	0.001***	-0.001**
	(0.00)	(0.00)	(0.00)	(0.00)
Estimated correlation (rho)	0.459***		0.459***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.364***		1.367***	
	(0.04)		(0.04)	

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Controls, constant, importer, exporter, HS4 product and time fixed effects and MR terms are included but not reported. Common religion is the selection variable and thus excluded in the outcome equations. Country clustered robust standard errors reported in parenthesis.

TABLE 16. Robustness: SPS and Trade, by Type of Concern (1996 - 2010) The Revealed Comparative Advantage

	Heckman Selection Model (maximum likelihood)			
Equation:	Selection	Outcome	Selection	Outcome
Dependent Variable:	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$
PANEL A: BILATERAL SPS (N = 5,452,147)				
	(A1)	(A2)	(A3)	(A4)
SPS Conformity$_{ij(t-1)s}$	-0.262***	-0.441**		
	(0.07)	(0.20)		
SPS Characteristic$_{ij(t-1)s}$	-0.002	0.871***		
	(0.07)	(0.18)		
SPSFreq Conformity$_{ij(t-1)s}$			-0.294***	-0.499**
			(0.09)	(0.24)
SPSFreq Characteristic$_{ij(t-1)s}$			0.002	0.909***
			(0.07)	(0.21)
RCA Importer$_{ist}$	-0.181***	-0.305***	-0.181***	-0.305***
	(0.01)	(0.02)	(0.01)	(0.02)
RCA Exporter$_{jst}$	0.313***	1.765***	0.313***	1.766***
	(0.01)	(0.02)	(0.01)	(0.02)
Estimated correlation (rho)	0.445***		0.446***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.043***		1.043***	
	(0.00)		(0.00)	
PANEL B: BILATERAL & MULTILATERAL SPS (N = 5,452,147)				
	(B1)	(B2)	(B3)	(B4)
SPS Conformity$_{ij(t-1)s}$	-0.187***	-0.393*		
	(0.07)	(0.21)		
SPS Conformity$_{ij(t-1)s}$ mult.	-0.114***	-0.083		
	(0.02)	(0.05)		
SPS Characteristic$_{ij(t-1)s}$	0.066	0.868***		
	(0.07)	(0.19)		
SPS Characteristic$_{ij(t-1)s}$ mult.	-0.078***	0.036		
	(0.02)	(0.05)		
SPSFreq Conformity$_{ij(t-1)s}$			-0.220***	-0.476*
			(0.08)	(0.25)
SPSFreq Conformity$_{ij(t-1)s}$ mult.			-0.117***	-0.035 *
			(0.02)	(0.06)
SPSFreq Characteristic$_{ij(t-1)s}$			0.087	0.916***
			(0.08)	(0.21)
SPSFreq Characteristic$_{ij(t-1)s}$ mult.			-0.100***	0.003
			(0.02)	(0.07)
RCA Importer$_{jst}$	-0.181***	-0.305***	-0.182***	-0.305***
	(0.01)	(0.02)	(0.01)	(0.02)
RCA Exporter$_{ist}$	0.312***	1.764***	0.312***	1.765***
	(0.01)	(0.02)	(0.01)	(0.02)
Estimated correlation (rho)	0.445***		0.446***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.042***		1.043***	
	(0.00)		(0.00)	

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Controls, constant, importer, exporter, HS4 product, time fixed effects and MR terms included but not reported. Common religion is the selection variable and thus excluded in the outcome equations. Country clustered robust standard errors reported in parenthesis. Following Balassa(1965), the Revealed Comparative Advantage (RCA) is equal to one if the proportion of the country's exports of product *s* divided by the proportion of world exports of that given product is greater than unity, and zero otherwise.

TABLE 17. Robustness: SPS and Trade, by Type of Concern (1996 - 2010) Linear Probability Model and Least Squares Dummy Variable

Equation:	1st stage	2nd stage	1st stage	2nd stage
Estimation Method:	LPM	LSDV	LPM	LSDV
Dependent Variable:	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$	$\Pr(\text{import}_{ijts} > 0)$	$\ln(\text{import}_{ijts})$
	(1)	(2)	(3)	(4)
PANEL A: BILATERAL SPS				
	(A1)	(A2)	(A3)	(A4)
SPS Conformity$_{ij(t-1)s}$	-0.076***	0.256		
	(0.02)	(0.23)		
SPS Characteristic$_{ij(t-1)s}$	0.013	0.822***		
	(0.02)	(0.17)		
SPSFreq Conformity$_{ij(t-1)s}$			-0.086***	0.288
			(0.03)	(0.27)
SPSFreq Characteristic$_{ij(t-1)s}$			0.018	0.795***
			(0.02)	(0.20)
Inverse Mills ratio$_{ijts}$		6.131***		6.143***
		(1.56)		(1.56)
Observations	5,452,147	1,960,755	5,452,147	1,960,755
Adjusted R^2	0.236	0.306	0.236	0.306
PANEL B: BILATERAL & MULTILATERAL SPS				
	(B1)	(B2)	(B3)	(B4)
SPS Conformity$_{ij(t-1)s}$	-0.060***	0.183		
	(0.02)	(0.22)		
SPS Conformity$_{j(t-1)s}$ mult.	-0.025***	0.096		
	(0.01)	(0.07)		
SPS Characteristic$_{ij(t-1)s}$	0.025	0.718***		
	(0.02)	(0.17)		
SPS Characteristic$_{j(t-1)s}$ mult.	-0.014**	0.164***		
	(0.01)	(0.06)		
SPSFreq Conformity$_{ij(t-1)s}$			-0.072***	0.202
			(0.03)	(0.26)
SPSFreq Conformity$_{j(t-1)s}$ mult.			-0.023***	0.130*
			(0.01)	(0.07)
SPSFreq Characteristic$_{ij(t-1)s}$			0.033	0.668***
			(0.02)	(0.21)
SPSFreq Characteristic$_{j(t-1)s}$ mult.			-0.020***	0.191***
			(0.01)	(0.07)
Inverse Mills ratio		6.130***		6.147***
		(1.56)		(1.56)
Observations	5,452,147	1,960,755	5,452,147	1,960,755
Adjusted R^2	0.237	0.306	0.237	0.306

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Controls, constant, importer-year, exporter-year, HS4 product fixed effects and MR terms are included but not reported. Common religion is the selection variable and thus excluded in columns (2) and (4). Country clustered robust standard errors reported in parenthesis. The inverse Mills ratio is calculated as described in Olsen (1980) and Chen and Mattoo (2008).

TABLE 18. Robustness: SPS and Trade, by Type of Concern (1996 - 2010)

Dependent Variable:	$import_{ijts} > 0$	$\ln(import_{ijts})$		$import_{ijts} > 0$	$\ln(import_{ijts})$	
Method:	Probit	OLS	2SLS	Probit	OLS	2SLS
PANEL A: BILATERAL SPS						
	(A1)	(A2)	(A3)	(A4)	(A5)	(A6)
SPS Conformity$_{ij(t-1)s}$	-0.249***	-0.222	-0.570*			
	(0.07)	(0.20)	(0.27)			
SPS Characteristic$_{ij(t-1)s}$	0.005	0.972***	0.999***			
	(0.06)	(0.17)	(0.22)			
SPSFreq Conformity$_{ij(t-1)s}$				-0.278***	-0.256	-0.509
				(0.08)	(0.24)	(0.27)
SPSFreq Characteristic$_{ij(t-1)s}$				0.006	0.991***	0.981***
				(0.07)	(0.20)	(0.22)
Observations	5,452,147	1,960,755	1,960,755	5,452,147	1,960,755	1,960,755
Adjusted R^2		0.295	0.295		0.295	0.294
Kleibergen-Paap Wald F stat.			167.37			139.43
Hansen *J* P-value			0.01			0.01
Kleibergen-Paap LM P-value			0.00			0.00
PANEL B: BILATERAL & MULTILATERAL SPS						
	(B1)	(B2)	(B3)	(B4)	(B5)	(B6)
SPS Conformity$_{ij(t-1)s}$	-0.178**	-0.217	-0.575**			
	(0.07)	(0.20)	(0.27)			
SPS Conformity$_{j(t-1)s}$ mult.	-0.107***	-0.016	0.021			
	(0.02)	(0.05)	(0.05)			
SPS Characteristic$_{ij(t-1)s}$	0.076	0.925***	0.943***			
	(0.06)	(0.17)	(0.23)			
SPS Characteristic$_{j(t-1)s}$ mult.	-0.086***	0.088*	0.086*			
	(0.02)	(0.05)	(0.05)			
SPSFreq Conformity$_{ij(t-1)s}$				-0.208**	-0.277	-0.531*
				(0.08)	(0.24)	(0.27)
SPSFreq Conformity$_{j(t-1)s}$ mult.				-0.110***	0.037	0.064
				(0.02)	(0.06)	(0.06)
SPSFreq Characteristic$_{ij(t-1)s}$				0.092	0.938***	0.920***
				(0.07)	(0.20)	(0.23)
SPSFreq Characteristic$_{j(t-1)s}$ mult.				-0.104***	0.078	0.078
				(0.02)	(0.06)	(0.06)
Observations	5,452,147	1,960,755	1,960,755	5,452,147	1,960,755	1,960,755
Adjusted R^2		0.295	0.295		0.295	0.295
Kleibergen-Paap Wald F stat.			107.651			93.488
Hansen *J* P-value			0.00			0.00
Kleibergen-Paap LM P-value			0.00			0.00

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Controls, constant, importer, exporter, HS4 product and time fixed effects and MR terms included but not reported. Gravity controls included but not reported. Country clustered robust standard errors reported in parenthesis. Instruments are the sum of SPS concerns related to conformity assessment or product characteristics of all other countries $k \neq i$ against the importer and the sum of SPS concerns related to conformity assessment or product characteristics raised by the exporter against the importer in sectors $l \neq s$ with $s, l \in HS2$, respectively.

TABLE 19. 2SLS First Stage Results, by Type of Concern (1996 - 2010)

Equation	Bilateral		Bilateral and Multilateral	
Endogenous regressor:	Conformity	Characteristic	Conformity	Characteristic
PANEL A: Dummy variable, SPS$_{ij(t-1)s}$ (N = 1,960,755)				
	(A1)	(A2)	(A3)	(A4)
IV1 SPS Conformity$_{ij(t-1)s}$	0.007***	0.003***	0.004***	0.001
	(0.00)	(0.00)	(0.00)	(0.00)
IV2 SPS Conformity$_{ij(t-1)s}$	0.073***	-0.013***	0.073***	-0.013***
	(0.00)	(0.00)	(0.00)	(0.00)
IV1 SPS Characteristic$_{ij(t-1)s}$	0.001**	0.003***	-0.001***	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)
IV2 SPS Characteristic$_{ij(t-1)s}$	-0.004***	0.082***	-0.004***	0.081***
	(0.00)	(0.00)	(0.00)	(0.00)
SPS Conformity $_{j(t-1)s}$ mult.			0.028***	0.009**
			(0.01)	(0.00)
SPS Characteristic$_{j(t-1)s}$ mult.			0.008***	0.033***
			(0.00)	(0.00)
F statistic	415.5697	692.0801	311.072	571.068
Adjusted R^2	0.697	0.745	0.700	0.749
PANEL B: Frequency Measure, SPSFreq$_{ij(t-1)s}$ (N = 1,960,755)				
	(B1)	(B2)	(B3)	(B4)
IV1 SPSFreq Conformity$_{ij(t-1)s}$	0.003***	0.002***	0.000	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)
IV2 SPSFreq Conformity$_{ij(t-1)s}$	0.076***	-0.012***	0.076***	-0.012***
	(0.00)	(0.00)	(0.00)	(0.00)
IV1 SPSFreq Characteristic$_{ij(t-1)s}$	0.001***	0.001***	-0.001***	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)
IV2 SPSFreq Characteristic$_{ij(t-1)s}$	-0.004***	0.083***	-0.004***	0.083***
	(0.00)	(0.00)	(0.00)	(0.00)
SPSFreq Conformity $_{j(t-1)s}$ mult.			0.020***	0.013***
			(0.01)	(0.00)
SPSFreq Characteristic$_{j(t-1)s}$ mult.			0.007***	0.014***
			(0.00)	(0.00)
F statistic	442.7317	729.7615	285.1379	621.5763
Adjusted R^2	0.832	0.872	0.834	0.873

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Controls, constant, importer, exporter, HS4 product and time fixed effects and MR terms included but not reported. Gravity controls included but not reported. Country clustered robust standard errors reported in parenthesis. Instruments are (IV1) the sum of SPS concerns related to conformity assessment or product characteristics of all other countries $k \neq i$ against the importer and (IV2) the sum of SPS concerns related to conformity assessment or product characteristics raised by the exporter against the importer in sectors $l \neq s$ with $s, l \in HS2$, respectively.

TABLE 20. Robustness: SPS and Trade, by Type of Concern, Negative Binomial (1996 - 2010)

Method:	GNegB	ZINegB		GNegB	ZINegB	
		Prob. (Zero Trade)	Trade		Prob. (Zero Trade)	Trade
PANEL A: BILATERAL SPS (N = 5,452,147)						
	(A1)	(A2)	(A3)	(A4)	(A5)	(A6)
SPS Conformity$_{ij(t-1)s}$	-0.108	0.429***	0.006			
	(0.18)	(0.12)	(0.17)			
SPS Characteristic$_{ij(t-1)s}$	0.567***	0.004	0.639***			
	(0.14)	(0.10)	(0.13)			
SPSFreq Conformity$_{ij(t-1)s}$				-0.258	0.480***	-0.027
				(0.23)	(0.14)	(0.21)
SPSFreq Characteristic$_{ij(t-1)s}$				0.605	0.003	0.642***
				(0.19)	(0.11)	(0.18)
PANEL B: BILATERAL & MULTILATERAL SPS (N = 5,452,147)						
	(B1)	(B2)	(B3)	(B4)	(B5)	(B6)
SPS Conformity$_{ij(t-1)s}$	0.043	0.312***	0.044			
	(0.19)	(0.12)	(0.17)			
SPS Conformity$_{j(t-1)s}$ multilateral	-0.266***	0.178***	-0.063			
	(0.06)	(0.03)	(0.05)			
SPS Characteristic$_{ij(t-1)s}$	0.524***	-0.118	0.536***			
	(0.15)	(0.10)	(0.15)			
SPS Characteristic$_{j(t-1)s}$ multilateral	0.174***	0.153***	0.216***			
	(0.06)	(0.03)	(0.06)			
SPSFreq Conformity$_{ij(t-1)s}$				-0.001	0.366***	0.020
				(0.23)	(0.14)	(0.21)
SPSFreq Conformity$_{j(t-1)s}$ multilateral				-0.314***	0.183***	-0.078
				(0.07)	(0.03)	(0.07)
SPSFreq Characteristic$_{ij(t-1)s}$				0.513***	-0.142	0.516***
				(0.19)	(0.11)	(0.18)
SPSFreq Characteristic$_{j(t-1)s}$ multilateral				0.218***	0.181***	0.272***
				(0.07)	(0.04)	(0.07)

Note: ***, **, * denote significance at the 1%, 5%, and 10% level, respectively. Controls, constant, importer, exporter, HS4 product and time fixed effects and MR terms included but not reported. Gravity controls included but not reported. Country clustered robust standard errors reported in parenthesis. GNegB, generalized negative binomial; ZINegB, zero-inflated negative binomial. For the ZINegB estimations in columns (A2)-(A3) and (B5)-(B6), as well as for the GNegB results of column (A4), the maximum number of iterations has been fixed to 50 because of convergence problems.