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SPS Measures and Trade: Implementation Matters

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SPS Measures and Trade: Implementation Matters*

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Abstract

In an attempt to disentangle the impact of sanitary and phytosanitary (SPS) measures on trade patterns, we estimate a Heckman selection model on the HS4 disaggregated level of trade. Using SPS measures obtained from the SPS Information Management System of the WTO and controlling for zero trade flows, we find that SPS concerns reduce the probability of trade in agricultural and food products consistently. However, the amount of trade is positively affected by SPS measures conditional on market entry. This suggests that SPS measures constitute an effective market entry barrier. Additionally, we split SPS measures into requirements related to (i) conformity assessment, and (ii) product characteristics. Both types of measures are implemented by policy makers to achieve a desired level of health safety, yet, entail diverse trade costs. We find that conformity assessment measures hamper not only the likelihood to trade but also the amount of trade, while measures related to product characteristics do not affect the market entry decision, but have a strong positive impact on the trade volume. This suggests that trade outcomes crucially depend on the measure policy makers decide to implement.

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

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I. Introduction

In the light of decreasing tariffs, quotas and prohibitions due to multilateral and bilateral agreements over the last decades, non-tariff measures (NTMs) are on the rise. Countries seek alternatives to protect what was previously carried out by classical trade policy instruments (Roberts et al., 1999). NTMs, such as sanitary and phytosanitary (SPS) measures[1] pose methods which are partly regulated under the SPS Agreement of the World Trade Organization (WTO), but their design and use are less restricted and rather flexible. Major concerns are regularly expressed that SPS regulations are used as protectionist devices. 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, they may, however, also be used as instruments to achieve certain policy objectives, such as protecting domestic producers, even though WTO members[2] are required to restrain from applying measures for any protective purposes.

Limited knowledge on the 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, reduce transaction costs and thus foster trade. Further, trade may also increase 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 to 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 have different SPS measures at hand. These measures entail diverse effects

[1] This paper focuses on SPS measures that are most prevalent in agricultural and food trade.
[2] All of which are also members of the SPS Agreement.

on trade as some affect fixed costs and thus market entry, while others affect post-entry activities of firms, hence, variable trade costs. Assessing the diverse effects is thus an empirical issue.

Recent empirical research on SPS measures has been focusing on the forgone trade via the gravity estimation using either log linear least squares, Poisson pseudo maximum likelihood or Heckman model specifications. They provide evidence that SPS measures hamper trade on the aggregate level (De Frahan and Vancauteren, 2006; Gebrehiwet et al., 2007; Disdier et al., 2008; Anders and Caswell, 2009). But Fontagné et al. (2005) and Disdier et al. (2008) find positive and negative effects when looking at various sectors. These approaches focus on the aggregate measure rather than on the trade effects of diverse regulations that equivalently reduce risk with respect to health safety, such as testing, inspection and approval procedures or requirements on quarantine treatment, pesticide levels, labeling or the regional application of measures. Evidence suggests that product-specific regulations, such as maximum residue levels, hamper trade (Otsuki et al., 2001a; Otsuki et al., 2001b; Wilson and Otsuki, 2004; Disdier and Marette, 2010; Jayasinghe et al., 2010). The latter studies focus on one specific measure but cannot compare the impact of various SPS instruments on trade, although countries may adopt different SPS measures to achieve equivalent health safety objectives. This heterogeneity across countries in implementing diverse SPS requirements may cause ambiguous outcomes on trade.

To our knowledge, the only two studies dealing with the impact of different regulatory measures on trade are Schlueter et al. (2009) and Fassarella et al. (2011). Both studies look specifically at the meat sector. Schlueter et al. (2009) estimate the impact of various types of SPS measures on trade in meat products. The authors extract the various regulatory instruments from the SPS Information Management System of the WTO and the International Portal on Food Safety, Animal and Plant Health. They arrange 29 specific regulatory instruments into six agricultural and food safety measures. Schlueter et al. (2009) 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 the amount of trade in meat products. Disaggregated results show diverse effects. In particular, conformity assessment promotes trade in the meat sector. In a similar manner, Fassarella et al. (2011) estimate the effect of SPS and TBT measures on Brazilian exports of poultry meat to the main world importers between 1996 and 2009. Deploying a PPML model, they find an insignificant impact of aggregated TBT and SPS measures on Brazilian exports of poultry meat. On the disaggregated level, they 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 volume of Brazilian poultry trade. As results on SPS measures on the aggregated and also on the disaggregated level are ambiguous across studies and even contradict each other, the topic needs more insight and investigation.

Previous studies often use notification-based data. Contrasting this, our paper deploys the more sophisticated specific trade concerns database of the WTO, as do Schlueter et al. (2009). The trade concerns database overcomes limitations of notification-based data, as government incentives increase to report a concern if an implemented measure potentially affects their trade. In addition, the database allows us to consistently differentiate SPS measures. This paper contributes to the existing literature by systematically assessing the impact of different SPS measures applied for various safety purposes on trade in agriculture and food. This is particularly interesting for policy makers as they often have to choose between different measures that are assumed to equivalently reduce health risks but entail diverse trade costs. Depending on the choice of SPS measures of policy makers, the implied impact on trade varies strongly.

In this paper, we look at the impact of SPS measures on the probability to enter an export market and the amount of trade. In addition, we attempt to understand the relevance of different SPS measures on trade outcomes. Relying on the database on specific trade concerns on SPS measures, the analysis distinguishes concerns related to conformity assessment (i.e., certificate requirements, testing, inspection and approval procedures) and concerns related to the characteristics of the product (i.e., requirements on quarantine treatment, pesticide residue levels, labeling or geographical application of measures). The impact of these two types of measures on the probability that firms enter a destination market and the amount of trade is analyzed both using a dummy for the existence of a concern over a SPS measure and a normalized frequency measure. To control for zero trade flows and a potential selection bias, we use a Heckman selection model with fixed effects and multilateral resistance terms. The key findings of the study are that concerns over SPS measures pose a negative impact on the likelihood that firms 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. In particular, most of the negative effect on the likelihood of market entry is due to conformity assessment-related SPS measures, which might be particularly burdensome and costly, while measures related to SPS product characteristics explain most of the positive impact on the amount of trade. A possible explanation of the positive effect relates to the fact that information provision to the consumer may be relatively stronger than costs of the producer. This indicates that SPS product characteristic measures enhance consumer trust in imported products and by this increase trade for those exporters that manage to overcome the fixed cost of entering a market.

The remainder of the paper is structured as follows. Section II. provides detailed information on the empirical strategy and describes the data. In section III., we provide benchmark results on the Heckman selection model and a sensitivity analysis of results. The last section concludes.

II. Empirical Strategy and Data

A. Empirical Strategy

In an attempt to disentangle the impact of sanitary and phytosanitary 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 zero trade flows or non-random selection in the data. Controlling for zero trade flows is important as SPS measures might be implemented in the wake of a disease outbreak or a pandemic and thus provoke a complete ban in the trade of some products. An alternative way to control for zero trade flows would be to estimate a Poisson model. In contrast to the Heckman model, the Poisson method assumes that there is nothing special about zeros in the trade matrix and would not allow us to tackle the sample selection issue with respect to reporting. Hence, we prefer the Heckman selection model over Poisson estimation. A further advantage of the Heckman model is that it enables us to distinguish the effect of SPS measures on the extensive margin (the probability of trade) and the intensive margin (the amount of trade). The Heckman method includes a selection equation that investigates the binary decision whether or not to trade, estimated through a probit, and the outcome equation, which focuses on the amount of trade conditional on market entry. The outcome equation considers zero trade values by potential censoring. We estimate both equations simultaneously using the maximum likelihood technique.[3] The selection and the outcome equations include the same independent variables, except for the selection variable, in our case common religion as in Helpman et al. (2008).[4] The selection variable is assumed to have an impact on the fixed costs of trade,

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

[4]Even though common religion is preferred by Helpman et al. (2008), they also use common language as an alternative selection variable. They find that results are robust and almost identical using either common language or common religion. We also find similar results using either of the two variables. Results on using common language as the selection variable can be obtained on request.

but to have a negligible effect on variable trade costs. This variable helps with the identification of the model. We estimate a probit binary choice model of the form

$$\begin{aligned}\Pr(M_{ijtHS4} > 0) = \boldsymbol{\Phi}[&\hat{\alpha_0} + \hat{\alpha_1} SPS_{ij(t-1)HS4} + \hat{\alpha_2}\ln(GDP_{it} \times GDP_{jt}) \\ &+ \hat{\alpha_3}\ln(POP_{it} \times POP_{jt}) + \boldsymbol{\hat{\alpha}_4 X_{ij}} + \boldsymbol{\hat{\alpha}_5 MR_{ijt}} \\ &+ \boldsymbol{\nu}_i + \boldsymbol{\nu}_j + \boldsymbol{\nu}_{HS4} + \boldsymbol{\nu}_t + \varepsilon_{ijtHS4}]\end{aligned} \tag{1}$$

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

$$\begin{aligned}\ln(M_{ijtHS4}|M_{ijtHS4} > 0) = &\alpha_0 + \alpha_1 SPS_{ij(t-1)HS4} + \alpha_2\ln(GDP_{it} \times GDP_{jt}) \\ &+ \alpha_3\ln(POP_{it} \times POP_{jt}) + \boldsymbol{\alpha_4 X_{ij}} + \boldsymbol{\alpha_5 MR_{ijt}} \\ &+ \alpha_\lambda \lambda(\boldsymbol{\hat{\alpha}}) + \boldsymbol{\nu}_i + \boldsymbol{\nu}_j + \boldsymbol{\nu}_{HS4} + \boldsymbol{\nu}_t + \varepsilon_{ijtHS4}\end{aligned} \tag{2}$$

with $\ln M_{ijtHS4}$ denoting the log of import values of a specific HS4 product of country j from country i at time t. $SPS_{ij(t-1)HS4}$ takes a value of one if there is a concern over a SPS measure in place between the reporting country i and the maintaining country j at time $t-1$ for a specific HS4 product line and zero otherwise. $\ln(GDP_{it} \times GDP_{jt})$ depicts the log of the product of GDPs of country i and country j at time t and $\ln(POP_{it} \times POP_{jt})$ denotes 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 $\boldsymbol{MR_{ijt}}$ contains multilateral resistance terms. 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. Hence, all regressions include multilateral resistance terms.[5] To control for any observable and unobservable country-specific characteristics, product specifics and time trends, we include full arrays of importer $\boldsymbol{\nu}_i$, exporter $\boldsymbol{\nu}_j$, HS4 product $\boldsymbol{\nu}_{HS4}$, and year dummies $\boldsymbol{\nu}_t$ separately in the equation. Hence, we control for a wide array of observables and unobservable determinants, i.e., geographical variables or global business cycles.[6] Error terms ε_{ijtHS4} are heteroskedasticity-robust and clustered at the country-pair level. $\lambda(\hat{\boldsymbol{\alpha}})$ denotes the inverse mills ratio that is predicted from equation (1).[7]
The focus of this paper is on SPS concerns reported by exporters to the WTO. For SPS measures, we consider two different variables: (i) a dummy variable equal to one if at least one concern is notified at the 4-digit level of the HS classification, and (ii) a normalized frequency measure SPSFreq_{ijtHS2}. The normalized frequency 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. To circumvent a potential endogeneity problem between imports and SPS measures, we use the first lag of the variables on SPS concerns $(t-1)$.[8]

B. 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

[5]A popular alternative way to account for multilateral remoteness would be to include the full array of interaction terms between country and year dummies. However, due to the large number of observations this is computationally not possible in our sample.

[6]The large number of observations does not allow for the use of combined fixed effects.

[7]The inverse mills ratio is the ratio of the probability density function over the cumulative distribution function of $\hat{M}_{ijtHS4}$ from equation (1).

[8]Using instrumentation methods is not straightforward in the Heckman model. For robustness reasons, we estimate a two-step Heckman model using a probit and a two stage least squares (2SLS) approach. The instrument is the sum of SPS concerns of all other countries $k \neq i, j$ against the importer. Results confirm our findings. Hence, forward looking actors seem not to be a problem in our framework.

towards a maintaining country for 1995 to 2010, respectively.[9] For each single concern, we have information on the raising and maintaining countries, the HS4 product codes concerned, the year in which the concern was reported to the WTO, and whether it has been resolved. To measure SPS requirements, we generate a simple dummy variable on SPS concerns that is equal to one when the 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 et al. (2005), Disdier et al. (2008), and Fontagné et al. (2012). If HS4 product codes are not available, but instead the HS2 sector is noted 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. Further, to consider the possible heterogeneity of different SPS measures, we divide concerns into two categories of measures 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, administrative procedure problems or the like. Measures related to the characteristics of the product refer to concerns related to requirements on process and production methods,

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

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 and the like. Concerns depicted in the SPS Information Management System of the WTO may relate to one, or both issues at the same time.

Trade data for the period 1995 to 2010 come from the United Nations Commodity Trade Statistics Database (Comtrade). Trade data 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 Indicators (WDI) and enter equations through the log of the product of the GDPs of the importer and the exporter countries and the log of the product of the total population of the importer and the exporter countries. Bilateral distance is the geographic distance between capitals.[10] 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 the colonial heritage. Data for the index on common religion across countries are obtained from Elhanan Helpman's homepage. Helpman et al. (2008) define the index on 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).

For robustness checks, we include applied tariff data that are combined from the WTO Integrated Data Base (IDB) and UNCTAD's Trade Analysis and Information System (TRAINS). As tariff data are missing to a large part, we only include them in a robustness check.[11] 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.

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

[11]Results on the impact of SPS measures on trade do not change qualitatively by the inclusion of tariff data.

To handle missing observations and to keep as many observations as possible, we adapt an "interpolation" rule. If a tariff is available for a certain HS4 product in a certain year, we assume that the same tariff was also valid for the HS4 product up to 4 years previous to the tariff reported in the database if these are missing. After the "interpolation" rule has been adapted, we further assume that all remaining missing observations are zero, to keep the exact similar sample as to when not including tariff data. We use applied tariff data that is weighted by imports.

Our sample consists of 164 importer and 150 exporting countries, as well as 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 endogeneity.

III. SPS Measures and Trade

A. Benchmark Results

Table 1 presents results using the SPS frequency measure (SPSFreq$_{ijtHS2}$), while Table 2 uses the SPS dummy variable. All regressions include importer, exporter, and HS4 product fixed effects, a fully array of year dummies and multilateral resistance terms. In addition, all columns include gravity controls. These include 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 we find no effect on the amount of trade conditional on market entry. As expected, distance has a negative impact on trade, and adjacency, common language and colonial heritage increase trade. Common religion reduces the fixed costs of trade, hence, positively affects the probability of market entry. This is in line with the findings by Helpman et al. (2008). As in Helpman et al. (2008), common religion is assumed not to affect the amount of trade once the exporting decision has been made.

In Table 1 column (1), we find a significantly lower probability of bilateral trade in the presence of SPS concerns. Our results suggest that the probability to enter an export market is about 16 percent lower if the SPS frequency measure increases by one unit. This indicates that SPS measures constitute an effective market entry barrier in agricultural and food sectors as they increase the fixed costs of trade. The outcome equation in column (2) indicates that, conditional on market entry, SPS measures significantly increase the amount of trade. The estimated correlation coefficient (rho) and the estimated selection coefficient (lambda) are statistically significant and different from zero, confirming that not controlling for zero trade flows would generate strongly biased coefficients. Results are broadly confirmed when using the SPS dummy variable in Table 2 columns (1) and (2), which are of similar magnitude and significance.

Besides a negative impact due to an increase in fixed costs, SPS measures may also have a positive effect on the trade volume once a market has been entered. If the impact of information on product safety creates consumer trust, which is proportionally larger than the impact of variable trade costs due to product adaption, producers gain market share conditional on market entry. Further, countries can choose from a range of SPS measures to achieve equivalent levels of animal or human health. The ensuing heterogeneity across countries in implementing various SPS measures may cause ambiguous outcomes on trade, as different SPS instruments entail diverse costs. Measures related to testing, inspection and approval procedures may be particularly costly and burdensome for the exporter proportional to the information they provide to the consumer and thus have a negative impact on market entry and the amount of trade. Conformity assessment-related measures entail fixed costs for exporters that relate

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

	Heckman Selection Model (maximum likelihood)			
Equation:	Selection	Outcome	Selection	Outcome
Dependent Variable:	$\Pr(\text{import}_{ijtHS4} > 0)$	$\ln(\text{import}_{ijtHS4})$	$\Pr(\text{import}_{ijtHS4} > 0)$	$\ln(\text{import}_{ijtHS4})$
	(1)	(2)	(3)	(4)
SPSFreq$_{ij(t-1)HS2}$	-0.160***	0.641***		
	(0.06)	(0.15)		
SPSFreq Conformity$_{ij(t-1)HS2}$			-0.309***	-0.473*
			(0.08)	(0.28)
SPSFreq Characteristic$_{ij(t-1)HS2}$			0.019	0.988***
			(0.07)	(0.22)
Controls				
ln GDP$_{it}\times$ GDP$_{jt}$	0.216***	0.449***	0.217***	0.449***
	(0.02)	(0.03)	(0.02)	(0.03)
ln POP$_{it}\times$ POP$_{jt}$	0.268***	0.103	0.268***	0.101
	(0.05)	(0.09)	(0.05)	(0.09)
ln Distance$_{ij}$	-0.329***	-0.946***	-0.329***	-0.946***
	(0.01)	(0.03)	(0.01)	(0.03)
Adjacency$_{ij}$	0.122***	0.393***	0.122***	0.393***
	(0.03)	(0.10)	(0.03)	(0.10)
Common Language$_{ij}$	0.123***	0.266***	0.123***	0.265***
	(0.02)	(0.05)	(0.02)	(0.05)
Ever Colony$_{ij}$	-0.020	0.056	-0.021	0.056
	(0.05)	(0.15)	(0.05)	(0.15)
Common Colonizer$_{ij}$	0.081***	0.266***	0.081***	0.267***
	(0.02)	(0.07)	(0.02)	(0.07)
Colonizer post 1945$_{ij}$	-0.113***	-0.442***	-0.112***	-0.441***
	(0.04)	(0.11)	(0.04)	(0.11)
Common Religion$_{ij}$	0.150***		0.150***	
	(0.02)		(0.02)	
Fixed Effects				
Importer	YES	YES	YES	YES
Exporter	YES	YES	YES	YES
Year	YES	YES	YES	YES
Product	YES	YES	YES	YES
Estimated correlation (rho)	0.461***		0.461***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.372***		1.091***	
	(0.04)		(0.04)	
Log pseudolikelihood	-7773030		-7772832	
Wald Chi2	49855.54		49752.98	
Observations	5,452,530	5,452,530	5,452,530	5,452,530

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

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 (potentially in several export markets) due to an increase in consumer trust through valuable product information.

To systematically compare the implied trade effects of different SPS instruments implemented to achieve a desired level of SPS safety and health, we distinguish concerns over SPS measure into requirements related to conformity assessment and concerns related to product characteristics. For trade in agriculture and food products, we find in Table 1 column (3) that the extensive margin of trade is significantly negatively affected by conformity assessment-related factors of SPS measures (SPSFreq Conformity$_{ijtHS2}$). The probability of trading bilaterally is lower by 31 percent if the SPS frequency measure of conformity assessment increases by one unit. SPS concerns related to product characteristics (SPSFreq Characteristic$_{ijtHS2}$) have no significant impact on the likelihood of trade. Hence, only conformity assessment-related SPS measures constitute a market entry barrier, probably due to the relatively high costs and burdensome procedures they impose on the producer. In column (4), the intensive margin of trade is negatively and significantly affected by conformity assessment-related SPS measures, while concerns on SPS product characteristics have a positive and significant impact on the amount of trade, conditional on market entry. This positive effect can be explained by the fact that SPS measures related to the characteristics of the product provide information to consumers that enhance consumer trust in the quality of imported goods. Hence, the positive impact of a gain in market share is relatively higher than the loss due to variable trade costs. This leads to increased trade volumes for exporters that manage to over-

TABLE 2
The Impact of SPS on Agricultural and Food Trade, Dummy (1996 - 2010)

	Heckman Selection Model (maximum likelihood)			
Equation:	Selection	Outcome	Selection	Outcome
Dependent Variable:	Pr(import$_{ijtHS4} > 0$)	ln(import$_{ijtHS4}$)	Pr(import$_{ijtHS4} > 0$)	ln(import$_{ijtHS4}$)
	(1)	(2)	(3)	(4)
SPS$_{ij(t-1)HS4}$	-0.144***	0.661***		
	(0.05)	(0.14)		
SPS Conformity$_{ij(t-1)HS4}$			-0.270***	-0.406*
			(0.07)	(0.23)
SPS Characteristic$_{ij(t-1)HS4}$			0.012	0.962***
			(0.06)	(0.19)
Controls				
ln GDP$_{it}\times$ GDP$_{jt}$	0.216***	0.449***	0.217***	0.449***
	(0.02)	(0.03)	(0.02)	(0.03)
ln POP$_{it}\times$ POP$_{jt}$	0.269***	0.104	0.268***	0.101
	(0.05)	(0.09)	(0.05)	(0.09)
ln Distance$_{ij}$	-0.329***	-0.946***	-0.329***	-0.946***
	(0.01)	(0.03)	(0.01)	(0.03)
Adjacency$_{ij}$	0.122***	0.393***	0.122***	0.393***
	(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$_{ij}$	-0.020	0.055	-0.021	0.056
	(0.05)	(0.15)	(0.05)	(0.15)
Common Colonizer$_{ij}$	0.081***	0.265***	0.081***	0.267***
	(0.02)	(0.07)	(0.02)	(0.07)
Colonizer post 1945$_{ij}$	-0.113***	-0.439***	-0.112***	-0.440***
	(0.04)	(0.11)	(0.04)	(0.11)
Common Religion$_{ij}$	0.150***		0.150***	
	(0.02)		(0.02)	
Fixed Effects				
Importer	YES	YES	YES	YES
Exporter	YES	YES	YES	YES
Year	YES	YES	YES	YES
Product	YES	YES	YES	YES
Estimated correlation (rho)	0.460***		0.460***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.370***		1.371***	
	(0.04)		(0.04)	
Log pseudolikelihood	-7772958		-7772781	
Wald Chi2	49914.95		49838.46	
Observations	5,452,530	5,452,530	5,452,530	5,452,530

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

come the fixed cost of entering a market. The frequency measure indicates that conformity assessment-related factors of SPS measures decreases the amount of trade in agriculture and food products by 18 percent on average. Marginal effects for the outcome equations[12] are depicted in Table 3 column (2). Estimates suggest qualitatively similar result when we uss the SPS dummy variables in Table 2, columns (3) and (4). The coefficient on conformity assessment is negative and significant for the probability and the amount of trade, while the positive and significant impact of SPS concerns related to product characteristics on the amount of trade prevails.

When we compare our results to the existing literature, we find that our positive effect of SPS measures on the amount of agricultural and food trade is in line with the positive effect Schlueter et al. (2009) find on the meat sector. Further, they find a positive and significant impact of tolerance limits on the amount of meat trade. This is also in accordance to our findings, as we consider pesticide residue levels as part of our SPS measure on the characteristics of the product. In contrast to our results, Schlueter et al. (2009) find a sector-specific positive effect of conformity assessment on trade in meat products, while we find an overall negative impact on agricultural and food products, even though substantial variation might exist across sectors. Our results compare well to the findings by Fassarella et al. (2011). Equally to our results on agricultural and food trade, they find a negative effect of conformity assessment-related measures on the volume of Brazilian poultry meat exports. In addition, our positive effect of measures related to requirements on quarantine treatment, prohibitions or labeling (characteristics of the product) on the amount of agricultural

[12]The estimated coefficient in the Heckman outcome equation does not indicate the marginal effect of SPS measures on the volume of trade 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 volume 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 ration*selection prediction).

TABLE 3
Marginal Effects of the Outcome Equation

	Heckman Selection Model (maximum likelihood)			
Equation:	Outcome	Outcome	Outcome	Outcome
	(1)	(2)	(3)	(4)
SPSFreq$_{ij(t-1)HS2}$	0.794***			
	(0.00)			
SPSFreq Conformity$_{ij(t-1)HS2}$		-0.177***		
		(0.00)		
SPSFreq Characteristic$_{ij(t-1)HS2}$		0.970***		
		(0.00)		
SPS$^{HS4}_{ij(t-1)}$			0.799***	
			(0.00)	
SPS Conformity$_{ij(t-1)HS4}$				-0.148***
				(0.00)
SPS Other$_{ij(t-1)HS4}$				0.950***
				(0.00)

Note: Marginal Effects of the outcome equations are calculated according to Greene (2003). Country clustered robust standard errors reported in parenthesis. *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.

and food trade compares well to their findings of positive effects on both, prohibition measures and labeling requirements, on the volume of trade in poultry meat. With respect to the aggregated SPS measure, Jayasinghe et al. (2010) find that a reduction in SPS requirements to 5 measures[13], deemed necessary to maintain safety standards, increase trade in the US corn seed market using a Heckman selection model. Their results indicate that SPS measures pose a threat to market entry, which is exactly what we find. In contrast to our results on aggregated agricultural and food trade, they find a negative impact also on the amount of US corn seed trade, which might, however, be a sector and country specific result. Our results also stand in contrast to the findings by Disdier and Marette (2010) on trade in crustaceans. They use maximum residue limits (MRL)[14] in a Heckman selection model to identify SPS measures on imports of

[13]Data on the number of SPS regulations are based on the EXCERPT (Export Certification Project Demonstration).

[14]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.

crustaceans. They find no effect in their selection equation and a trade reducing effect in the outcome equation. Yet again, their result may be sector specific to crustaceans and cannot directly assigned to aggregated trade in agricultural and food products.

B. Sensitivity

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 bilateral applied tariff protection as a further control variable in Table 4 and Table 5. We include a specific control for bilateral tariffs only in the robustness section for several reasons. Firstly, even though data on bilateral tariffs are provided by IDB and TRAINS, the data pose several limitations with respect to missing values over time. Secondly, data do not include all specific duties, tariff quotas and anti-dumping duties applied by importers. Thirdly, we cannot distinguish preferential tariffs and general tariffs, as data are not always available. In the following, we include import weighted bilateral applied tariffs, with missing values interpolated as discussed above. We provide evidence that our previous results do not suffer from a bias due to the omission of tariff data in the framework. Table 4 and Table 5 provide the results.

Coefficients on gravity controls remain qualitatively similar in Table 4 and 5 compared to Table 1 and 2. So do our results on the effect of SPS measures on the likelihood and the amount of trade. While SPS measures pose a barrier to market entry, producers who meet the more stringent standard increase their amount of agricultural and food trade conditional on market entry. In addition, results still show that most of the negative effect on the probability of entering a market is due to conformity assessment-related factors of SPS measures, while concerns related to risk reducing product characteristics explain most of the positive impact on the amount of trade. This applies to the frequency as well as to the SPS dummy measure.

TABLE 4
Robustness: SPS, Tariffs and Trade, Frequency (1996 - 2010)

	Heckman Selection Model (maximum likelihood)			
Equation:	Selection	Outcome	Selection	Outcome
Dependent Variable:	$\Pr(\text{import}_{ijtHS4} > 0)$	$\ln(\text{import}_{ijtHS4})$	$\Pr(\text{import}_{ijtHS4} > 0)$	$\ln(\text{import}_{ijtHS4})$
	(1)	(2)	(3)	(4)
SPSFreq$_{ij(t-1)HS2}$	-0.156***	0.639***		
	(0.06)	(0.15)		
SPSFreq Conformity$_{ij(t-1)HS2}$			-0.304***	-0.474*
			(0.08)	(0.28)
SPSFreq Characteristic$_{ij(t-1)HS2}$			0.019	0.986***
			(0.07)	(0.22)
Controls				
ln GDP$_{it}\times$ GDP$_{jt}$	0.217***	0.448***	0.217***	0.449***
	(0.02)	(0.03)	(0.02)	(0.03)
ln POP$_{it}\times$ POP$_{jt}$	0.267***	0.105	0.267***	0.103
	(0.05)	(0.09)	(0.05)	(0.09)
ln Distance$_{ij}$	-0.329***	-0.946***	-0.329***	-0.946***
	(0.01)	(0.03)	(0.01)	(0.03)
Adjacency$_{ij}$	0.122***	0.393***	0.122***	0.393***
	(0.03)	(0.10)	(0.03)	(0.10)
Common Language$_{ij}$	0.123***	0.266***	0.123***	0.265***
	(0.02)	(0.05)	(0.02)	(0.05)
Ever Colony$_{ij}$	-0.020	0.056	-0.021	0.056
	(0.05)	(0.15)	(0.05)	(0.15)
Common Colonizer$_{ij}$	0.080***	0.266***	0.080***	0.268***
	(0.02)	(0.07)	(0.02)	(0.07)
Colonizer post 1945$_{ij}$	-0.114***	-0.440***	-0.113***	-0.440***
	(0.04)	(0.11)	(0.04)	(0.11)
Common Religion$_{ij}$	0.150***		0.150***	
	(0.02)		(0.02)	
Tariff$_{ijtHS4}$, weighted average	0.001***	-0.001**	0.001***	-0.001**
	(0.00)	(0.00)	(0.00)	(0.00)
Fixed Effects				
Importer	YES	YES	YES	YES
Exporter	YES	YES	YES	YES
Year	YES	YES	YES	YES
Product	YES	YES	YES	YES
Estimated correlation (rho)	0.461***		0.461***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.372***		1.372***	
	(0.04)		(0.04)	
Log pseudolikelihood	-7772189		-7772189	
Wald Chi2	49966.37		49966.37	
Observations	5,452,530	5,452,530	5,452,530	5,452,530

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

Regarding the applied tariffs, we find a slightly positive coefficient on the probability of market entry, which suggests only a minor influence of tariffs on market entry fixed costs for agricultural and food trade in Table 4 and 5 column (1) and column (3), respectively. The positive minimal effect is in line with the findings of Schlueter et al. (2009) for the meat sector. Further, column (2) and column (4) suggest a minimal negative impact of tariffs on the amount of trade in agricultural and food products. This negative impact of tariffs on the trade volume stands in line with findings by Disdier et al. (2008) and Fontagné et al. (2005). Still, our results on the minor impact of tariffs on agricultural and food trade should be read with caution since we apply an interpolation rule, as discussed above, and are not able to distinguish imports under preferential tariffs and imports under general tariffs. Besides, keep in mind that the focus lies on the identification of the impact of diverse SPS measures 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 affect our results.

A further concern is that reverse causality might still be a problem in our estimated framework if actors are forward looking. However, the use of instrumentation methods is not straightforward in the Heckman model. To give an indication that forward looking actors are not a problem in our approach, we estimate a Heckman two-step estimation using a probit and a two stage least squares (2SLS) model separately. Keep in mind that we provide results only for indication, as estimating the two equations separately does not consider censoring in the 2SLS outcome estimation and might inflate standard errors.[15] We use the sum of SPS concerns of all other countries $k \neq i, j$ against the importer as an instrument for concerns over SPS measures between country i and country j. This should be uncorrelated to trade between i and j, but is strongly correlated to SPS concerns of the exporter against the importer. Table 8 and Table

[15]The correction of standard errors is cumbersome and not straightforward within the 2SLS estimation

TABLE 5
Robustness: SPS, Tariffs and Trade, Dummy (1996 - 2010)

	Heckman Selection Model (maximum likelihood)			
Equation:	Selection	Outcome	Selection	Outcome
Dependent Variable:	$\Pr(\text{import}_{ijtHS4} > 0)$	$\ln(\text{import}_{ijtHS4})$	$\Pr(\text{import}_{ijtHS4} > 0)$	$\ln(\text{import}_{ijtHS4})$
	(1)	(2)	(3)	(4)
$\text{SPS}_{ij(t-1)HS4}$	-0.141***	0.660***		
	(0.05)	(0.14)		
SPS $\text{Conformity}_{ij(t-1)HS4}$			-0.267***	-0.406*
			(0.07)	(0.23)
SPS $\text{Measure}_{ij(t-1)HS4}$			0.012	0.960***
			(0.06)	(0.19)
Controls				
ln $\text{GDP}_{it} \times \text{GDP}_{jt}$	0.217***	0.448***	0.217***	0.448***
	(0.02)	(0.03)	(0.02)	(0.03)
ln $\text{POP}_{it} \times \text{POP}_{jt}$	0.267***	0.106	0.267***	0.103
	(0.05)	(0.09)	(0.05)	(0.09)
ln Distance_{ij}	-0.329***	-0.946***	-0.329***	-0.946***
	(0.01)	(0.03)	(0.01)	(0.03)
Adjacency_{ij}	0.122***	0.393***	0.122***	0.393***
	(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	0.054	-0.021	0.055
	(0.05)	(0.15)	(0.05)	(0.15)
Common Colonizer_{ij}	0.080***	0.266***	0.080***	0.267***
	(0.02)	(0.07)	(0.02)	(0.07)
Colonizer post 1945_{ij}	-0.114***	-0.438***	-0.113***	-0.438***
	(0.04)	(0.11)	(0.04)	(0.11)
Common Religion_{ij}	0.150***		0.150***	
	(0.02)		(0.02)	
Tariff_{ijtHS4}, weighted average	0.001***	-0.001**	0.001***	-0.001**
	(0.00)	(0.00)	(0.00)	(0.00)
Fixed Effects				
Importer	YES	YES	YES	YES
Exporter	YES	YES	YES	YES
Year	YES	YES	YES	YES
Product	YES	YES	YES	YES
Estimated correlation (rho)	0.460***		0.461***	
	(0.01)		(0.01)	
Estimated selection (lambda)	1.371***		1.372***	
	(0.04)		(0.04)	
Log pseudolikelihood	-7772313		-7772385	
Wald Chi2	50109.71		50051.45	
Observations	5,452,530	5,452,530	5,452,530	5,452,530

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

9 in the Appendix report the results for the SPS frequency measure and the SPS dummy variable, respectively. Overall, instruments seem valid and feasible, as they pass the most stringent criterion of the weak identification test and F-Tests on the instrument are way above the thumb rule of 10 in both setups. Results on the impact of SPS measures confirm our previous findings. Estimates show the correct signs and significance levels, although 2SLS estimates in columns (2) and (4) in both tables are inflated by the two-step strategy.[16] Still, results suggest that forward looking actors are not a problem in our previous estimations using the lag of SPS measures.

IV. Concluding Remarks

This paper contributes to the literature by investigating the impact of SPS measures on the extensive and the intensive margin of aggregated agricultural and food trade. In addition, we determine the diverse trade outcomes on agricultural and food products of different SPS measures implemented by policy makers to achieve similar health safety objectives. We use the database on specific trade concerns on SPS measures of the WTO, which allows us to 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, labeling or geographical application of measures). We deploy a Heckman selection model at the HS4 disaggregated level that controls for zero trade flows and a potential selection bias using both a dummy variable and a normalized frequency measure on SPS concerns.

We find that aggregates SPS measures pose a negative impact on the probability that firms export to a concerned market, but, conditional on market entry, the amount of trade to markets with SPS measures in place tends to be higher. In

[16]As mentioned before, estimating the two equations separately for instrumentation purposes does not consider censoring in the 2SLS estimation and might thus cause 2SLS estimates to be upward biased.

particular, findings suggest that most of the negative impact on the probability of trade is due to conformity assessment-related factors of SPS measures, while concerns related to product characteristics explain most of the positive impact on the amount of trade. This suggests that conformity assessment-related factors of SPS measures pose a serious barrier to market entry by increasing the costs for producers due to often burdensome and separate certification, testing and inspection procedures in different export markets. SPS measures related to product characteristics exert a positive impact on the amount of trade for those exporters that manage to overcome the fixed cost of entering the market. These SPS measures provide information on the safety of the product to consumers and increase consumer trust in imported products. Thereby, foreign producers gain market share. The positive effect of increased market share outweighs the trade costs of product adaption and leads to a positive effect on the volume of trade. Our results are robust to the inclusion of applied bilateral tariff data.

Further research is needed to approve the specific channels and mechanisms that cause different SPS measures, implemented to achieve a desired level of SPS health and safety, to affect trade outcomes in diverse ways. The results found in this study lay the ground for further research in this direction. In particular, conformity assessment-related factors of SPS measures are an important factor contained in fixed costs for trade in agricultural and food products.

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Appendix

TABLE 6
Summary Table

Variable	Observations	Mean	Std. Dev.	Source
$\ln$(import$_{ijtHS4}$)	1961068	10.441	3.305	Comtrade (2011)
$\Pr$(import$_{ijtHS4} > 0$)	5452530	0.360	0.480	Comtrade (2011)
SPSFreq$_{ij(t-1)HS2}$	5452530	0.004	0.062	SPS IMS (2011)
SPSFreq Conformity$_{ij(t-1)HS2}$	5452530	0.003	0.049	SPS IMS (2011)
SPSFreq Characteristic$_{ij(t-1)HS2}$	5452530	0.004	0.058	SPS IMS (2011)
SPS$_{ij(t-1)HS4}$	5452530	0.005	0.067	SPS IMS (2011)
SPS Conformity$_{ij(t-1)HS4}$	5452530	0.003	0.053	SPS IMS (2011)
SPS Characteristic$_{ij(t-1)HS4}$	5452530	0.004	0.062	SPS IMS (2011)
ln GDP$_{it}\times$ GDP$_{jt}$	5452530	22.928	3.255	WDI (2011)
ln POP$_{it}\times$ POP$_{jt}$	5452530	6.211	2.759	WDI (2011)
ln Distance$_{ij}$	5452530	8.511	0.949	CEPII (2005)
Adjacency$_{ij}$	5452530	0.080	0.271	CEPII (2005)
Common Language$_{ij}$	5452530	0.358	0.480	CEPII (2005)
Ever Colony$_{ij}$	5452530	0.095	0.293	CEPII (2005)
Common Colonizer$_{ij}$	5452530	0.159	0.366	CEPII (2005)
Colonizer post 1945$_{ij}$	5452530	0.062	0.240	CEPII (2005)
Common Religion$_{ij}$	5452530	0.251	0.298	Helpman et al. (2008)
Tariff$_{ijtHS4}$, weighted average	5452530	2.977	15.071	IDB (2011) & TRAINS (2011)
MR Distance$_{ijt}$	5452530	9.511	0.835	own calculation, Baier & Bergstrand (2009)
MR Adjacency$_{ijt}$	5452530	-0.032	0.146	own calculation, Baier & Bergstrand (2009)
IV SPSFreq$_{ij(t-1)HS2}$	5452530	0.200	1.262	own calculation
IV SPSFreq Conformity$_{ij(t-1)HS2}$	5452530	0.098	0.674	own calculation
IV SPSFreq Characteristic$_{ij(t-1)HS2}$	5452530	0.182	1.202	own calculation
IV SPS$_{ij(t-1)HS4}$	5452530	0.213	1.359	own calculation
IV SPS Conformity$_{ij(t-1)HS4}$	5452530	0.103	0.780	own calculation
IV SPS Characteristic$_{ij(t-1)HS4}$	5452530	0.192	1.256	own calculation

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

HS2 Code	Constraint	Specification
01		Live Animals
02		Meat and Edible Meat Offal
03		Fish and Crustaceans
04		Dairy, Eggs, Honey and Edible Products
05		Products of Animal Origin
06		Live Trees and other Plants
07		Edible Vegetables
08		Edible Fruits and Nuts, Peel of Citrus and Melons
09		Coffee, Tea, Mate and Spices
10		Cereals
11		Milling Industry Products
12		Oil Seeds, Miscellaneous Grains, Medical Plants and Straw
13		Lac, Gums, Resins, Vegetable Saps and Extracts Nes
14		Vegetable Plaiting Materials
15		Animal and Vegetable Fats, Oils and Waxes
16		Edible Preparations of Meat, Fish, Crustaceans
17		Sugars and Sugar Confectionery
18		Cocoa and Cocoa Preparations
19		Preparations of Cereals, Flour, Starch or Milk
20		Preparations of Vegetables, Fruits and Nuts
21		Miscellaneous Edible Preparations
22		Beverages, Spirits and Vinegar
23		Residues from Food Industries and Animal Feed
24		Tobacco and Manufacturing Tobacco Substitutes
29	includes 2905	Organic Chemicals
33	includes 3301	Essential Oils, Resinoids, Perfumery, Cosmetic or Toilet Preparations
35	includes 3501 to 3505	Albuminoidal Substances, Starches, Glues, Enzymes
38	includes 3809 and 3824	Miscellaneous Chemical Products
41	includes 4101 to 4103	Raw Hides and Skins (other than Furskins) and Leather
43	includes 4301	Furskins and Artificial Fur, Manufactures thereof
50	includes 5001 to 5003	Silk
51	includes 5101 to 5103	Wool, Animal Hair, Horsehair Yarn and Fabric thereof
52	includes 5201 to 5203	Cotton
53	includes 5301 and 5302	Vegetable Textile Fibers Nes, Paper Yarn, Woven Fabric

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.

TABLE 8
IV Robustness: SPS and Agricultural and Food Trade, Frequency (1996 - 2010)

	Heckman Selection Model (two-step)			
Equation:	Selection	Outcome	Selection	Outcome
Method:	Probit	2SLS	Probit	2SLS
Dependent Variable:	$\Pr(\text{import}_{ijtHS4} > 0)$	$\ln(\text{import}_{ijtHS4})$	$\Pr(\text{import}_{ijtHS4} > 0)$	$\ln(\text{import}_{ijtHS4})$
	(1)	(2)	(3)	(4)
$\text{SPSFreq}_{ij(t-1)HS2}$	-0.166***	0.879**		
	(0.06)	(0.42)		
SPSFreq $\text{Conformity}_{ij(t-1)HS2}$			-0.297***	-2.803***
			(0.08)	(0.91)
SPSFreq $\text{Characteristic}_{ij(t-1)HS2}$			0.005	2.553***
			(0.07)	(0.74)
Controls				
$\ln \text{GDP}_{it} \times \text{GDP}_{jt}$	0.214***	0.254***	0.215***	0.255***
	(0.02)	(0.03)	(0.02)	(0.03)
$\ln \text{POP}_{it} \times \text{POP}_{jt}$	0.282***	-0.221***	0.281***	-0.232***
	(0.05)	(0.08)	(0.05)	(0.08)
$\ln \text{Distance}_{ij}$	-0.322***	-0.671***	-0.322***	-0.672***
	(0.01)	(0.03)	(0.01)	(0.03)
Adjacency_{ij}	0.117***	0.339***	0.117***	0.339***
	(0.03)	(0.10)	(0.03)	(0.10)
Common Language_{ij}	0.116***	0.139***	0.116***	0.138***
	(0.02)	(0.04)	(0.02)	(0.04)
Ever Colony_{ij}	-0.019	0.032	-0.020	0.038
	(0.05)	(0.14)	(0.05)	(0.14)
Common Colonizer_{ij}	0.080***	0.198***	0.079***	0.201***
	(0.02)	(0.06)	(0.02)	(0.06)
Colonizer post 1945_{ij}	-0.103***	-0.396***	-0.102***	-0.396***
	(0.04)	(0.10)	(0.04)	(0.11)
Common Religion_{ij}	0.181***		0.181***	
	(0.03)		(0.03)	
Log pseudolikelihood/ R^2	-2994839	0.295	-2994706	0.294
Observations	5,452,530	1,961,068	5,452,530	1,961,068
Partial R^2		0.06		
Partial R^2 Conformity				0.07
Partial R^2 Characteristic				0.06
F-Test on excl. Instrument		41.29		
F-Test on excl. Conformity				18.65
F-Test on excl. Characteristic				19.90

Note: All regressions include importer, exporter, HS4 product, time fixed effects and multilateral resistance terms. Constant, importer, exporter, product and time fixed effects, MR terms and Inverse Mills Ratio not reported. Common religion is the selection variable and thus excluded in columns (2) and (4). The outcome equation is estimated using 2SLS IV estimation. The instrument is the sum of concerns of all other countries $k \neq i, j$ against country j. Country clustered robust standard errors reported in parenthesis. *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.

TABLE 9

IV Robustness: SPS on Agricultural and Food Trade, Dummy (1996 - 2010)

	Heckman Selection Model (two-step)			
Equation:	Selection	Outcome	Selection	Outcome
Method:	Probit	2SLS	Probit	2SLS
Dependent Variable:	Pr(import$_{ijtHS4} > 0$)	ln(import$_{ijtHS4}$)	Pr(import$_{ijtHS4} > 0$)	ln(import$_{ijtHS4}$)
	(1)	(2)	(3)	(4)
SPS$_{ij(t-1)HS4}$	-0.151***	0.858**		
	(0.05)	(0.37)		
SPS Conformity$_{ij(t-1)HS4}$			-0.262***	-2.601***
			(0.07)	(0.79)
SPS Characteristic$_{ij(t-1)HS4}$			-0.001	2.544***
			(0.06)	(0.69)
Controls				
ln GDP$_{it}\times$ GDP$_{jt}$	0.214***	0.254***	0.215***	0.255***
	(0.02)	(0.03)	(0.02)	(0.03)
ln POP$_{it}\times$ POP$_{jt}$	0.282***	-0.221***	0.282***	-0.228***
	(0.05)	(0.08)	(0.05)	(0.08)
ln Distance$_{ij}$	-0.322***	-0.671***	-0.322***	-0.672***
	(0.01)	(0.03)	(0.01)	(0.03)
Adjacency$_{ij}$	0.117***	0.339***	0.117***	0.340***
	(0.03)	(0.10)	(0.03)	(0.10)
Common Language$_{ij}$	0.116***	0.138***	0.116***	0.138***
	(0.02)	(0.04)	(0.02)	(0.04)
Ever Colony$_{ij}$	-0.019	0.031	-0.020	0.037
	(0.05)	(0.14)	(0.05)	(0.14)
Common Colonizer$_{ij}$	0.080***	0.198***	0.079***	0.200***
	(0.02)	(0.06)	(0.02)	(0.06)
Colonizer post 1945$_{ij}$	-0.103***	-0.395***	-0.102***	-0.390***
	(0.04)	(0.10)	(0.04)	(0.11)
Common Religion$_{ij}$	0.181***		0.181***	
	(0.03)		(0.03)	
Log pseudolikelihood/R^2	-2994847	0.295	-2994722	0.294
Observations	5,452,530	1,961,068	5,452,530	1,961,068
Partial R^2		0.06		
Partial R^2 Conformity				0.07
Partial R^2 Characteristic				0.06
F-Test on excl. Instrument		47.99		
F-Test on excl. Conformity				23.73
F-Test on excl. Characteristic				21.87

Note: All regressions include importer, exporter, HS4 product, time fixed effects and multilateral resistance terms. Constant, importer, exporter, product and time fixed effects, MR terms and Inverse Mills Ratio not reported. Common religion is the selection variable and thus excluded in columns (2) and (4). The outcome equation is estimated using 2SLS IV estimation. The instrument is the sum of concerns of all other countries $k \neq i, j$ against country j. Country clustered robust standard errors reported in parenthesis. *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.