Standards and regulatory cooperation in Regional Trade Agreements: What the effects on trade?

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Abstract

The agenda of trade negotiation in the agri-food sector is characterised by an exponential increase of Sanitary and Phytosanitary (SPS) measures and of Regional Trade Agreements (RTAs). Their joint effect on trade is puzzling and still an open empirical question. Once assessed the trade effect of standards provided in SPS measures, the study evaluates how regulatory cooperation and commitments beyond WTO requirements affect trade between signatories of RTAs. Trade between signatories seems obstructed by non discriminatory (multilateral) SPS measures. However, SPS-specific commitments negotiated in joint SPS committees within RTAs tend to create conditions to meet standards, contributing to boost trade.

Keywords: RTA, SPS measures, Agri-food, Trade policy.

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Introduction

The agenda of trade negotiation is characterised by an exponential increase of the technical measures at the border, a reduction of the tariff levels, and a growing diffusion of the Regional Trade Agreements (RTAs). The trade effects of the standards of the Sanitary and Phytosanitary (SPS) measures[1] and of the trade agreements are complex.

Thought to facilitate trade by ensuring an adequate level of safety in the importing markets (trade catalysts), the standards may, on the other hand, prevent the market access due to the high compliance costs (trade barrier)[2] (Peci and Sanjuán 2020). The net effect of standard depends on the ability of domestic and foreign producers to comply with the more stringent requirements (Beghin et al. 2015). As discussed in Swinnen (2016; 2017), standards are trade catalysts if domestic producers face costs of compliance higher than foreign producers; in the opposite case, standards are trade barriers.

The RTAs allow for regulatory cooperation. Defined by Hooker (1999) as 'rapprochement', the regulatory cooperation between trading partners consists in actions (e.g., mutual recognition of standards, harmonisation of standards) aimed at eliminating, reducing, and preventing regulatory differences between them. The rapprochement is supportive of a positive integration of countries at the regional level (i.e., in the context of RTAs) (Wieck and Rudloff 2020). Through the regulatory cooperation, the RTAs may enhance trade between signatories but may also divert trade from non-signatory countries (Grant 2013). The trade diverting *versus* trade creating potential of trade agreements, firstly discussed by Viner (1950), reflects the theory of the second

best and conveys the idea that (regional) trade agreements differ from non-discriminatory trade liberalisation of multilateral trade negotiations and may damage world welfare.

Understanding how the standards impact trade among signatories of RTAs is also an interesting empirical question. The RTAs provide for specific commitments, whose effect in terms of trade may vary according to the presence of standards and to the depth of regulatory cooperation (Grant and Boys 2012; Lejarraga and Shepherd 2013). We investigate these issues focusing on the agri-food sector, by far the most regulated by SPS measures. We address the following questions: which are the trade effects of the standards provided in the SPS measures and how they differ among signatories and non-signatories of RTAs? To what extent the RTAs go beyond the WTO requirements, in facilitating the regulatory cooperation among signatories? Although SPS measures implemented by WTO members are grounded on international standards, guidelines and recommendations developed by the relevant international organisations, the RTAs may provide a forum for additional cooperation to carry out the scopes of the WTO SPS Agreement: i.e., "*the establishment of a multilateral framework of rules and disciplines to guide the development, adoption and enforcement of sanitary and phytosanitary measures in order to minimize their negative effects on trade*". Regulatory cooperation may help in reducing (enhancing) the negative (positive) effect of standards on trade, for instance, by avoiding trade conflicts and disputes and by favouring the resolution of specific trade concerns. As argued by Grant et al. (2018), products of the agri-food sector are often caught in the crossfire of trade disputes rooted in non-tariff related measures. The resolution of concerns related to standards potentially able to restrict trade or to violate the implementation of the WTO SPS Agreement is a strong signal of cooperation (Grant and Arita 2016).

Many countries have improved their market access through trade agreements. In fact, trade agreements may facilitate market access by lowering tariffs and providing other market access concessions (OECD 2015). The trade creating benefits of regionalism are well documented in the empirical literature (e.g., Baier and Bergstrand 2007; Lambert and McKoy 2009; Sun and Reed 2010). However, RTAs are not always trade creating: some RTAs may provide limited benefits in terms of trade and, more importantly, most of their benefits depend on the scope and depth of the economic integration (Grant 2013). These empirical evidence are well-grounded on an extensive literature that, starting from Bhagwati (1991), introduced the static concepts of trade diversion and trade creation proposed by Viner (1950) into a dynamic time-path case of trade agreement acting as 'stumbling blocks' or 'building blocks' to investigate the potential of trade agreements in favouring or limiting market access with respect to the multilateral non-discriminatory trade liberalisation. The effects on trade tend to depend on the extent to which the RTAs are able to improve transparency, harmonisation, and equivalence of regulatory frameworks (OECD 2011).

Little attention has been paid to the linkages between standards provided in the SPS measures and within the RTAs, while several studies have examined the impacts of heterogeneous standards on trade. As suggested in a meta-analysis (Santeramo and Lamonaca 2019) on the trade effects of non-tariff measures (NTMs), the standards provided in SPS measures are not always detrimental for trade; the effects of SPS measures are highly dependent on products and countries involved, due to the differences in food safety regulations and standards and to the countries' market shares (Fiankor et al. 2021). Indeed, a large body of literature provides evidence on the trade (impeding) enhancing effect of (dis-)similarity of the standards required by the SPS measures. For instance, Drogué and DeMaria (2012) suggest that differences between

sanitary regulations do matter and may, in some case, hinder trade; similarly, de Faria and Wieck (2015) conclude on the trade impeding effect of high levels of dissimilarity in safety standards. These studies suggest that the stringency of standards may be irrelevant when heterogeneity in standard requirements is low across countries: regulatory cooperation moves in this direction (Karemera et al. 2020).

As demonstrated in Winchester et al. (2012), at least for some import standards, harmonising regulations would increase trade of crop products. Similarly, Schmidt and Steingress (2019) show that the introduction of harmonised standards increases trade through a larger sales volume of existing exporters (i.e., intensive margin) and more entry of new exports (i.e., extensive margin). However, these studies do not deepen on the linkages between regulatory cooperation and RTAs, even though the harmonisation of food standards and regulations at the regional level is important for enhancing trade (Devadason et al. 2018). Indeed, being part of deep trade agreements seems to reduce the difficulties related to comply with stringent standards (Murina and Nicita 2017). In fact, "deep" trade agreements are the ones that not only, according to the GATT Article XXIV, reduce or eliminate trade barriers on substantially all trade (i.e., with some exceptions depending on specific agreements) and progress toward the harmonisation of non-tariff policies, but also mandate cooperative choices of regulations (Grossman et al. 2021) and contain a range of deeper provisions other than the traditional trade policy instruments such as investment liberalisation and intellectual property protection commitments (Mattoo et al. 2020; Dhingra et al. 2021).

Among the few studies on the interaction between technical measures and RTAs, Cadot and Gourdon (2016) explore how the RTAs and NTMs are related, concluding that countries gain

92 from transparency provisions in RTAs. Disdier et al. (2015) analyse the trade effects of
93 provisions for technical regulations within economic integration agreements involving partners
94 with different levels of economic development. Their results reveal that the harmonisation of
95 regional standards negatively impacts exports of developing countries to developed countries.
96 However, the study pays attention to technical barriers to trade (TBT), thus nothing can be
97 argued on SPS measures. The OECD study (2011) examines agreements' chapters on SPS
98 measures and finds that only a few RTAs contain specific commitments that go beyond the core
99 principles set in the WTO Agreement on the application of SPS measures. The study provides an
100 interesting qualitative synthesis of SPS-specific provisions in RTAs, but the effects on trade are
101 not investigated. We focus on underinvestigated aspects: how the SPS measures and the
102 provisions embedded in the trade agreements are related, and how these connections impact on
103 trade.
104 The contribution of our study is at least two-fold. First, we show the different trade effects that
105 the standards provided in the SPS measures have on signatories and non-signatories of RTAs.
106 This contribution adds value to the debate on the effects of the SPS measures in relation to the
107 trade agreements. The WTO principles recall that the SPS measures tend to be country-specific
108 agreements. This tendency increases the number of SPS measures and the requirements to
109 comply with (Cadot and Gourdon 2016), with effects that are difficult to be fully forecasted prior
110 the implementation of the measures.
111 A second contribution of our research is to assess the effects of intra-RTAs regulatory
112 cooperation efforts. In fact, while SPS-specific commitments negotiated in a more versatile
113 framework, such as RTAs, may facilitate the compliance with standards and, thus, the

achievement of the adequate levels of safety required by trading partners (Lejarraga and Shepherd 2013), it is not always true that negotiations lead to a successful outcome.

In the next Section we analyse the policy interventions, as well as the evolution of both RTAs and SPS measures. The methodological framework is described before the discussion of the empirical results. The empirical findings are examined in two subsections, respectively devoted to trade effects of the SPS for signatories and non-signatories of RTAs, and to the trade effects that deeper commitments on SPS measures provided in RTAs tend to have on trade dynamics. We conclude our investigation by providing insightful reflections for the policy debate.

An overview of RTAs and SPS measures

While the number of multilateral negotiations has stalled during the last decades, several collective trade agreements have entered into force. Since 2000, the number of new agreements notified to the WTO had a considerable growth. In 2020, trade agreements in force have been 349, as compared to less than 100 in 2000 and 23 in 1990: a domino effect that, from unilateralism to regionalism, led to a chaotic tangle of RTAs (Baldwin 2008), firstly defined by Bhagwati and Policy (1995) as the 'Noodle Bowl Syndrome'. According to the WTO, many countries participate in multiple RTAs, with a consequent overlap of trade agreements with the set of market access rules and regulatory frameworks that may potentially have detrimental effects on trade (OECD 2011). In fact, standards that products traded between countries in a trade bloc should satisfy (i.e., rules of origins, Baldwin 2006) aim at preventing trade deflection but may impose fixed compliance costs (Cadot et al. 2006). As argued by Cadot and Ing (2019), one of the challenges of RTAs is to prevent standards (or rules of origins) to hinder the rise of global value chains. Regulatory cooperation may be solution.

Over years, RTAs have increased in number, depth, and complexity. While older RTAs cover tariff liberalisation and related rules, more recent and complex RTAs develop more integrated unions, harmonising domestic and non-tariff policies (Grant 2013). RTAs aim at favouring trade between signatories, given that they do not raise trade barriers against third parties. By definition, RTAs are discriminatory as only their signatories enjoy more favourable market-access conditions. Accordingly, the effects of RTAs on trade liberalisation may be diverse: RTAs are designed to benefit signatory countries, however expected benefits may be undercut without minimising potential trade diversion (Sheldon et al. 2018).

After the Uruguay Round, while tariffs on goods have been extensively lowered to an average below 5%, a number of at the border measures, such as SPS measures, for several agri-food categories have remained high and, indeed, have increased over time (Disdier et al. 2015). As non-tariff measures, SPS are policy instruments that can potentially have an economic effect on international trade in goods, changing quantities traded, or prices or both (UNCTAD 2012). Trading partners have to comply with standards provided in SPS measures to ensure that traded products do not hurt human, animal or plant life or health with risks arising from disease-carrying or disease-causing organisms: the sensitive nature of the covered issues explains the pervasiveness of SPS measures in the agri-food sector (Santeramo 2019).

The SPS measures are developed and implemented by the regulatory institutions of a country and need to be consistent with international standards, guidelines and recommendations developed under the auspices of the Codex Alimentarius Commission for food safety, of the International Office of Epizootics (OIE) for animal health and zoonoses, of the Secretariat of the International Plant Protection Convention (IPPC) in cooperation with regional organisations operating within

160 the framework of the IPPC for plant health. At the regional level, there are programmes to
161 facilitate the harmonisation of standards: in fact, as suggested in the WTO SPS Agreement, SPS
162 measures are often applied based on bilateral agreements or protocols. This is particularly true in
163 cases in which countries sharing SPS measures are signatories of RTAs. Indeed, RTAs may
164 contain provisions on SPS measures. Provisions may be related to a general cooperation on SPS
165 issues (e.g., inspection, quarantine, capacity building for implementation of SPS measures), or to
166 the respect of regulations on SPS measures established in each signatory county of a specific
167 RTA. In most cases, RTAs specifically reaffirm or incorporate rights and/or obligations
168 established under the WTO SPS Agreement. This occurs for RTAs having a general reference to
169 the WTO[3] and for RTAs in which there is no specific reaffirmation of the WTO SPS Agreement
170 but a substantive part of the text of the WTO SPS Agreement is reproduced in the text of the
171 agreements[4]. In some cases, RTAs encourage their signatories to coordinate SPS measures
172 through a variety of approaches that include basic SPS principles and mutual recognition (Cadot
173 and Gourdon 2016).
174

175 **Methodological framework**

176 We adopt a gravity-based approach to observe how standards and regulatory cooperation within
177 RTAs affect the level of imports between country-pairs. The gravity model of trade it is one of
178 the most effective frameworks used in the international trade literature to quantify the effects of
179 trade policies (Yotov et al. 2016). Based on solid theoretical foundations (for a review see
180 Costinot and Rodriguez-Clare 2014), this structural model allows to capture the linkages
181 between multiple markets (e.g., countries) and the effects of policy changes in one market on the

rest of the world. Using an Armington-type model (Anderson and Wincoop 2003), we explain bilateral trade flows, X_{ijt}, with the following structural gravity system:

$$X_{ijt} = \left(\frac{E_{it}}{\Phi_{it}}\right)^{\beta_{it}} \left(\frac{Y_{jt}}{\Omega_{jt}}\right)^{\beta_{jt}} \left(\theta_{ijt}\right)^{(\beta_{ij}+\gamma \mathrm{Z}_{ijt})} \quad (1)$$

The term E_{it} is the total expenditure of the importer i at time t from all sources J including i ($E_{it} = \sum_J X_{ijt}$), indicating that large importing economies tend to import more from all sources. The term Y_{jt} is the value of production of the exporter j at time t and equal to the sum of all bilateral shipments from j ($Y_{jt} = \sum_I X_{ijt} \ \forall \ i$); $Y_{j,t}$ indicates that large producing economies tend to export more to all destinations. The size terms of equation (1), E_{it} and Y_{jt}, indicate that trading partners with a similar size tend to share larger trade flows. As defined in Anderson and van Wincoop (2003), the terms Φ_{it} and Ω_{jt} are inward and outward multilateral resistances, proxying the competitiveness of trading partners: they depend on the relative price indexes and are based on market clearing conditions. The term θ_{ijt} proxies bilateral trade costs and includes country-pair determinants of trade: β_{ij} indicates economic and geopolitical distance between country-pairs (e.g., distance, common language, contiguity, colonial ties) and $\gamma \mathrm{Z}_{ijt}$ includes factors that tend to increase or reduce such a distance (e.g., standards, regulatory cooperation).

After log-transformation, the model in equation (1) is estimated in a linear form:

$$\ln\left(X_{ijt}\right) = \alpha + \boldsymbol{\beta}_{it}(k_{it}) + \boldsymbol{\beta}_{jt}\left(k_{jt}\right) + \left(\boldsymbol{\beta}_{ij} + \boldsymbol{\gamma}\boldsymbol{Z}_{ijt}\right)\left(k_{ij}\right) + \varepsilon_{ijt} \quad (2)$$

where imports of i from j at time t, $\ln\left(X_{ijt}\right)$, are a log-linear function of standard-specific variables, $\boldsymbol{Z}_{ijt}$, and of a number of fixed effects. Yotov et al. (2016, p. 24) recommend that "*in accordance with gravity theory, directional time-varying (importer and exporter) fixed effects should be included in panel trade data*". The term $\boldsymbol{\beta}_{it}$ is a vector of importer-time fixed effects which control for inward multilateral resistances and countries' total expenditure; the term $\boldsymbol{\beta}_{jt}$ is

a vector of exporter-time fixed effects which control for outward multilateral resistances and countries' output shares. As argued by Olivero and Yotov (2012) and Feenstra (2016), the use of exporter-time and importer-time fixed effects enables to control for the unobservable multilateral resistances in a dynamic gravity estimation framework with panel data, avoiding the "Gold Medal Mistake" evoked by Baldwin and Taglioni (2006). Moreover, the exporter-time and importer-time fixed effects enables to absorb the size variables (i.e., total expenditure of the importer and the value of production of the exporter) from the structural gravity model in equation (1) and to control for any other observable and unobservable country-specific characteristics, which vary over time for each exporter and importer (e.g., national policies, institutions, exchange rates) and may influence bilateral trade (Anderson and van Wincoop 2003). While this specification is quite stringent, it allows us to obtain consistent estimates of the parameters of interest (Yotov et al., 2016). The term $\boldsymbol{\beta}_{ij}$ is the vector of country-pair fixed effects which account for the unobservable linkages between the endogenous standard-specific covariates ($\boldsymbol{Z}_{ijt}$) and the error term (ε_{ijt}); the use of country-pair fixed effects solves for the problem of endogeneity of trade policy variables (Baier and Bergstrand 2007), absorbs all bilateral time-invariant determinants of trade (e.g. distance, common language, contiguity, colonial ties) (Agnosteva et al. 2019), does not prevent the estimation of the effects of time-varying bilateral trade policies (i.e., standards, regulatory cooperation) (Egger and Nigai 2015). α, k_{it}, k_{jt}, and k_{ij} are constants, $\boldsymbol{\gamma}$ is the vector of parameters of interest, and ε_{ijt} is the error term[5]. The vector $\boldsymbol{Z}_{ijt}$ contains standard-specific variables (i.e., bilateral and multilateral SPS measures[6]) and commitments on standards provided by each RTAs that proxy regulatory cooperation. As for commitments on standards, the model (2) considers if an RTA (i) reaffirms or incorporates rights and/or obligations established under the WTO SPS Agreement (i.e.,

no/limited cooperation in SPS chapters); (ii) provides additional commitments for basic SPS principles established by the WTO SPS Agreement; (iii) provides for technical cooperation on SPS measures through a specific Committee; (iv) provides for mutual recognition of SPS measures. The variables included in $\boldsymbol{Z}_{ijt}$ are modelled as time-specific dummies: they allow us to estimate the extent to which the presence of standard and of commitments on standards increases (or decreases) bilateral trade flows.

The model (2) is estimated through the Gamma Pseudo Maximum Likelihood (GPML) estimator[7] that is robust to heteroskedastic errors and allows to deal with zero trade flows[8] (Egger and Staub 2016). We estimate different specifications: first, we disentangle differences in the effects of standards for signatories and non-signatories of an RTA[9] in terms of trade levels; second, we examine the impacts of specific commitments on standards in terms of trade levels between signatories of RTAs, net to the effects of standards. The subsamples of signatories and non-signatories of RTAs are identified regardless of the year of entry into force of the agreements, in order to assess if and how standards and regulatory cooperation may affect trade between countries that tend to be part (or not) of RTAs. From GPML estimates we obtain the trade volume effects as follows: $TVE = \left(e^{\hat{\gamma}} - 1\right) * 100$, where $\hat{\gamma}$ is the coefficient of interest (Yotov et al. 2016).

Empirical application

Our empirical analysis is grounded on the qualitative synthesis of SPS-specific provisions in 48 RTAs provided by OECD (2011). We compiled a rich dataset of annual bilateral data covering the period between 1997 and 2017 for 38 countries, involved in the 48 RTAs. The

methodological appendix provides a detailed description of data used to develop the empirical analysis and sources of adoption.

The scope of an RTA is to facilitate trade flows between signatories of that RTA, without imposing barriers to trade with countries out of that agreement. As shown in the figure 1, the value of imports between signatories is systematically larger than non-signatories and SPS measures tend to be lower for non-signatories across years. However, standards provided in SPS measures, regulating relationships between signatories of the RTA, may contribute to shape trade. Indeed, it is likely that bilateral measures tend to be set in the occasion of trade agreements between implementing country and trading partners (Santeramo et al. 2019). By definition, trade agreements are a more versatile negotiating environment, in which trade partners may converge easily on a deeper and mutually beneficial liberalisation of trade (Disdier et al. 2015). Regulatory cooperation frequently covers standards provided in SPS measures, although with high heterogeneity across different RTAs.

[Figures 1 and 2 about here]

Participating to RTAs may provide substantial differences between countries. This is what we observe in our sample where, for instance, bilateral SPS measures are 20% for non-signatories and 36% for signatories of RTAs. In the sample of RTAs in OECD (2011), almost the half of the analysed agreements provides for specific commitments on SPS measures[10] (figure 2, panel I). Within them we find sufficient variability in specific provisions (figure 2, panel II): 7 out of 48 RTAs harmonise their national measures on the international standards (principle of harmonisation); 8 out of 48 RTAs accept SPS measures of trading partners as equivalent (principles of equivalence); 9 out of 48 RTAs ensure that their SPS measures are adapted to the SPS characteristics of the region of origin and destination of the product (principle of

regionalisation); 7 out of 48 RTAs ensure that their SPS measures are based on an assessment of the risks to human, animal or plant life or health (principle of assessment of risk); 19 out of 48 RTAs establish national enquiry points and notify the creation or change of any SPS regulation before they are adopted to ensure transparency (principle of transparency). Moreover, different agreements tend to introduce different combinations additional commitments on SPS measures (see table A.1). For instance, Australia is committed to improve the equivalence and transparency of SPS measures in the agreement with Singapore, but only the equivalence in the Agreement with Thailand. The EU and Chile have additional commitments on all but one SPS principles (i.e., assessment of risk), but Chile is committed only to ensure greater transparency of SPS measures in the agreement with China. While all but 15 RTAs in our sample address the technical cooperation issue and establish an institutional framework to do so[11] (figure 2, panel III) rarely the agreements include commitments on mutual recognition of SPS certificates, inspection, or control systems (in one case only: the agreement between New Zealand and Singapore) or mutual recognition provisions (in 6 out 48 RTAs) (figure 2, panel IV). Details on each agreement are in table A.1 of the Appendix.

Trade effects for signatories and non-signatories of RTAs

In order to provide formal evidence on the overall effect of standards required in SPS measures on import levels, we run regression equation (2) using only standard-specific variables (i.e., bilateral and multilateral SPS measures) and controlling for the full battery of fixed effects. The results are reported in table 1. The benchmark is the overall trade effect of bilateral and multilateral SPS measures. We decompose the overall sample into signatories and non-signatories of RTAs, regardless of the year of entry into force of the agreements. The idea behind

293 the identification of the subsamples is that considering signatories and non-signatories regardless
294 the year of entry into force of the agreement would allow to understand trade dynamics between
295 trade partners that tend to be part (or not) of RTAs[12].

296 [Tables 1 about here]

297 Overall, bilateral and multilateral SPS measures are trade barriers, but differences are observed
298 between signatories and non-signatories of RTAs (column (1), table 1). The results for non-
299 signatories of RTAs provide evidence that SPS measures, both bilateral and multilateral, hinder
300 trade between countries that tend to not be part of RTAs. The trade volume effects reported in
301 table 3 suggest that, on average, the value of imports reduces by 31.45% with a SPS measure
302 implemented between trading partners on a country-pair basis and by 36.73% with a multilateral
303 SPS measure. In absolute value, the impact on import values is much greater for multilateral
304 rather than for bilateral SPS measures: the introduction of a SPS measure that applies to all
305 trading partners has a stronger impact than SPS measures defined on a country-pair basis.
306 Our results complement the findings of Crivelli and Gröschl (2016) who conclude that
307 multilateral SPS measures exert a negative impact on the intensive margin of trade for all
308 potential trading partners.
309 We notice that the introduction of multilateral SPS measures is associated with a negative effect
310 on both non-signatories and signatories of RTAs; in absolute value, the effect is higher on the
311 former than on the latter. For the sample of signatories of RTAs, the trade volume effect of
312 multilateral SPS measures suggests a reduction of 26.24% in the value of imports (table 3).
313 Differently, the trade response of signatories of RTAs to bilateral SPS measures is null (the
314 estimated coefficients, reported in column (3) of table 1, is not statistically significant).

315 Similarly, Ferro et al. (2015) show that, for existing trade relationships, the trade effect is
316 indistinguishable from zero: once a country adjusts its production to comply with the standards
317 of a trading partner, those standards tend to not impact the intensity of trade between them.
318 Being part of deep trade agreements tends to reduce difficulties related to the compliance with
319 SPS measures (Murina and Nicita 2017). Allowing for the harmonisation of domestic and non-
320 tariff policies (Grant 2013), deep trade agreements provide technical assistance to enhance the
321 competitiveness of signatories operating in markets where the stringency of SPS measures and
322 the costs of compliance are high (Hoekman, 2002; Henson and Jaffee 2008; Murina and Nicita
323 2017). In line with our hypothesis that being part of RTAs may help in reducing the negative
324 effect of standards on trade we noted that, for instance, the number of specific trade concerns
325 raised on SPS issues is about four times lower for signatories of RTAs. Overall, 47% of all SPS
326 specific trade concerns between signatories are reported as being resolved, as compared to 34%
327 of concerns regarding SPS issues between non-signatories (table 2). The discussion of SPS issues
328 and the monitoring and harmonising efforts as well –a standard practice for countries adhering to
329 the WTO SPS Agreement (Gant and Arita 2016)– seems a critical and well-functioning
330 mechanism for signatories of RTAs.
331
332 [Table 2 about here]
333
334 The results suggest changes in the level of imports due to the adoption of a SPS measure. But
335 how do these trade volume effects compare to observable changes in import values? To answer
336 this question, we combine the trade volume effects with the average import values (in million

US$) across years and for the last year available in the sample (i.e., 2017) to compute the change in average import values (table 3).

For non-signatories of RTAs, the decrease in traded values after the introduction of a bilateral SPS measure can be associated with a reduction of 31.45 percentage points, equivalent to an average of -73 million US$ (-137 million US$ in 2017 only). Differently, given the average implied decrease of 36.73 percentage points associated with the introduction of a multilateral SPS measures, the estimate suggests a reduction in the value of imports of 86 million US$ that tend to exacerbate in the last year of the sample (-161 million US$ in 2017). Losses in economic terms, due to the introduction of multilateral SPS measures, are greater for signatories of RTAs, whose import values decrease by -67 million US$ (-111 million US$ in 2017).

[Table 3 about here]

Being part of an RTA contributes significantly more to higher import values as compared to trade that would occur between trading partners that tend to be more economically and geopolitically distant[13]. While the scope of an RTA is to facilitate trade flows between signatories of that RTA and improve their market access, standards on SPS issues may still constitute a barrier to trade that jeopardise the trade creating benefits of regionalism. Indeed, it is frequent that all non-tariff measures, except SPS measures, on agri-food trade are eliminated between signatories. This is, for instance, what occurred under the NAFTA, where SPS measures still regulate agri-food trade between the United States and Mexico, while all other non-tariff barriers to agricultural trade and many tariffs were eliminated immediately after the entry into force of the agreement (Jayasinghe and Sarker 2008).

All in all, our empirical results suggest that trade between countries that do not share RTAs are significantly affected by standards provided in SPS measures: the trade hindering effect depends on the type of SPS measures implemented and is more marked for standards not shared between trading partners (i.e., multilateral SPS measures). The lower trade impeding effect of country-specific standards (i.e., bilateral SPS measures) may be due to the fact that trading partners agree on those standards (Santeramo et al. 2019), although they do not share an RTA. Multilateral SPS measures are barriers for trade in the agri-food sector also for signatories of RTAs. The increase in trade flows between signatories of RTAs, operated through economic and geopolitical proximity, seems not affect by shared standards provided in bilateral SPS measures, but frictioned by standards implemented unilaterally by one of the trading partners.

Trade effects of regulatory cooperation in RTAs

In order to quantify the effects of regulatory cooperation, we run the same regression model as before, but we include the commitment-specific information as additional explanatory variables and limit the analysis to the subsample of signatories of RTAs for which information on regulatory cooperation are available. Recall that trade relationships between signatories are considered regardless of the year of entry into force of the agreements to evaluate the impact of additional commitments on standards for trading partners that tend to be part of RTAs. The regression results (displayed in table 4) control for bilateral and multilateral SPS measures and outline the different channels via which regulatory cooperation can affect import levels: a specification (column 1 of table 4) informs on the existence or not of regulatory cooperation on SPS measures in RTAs (the explanatory variable indicates if a RTA simply reaffirms or incorporates rights and/or obligations established under the WTO SPS Agreement); another

specification (column 2 of table 4) evaluates the impact of additional commitments for each of the basic SPS principles established in the WTO SPS Agreement[14]; a further specification (column 3 of table 4) controls for the effects of technical cooperation on SPS measures through a specific Committee; the last specification (column 4 of table 4) looks at the impact of mutual recognition of SPS measures provided in RTAs.

[Table 4 about here]

Next, we use the point estimates of variables indicating regulatory cooperation (reported in table 4) to derive the implied change in import values between countries sharing RTAs that is due to additional commitments on SPS issues. We simply multiply the trade volume effects estimated for regulatory cooperation variables by the average import value for signatories of RTAs across years (i.e., 483 million US$) and in the last year available in the sample (i.e., 846 million US$). The trade volume effect and the trade-weighted average change in trade flows between signatories of RTAs due to regulatory cooperation are reported in table 5.

[Table 5 about here]

The results for the impact of regulatory cooperation suggest that, overall, a limited or non-existent cooperation between trading partners sharing RTAs but also a mutual recognition of SPS measures do not impact trade. Although the inclusion of chapters on SPS measures is a common practice in RTAs, the effectiveness of SPS-specific provisions for the agri-food trade would be relevant if commitments go further than requirements established in the WTO SPS Agreement (OECD 2011). Indeed, we find that if the role of a RTA is limited to instruct the parties to observe the rights and obligations set forth in the WTO SPS Agreement, the agri-food trade

seems not affected. Differently, signatories that commit to implement additional provisions on SPS issues with respect to the requirements set in the WTO SPS Agreement tend to bring attention to, discuss, and resolve more SPS-related specific trade concerns in a lower period of time. On average, signatories of RTAs without additional commitments on SPS measures resolve 42% of concerns raised in 15 years and 1 quarter, whereas signatories of RTAs with additional commitments on SPS measures resolve 60% of concerns raised (43% more) in 12 years and 2 quarters (-2 years and 3 quarter less)[15] (table 6). As argued by Grant and Arita (2016, p. 10), "*this type of 'revealed concern' approach allows us to focus on measures more likely to be targeted for reform*".

The trade between signatories of RTAs tends to be unaltered also if RTAs establish a commitment to work toward the identification of areas for mutual recognition agreements. In fact, the provision just encourages the parties to make efforts to identify areas that allow mutual recognition of SPS inspection, control and certification procedures (OECD 2011), but the cooperation toward mutual recognition is far from a binding commitment.

[Table 6 about here]

Considering the core SPS principles, imports are negatively correlated with more stringent provisions on harmonisation; not significant effects are found for other SPS principles. The results reveal that additional commitments on harmonisation specifying the steps and/or timeframe to establish, recognise, and apply the common SPS measures by different WTO Members are detrimental for imports, whose value reduces by 64.49% (table 4). In economic terms, the trade distortionary effect of more stringent provisions on harmonisation of SPS

measures across partners of RTAs is quantified in a reduction of import values of 311 million US$ (546 million US$ in 2017 only).

The harmonisation of standards affects the frequency of border controls (Garcia-Alvarez-Coque et al. 2020). If RTAs lack of a bureaucratic mechanism for implementing regulatory cooperation on SPS issues, it is difficult to achieve a concrete and effective harmonisation of standards between signatories. An example is the joint strategy to harmonise standards for bovine spongiform encephalopathy (BSE) measures in North America adopted by signatories of the NAFTA. The strategy provides for a set of minimum standards that signatory countries (i.e., Canada, Mexico, the United States) should propose for consideration to the national authorities. The harmonised system does not require the monitoring of cross-shipping between signatories. Thus, if the failure to implement the harmonised standards in one of the signatory countries (e.g., Canada) causes a safety problem in that country, the problem may automatically be attributed to the other signatories (i.e., Mexico, the United States). The mild coordination of regulatory cooperation at the policy level may compromise the effective harmonisation of standards and the benefits in trade terms (Sparling and Caswell 2006).

Differently, we notice that a deeper technical cooperation on SPS issues is associated with a positive effect on import levels. If an RTA includes an institutional component mandating the creation of a specific committee or working group to address SPS issues, the trade between signatories tends to increase (+20.04%) by 97 million US$ on average, and by 170 million US$ in 2017. The positive effect is much larger (+40.77%) if the committee on SPS issues also provides for technical cooperation: in dollar terms, imports of signatories of RTAs would increase by 197 million US$, and by 345 million US$ only in 2017 (table 4).

449 As argued in Çakır et al. (2018), RTAs establishing an SPS committee with the objectives of
450 enhancing the implementation of SPS measures, and the communication and coordination on
451 SPS issues, such as NAFTA, TTP, or TTIP, contributed to avoid the disruption of the US turkey
452 industry during the avian flu outbreak in the United States in 2015. Without such RTAs that
453 facilitate technical cooperation on SPS issues between trading partners, the implementation of
454 SPS measures in 2015 to face the avian flu outbreak would have caused more economic losses to
455 the US turkey producers. Indeed, periodic consultations in RTAs contribute to contain trade costs
456 associated with SPS issues (Beghin and Schweizer 2020),
457

458 **Main conclusions and implications**

459 The objective of this study was to provide empirical evidence on the effects that standards and
460 regulatory cooperation within the RTAs tend to have on trade relationships.
461 The study has evaluated the impacts on trade due to the implementation of standards provided in
462 the SPS measures. We examined whether the trade effects of bilateral and multilateral SPS
463 measures differ for trading partners that are involved (or not) in RTAs. The evidence we have
464 discussed in the paper allows us to conclude that the SPS measures tend to friction trade, unless a
465 coordination effort has been put in place (i.e., if trading partners share an RTA). The importance
466 of the coordination effort is strengthened by the persistency of a negative effect of the
467 multilateral SPS also among trading partners that share an RTA. In economic terms, the
468 multilateral SPS measures are the most impactful: the loss of trade value is estimated in about 86
469 million of US dollars for trading partners that are part of RTAs and raises to 127 million when no
470 RTA have been signed. Differently, the bilateral SPS measures reduce the trade value only for
471 countries not sharing an RTA.

RTAs and SPS are hard to be thought as simple trade tools. Indeed, their efficacy calls for much more that an aseptic set of rules. Sparling and Caswell (2006, p. 215) notably argued that "[the] *harmonisation requires agreement on regulatory goals and mechanisms that is hard to achieve among independent countries*". Deepening on the effects of cooperation in trade agreements, we show that The OECD (2011) pointed that the development of a joint SPS committee may foster regulatory cooperation and conformity assessment, reducing trade costs and increasing trade (Cadot and Gourdon, 2016). We quantify those effects and find that the technical cooperation is quite effective. More specifically, establishing a committee on SPS issues tends to increase bilateral trade by more than twenty percent. Furthermore, actively working on technical cooperation boost trade two times more, with gains estimated in about 111 million US dollars.

The findings of the present article have important implications for the ongoing negotiations and may help shaping the newly established agreements, such as the African Continental Free Trade Area, as well as the future treats on agricultural trade. In particular, to maximise the coordination efforts, the trade agreements should tend to be inclusive, simple, and with shared rules.

[1] SPS measures are the technical measures most implemented in the agri-food sector. According to data from the UNCTAD's global database on non-tariff measures, the food and beverage sector accounts for 83% of total SPS measures. This is because of the greater exposure and vulnerability of the food and beverage to diseases and pests (Dal Bianco et al. 2016) and "*because of the sensitive nature of issues such as food safety and the protection of plant and animal health from pest and disease risks*" (Grant and Arita 2017, p. 6). In fact, according to the definition proposed in the World Trade Organisation (WTO) SPS Agreement, SPS measure are applied to protect human, animal or plant life or health from risks arising from the entry,

establishment or spread of pests, diseases, disease-carrying organisms or disease-causing organisms in foods, beverages or feedstuffs. Within the food and beverage sector, 41% of SPS measures refer to raw animal-based products, 32% to raw vegetable-based products, 27% to processed products.

[2] The trade catalyst and trade barrier effects tend to be product- and country-specific and may cancel out each other at the sector level or at the global level (Santeramo and Lamonaca 2019). Null trade effects occur if their effects of standards on domestic production exactly offset the effects on domestic consumption.

[3] In RTAs having a general reference to the WTO there are no specific paragraphs or chapter dealing with SPS.

[4] The chapter dealing with SPS is limited to few paragraphs in RTAs in which a substantive part of the text of the WTO SPS Agreement is reproduced in the text of the agreements.

[5] Given the multiplicative nature of the structural gravity model in equation (1), we can expand it with an additive error term.

[6] Multilateral SPS measures are unilateral measures that importers apply indiscriminately to all trading partners. Empirically, multilateral SPS measures have the importer and exporter dimensions, thus collinearity problems may arise with the vector of importer-time fixed effects. To solve this concern, we replace the importer-time fixed effects with importer fixed effects and time fixed effects.

[7] The use of the GPML estimator requires the estimation of the model in equation (2) with the dependent variable in level, i.e. $X_{ijt} = \alpha + \boldsymbol{\beta}_{it}(k_{it}) + \boldsymbol{\beta}_{jt}(k_{jt}) + (\boldsymbol{\beta}_{ij} + \boldsymbol{\gamma}\boldsymbol{Z}_{ijt})(k_{ij}) + \varepsilon_{ijt}$.

To test the robustness of the GPML estimators, we estimate the gravity model through the Poisson Pseudo Maximum Likelihood (PPML) estimator and compare the results (table A.4 of

the Appendix). The GPML and PPML estimates are similar, then the model is well specified and is approximately log-normal with a constant parameter (Head and Mayer 2014).

[8] Heteroskedasticity and the presence of zeros are common features of trade data.

[9] In the sample, in 32% of cases countries participate in more than one RTA. The variable capturing the participation in more than one RTA is omitted for collinearity. The phenomenon is absorbed in time-varying country fixed effects.

[10] In the sample, 26 RTAs do not go further than required by the WTO SPS Agreement, of which 7 do not have a specific chapter on SPS measures in the text of the agreement.

[11] The related provisions specify the committee composition, functions, and mode of operation.

[12] In a sensitivity analysis we estimated the effects of SPS measures on trade between non-signatories and signatories of RTAs considering the year of entry into force of the agreements. The results show no significant differences.

[13] The trade creating benefits of regionalism are highlighted in several empirical analyses. For instance, Koo et al. (2006) find that agricultural trade between signatories of RTAs increases by 95%. Baier and Bergstrand (2007) show that trade flows tend to be twice larger between signatories of trade agreements. Similar evidence are found by Grant and Lambert (2008) who report a 149% increase in agricultural trade between signatories of RTAs, and by Lambert and McKoy (2009) who assess trade increases in the agricultural sector (+153%) and in the food sector (+101%). Also case specific studies document that trade agreements favour the creation of intra-bloc trade (e.g. Sarker and Jayasinghe 2007; Jayasinghe and Sarker 2008; Sun and Reed 2010).

[14] According to the WTO SPS Agreement, the development and application of SPS measures should follow five basic principles: harmonisation (i.e., establishment, recognition and

application of common SPS measures by different WTO Members; art. 3), equivalence (i.e., acceptance of SPS measures of trading partners as equivalent, art. 4), assessment of risk (i.e., adoption of SPS measure on the basis of assessment of risks to human, animal or plant life or health, art. 5), regionalisation (i.e., adaptation of SPS measures to the SPS characteristics of the area from which the product originated and to which the product is destined, art. 6), transparency (i.e., provision of information on new or changes in SPS measures, art. 7, annex B).

[15] The table A.5 in the Appendix reports the number of specific trade concerns, the percentage of specific trade concerns resolved, and the average speed of resolution between signatories of RTAs without and with additional commitments on specific SPS principles.

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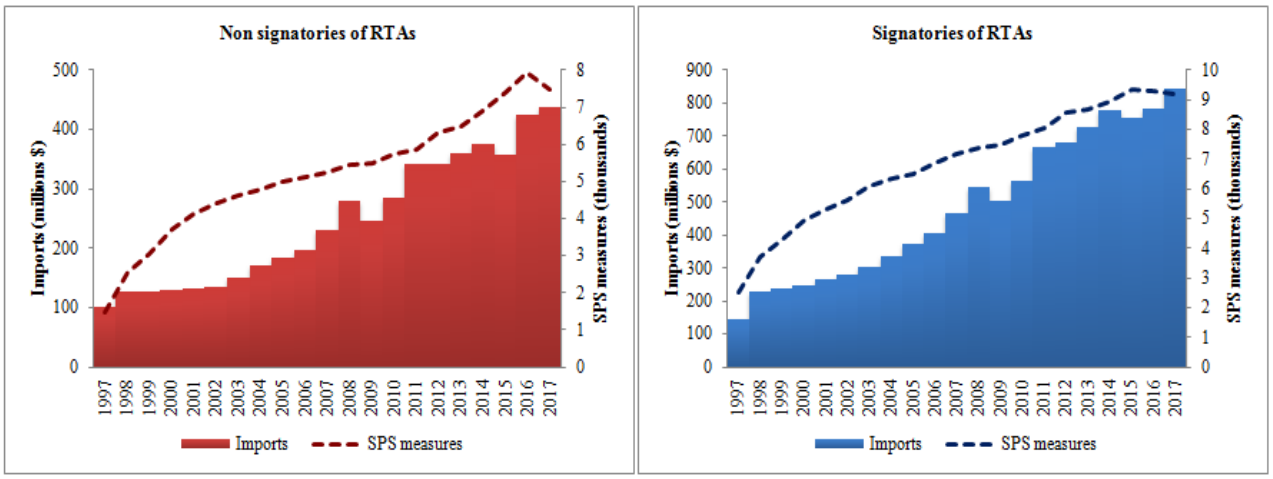
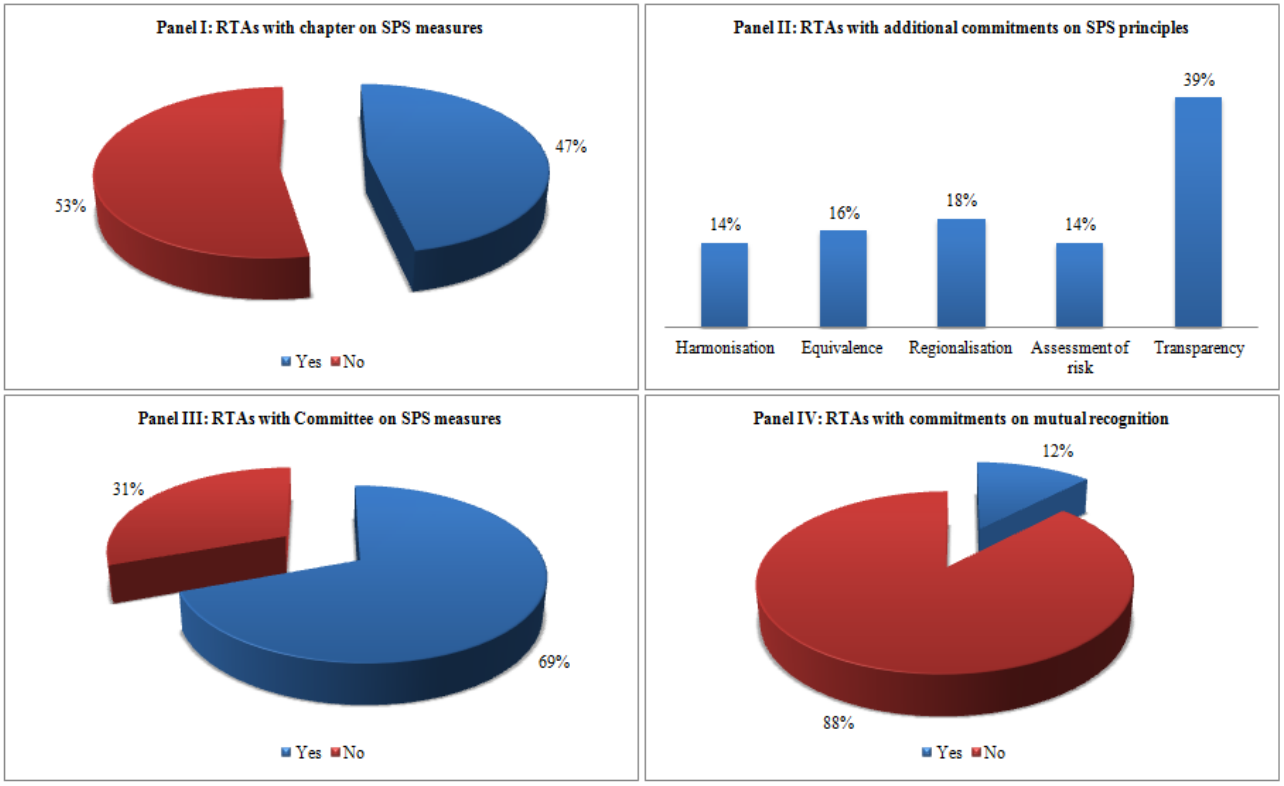
640

Figure 1. Trends in average import values and number of SPS measures of non-signatories and signatories of RTAs (regardless of the year of entry into force of RTAs)



Source: elaboration on data from UN Comtrade, and UNCTAD.

646 **Figure 2. Commitments on standards provided in RTAs**



647

648 Source: elaboration on data from OECD (2011).

649

650 **Table 1. Effects of SPS measures on trade between non signatories and signatories of RTAs**

	(1)	(2)	(3)
Variables	All countries	Non-signatories of RTAs	Signatories of RTAs
Bilateral SPS measures	-0.260 ***	-0.378 ***	-0.021
	(0.069)	(0.113)	(0.046)
Multilateral SPS measures	-0.448 ***	-0.458 ***	-0.304 ***
	(0.059)	(0.088)	(0.057)
Observations	29,101	19,670	9,431

651 Notes: Gamma Pseudo Maximum Likelihood (GPML) estimation of the equation (2). The
652 dependent variable is the value of imports (in level). The explanatory variables are modelled as
653 dummy variables. Bilateral SPS measures are 20% for non-signatories and 36% for signatories of
654 RTAs. All specifications include a constant, importer, time, exporter-time, and country-pair fixed
655 effects. Robust standard errors are in parentheses.

656 *** Significant at the 1 percent level.

657

Table 2. Number of specific trade concerns (STC) and speed of resolution for non-signatories and signatories of RTAs

		Non-signatories	Signatories
Number of STC of which		1,730	484
	resolved	34%	47%
Avg. speed of STC resolution		14 years and 2 quarters	
	pre-RTA		18 years and 3 quarters
	post-RTA		14 years and 1 quarter

Source: elaboration on data from SPS IMS.

Notes: Of the total STC between non-signatories, 588 are resolved and 1,142 are partially resolved. Of the total STC between signatories, 228 are resolved and 256 are partially resolved. The inter quartile range of the speed of resolution is 12 years for non-signatories, 3 years and 2 quarters for signatories before the entry into force of the RTA and 6 years after the entry into force of the RTA.

667 **Table 3. Marginal impacts of SPS measures on import values between signatories and**

668 **between non-signatories of RTAs**

	Trade volume effect (%)	Change in average imports (million US$)	Change in average imports in 2017 (million US$)
Non signatories of RTAs			
Bilateral SPS measures	-31.45	-73	-137
Multilateral SPS measures	-36.73	-86	-161
Signatories of RTAs			
Bilateral SPS measures	-	-	-
Multilateral SPS measures	-26.24	-67	-111

669 Notes: Trade volume effect computed on (statistically significant) coefficients derived from the
670 Gamma Pseudo Maximum Likelihood (GPML) estimation of the equation (2). The average
671 import value is 233 million US$ for non-signatories and 251 million US$ for signatories. The
672 average imports in million of 2017 US$ are 437 for non-signatories and 421 for signatories.
673 Bilateral SPS measures are 17% for non-signatories and 26% for signatories of RTAs.

674

675 **Table 4. Effects of regulatory cooperation on trade between signatories of RTAs**

Variables	(1) No/limited cooperation in SPS Chapter	(2) Cooperation on SPS principles	(3) Technical cooperation on SPS issues	(4) Cooperation on mutual recognition
No/limited cooperation in SPS Chapter	0.015			
	(0.087)			
Harmonisation		-1.035 ***		
		(0.191)		
Equivalence		0.134		
		(0.156)		
Assessment of risk		0.468		
		(0.369)		
Regionalisation		0.080		
		(0.124)		
Transparency		0.560		
		(0.360)		
Committee on SPS issues			0.183 **	
			(0.077)	
Technical			0.342 *	

cooperation on SPS issues				
			(0.175)	
Mutual recognition				0.047
				(0.060)
Observations	4,125	4,125	4,125	4,125

Notes: Notes: Gamma Pseudo Maximum Likelihood (GPML) estimation of the equation (2). The dependent variable is the value of imports (in level). The explanatory variables are modelled as dummy variables. Bilateral SPS measures are 20% for non-signatories and 36% for signatories of RTAs. All specifications include a constant, importer, time, exporter-time, and country-pair fixed effects, and control for the presence of bilateral and multilateral SPS measures. Robust standard errors are in parentheses.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

686 **Table 5. Marginal impacts of regulatory cooperation on import values between signatories**

687 **of RTAs**

	Trade volume effect (%)	Change in average imports (million US$)	Change in average imports in 2017 (million US$)
Harmonisation	-64.49	-311	-546
Committee on SPS issues	20.04	97	170
Technical cooperation on SPS issues	40.77	197	345

688 Notes: Trade volume effect computed on (statistically significant) coefficients derived from the
689 Gamma Pseudo Maximum Likelihood (GPML) estimation of the equation (2). The average
690 import value for signatories of RTAs in OECD (2011) is 483 million US$ across years and 846
691 in 2017. Bilateral SPS measures are 36%.

692

693 **Table 6. Number of STC and speed of resolution for signatories of RTAs without and with**

694 **additional commitments on SPS**

	RTAs without additional commitments on SPS	RTAs with additional commitments on SPS
Number of STC of which	130	224
resolved	42%	60%
Avg. speed of STC resolution	15 years and 1 quarter	12 years and 2 quarters

695 Source: elaboration on data from SPS IMS.

696 Notes: Of the total STC between signatories of RTAs without additional commitments on SPS,
697 54 are resolved and 76 are partially resolved. Of the total STC between signatories of RTAs with
698 additional commitments on SPS, 135 are resolved and 89 are partially resolved. The inter
699 quartile range of the speed of resolution is 8 years for signatories of RTAs without additional
700 commitments on SPS and 6 years for signatories of RTAs with additional commitments on SPS.

701

Appendix

Data collection and sample description

The study deepens on the 48 RTAs analysed in OECD (2011): they are listed in table A.1 and involve 38 countries: Argentina (ARG), Australia (AUS), Bolivia (BOL), Brazil (BRA), Brunei (BRN), Canada (CAN), Chile (CHL), China (CHN), Columbia (COL), Costa Rica (CRI), Ecuador (ECU), El Salvador (SLV), Egypt (EGY), European Union[1] (EUN), Guatemala (GTM), Honduras (HND), Hong Kong (HKG), Iceland (ISL), Japan (JPN), Kenya (KEN), Korea (KOR), Mexico (MEX), Morocco (MAR), New Zealand (NZL), Nicaragua (NIC), Norway (NOR), Paraguay (PRY), Peru (PER), Singapore (SGP), South Africa (ZAF), Switzerland (CHE), Tanzania (TZN), Thailand (THA), Turkey (TUR), Uganda (UGA), United States (USA), Uruguay (URY), Venezuela (VEN). The table A.1 also syntheses main information on SPS-specific commitments provided in each agreement.

[Table A.1 about here]

We compiled a rich dataset of annual bilateral data (described in table A.2) covering the period between 1997 and 2017 for 38 countries, involved in the 48 RTAs[2]. A first part of the study, analysing how the effect of standards provided in SPS measures differs between signatories and non-signatories of RTAs, considers all bilateral trade relationships between the selected countries[3]. A second part of the study, related to the analysis of the trade effects of regulatory cooperation in RTAs, analyses the subsample of signatories of the 48 RTAs[4].

[Table A.2 about here]

Signatories of RTAs, regardless of the year of entry into force of the agreements, are 14% of the sample. The trade effects of standards provided in SPS measures may differ between signatories and non-signatories of RTAs. These differential impacts are analysed by collecting information

on trade flows and SPS measures for selected countries: bilateral imports data[5] (in 1,000 US$) are from the UN Comtrade database. We work at the one-digit level of the classification by Broad Economic Categories (BEC 1996: 01 'Food and beverages'), in order to avoid potential endogeneity bias implied by standards implemented for protectionist purposes or to control imports in the absence of sizeable tariffs (Disdier et al. 2008). The value of imports between the selected countries is 239 million US$; this average tends to increase for signatories of RTAs (483 million US$) (table A.2).

As for SPS measures, annual data have been collected from the UNCTAD's global database on non-tariff measures, which provides information on official measures implemented at country and product level: information on the number of SPS measures that regulate bilateral trade are available for each product at the HS 6-digit level. In order to facilitate the match between trade and SPS data, we aggregate the information on SPS measures at the one-digit level of BEC classification, using the conversion table from HS 1996 to BEC 1996 of the UN Trade Statistics. The UNCTAD's database also provides, for each measure, information on the date of entry into force and on the expiry date: this allows us to track the validity of SPS measures. In our sample, about two thirds of bilateral trade relationships are regulated by SPS measures, and SPS measures become more frequent between country-pairs sharing RTAs (SPS measures are in place in 87% of cases). Bilateral SPS measures account only for 20% in our sample, the remaining part consists of multilateral SPS measures[6]; however, this percentage increases for signatories of RTAs (36%) (table A.2).

Considering that the aim of the paper is to investigate how SPS measures and provisions on SPS measures embedded in RTAs are related, and how these connections impact on trade, we chose a level of aggregation of trade and SPS data comparable to that of information on SPS provisions

47 available in RTAs. In fact, SPS provisions embedded in RTAs tend to be referred not to specific
48 products interested by a SPS measure but to the functioning of SPS measures applied to the food
49 and beverages sector. As an example, the box below provides extracts of the chapter dealing with
50 SPS measures in EU-Chile Agreement: the Annex IV describes the agreement on SPS measures
51 applicable to trade in food products, whereas the Annexes V and VI describe the agreement on
52 SPS measures applicable to trade in beverages.

53 [Box A.1 about here]

54 In order to investigate the trade effects of regulatory cooperation within RTAs, we model
55 qualitative information provided in OECD (2011) as time-specific dummy variables: we thus
56 obtain indicators synthesising main information on regulatory cooperation in each RTAs[7]. A first
57 indicator discriminates between RTAs that do not go further than requirements set in the WTO
58 SPS Agreement: the dummy is 1 if RTAs do not have a specific chapter on SPS measures or, if
59 available, a chapter on SPS measures limited to one or two paragraphs, instructing the parties to
60 observe the rights and obligations set forth in the WTO SPS Agreement; the dummy is 0
61 otherwise. A second set of indicators identifies the RTAs that assume commitments on a specific
62 SPS principle[8] beyond the WTO-SPS Agreement. For each SPS principle, a dummy variable
63 assumes value 1 if the commitment on a specific SPS principle goes beyond than what is
64 required by the WTO SPS Agreement by specifying the steps and/or timeframe to apply the
65 principle, and 0 otherwise. Further indicators are used to model the creation of an institutional
66 framework to monitor the implementation of SPS commitments (joint SPS Committees): a first
67 dummy indicates if the RTAs include an institutional component mandating the creation of a
68 special committee or working group to address SPS issues, but do not provide for technical
69 cooperation; a second dummy identifies RTAs that provide for technical cooperation. The last

indicator discriminates between RTAs that establish a commitment to work toward the identification of areas for mutual recognition agreements, also specifying their scope (i.e., standards relating to packaging and labelling), and RTAs that do not establish mutual recognition.

Sensitivity analyses

The idea behind the identification of the subsamples is that considering signatories and non-signatories regardless the year of entry into force of the agreement would allow to understand trade dynamics between trade partners that tend to be part (or not) of RTAs. In a sensitivity analysis we estimated the effects of SPS measures on trade between non-signatories and signatories of RTAs considering the year of entry into force of the agreements. The table A.3 compares the estimates for the sample of non-signatories and signatories of RTAs regardless (A) and considering (B) the year of entry into force of the agreements. The results show a not statistically significant difference between coefficients estimated in specifications (A) and (B) for both non-signatories and signatories.

[Table A.3 about here]

To test the robustness of the Gamma Pseudo Maximum Likelihood (GPML) estimators, we estimate the gravity model through the Poisson Pseudo Maximum Likelihood (PPML) estimator and compare the results (table A.4). As argued by Head and Mayer (2014, p. 174), "*given that both Poisson and Gamma PML are consistent under the same conditional expectation assumption, their estimates […] should be approximately the same if the sample is large enough*". The dimension of our sample should support this assumption. The results, reported in

93 the table below, support the conclusion of Head and Mayer (2014): the GPML and PPML
94 estimates are similar, then the model is well specified and is approximately log-normal with a
95 constant parameter.

96 [Table A.4 about here]

97

[1] The 48 RTAs described in the OECD study consider the EU as a unique trade partner: we thus consider the same aggregation. It is also worth noting that intra-EU trade is not impacted by SPS measures. Indeed, the EU applies the principle of mutual recognition on SPS measures, according to which Member States do not need to comply with a SPS measure of the destination (non-member) country but only to prove that the SPS measure in the origin country (i.e., EU) is equivalent (European Commission 2002; Disdier et al. 2008).

[2] We started from the OECD study (2011) to select the sample of countries to be included in the analysis. We selected all the 38 countries involved in the 48 RTAs analysed in OECD (2011). We collected information (e.g., trade data, SPS data, data on belonging to RTAs) for these countries over the period 1997-2017. The Regional Trade Agreements Information System (RTA-IS) provides information on RTAs that have either been notified to the WTO, or for which an early announcement has been made. The RTA-IS makes available information on (i) coverage of the agreement (goods or services), (ii) type of the agreement (Custom Union, Free Trade Agreement, Partial Scope Agreement), (iii) year of entry into force and year of end of implementation, (iv) signatory countries and involved regions. According to RTA-IS data, selected countries are involved in 41% of the RTAs currently in force. However, our analysis focuses only on the 48 RTAs in OECD (2011).

[3] Some of the country-pairs share trade agreements; some others do not share trade agreements. For instance, Australia and Singapore have an RTA in place, vice-versa Singapore does not share an agreement with Canada; however, trade relationships between Canada and Singapore are analysed in the first part of the study. This allowed us to discriminate between signatories and non-signatories of RTAs. We retrieved information on the belonging to RTAs from the RTA-IS. The information collected is time-specific: a dummy takes the value 1 the year in which a country enters in a certain RTA (0 otherwise). This variable allowed us to discriminate between signatories and non-signatories of RTAs considering the year of entry into force of the agreements. Starting from this information we also obtained the samples of signatories and non-signatories of RTAs regardless of the year of entry into force of the agreements: a dummy takes the value 1 if a country shares at least an RTA over the whole period (0 otherwise).

[4] This choice is driven by the availability of information on SPS provisions and regulatory cooperation embedded in RTAs. For each RTA considered in OECD (2011), a dummy variable identifies the specific country-pair involved in the agreement, starting from the year of entry into force of the agreement. Information about the year of entry into force of RTAs have been collected from RTA-IS database: dummies are not limited by a specific year if the RTA entered into force before 1997 (e.g., Mexico and Colombia, NAFTA), or the year of entry into force of the RTA is not available in RTA-IS (e.g., MERCOSUR and Andean Community, MERCOSUR and Peru). Similarly, a dummy variable for each of the agreements identifies the specific country-pair involved in each agreement, regardless of the year of entry into force of the RTA: this allows us to identify countries that tend to sign agreements with their trading partners.

[5] As suggested in Baldwin and Taglioni (2006, p. 13), *"there is an old tradition in the gravity literature of using only import data on the grounds that nations spend more on measuring imports than exports"*.

[6] Recall that bilateral SPS measures are country-pair specific, whereas multilateral SPS measures are implemented by a country against all its trading partners.

[7] The table A.1 provides a more in-depth description of SPS-commitments in RTAs included in the empirical analysis.

[8] The development and application of SPS measures should follow five basic principles: harmonisation, equivalence, assessment of ris, regionalisation, transparency.

98 **Box 1. Parts of the EU-Chile Agreement containing provisions for SPS measures**

Part III (Cooperation), Title I (Economic Cooperation), art. 24 (Cooperation on agriculture and rural sectors and sanitary and phytosanitary measures):

1. *Cooperation in this area is designed to support and stimulate agricultural policy measures in order to promote and consolidate the Parties' efforts towards a sustainable agriculture and agricultural and rural development.*
2. *The cooperation shall focus on capacity-building, infrastructure and technology transfer, addressing matters such as:*
   a) *specific projects aimed at supporting sanitary, phytosanitary, environmental and food quality measures, taking into account the legislation in force for both Parties, in compliance with WTO rules and other competent international organisations;*
   b) *diversification and restructuring of agricultural sectors;*
   c) *the mutual exchange of information, including that concerning the development of the Parties' agricultural policies;*
   d) *technical assistance for the improvement of productivity and the exchange of alternative crop technologies;*
   e) *scientific and technological experiments;*
   f) *measures aimed at enhancing the quality of agricultural products and supporting trade promotion activities;*
   g) *technical assistance for the strengthening of sanitary and phytosanitary control systems, with a view to supporting as far as possible the promotion of equivalence and mutual recognition agreements.*

Part IV (Trade and trade-related matters), Title II (Free movement of goods), Chapter II (Non-tariff measures), Section 5 (Sanitary and Phytosanitary Measures), art. 89 (Sanitary and phytosanitary measures):

1. *The objective of this section is to facilitate trade between the Parties in the field of sanitary and phytosanitary legislation, whilst safeguarding public, animal and plant health by further implementing the principles of the WTO on the Application of Sanitary and Phytosanitary Measures ('the WTO SPS Agreement'). An additional objective of this section is to consider animal welfare standards.*
2. *The objectives of this section are pursued through the 'Agreement on Sanitary and Phytosanitary Measures Applicable to Trade in Animals and Animal Products, Plants, Plant Products and other Goods and Animal Welfare', which is attached as Annex IV.*
3. *By way of derogation from Article 193, the Association Committee, when dealing with sanitary or phytosanitary measures, shall be composed of representatives of the Community and Chile with responsibility for sanitary and phytosanitary matters. This Committee shall then be called the 'Joint Management Committee for Sanitary and Phytosanitary Matters'. The functions of the Committee are set out in Article 16 of Annex IV.*
4. *For the purpose of Article 184, consultations held under Article 16 of Annex IV shall be deemed to constitute the consultations referred to in Article 183, unless the Parties decide otherwise.*

Annex IV (Referred to in Article 89(2) of the Association Agreement)

Agreement on sanitary and phytosanitary measures applicable to trade in animals and animal

products, plants, plant products and other goods and animal welfare

Objective (art. 1)

Multilateral obligations (art. 2)

Scope (art. 3)

Definitions (art. 4)

Competent authorities (art. 5)

Recognition for trade of animal health and pest status and regional conditions (art. 6)

A. *Recognition of status for animal diseases, infections in animals or pests*

B. *Recognition of regionalization*

Determination of equivalence (art. 7)

Transparency and trade conditions (art. 8)

Certification procedures (art. 9)

Verification (art. 10)

Import checks and inspection fees (art. 11)

Information exchange (art. 12)

Notification and consultation (art. 13)

Safeguard clause (art. 14)

Outstanding issues (art. 15)

Joint Management Committee (art. 16)

Facilitation of communication (art. 17)

Territorial application (art. 18)

Annex V (Referred to in Article 90 of the Association Agreement)

Agreement on trade in wines

Title IV (Sanitary and phytosanitary measures), art. 26 (Sanitary and phytosanitary measures):

1. *The provisions of this Agreement are without prejudice to the right of the Parties to apply sanitary and phytosanitary measures necessary for the protection of human, animal or plant life or health, provided that such measures are compatible with the provisions of the WTO SPS Agreement and of the Agreement on Sanitary and Phytosanitary Measures applicable to Trade in Animals and Animal Products, Plants, Plant Products and other Goods and Animal Welfare, set out in Annex IV of the Association Agreement.*
2. *Without prejudice to paragraph 1, each Party shall endeavour to inform the other Party under the procedures set out in Article 29 at the earliest reasonable opportunity of developments which could lead, in relation to wine marketed in that Party, to the adoption of such measures, especially those concerning the setting of specific limits on contaminants and residues with a view to agreeing a common approach.*

Annex VI (Referred to in Article 90 of the Association Agreement)

Agreement on trade in spirit drinks and aromatised drinks

Title II (Sanitary and phytosanitary measures), art. 13 (Sanitary and Phytosanitary Measures):

1. *The provisions of this Agreement shall be without prejudice to the right of the Parties to take sanitary and phytosanitary measures necessary for the protection of human, animal or plant life or health, provided that such measures are not incompatible with the provisions of the WTO SPS Agreement and of the Agreement on Sanitary and Phytosanitary Measures applicable to Trade in Animals and Animal Products, Plants, Plant Products and other Goods and Animal Welfare, set out in Annex IV of the Association Agreement.*

2. *Without prejudice to paragraph 1, each Party shall endeavour to inform the other Party, under the procedures set out in Article 19 and at the earliest reasonable opportunity of developments which could lead, in relation to spirit drinks and aromatised drinks marketed in that Party, to the adoption of such measures, especially those concerning the setting of specific limits on contaminants and residues with a view to agreeing a common approach.*

99

100 **Table A.1. List of RTAs analysed in OECD (2011) and related SPS-specific commitments provided in RTAs**

RTA	Year of entry into force (RTA-IS)	SPS chapter (**A**)	Harmonisation (**B**)	Equivalence (**C**)	Regionalisation (**D**)	Assessment of risk (**E**)	Transparency (**F**)	Joint Committee (**G**)	Mutual Recognition (**H**)
AUS-SGP	2003	Yes	Yes	Plus WTO-SPS	Yes	Yes	Plus WTO-SPS	Yes	Yes
AUS-THA	2005	Yes	Yes	Plus WTO-SPS	Yes	Yes	Yes	SPS issues	No
AUS-USA	2005	Yes	Yes	Yes	Yes	Yes	Yes	SPS issues	No
CAN-PER	2009	Yes	Yes	Yes	Yes	Yes	Yes	SPS issues	No
CentralAmerica-CHL[a]	2002	Yes	Yes	Yes	Yes	Plus WTO-SPS	Yes	SPS issues	No
CHL-CHN	2006	Yes	Yes	Yes	Yes	Yes	Plus WTO-SPS	SPS issues	No
CHL-EUN	2003	Yes	Plus WTO-SPS	Plus WTO-SPS	Plus WTO-SPS	Yes	Plus WTO-SPS	SPS issues	Yes
CHL-KOR	2004	Yes	Yes	Yes	Plus WTO-SPS	Yes	Plus WTO-SPS	SPS issues	No
CHL-MEX	1999	Yes	Plus WTO-SPS	Yes	Plus WTO-SPS	Yes	Plus WTO-SPS	SPS issues	No
CHL-PER	2009	Yes	Plus WTO-SPS	Yes	Plus WTO-SPS	Yes	Plus WTO-SPS	SPS issues	No
CHN-NZL	2008	Yes	Yes	Plus WTO-SPS	Plus WTO-SPS	Plus WTO-SPS	Plus WTO-SPS	SPS issues	No
MERCOSUR-AndeanCommunity[b]	n.a.	Yes	Plus WTO-SPS	Plus WTO-SPS	Plus WTO-SPS	Plus WTO-SPS	Plus WTO-SPS	Yes	No
MERCOSUR-PER	n.a.	Yes	Plus WTO-SPS	Plus WTO-SPS	Yes	Plus WTO-SPS	Plus WTO-SPS	Yes	No
MEX-COL	1995	Yes	Yes	Yes	Yes	Plus WTO-SPS	Plus WTO-SPS	SPS issues	No
MEX-CRI	2012	Yes	Yes	Yes	Yes	Yes	Plus WTO-SPS	SPS issues	No
MEX-NIC	n.a.	Yes	Plus WTO-SPS	Yes	Plus WTO-SPS	Yes	Plus WTO-SPS	SPS issues	No
MEX-NorthernTriangle[c]	2012	Yes	Plus WTO-SPS	Yes	Plus WTO-SPS	Plus WTO-SPS	Plus WTO-SPS	SPS issues	Yes

MEX-PER	2012	Yes	Yes	Yes	Yes	Yes	Yes	SPS issues	No
MEX-URY	2004	Yes	Yes	Yes	Plus WTO-SPS	Plus WTO-SPS	Plus WTO-SPS	SPS issues	No
NAFTA[d]	1994	Yes	Yes	Plus WTO-SPS	Yes	Yes	Plus WTO-SPS	SPS issues	No
NZL-SGP	2001	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
NZL-THA	2005	Yes	Yes	Yes	Yes	Yes	Plus WTO-SPS	SPS issues	No
PER-THA	n.a.	Yes	Yes	Yes	Yes	Yes	Plus WTO-SPS	SPS issues	No
AUS-CHL	2008	Limited	Yes	Yes	Yes	Yes	Yes	No	No
CAFTA[e]	2006	Limited	Yes	Yes	Yes	Yes	Yes	SPS issues	No
CAN-CRI	2002	Limited	Yes	Yes	Yes	Yes	Yes	SPS issues	No
CHL-JPN	2007	Limited	Yes	Yes	Yes	Yes	Yes	SPS issues	No
CHL-USA	2004	Limited	Yes	Yes	Yes	Yes	Yes	SPS issues	No
EFTA-CHL[f]	2004	Limited	Yes	Yes	Yes	Yes	Yes	No	No
KOR-SGP	2006	Limited	Yes	Yes	Yes	Yes	Yes	No	No
MERCOSUR-BOL	n.a.	Limited	Yes	Yes	Yes	Yes	Yes	No	Yes
MERCOSUR-CHL	2017	Limited	Yes	Yes	Yes	Yes	Yes	No	Yes
MEX-BOL	n.a.	Limited	Yes	Yes	Yes	Yes	Plus WTO-SPS	SPS issues	No
MEX-EFTA	2001	Limited	Yes	Yes	Yes	Yes	Yes	No	No
MEX-EUN	2000	Limited	Yes	Yes	Yes	Yes	Yes	SPS issues	No
MEX-JPN	2005	Limited	Yes	Yes	Yes	Yes	Yes	SPS issues	No
P4[g]	n.a.	Limited	Yes	Plus WTO-SPS	Yes	Yes	Plus WTO-SPS	SPS issues	No
TUR-EGY	2007	Limited	Yes	Yes	Yes	Yes	Yes	No	No
USA-COL	2012	Limited	Yes	Yes	Yes	Yes	Yes	SPS issues	No
USA-MAR	2006	Limited	Yes	Yes	Yes	Yes	Yes	SPS issues	No

USA-PER	2009	Limited	Yes	Yes	Yes	Yes	Yes	SPS issues	No
CHL-CAN	1997	No	No	No	No	No	No	No	No
CHN-HKG	2003	No	No	No	No	No	No	No	No
EFTA-TUR	1992	No	No	No	No	No	No	No	No
EUN-EGY	2004	No	No	No	No	No	No	No	No
EUN-ZAF	2000	No	No	No	No	No	No	No	No
JPN-THA	2007	No	No	No	No	No	No	No	No
USA-SGP	2004	No	No	No	No	No	No	No	No

Notes: '*Yes'* means that the RTA has a chapter on SPS measures, or commitments on SPS basic principles, or a joint Committee, or provides for mutual recognition ('*No'* otherwise); '*Limited'* means that the RTA has a chapter on SPS measures limited to few paragraphs reaffirming rights and obligations set in the WTO SPS Agreement; '*Plus WTO'* means that the RTA assumes commitments on SPS basic principles beyond the WTO SPS Agreement; *'SPS issues'* means that the RTA has a joint Committee working on SPS issues. Acronyms are Australia (AUS), Singapore (SGP), Thailand (THA), United States (USA), Canada (CAN), Peru (PER), Chile (CHL), China (CHN), European Union (EUN), Korea (KOR), Mexico (MEX), New Zealand (NZL), Colombia (COL), Costa Rica (CRI), Nicaragua (NIC), Uruguay (URY), Japan (JPN), Bolivia (BOL), Turkey (TUR), Egypt (EGY), Morocco (MAR), Hong Kong (HKG).

[a] Countries of the group of Central America shared agreements with CHL staggered over time: CRI and SLV since 2002, HND since 2008, GTM since 2010, NIC 2012.

[b] MERCOSUR involves ARG, BRA, PAR, URY, VEN, BOL, CHL, PER, COL, ECU; Andean Community involves BOL, COL, ECU, PER.

[c] Northern Triangle involves GTM, HND, SLV.

[d] NAFTA involves USA, CAN, MEX.

[e] CAFTA involves CRI, SLV, GTM, HND, NIC.

[f] EFTA involves ISL, NOR, CHE.

[g] P4 involves CHL, NZL, SGP, BRN.

Table A.2. Average values of dependent variable and regressors

Variable	Type	All countries	Signatories of RTAs (14% of the sample)
Imports (billion US$)	Numerical [0; 27][a]	0.24 (±1.23)	0.48 (±1.99)
SPS measures	Dummy [0, 1]	0.65 (±0.48)	0.87 (±0.33)
Bilateral SPS measures	Dummy [0, 1]	0.20 (±0.40)	0.36 (±0.48)
No/limited cooperation in SPS chapter	Dummy [0, 1]	n.a.	0.40 (±0.49)
Harmonisation	Dummy [0, 1]	n.a.	0.30 (±0.46)
Equivalence	Dummy [0, 1]	n.a.	0.38 (±0.48)
Regionalisation	Dummy [0, 1]	n.a.	0.32 (±0.47)
Assessment of risk	Dummy [0, 1]	n.a.	0.32 (±0.46)
Transparency	Dummy [0, 1]	n.a.	0.46 (±0.50)
Committee on SPS issues	Dummy [0, 1]	n.a.	0.35 (±0.48)
Technical cooperation on SPS issues	Dummy [0, 1]	n.a.	0.27 (±0.44)
Mutual recognition	Dummy [0, 1]	n.a.	0.12 (±0.32)

Notes: Standard deviations are in parentheses; minimum and maximum values are in brackets.

[a] Zero trade flows are 15% for all countries, 3% for the subsample of signatories of RTAs.

[b] Descriptive statistics for SPS-specific commitments provided in RTAs are not available (n.a.) for all countries, but only for the subsample of signatories of RTAs.

Table A.3. Effects of SPS measures on trade between non signatories and signatories of RTAs regardless of (A) and considering (B) the year of entry into force of the agreements

	Non-signatories of RTAs		Signatories of RTAs	
Variables	(A)	(B)	(A)	(B)
Bilateral SPS measures	-0.378 ***	-0.380 ***	-0.021	-0.006
	(0.113)	(0.109)	(0.046)	(0.046)
Multilateral SPS measures	-0.458 ***	-0.455 ***	-0.304 ***	-0.299 ***
	(0.088)	(0.086)	(0.057)	(0.056)
Observations	19,670	19,670	9,431	9,431

Notes: Gamma Pseudo Maximum Likelihood (GPML) estimation of the equation (2). The dependent variable is the value of imports (in level). The explanatory variables are modelled as dummy variables. Bilateral SPS measures are 20% for non-signatories and 36% for signatories of RTAs. All specifications include a constant, importer, time, exporter-time, and country-pair fixed effects. Robust standard errors are in parentheses.

*** Significant at the 1 percent level.

Table A.4. Effects of SPS measures on trade between non signatories of RTAs

Variables	Non-signatories of RTAs	
	(1)	(2)
	GPML	PPML
Bilateral SPS measures	-0.378 ***	-0.378 ***
	(0.113)	(0.0.38)
Multilateral SPS measures	-0.458 ***	-0.458 ***
	(0.088)	(0.034)
Observations	19,670	19,670

Notes: Estimation of the equation (2) through Gamma Pseudo Maximum Likelihood (GPML) and Poisson Pseudo Maximum Likelihood (PPML) estimators. The dependent variable is the value of imports (in level). The explanatory variables are modelled as dummy variables. Bilateral SPS measures are 20% for non-signatories and 36% for signatories of RTAs. All specifications include a constant, importer, time, exporter-time, and country-pair fixed effects. Robust standard errors are in parentheses.

*** Significant at the 1 percent level.

Table A.5. Number of STC, percentage of STC resolved, average speed of resolution between signatories of RTAs without and with additional commitments on SPS principles

SPS principles	RTAs without additional commitments on SPS principles			RTAs with additional commitments on SPS principles		
	Total STC	Resolved	Avg. speed of resolution	Total STC	Resolved	Avg. speed of resolution
Harmonisation	192	38%	13 years	53	21%	10 years, 1 quarter
Equivalence	4	0%	-	28	57%	15 years
Regionalisation	89	65%	12 years, 2 quarters	0	-	-
Risk assessment	95	33%	7 years	26	100%	14 years, 3 quarters
Transparency	0	-	-	21	100%	16 years

Source: elaboration on data from SPS IMS.