Received: 30 June 2021 | Accepted: 4 March 2022

DOI: 10.1002/aepp.13276

FEATURED ARTICLE

Standards and regulatory cooperation in regional trade agreements: What the effects on trade?

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Editor in charge: Stefano Boccaletti

Abstract

The agenda of trade negotiation in the agri-food sector is characterized 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 World Trade Organization 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

agri-food, RTA, SPS measure, trade policy

JEL CLASSIFICATION

F13, O24, Q17

The agenda of trade negotiation is characterized 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 & 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, harmonization 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 & 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 liberalization 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 & Boys, 2012; Lejárraga & 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 World Trade Organization (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 organizations, 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 favoring 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 & 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 & Bergstrand, 2007; Lambert & McKoy, 2009; Sun & 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 favoring or limiting market access with respect to the multilateral non-discriminatory trade liberalization. The effects on trade tend to depend on the extent to which the RTAs are able to improve transparency, harmonization, 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 & 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, harmonizing regulations would increase trade of crop products. Similarly, Schmidt and Steingress (2019) show that the introduction of harmonized 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 harmonization 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 & 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 harmonization 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 liberalization and intellectual property protection commitments (Dhingra et al., 2021; Mattoo et al., 2020).

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 from transparency provisions in RTAs. Disdier et al. (2015) analyze the trade effects of provisions for technical regulations within economic integration agreements involving partners with different levels of economic development. Their results reveal that the harmonization of regional standards negatively impacts exports of developing countries to developed countries. However, the study pays attention to technical barriers to trade, thus nothing can be argued on SPS measures. The OECD study (, 2011) examines agreements' chapters on SPS measures and finds that only a few RTAs contain specific commitments that go beyond the core principles set in the WTO Agreement on the application of SPS measures. The study provides an interesting qualitative synthesis of SPS-specific provisions in RTAs, but the effects on trade are not investigated. We focus on underinvestigated aspects: how the SPS measures and the provisions embedded in the trade agreements are related, and how these connections impact on trade.

The contribution of our study is at least two-fold. First, we show the different trade effects that the standards provided in the SPS measures have on signatories and non-signatories of RTAs. This contribution adds value to the debate on the effects of the SPS measures in relation to the trade agreements. The WTO principles recall that the SPS measures tend to be country-specific agreements. This tendency increases the number of SPS measures and the requirements to comply with (Cadot & Gourdon, 2016), with effects that are difficult to be fully forecasted prior the implementation of the measures.

A second contribution of our research is to assess the effects of intra-RTAs regulatory cooperation efforts. In fact, while SPS-specific commitments negotiated in a more versatile framework, such as RTAs, may facilitate the compliance with standards and, thus, the achievement of the adequate levels of safety required by trading partners (Lejárraga & Shepherd, 2013), it is not always true that negotiations lead to a successful outcome.

In the next Section we analyze 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 liberalization and related rules, more recent and complex RTAs develop more integrated unions, harmonizing domestic and non-tariff policies (Grant, 2013). RTAs aim at favoring 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 favorable market-access conditions. Accordingly, the effects of RTAs on trade liberalization may be diverse: RTAs are designed to benefit signatory countries, however expected benefits may be undercut without minimizing 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

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

METHODOLOGICAL FRAMEWORK

We adopt a gravity-based approach to observe how standards and regulatory cooperation within RTAs affect the level of imports between country-pairs. The gravity model of trade is one of the most effective frameworks used in the international trade literature to quantify the effects of trade policies (Yotov et al., 2016). Based on solid theoretical foundations (for a review see Costinot & Rodríguez-Clare, 2014), this structural model allows to capture the linkages 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 & Van Wincoop, 2003), we explain bilateral trade flows, X_{ijt}, with the following structural gravity system:

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

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 γZ_{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:

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

where imports of i from j at time t, $\ln(X_{ijt})$, 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 & 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 that 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 & 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 & 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 modeled 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 & 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: $\mathrm{TVE} = \left(\widehat{e^{\gamma}} - 1\right) * 100$, where $\widehat{\gamma}$ 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 liberalization of trade (Disdier

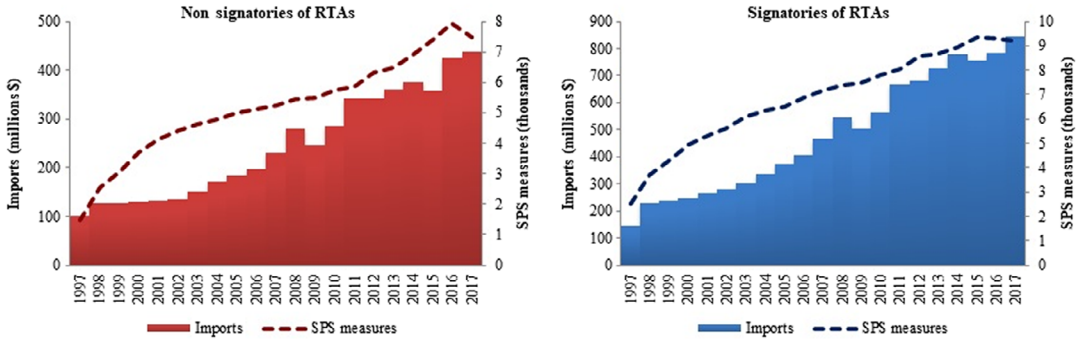

FIGURE 1 Trends in average import values and number of SPS measures of non-signatories and signatories of RTAs (regardless of the year of entry into force of RTAs). Source: elaboration on data from UN Comtrade and UNCTAD. RTA, Regional Trade Agreement; SPS, sanitary and phytosanitary [Color figure can be viewed at wileyonlinelibrary.com]

et al., 2015). Regulatory cooperation frequently covers standards provided in SPS measures, although with high heterogeneity across different RTAs.

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 half of the analyzed 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 harmonize their national measures on the international standards (principle of harmonization); 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, Appendix S1). 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

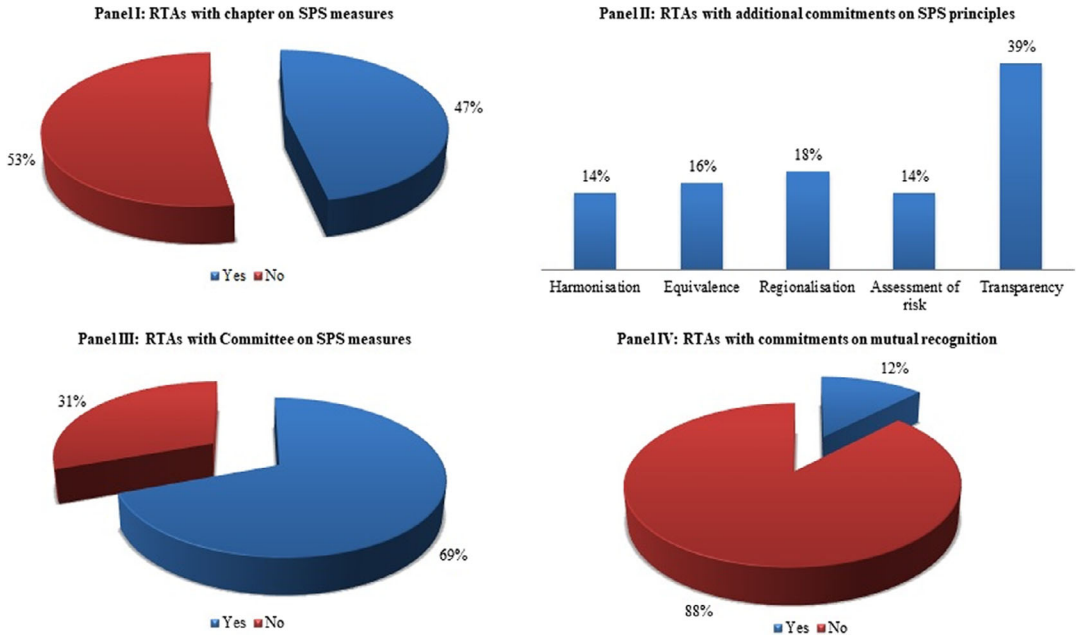

FIGURE 2 Commitments on standards provided in RTAs. Source: elaboration on data from OECD (2011). RTA, Regional Trade Agreement [Color figure can be viewed at wileyonlinelibrary.com]

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 S1.

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 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.[12]

Overall, bilateral and multilateral SPS measures are trade barriers, but differences are observed between signatories and non-signatories of RTAs (column (1), Table 1). The results for non-signatories of RTAs provide evidence that SPS measures, both bilateral and multilateral, hinder trade between countries that tend to not be part of RTAs. The trade volume effects reported in Table 3 suggest that, on average, the value of imports reduces by 31.45% with a SPS measure implemented between trading partners on a country-pair basis and by 36.73% with a multilateral SPS measure. In absolute value, the impact on import values is much greater for multilateral rather than for bilateral SPS measures: the introduction of a SPS measure that applies to all trading partners has a stronger impact than SPS measures defined on a country-pair basis.

Our results complement the findings of Crivelli and Gröschl (2016) who conclude that multilateral SPS measures exert a negative impact on the intensive margin of trade for all potential trading partners.

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	9431

Note: Gamma Pseudo Maximum Likelihood (GPML) estimation of the Equation (2). The dependent variable is the value of imports (in level). The explanatory variables are modeled 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.

Abbreviations: RTA, Regional Trade Agreement; SPS, sanitary and phytosanitary.

***Significant at the 1% level.

We notice that the introduction of multilateral SPS measures is associated with a negative effect on both non-signatories and signatories of RTAs; in absolute value, the effect is higher on the former than on the latter. For the sample of signatories of RTAs, the trade volume effect of multilateral SPS measures suggests a reduction of 26.24% in the value of imports (Table 3). Differently, the trade response of signatories of RTAs to bilateral SPS measures is null (the estimated coefficients, reported in column (3) of Table 1, is not statistically significant).

Similarly, Ferro et al. (2015) show that, for existing trade relationships, the trade effect is indistinguishable from zero: once a country adjusts its production to comply with the standards of a trading partner, those standards tend to not impact the intensity of trade between them. Being part of deep trade agreements tends to reduce difficulties related to the compliance with SPS measures (Murina & Nicita, 2017). Allowing for the harmonization of domestic and non-tariff policies (Grant, 2013), deep trade agreements provide technical assistance to enhance the competitiveness of signatories operating in markets where the stringency of SPS measures and the costs of compliance are high (Henson & Jaffee, 2008; Hoekman, 2002; Murina & Nicita, 2017). In line with our hypothesis that being part of RTAs may help in reducing the negative effect of standards on trade we noted that, for instance, the number of specific trade concerns raised on SPS issues is about four times lower for signatories of RTAs. Overall, 47% of all SPS specific trade concerns between signatories are reported as being resolved, as compared with 34% of concerns regarding SPS issues between non-signatories (Table 2). The discussion of SPS issues and the monitoring and harmonizing efforts as well—a standard practice for countries adhering to the WTO SPS Agreement (Grant & Arita, 2016)—seems a critical and well-functioning mechanism for signatories of RTAs.

The results suggest changes in the level of imports due to the adoption of a SPS measure. But how do these trade volume effects compare to observable changes in import values? To answer 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% points, equivalent to an average of −73 million US$ (−137 million US$ in 2017 only). Differently, given the average implied decrease of 36.73% points associated with the introduction of a multilateral SPS measures, the

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		1730	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.

Note: Of the total STC between non-signatories, 588 are resolved and 1142 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.

Abbreviations: RTA, Regional Trade Agreement; SPS, sanitary and phytosanitary.

TABLE 3 Marginal impacts of SPS measures on import values between signatories and 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

Note: Trade volume effect computed on (statistically significant) coefficients derived from the Gamma Pseudo Maximum Likelihood (GPML) estimation of the Equation (2). The average import value is 233 million US$ for non-signatories and 251 million US$ for signatories. The average imports in million of 2017 US$ are 437 for non-signatories and 421 for signatories. Bilateral SPS measures are 17% for non-signatories and 26% for signatories of RTAs.
Abbreviations: RTA, Regional Trade Agreement; SPS, sanitary and phytosanitary.

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).

Being part of an RTA contributes significantly more to higher import values as compared with 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 jeopardize the trade creating benefits of regionalism. Indeed, it is frequent that all NTMs, 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 & 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 & Lamonaca, 2022), 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 is 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.

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.

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.

Considering the core SPS principles, imports are negatively correlated with more stringent provisions on harmonization; not significant effects are found for other SPS principles. The results reveal that additional commitments on harmonization specifying the steps and/or timeframe to establish, recognize, 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

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)			
Harmonization		−1.035***		
		(0.191)		
Equivalence		0.134		
		(0.156)		
Assessment of risk		0.468		
		(0.369)		
Regionalization		0.080		
		(0.124)		
Transparency		0.560		
		(0.360)		
Committee on SPS issues			0.183**	
			(0.077)	
Technical cooperation on SPS issues			0.342*	
			(0.175)	
Mutual recognition				0.047
				(0.060)
Observations	4125	4125	4125	4125

Note: Gamma Pseudo Maximum Likelihood (GPML) estimation of the Equation (2). The dependent variable is the value of imports (in level). The explanatory variables are modeled 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.

Abbreviations: RTA, Regional Trade Agreement; SPS, sanitary and phytosanitary.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

trade distortionary effect of more stringent provisions on harmonization 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 harmonization 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 harmonization of standards between signatories. An example is the joint strategy to harmonize standards for bovine spongiform encephalopathy measures in North America adopted by signatories of the NAFTA. The strategy provides for a set of minimum standards that signatory countries

TABLE 5 Marginal impacts of regulatory cooperation on import values between signatories of RTAs

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

Note: Trade volume effect computed on (statistically significant) coefficients derived from the Gamma Pseudo Maximum Likelihood (GPML) estimation of the Equation (2). The average import value for signatories of RTAs in OECD (2011) is 483 million US$ across years and 846 in 2017. Bilateral SPS measures are 36%.
Abbreviations: RTA, Regional Trade Agreement; SPS, sanitary and phytosanitary.

TABLE 6 Number of STC and speed of resolution for signatories of RTAs without and with 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

Source: Elaboration on data from SPS IMS.
Note: Of the total STC between signatories of RTAs without additional commitments on SPS, 54 are resolved and 76 are partially resolved. Of the total STC between signatories of RTAs with additional commitments on SPS, 135 are resolved and 89 are partially resolved. The inter quartile range of the speed of resolution is 8 years for signatories of RTAs without additional commitments on SPS and 6 years for signatories of RTAs with additional commitments on SPS.
Abbreviations: RTA, Regional Trade Agreement; SPS, sanitary and phytosanitary.

(i.e., Canada, Mexico, the United States) should propose for consideration to the national authorities. The harmonized system does not require the monitoring of cross-shipping between signatories. Thus, if the failure to implement the harmonized 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 harmonization of standards and the benefits in trade terms (Sparling & 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).

As argued in Çakır et al. (2018), RTAs establishing an SPS committee with the objectives of enhancing the implementation of SPS measures, and the communication and coordination on SPS issues, such as NAFTA, TTP, or TTIP, contributed to avoid the disruption of the US turkey industry during the avian flu outbreak in the United States in 2015. Without such RTAs that facilitate technical cooperation on SPS issues between trading partners, the implementation of

SPS measures in 2015 to face the avian flu outbreak would have caused more economic losses to the US turkey producers. Indeed, periodic consultations in RTAs contribute to contain trade costs associated with SPS issues (Beghin & Schweizer, 2020),

MAIN CONCLUSIONS AND IMPLICATIONS

The objective of this study was to provide empirical evidence on the effects that standards and regulatory cooperation within the RTAs tend to have on trade relationships.

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

Regional Trade Agreements 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 & 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 20%. 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 maximize the coordination efforts, the trade agreements should tend to be inclusive, simple, and with shared rules.

ACKNOWLEDGMENTS

The authors are grateful to Charlotte Emlinger, Dela-Dem Doe Fiankor, and to the seminar audiences at the 2019 IATRC Symposium, the 2019 IATRC Meeting, the 13th Annual AAWE Conference, the 175 EAAE Seminar for helpful comments. Open access funding enabled and organized by Projekt DEAL. Open access funding enabled and organized by Projekt DEAL.

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ENDNOTES

[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 & Arita, 2017, p. 6). In fact, according to the definition proposed in the World Trade Organization (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 & 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. $X_{ijt} = \alpha + \boldsymbol{\beta}_{it}(k_{it}) + \boldsymbol{\beta}_{jt}(k_{jt}) + \left(\boldsymbol{\beta}_{ij} + \boldsymbol{\gamma}\boldsymbol{Z}_{ijt}\right)(k_{ij}) + \varepsilon_{ijt}$.
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 S1). The GPML and PPML estimates are similar, then the model is well specified and is approximately log-normal with a constant parameter (Head & 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 favor the creation of intra-bloc trade (e.g. Jayasinghe & Sarker, 2008; Sarker & Jayasinghe, 2007; Sun & Reed, 2010).

[14] According to the WTO SPS Agreement, the development and application of SPS measures should follow five basic principles: harmonization (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 S1 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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How to cite this article: Santeramo, Fabio Gaetano, and Emilia Lamonaca. 2022. "Standards and Regulatory Cooperation in Regional Trade Agreements: What the Effects On Trade?."*Applied Economic Perspectives and Policy* 1–20. https://doi.org/10.1002/aepp.13276