The role of non-tariff measures in the agri-food sector: positive or negative instruments for trade?

Santeramo, Fabio Gaetano and Lamonaca, Emilia

University of Foggia (Italy), University of Foggia (Italy)

2019

The role of non-tariff measures in the agri-food sector: positive or negative instruments for trade?

Fabio G. Santeramo*

Emilia Lamonaca*

Contents

Abstract

The contribution shows the state of the art of "trade and non-tariff measures" debate in the agri-food sector. It provides an overview on trends in trade and in the level of policy interventions over the last decades, in order to shed lights on potential cause-effect relations. Comparing the evolution of trade and of non-tariff measures (NTMs) in agri-food sector, it appears that the pervasiveness of NTMs is likely to be strictly related to changes in trade patterns. Although the main scope of NTMs is to correct market inefficiencies, they may have a two-fold role: trade catalysts or trade barriers. The potential relationships between trade and NTMs, however, differ across involved countries, products under regulation, and types of measure. Indeed, evidence from the empirical literature support either the "standards as catalysts" and the "standards as barriers" points of view. Our contribution aims at outlining how NTMs and trade influence each other.

A revised version of the present paper will appear in a chapter of the European Yearbook of International Economic Law.

Suggested citation: Santeramo F.G., Lamonaca E. (2020) The Role of Non-tariff Measures in the Agri-Food Sector: Positive or Negative Instruments for Trade?. In: Krämer-Hoppe R. (eds) Positive Integration - EU and WTO Approaches Towards the "Trade and" Debate. European Yearbook of International Economic Law. Springer, Cham.

* Fabio G. Santeramo
University of Foggia, Via Napoli 25, 71122 - Italy
e-mail: fabio.santeramo@unifg.it
* Emilia Lamonaca
University of Foggia, Via Napoli 25, 71122 - Italy
e-mail: emilia.lamonaca@unifg.it

1 Introduction

International agri-food trade is a priority area due to a set of important policy questions that need to be deepened. Although most of the driving forces of agri-food markets are not new, the implications of trade policy issues are frequently substantial, redistributive and pervasive[1]. Therefore, understanding the dynamics of agri-food trade, and of related trade policies, has become a topic of utmost importance for policymakers and for applied economists.

Despite its small and declining importance in the global economy, agri-food market is politically sensitive and highly contentious in international trade negotiations[2]. The political sensitiveness of agri-food trade is related to the complex dynamics that occur among involved stakeholders: trade allows specialisation, and thus comparative advantages, of producers, and provides a wider and diversified range of products to consumers[3]. The frequent disputes arising in international negotiations for agri-food trade are due to the high levels of protection: as a consequence, trade distortions in agri-food sector are exceptional and highly controversial relative to those in other sectors[4].

The trade policy agenda is greatly different from that over the past 25 years. The main reason is the emergence of trade policy issues to be addressed at national and regional levels. The recent period of relative openness to trade of agri-food markets has contributed to a substantial redistribution of market shares and levels of protection from developed to developing countries. The main challenge of policymakers is to obtain an *optimum* for all countries, given the trade gains reached from international negotiations[5]. In this regard, the risk is to incur in high protection and strong political support at domestic level, which may be suboptimal at global level[6].

In recent years, much of the attention of the international political agenda is on the trade disputes that gravitate towards agri-food support, protection, and market access. Indeed, the long-lasting protection of domestic agri-food markets has determined severely distortions at national and international levels. The consequent delay in development of agri-food sector has contributed to a growing pressure for reforming agri-food policies. The crucial and complex set of negotiations of the World Trade Organisation (WTO), in the mid-1990s, has attempted to liberalise trade and to create a trade policy environment, characterised by a more sustainable growth and a less government intervention.

The negotiations of the WTO has increased opportunities of market access, by lowering traditional barriers to trade (i.e., tariffs). However, growing concerns have been raised on the proliferation of non-tariff measures (NTMs) and on their potential impacts on trade performances[7]. Although the main scope of NTMs is to correct market inefficiencies, they may have a two-fold role: trade catalysts or trade barriers[8]. For instance, if Panel and Appellate Body reports or the ECJ judgements are in favour of non-integration, the national regulation may hamper trade and vice-versa. The potential of having both negative and positive effects on trade may explain the move

[1] Martin, 2018.
[2] Anderson and Martin, 2005.
[3] Martin, 2018.
[4] Trebilcock and Pue, 2015.
[5] Bagwell and Staiger, 2011.
[6] Anderson and Nelgen, 2012; Ivanic and Martin, 2014.
[7] Fernandes et al., 2017.
[8] Xiong and Beghin, 2014.

from non-tariff barriers (a more restrictive definition) to non-tariff measures. Thus, non-tariff trade policies may have both potential winners and losers: while many countries benefit from trade liberalisation, others may suffer considerable loss. Understanding what are the policy implications of such changes is essential in order to identify positive and negative perspectives.

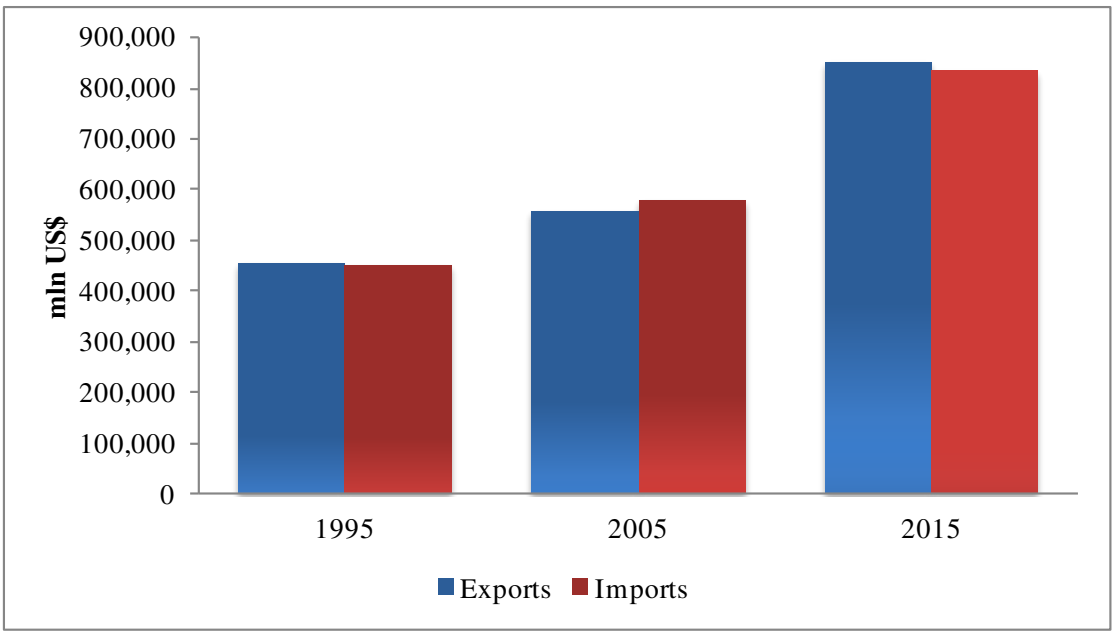
The contribution provides analytically based insights into the potential correlations between trade and the level of policy interventions in agri-food sector. It offers perspectives and evidence on the evolution of trade and NTMs over recent decades. It aims to extend the understanding of the "trade and NTMs" debate to stimulate more research into this important topic.

2 Trade of agri-food products: a global perspective

During the last two decades, global agri-food trade has been interested by rapid and dynamic changes with a significant re-shaping of trade patterns.

The traded value of agri-food products has progressively increased at global level over the longer term. Since the negotiations of the World Trade Organisation (WTO) in the mid-1990s, exports grew by 23% from 1995 to 2005, and by 53% from 2005 to 2015; similarly, imports expanded by 30% from 1995 to 2005, and by 44% from 2005 to 2015 (figure 1). The results is a global trade balance in agri-food sector significantly higher in 2015 compared to 1995[9].

Figure 1. Global trade balance in agri-food sector in 1995, 2005, 2015.



Source: elaboration on UN Comtrade (2017).

A remarkable increase has interested, in particular, developing countries: since 1995 until 2015, their trade flows have grown more rapidly than those of developed

[9] UN Comtrade (2017). See comtrade.un.org/data/ (last accessed 29 September 2017).

economies[10]. Considering a selection of developed (North) and developing countries (South)[11], we find that South-North and South-South trade have grown exponentially (from 21 to4,230 billion US$), North-North trade has become six times greater, and North-South trade has decoupled[12] (table 1).

Table 1. Trade (in billion US$) of selected agri-food product categories[a] in 1995 and 2015: detail by trade patterns[b].

	Destination country					
Origin country	North		South		Total	
	1995	*2015*	*1995*	*2015*	*1995*	*2015*
North	556	3,200	279	2,850	835	6,050
South	10	1,660	11	2,570	21	4,230
Total	566	4,860	290	5,420	856	10,280

Source: elaboration on UN Comtrade (2017).

[a] Product categories, coded according to the Harmonised System (HS) 2-Digit Chapter Headings, are as follows: (02) Meat; (03) Fish; (04) Dairy produce; (07) Edible vegetables; (08) Edible fruit and nuts; (10) Cereals; (12) Oil seeds and oleaginous fruits; (16) Preparation of meat, fish.

[b] Origin and destination countries, labelled according to the officially assigned ISO 3166-1 alpha-3 codes (UN Statistics Divisions, 2018), are classified into North (Developed Economies) and South (Developing Economies and Economies in transition), according to the United Nations' country classification (2017). They are as follows: Australia (AUS), Canada (CAN), European Union (EUN), New Zealand (NZL), United States (USA) for North; Argentina (ARG), Bolivia (BOL), Brazil (BRA), China (CHN), Congo (COG), Egypt (EGY), Indonesia (IDN), India (IND), Libya (LBY), Morocco (MAR), Peru (PER), Russian Federation (RUS), Tunisia (TUN), South Africa (ZAF) for South.

It seems that national policies are pushing consumers' preferences toward nationally produced goods (in the North), to the detriment of imported goods (from the South). However, the expansion of trade flows originating from South balances out the closure of developed countries.

[10] Martin (2018).

[11] According to the United Nations' country classification (2017), we consider Australia, Canada, the European Union (EU), New Zealand, and the United States (US) as Northern (developed) countries, and emerging economies of the group of BRIICS (Brazil, Russian Federation , China, Indonesia, India, South Africa), as well as other countries of Latin America (Argentina, Bolivia, Peru) and of the Northern and Central Africa (Congo, Egypt, Libya, Morocco, Tunisia) as Southern (developing) countries. They cover 77% of the global gross domestic product (GDP): in 2015, developed economies, BRIICS countries, Egypt, and Peru are listed as top 25% economies for level of GDP. All these economies have benefited from a general growth in global welfare from 1995 to 2015: in particular, Bolivia and Congo have more than quadrupled their GDPs, while Libya, Morocco, and Tunisia have tripled their GDPs (CEPII, 2017). See www.cepii.fr/CEPII/en/bdd_modele/bdd.asp (last accessed in 9 June 2017).

[12] UN Comtrade (2017). See comtrade.un.org/data/ (last accessed 29 September 2017).

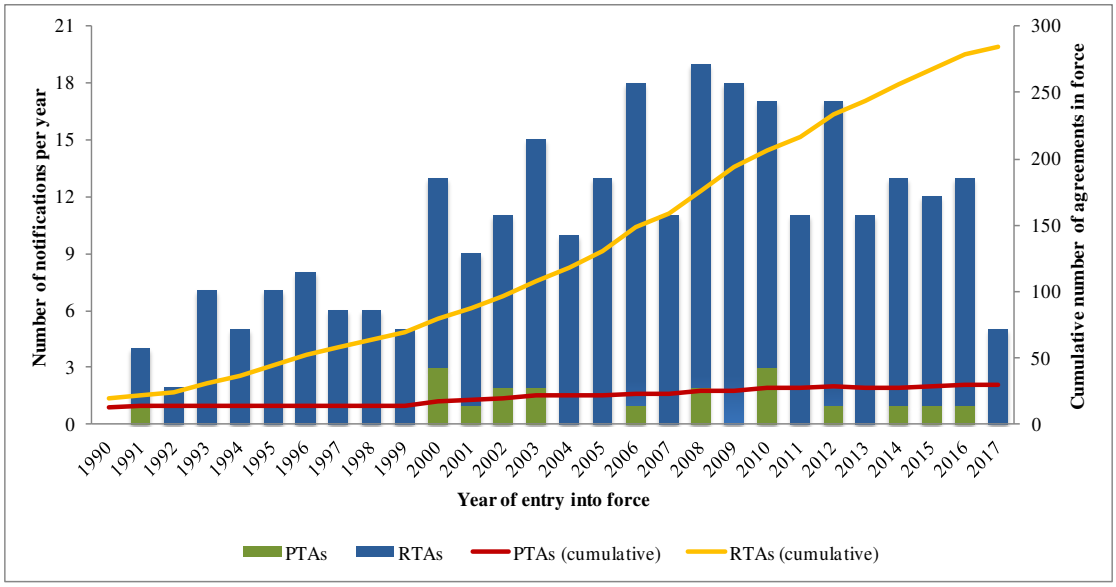
The rapid growth in trade intensity of developing economies may be a direct consequence of two determinants: economic globalisation and structural changes in the composition of agri-food trade[13]. The globalisation has stimulated the development of global commodity chains and has created a deep economic integration[14]. In this regard, since 2000, the importance of developing economies has driven the development of global agri-food markets. In addition, developing countries have became export-oriented economies, with substantial variations within the composition of exports. In fact, trade has moved from traditional commodities (e.g., coffee, tea, sugar, cocoa) to non-traditional, high value commodities (e.g., fruit and vegetables, poultry, fish)[15].

The general increase in trade intensity may be also due to the progressive process of trade liberalisation, as well as to the provision of restrictive standards to fulfil bilateral agreements[16]. The vast majority of countries have sought to improve their market access though preferential, bilateral, and regional trade agreements. In fact, while multilateral negotiations have stalled, a number of collective trade agreements has entered into force (figure 2). Since 2000, there has been an increasing number of new agreements notified to the WTO and a consistent growth in the stock of agreements in place: in 2017, the trade agreements are 314 (compared to 96 in 2000), of which 90% are regional (RTAs) and 10% are preferential (PTAs)[17].

Successful trade agreements facilitate market access, by including tariff cuts and other market access concessions[18], and contribute to a larger trade response[19]. In particular, trade agreements have a dual effect on trade response: they push toward the creation of intra-bloc trade, and lead to trade diversion toward developing countries[20].

[13] Henson et al. (2000).
[14] Disdier et al. (2015).
[15] Henson and Loader (2001).
[16] Disdier et al. (2015).
[17] See rtais.wto.org/UI/Charts.aspx# and ptadb.wto.org/ptaList.aspx (last accessed 12 January 2018).
[18] OECD (2015).
[19] Grant and Lambert (2008).
[20] Koo et al. (2006), Lambert and McKoy (2009), Sun and Reed (2010).

Figure 2. Global trade agreements by year of entry into force, 1990-2017.



Source: elaboration on Regional Trade Agreements Information System (RTA-IS, 2018) and Database on Preferential Trade Arrangements (WTO, 2018).

Notes: Acronyms are as follows: Preferential Trade Agreements (PTAs) and Regional Trade Agreements (RTAs).

3 Policy instruments in agri-food trade

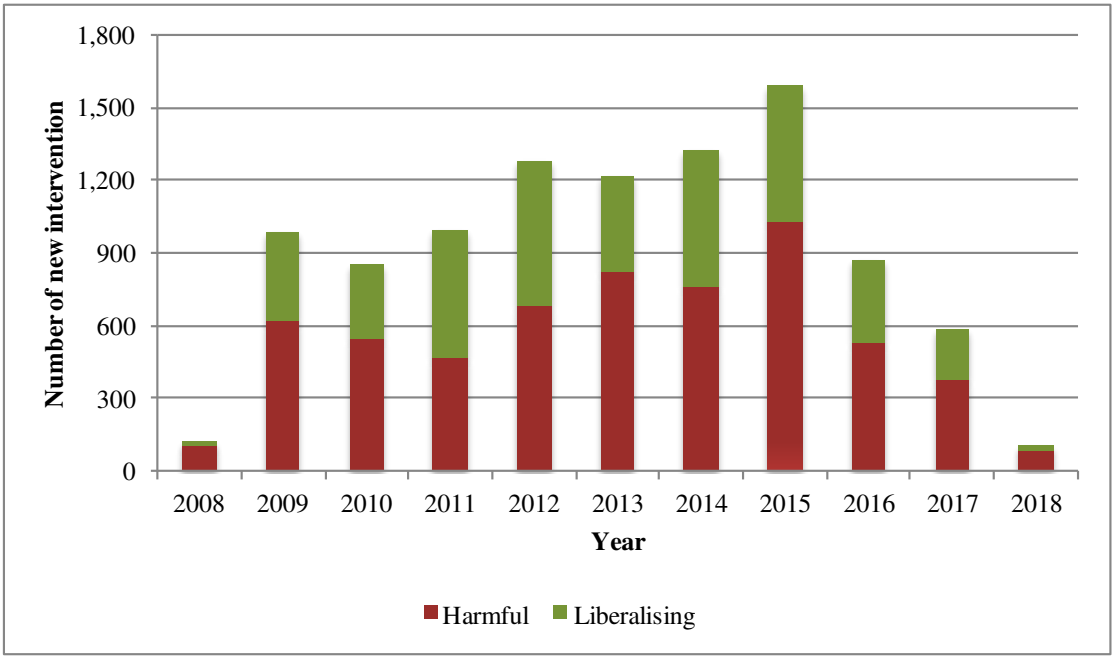
Changes in global agri-food trade have stimulated a reorganisation in the system of policy interventions. Since the negotiations of the World Trade Organisation (WTO), which have substantially reduced tariffs and fostered trade across the globe, a number of border measures for several agri-food categories remains high.

Figure 3 shows the number of new policy interventions occurred in agri-food sector in a decade, distinguishing between harmful and liberalising instruments. Harmful interventions are in great number with respect to liberalising ones. In 2018, the policy interventions in force in agri-food sector are 11,236 (46% import tariffs, 54% non-tariff instruments). In particular, import tariffs account for 47% and 53% for harmful and liberalising interventions, vice-versa non-tariff instruments account respectively for 75% and 25%. It is worth noting that 85% of the total number of policy interventions is implemented by countries of the European Union (EU) and by emerging economies of BRIIC (Brazil, Russian Federation, India, Indonesia, China)[21].

Despite a reduction in the level of tariffs (in particular of harmful tariffs), the level of non-tariff instruments has remained high and, indeed, has increased over time: non-tariff instruments are policy measures, alternative to tariffs, capable of shaping trade flows[22]; their growing (ab)use has led to a less transparent trade policy environment[23].

[21] See www.globaltradealert.org/ (last accessed 15 March 2018).
[22] Arita et al. (2017).
[23] Fernandes et al. (2017).

Figure 3. Number of policy interventions per year in agri-food sector: 2008-2018.



Source: elaboration on Global Trade Alert (2018).

The rationale of non-tariff policies has changed overtime. A dated view depicts non-tariff instruments as "non-tariff barriers" (NTBs), so to emphasise their protectionist scopes (e.g. quotas, export restraints). More recently, economists and policymakers prefer the term "non-tariff measures" (NTMs), in order to include a wider, and more diversified, set of measures which may hamper or facilitate trade[24].

The United Nations Conference on Trade and Development defines NTMs as "*policy measures other than ordinary customs tariffs that can potentially have an economic effect on international trade in goods, changing quantities traded, or prices or both*"[25]. NTMs may also have a corrective role, by reducing asymmetric information in the marketplace (Technical Barriers to Trade, TBTs), mitigating risks in consumption, improving the sustainability of eco-systems (Sanitary and Phytosanitary Standards, SPSs), and influencing the competition and the decision to import or export (non-technical NTMs). Table 2 lists and describes NTMs set on the occasion of WTO consultations.

[24] Grant and Arita (2017).
[25] UNCTAD (2012, p. 1).

Table 2. Classification and description of Non-Tariff Measures (NTMs).

Type	Chapter	Classification	Description
Technical measure	A	Sanitary and Phytosanitary Standards (SPSs)	Measures that are applied to protect human or animal life from risks arising from additives, contaminants, toxins or disease-causing organisms in their food; to protect human life from plant- or animal-carried diseases; to protect animal or plant life from pests, diseases, or disease-causing organisms; to prevent or limit other damage to a country from the entry, establishment or spread of pests; and to protect biodiversity.
	B	Technical Barriers to Trade (TBTs)	Measures referring to technical regulations, and procedures for assessment of conformity with technical regulations and standards, excluding measures covered by the SPS Agreement.
	C	Pre-Shipment inspections	Compulsory quality, quantity and price control of goods prior to shipment from the exporting country, conducted by an independent inspecting agency mandated by the authorities of the importing country.
Non technical measure	D	Contingent trade-protective measures	Measures implemented to counteract particular adverse effects of imports in the market of the importing country, including measures aimed at unfair foreign trade practices, contingent upon the fulfillment of certain procedural and substantive requirements.
	E	Quantity-control measure	Control measures generally aimed at restraining the quantity of goods that can be imported, regardless of whether they come from different sources or one specific supplier.
	F	Price-control measures	Measures implemented to control or affect the prices of imported goods in order to, *inter alia*, support the domestic price of certain products when the import prices of these goods are lower; establish the domestic price of certain products because of price fluctuation in domestic markets, or price instability in a foreign market; or to increase or preserve tax revenue. This category also includes measures other than tariffs measures that increase the cost of imports in a similar manner, i.e. by fixed percentage or by a fixed amount. They are also known as para-tariff measures.

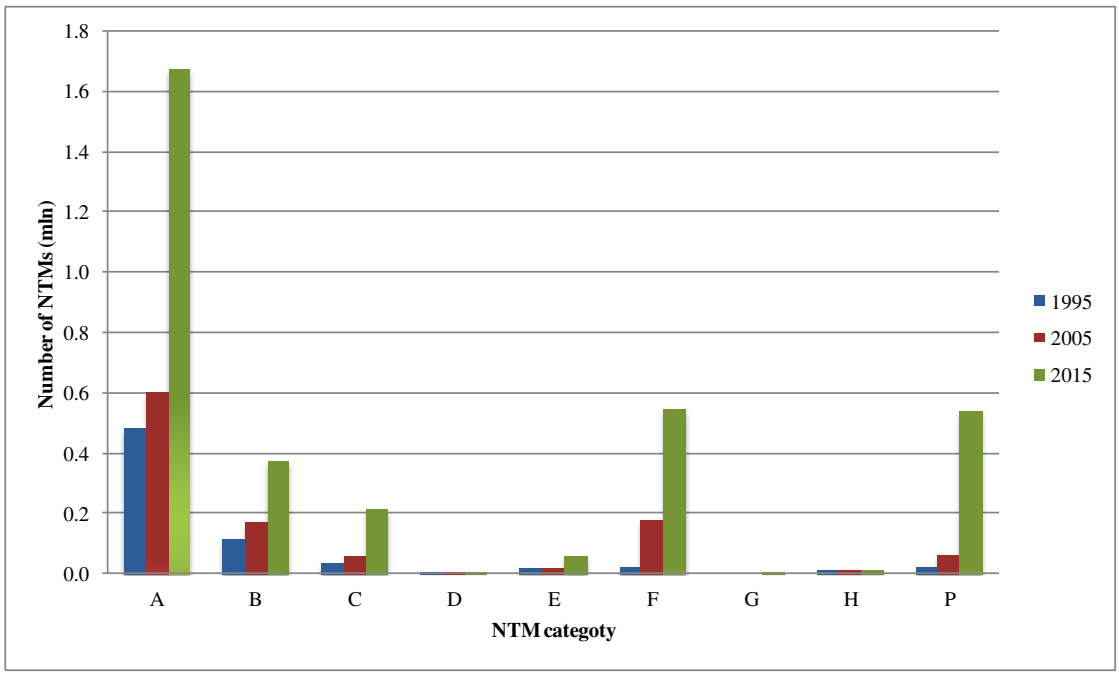
G	Finance measures	Finance measures are intended to regulate the access to and cost of foreign exchange for imports and define the terms of payment. They may increase import costs in the same manner as tariff measures.
H	Measures affecting competition	Measures to grant exclusive or special preferences or privileges to one or more limited group of economic operators.
I	Trade-related investment measures	Requirements to purchase or use certain minimum levels or types of domestically produced or sourced products, or restrictions on the purchase or use of imported products based on the volume or value of exports of local products. Restrictions on the importation of products used in or related to local production, including in relation to the amount of local products exported; or limitations on access to foreign exchange used for such importation based on the foreign exchange inflows attributable to the enterprise in question.
J	Distribution restrictions	Distribution of goods inside the importing country may be restricted. It may be controlled through additional license or certification requirements.
K	Restrictions on post-sales services	Measures restricting producers of exported goods to provide post-sales service in the importing country.
L	Subsidies	Financial contribution by a government or public body, or via government entrustment or direction of a private body (direct or potential direct transfer of funds.
M	Government Procurement	Measures controlling the purchase of goods by government agencies, generally by preferring national providers.
N	Intellectual property	Measures related to intellectual property rights in trade: Intellectual property legislation covers patents, trademarks, industrial designs, layout designs of integrated circuits, copyright, geographical indications and trade secrets.
O	Rules of origin	Rules of origin cover laws, regulations and administrative determinations of general application applied by government of importing countries to determine the country of

		origin of goods. Rules of origin are important in implementing trade policy instruments such as antidumping and countervailing duties, origin marking and safeguard measures.
P	Export-related measures	Export-related measures are measures applied by the government of the exporting country on exported goods.

Source: International Classification of Non-Tariff measures, February 2012 version (UNCTAD/DITC/TAB/2012/2).

The total number of NTMs that governs trade of agri-food products has increased tremendously over the past decades, in particular during the period 2005-2015 (from 1.09 mln to 3.41 mln)[26]. In fact, the food price crisis in 2007/2008 has led to changes in agri-food trade policies. In the short term, a number of governments imposed export restrictions and varied import duties in an attempt to insulate domestic consumption from volatility of international price[27]. However, the effect of protectionist trade policy on domestic and international markets is asymmetric. In that, the gain in terms of reduced volatility of domestic market comes at expenses of an increase in volatility of international market: the larger the trading country interested by the intervention, the larger the impact[28]. In the medium-long term, many countries have maintained more defensive trade policies towards international markets, exacerbating standards requirements for imports: emblematic is the case of SPSs which have dramatically increased by 178% from 2005 to 2015 (figure 4)[29].

Figure 4. Global number of NTMs imposed on agri-food products: detail by type of NTMs in 1995, 2005, 2015.



Source: elaboration on UNCTAD (2017), TRAINS NTMs: The Global Database on Non-Tariff Measures.

Notes: Categories of non-tariff measures (NTMs) are coded according to the UNCTAD classification (UNCTAD, 2012): Sanitary and Phytosanitary Standard (SPS) (A), Technical Barrier to Trade (TBT) (B), Pre-Shipment inspection (C), Contingent trade-protective measure (D), Quantity-control measure (E), Price-control measure (F), Finance measure (G), Measure affecting competition (H), Export-related measure (P).

[26] See trains.unctad.org/Forms/Analysis.aspx (last accessed 15 September 2017).
[27] Greenville (2015).
[28] Anderson and Nelgen (2011), Ivanic and Martin (2014), Santeramo et al. (2018); Santeramo and Lamonaca (2018a).
[29] See trains.unctad.org/Forms/Analysis.aspx (last accessed 15 September 2017).

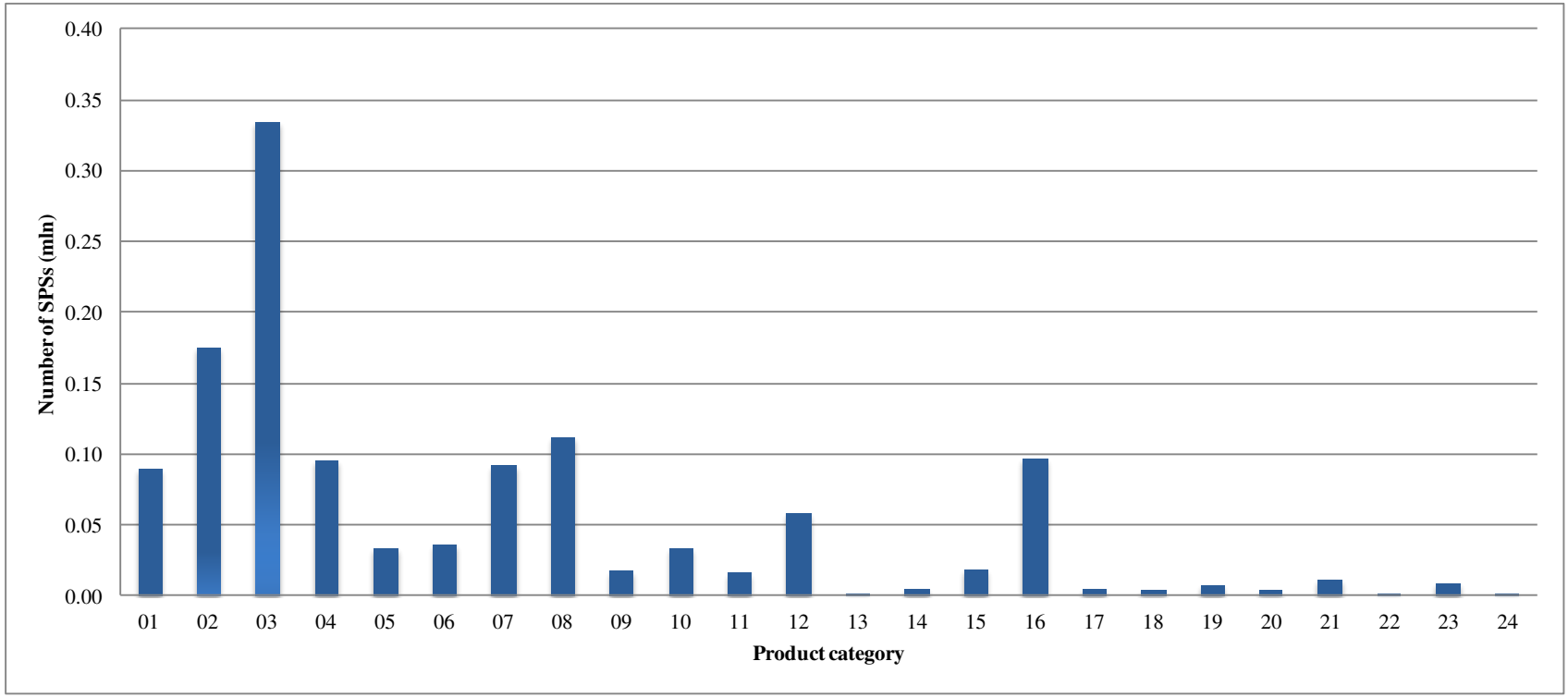
SPSs are the most widespread measures that affect agri-food trade, due to their economic significance and negotiating options for reform[30]. The pervasiveness of SPSs in agri-food trade is essentially due to the sensitive nature of covered issues (e.g. protection of human or animal life from risks arising from additives, contaminants, toxins or disease-causing organisms in their food; protection of human life from plant- or animal-carried diseases; protection of animal or plant life from pests, diseases, or disease-causing organisms; prevention of damage to a country from the entry, establishment or spread of pests; protection of biodiversity)[31].

Figure 5 shows the number of SPSs implemented in agri-food sector, in force in 2017. The most affected product categories are fish (27%), meat (14%), vegetables (9%), dairy produce (8%), preparation of meat and fish (8%), fruits and nuts (7%), oil seeds and oleaginous fruits (5%), and cereals (3%)[32]. In general, SPSs concern trade of fresh products[33]. In that, the risk that the abovementioned product categories are subject to dissemination of disease or pests is higher, due to a greater perishability.

In particular, the most implemented SPSs, in force in 2017 for agri-food products, are certification requirement (A830, 18%), special authorisation requirement for SPS reasons (A140, 17%), tolerance limits for residues of or contamination by certain (non-microbiological) substances (A210, 10%), testing requirement (A820, 8%), geographic restrictions on eligibility (A120, 7%), packaging requirements (A330, 6%), labelling requirements (A310, 4%) (figure 6)[34]. Table 2 describes in detail the most implemented SPSs, according to the UNCTAD's international classification of NTMs[35].

[30] Dal Bianco et al. (2016), Grant and Arita (2017).
[31] UNCTAD (2012, p.7).
[32] See trains.unctad.org/Forms/Analysis.aspx (last accessed 15 September 2017).
[33] Grant and Arita (2017).
[34] See trains.unctad.org/Forms/Analysis.aspx (last accessed 15 September 2017).
[35] UNCTAD (2012).

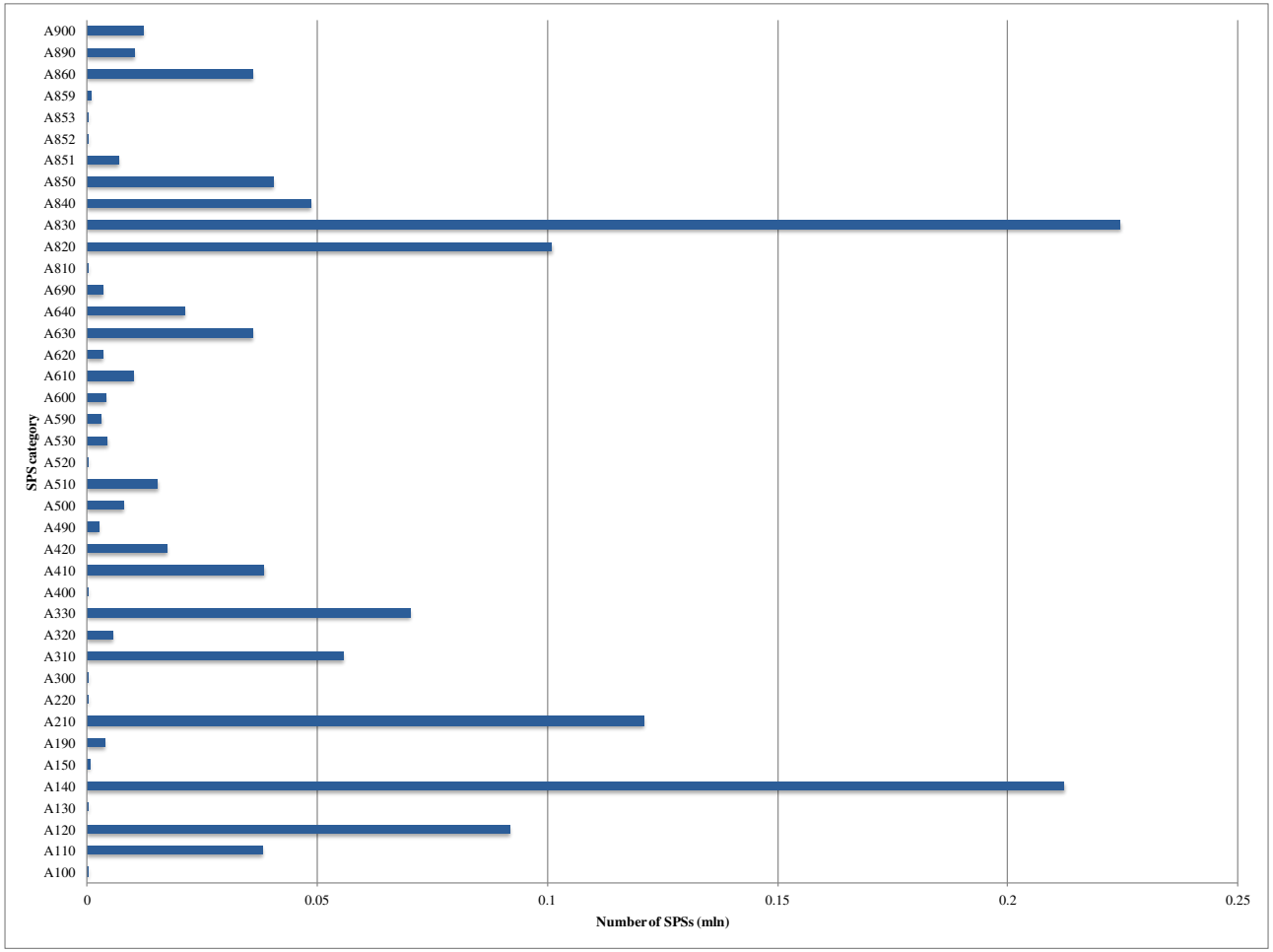
Figure 5. Number of Sanitary and Phytonaitary Standards (SPSs) imposed in agri-food sector: detail by product category in 2017.



Source: elaboration on UNCTAD (2017), TRAINS NTMs: The Global Database on Non-Tariff Measures.

Notes: Product categories are coded according to the Harmonised System (HS) 2-Digit Chapter Headings: (01) Live animals; (02) Meat; (03) Fish; (04) Dairy produce; (05) Products of animal origin; (06) Live trees and other plants; (07) Edible vegetables; (08) Edible fruit and nuts; (09) Coffee, tea, mate and spices; (10) Cereals; (11) Products of the milling industry; (12) Oil seeds and oleaginous fruits; (13) Lac; (14) Vegetable planting material; (15) Animal or vegetable fats and oils; (16) Preparation of meat, fish; (17) Sugars and sugar confectionery; (18) Cocoa and cocoa preparations; (19) Preparations of cereals, flour, starch or milk; (20) Preparations of vegetables, fruits; (21) Miscellaneous edible preparations; (22) Beverages, spirits and vinegar; (23) Residues and wastes of food industries; (24) Tobacco.

Figure 6. Number of Sanitary and Phytosanitary Standards (SPSs) imposed in agri-food sector: detail by SPS category in 2017.



Source: elaboration on UNCTAD (2017), TRAINS NTMs: The Global Database on Non-Tariff Measures.

Notes: SPS macro-categories are coded according to the UNCTAD classification: (A1) Prohibitions/restriction of imports for SPS reasons; (A2) Tolerance limits for residues and restricted use of substances; (A3) Labelling, Marking and Packaging requirements; (A4) Hygienic Requirements; (A5) Treatments for elimination of plant and animal pests and disease-causing organisms in the final product (e.g. Post-harvest treatment); (A6) Other Requirements on Production or Post-Production Processes; (A8) Conformity Assessment related to SPS; (A9) SPS Measures, not elsewhere specified (n.e.s.).

Table 3. Details on types of Sanitary and Phytosanitary Standards (SPSs).

Code	Name	Description	Example
A120	Geographic restrictions on eligibility	Prohibition of imports of specified products from specific countries or regions due to lack of evidence of sufficient safety conditions to avoid sanitary and phytosanitary hazards. The restriction is imposed automatically until the country proves employment of satisfactory sanitary and phytosanitary measures to provide a certain level of protection against hazards that is considered acceptable. Eligible countries are put on a "positive list". Imports from other countries are prohibited. The list may include authorized production establishments within the eligible country	Imports of dairy products from countries that have not proven satisfactory sanitary conditions are prohibited.
A140	Special authorisation requirement for SPS reasons	A requirement that importers should receive authorisation, permits or approval from a relevant government agency of the destination country for SPS reasons: In order to obtain the authorisation, importers may need to comply with other related regulations and conformity assessments.	An import authorisation from the Ministry of Health is required.
A210	Tolerance limits for residues of / or contamination by certain (non-microbiological)	A measure that establishes a maximum residue limit (MRL) or tolerance limit of substances such as fertilisers, pesticides, and certain chemicals and metals in food and feed, which are used during their production process but are not their intended ingredients. It includes a permissible maximum level for non-	(a) Maximum residue level is established for insecticides, pesticides, heavy metals and veterinary drug residues;

	substances	microbiological contaminants.	(b) chemicals generated during processing; (c) residues of dithianon in apples and hop.
A310	Labelling requirements	Measures defining the information directly related to food safety, which should be provided to the consumer: Labelling is any written, electronic or graphic communication on the consumer packaging or on a separate but associated label.	(a) Labels that must specify the storage conditions such as “5 degree C maximum”; (b) potentially dangerous ingredients such as allergens, e.g. “contains honey not suitable for children under one year of age”.
A330	Packaging requirements	Measures regulating the mode in which goods must be or cannot be packed, or defining the packaging materials to be used, which are directly related to food safety.	Use of PVC films for food packaging is restricted.
A820	Testing requirement	A requirement for products to be tested against a given regulation, such as maximum residue level: This measure includes the cases where there is sampling requirement.	A test on a sample of orange imports is required to check against the maximum residue level of pesticides.
A830	Certification requirement	Certification of conformity with a given regulation that is required by the importing country but may be issued in the exporting or the importing country.	Certificate of conformity for materials in contact with food (containers, papers, plastics, etc.) is required.

Source: International Classification of Non-Tariff measures, February 2012 version (UNCTAD/DITC/TAB/2012/2).

Considering the most regulated agri-food products and a set of developed (North) and developing (South) countries[36], we find that the total number of implemented SPSs has more than tripled during the period 1995-2015 (from 33 to 126 thousand)[37] (table 3) In particular, SPSs implemented by developed countries have doubled, while the growth in the number of SPSs set by developing countries has been impressive: from 0.8 to 65.8 thousand[38]. Albeit traditional trade barriers (tariffs) continue to decline, protectionist interests of countries persist through an increasing and frequently non-transparent use of food safety regulations[39].

Table 4. Number of Sanitary and Phytosanitary Standards (SPSs) imposed on selected agri-food product categories[a] in 1995 and 2015: detail by trade patterns[b].

Implementing country	**Affected country**					
	North		South		Total	
	1995	*2015*	*1995*	*2015*	*1995*	*2015*
North	14,025	24,044	18,622	36,455	32,647	60,499
South	151	29,067	649	36,696	800	65,763
Total	14,176	53,111	19,271	73,151	33,447	126,262

Source: TRAINS NTMs: The Global Database on Non-Tariff Measures (UNCTAD, 2017).

[a] Product categories, coded according to the Harmonized System (HS) 2-Digit Chapter Headings, are as follows: (02) Meat; (03) Fish; (04) Dairy produce; (07) Edible vegetables; (08) Edible fruit and nuts; (10) Cereals; (12) Oil seeds and oleaginous fruits; (16) Preparation of meat, fish.

[b] Origin and destination countries, labelled according to the officially assigned ISO 3166-1 alpha-3 codes (UN Statistics Divisions, 2018), are classified into North (Developed Economies) and South (Developing Economies and Economies in transition), according to the United Nations' country classification (2017). They are as follows: Australia (AUS), Canada (CAN), European Union (EUN), New Zealand (NZL), United States (USA) for North; Argentina (ARG), Bolivia (BOL), Brazil (BRA), China (CHN), Congo (COG), Egypt (EGY), Indonesia (IDN), India (IND), Libya (LBY), Morocco (MAR), Peru (PER), Russian Federation (RUS), Tunisia (TUN), South Africa (ZAF) for South.

Differences related to the intensity of regulations emerges at country level (figure 7): from 1995 to 2015, the number of countries implementing SPSs has more than doubled, and the number of SPSs is about seven times greater (from 33 to 126 thousand). In 1995, the United States (US) were responsible for 96% of the total of implemented SPSs; China (2%), New Zealand (2%), Brazil, and Argentina (1%) had a lower contribution. In 2015, the set of imposing countries includes also economies of Latin America (i.e. Bolivia and Peru) and some of the BRIICS countries (i.e. Russian

[36] We analyse product categories, coded according to the Harmonised System (HS) 2-Digit Chapter Headings: meat (02), fish (03), dairy produce (04), edible vegetables (07), edible fruits and nuts (08), cereals (10), oil seeds and oleaginous fruits (12), preparation of meat and fish (16).According to the United Nations' country classification (2017), we consider Australia, Canada, the European Union (EU), New Zealand, and the United States (US) as Northern (developed) countries, and emerging economies of the group of BRIICS (Brazil, Russian Federation , China, Indonesia, India, South Africa), as well as other countries of Latin America (Argentina, Plurinational State of Bolivia, Peru) and of the Northern and Central Africa (Congo, Egypt, Libya, Morocco, Tunisia) as Southern (developing) countries.
[37] See trains.unctad.org/Forms/Analysis.aspx (last accessed 15 September 2017).
[38] See trains.unctad.org/Forms/Analysis.aspx (last accessed 15 September 2017).
[39] Jongwanich (2009).

Federation and Indonesia). In particular, the US preserves the leadership of implementing country (35%), followed by Indonesia (32%), New Zealand (10%), Brazil (8%), and Russian Federation (7%). From 1995 to 2015, the number of imposed SPSs has approximately doubled in China (from 684 to 1,247) and in the US (from 32,096 to 43,982), and it has grown exponentially in Argentina (from 4 to 915), Brazil (from 112 to 10,207), and New Zealand (from 551 to 12,947)[40].

A distinctive trait: none of the African countries (Congo, Egypt, Libya, Morocco, Tunisia) has implemented SPSs neither in 1995 nor in 2015; the same consideration is for the EU, Australia, and India.

A plausible explanation of the lack of imposition in African countries or in India is that the effective implementation of SPSs requires binding commitments to provide adequate financial and technical assistance to developing countries. As a consequence, developing countries do not consider the implementation of SPSs a way to establish a dynamic trade environment in domestic economy[41]. In addition to this general belief, developing countries have frequently incurred in SPSs' crises. For instance, in 1998 the EU banned fishery product imports from Kenya, Mozambique, Tanzania, and Uganda to safeguard the EU consumers from the risk of cholera[42]. In 2000, the EU also removed India from the list of approved countries for imports of egg powder, seafood products, and mango pulp due to high pesticide residues[43]. The inability of developing countries to meet foreign standards may contribute to reduce the probability to set domestic standards in WTO consultations.

As regard the EU, member states frequently use requirements on Maximum Residue Levels (MRLs) to ensure safe imports as an alternative to SPSs. For all food and animal feed, the European Commission fixes MRLs that considers legally tolerable. Requirements on MRLs are not set on the occasion of WTO consultations, but they may be assimilated to the SPS A200 on the tolerance limits for residues and the restricted use of certain substances in food and feed[44]. It seems that Australia follows a similar approach in adopting MRLs instead of SPSs. The imposition of MRLs in the EU and/or in Australia is well documented in a number of eminent studies[45].

Countries that have increased or introduced SPSs have also amplified their trade openness ratio[46] from 1995 to 2015: in particular, we observe the greatest growth in trade openness ratio (from 1995 to 2015) for Bolivia (+20%), China (+13%), Argentina (+6%), and Peru (+4%); Canada and New Zealand are economies with the highest agricultural propensity (figure 7). Changes in the intensity of trade and the increase of SPSs is unlikely to be a coincidence.

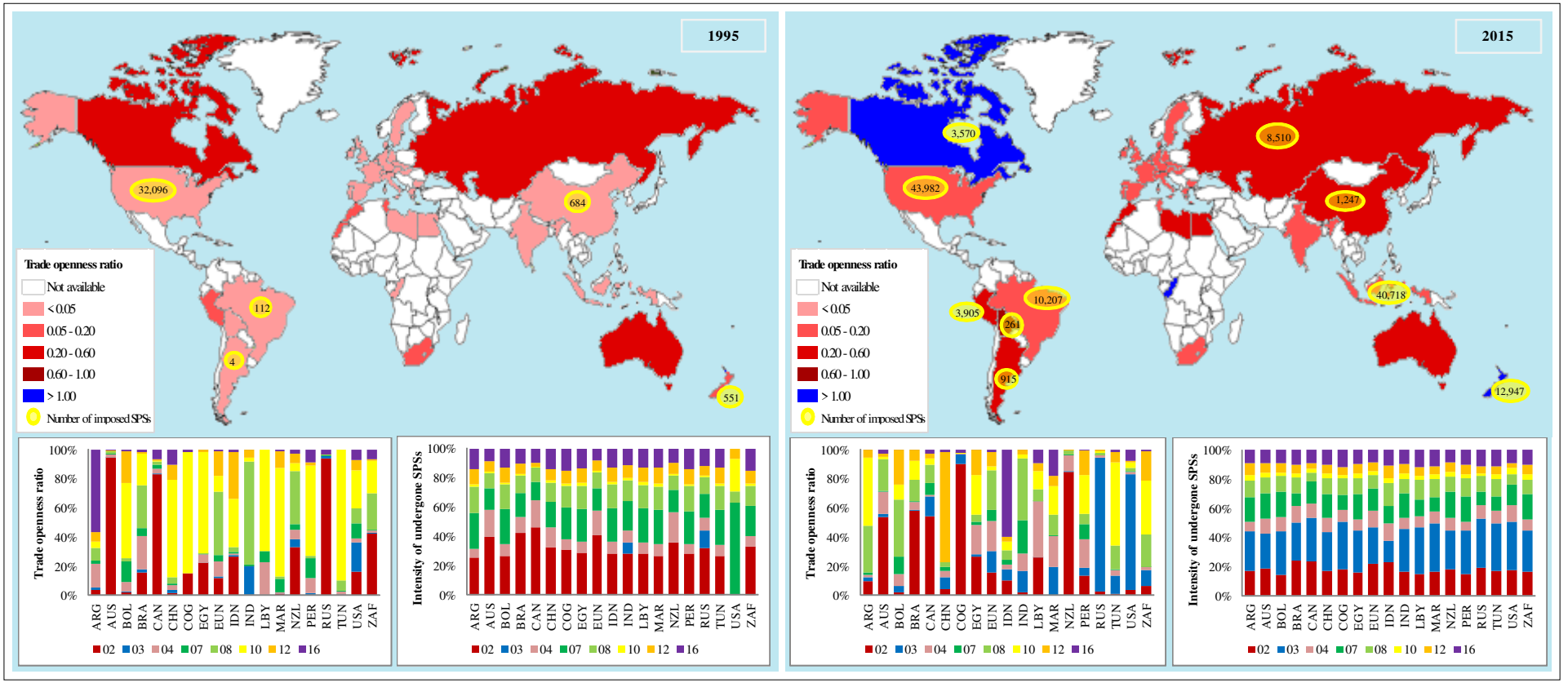
From 1995 to 2015, the number of undergone SPSs is almost unchanged, exception made for the US, whose intensity of undergone SPSs (almost non-existent in 1995) was 4% in 2015, and Indonesia, for which the intensity of undergone SPSs decreases from 4% to 2% in two decades. The number of implemented SPSs has been reduced for meat-based products (-41%) and vegetables (-36%), and it has tremendously increased for fishery products (+2773%). While in 1995 only Indonesia and Russian Federation have been interested by SPSs on fishery products, in 2015 SPSs have been raised against all countries: the relevant growth in the intensity of SPSs on fishery products may be due to a general increase in trade openness ratio for this category. The intensity of

[40] See trains.unctad.org/Forms/Analysis.aspx (last accessed 15 September 2017).
[41] Athukorala and Jayasuriya (2003).
[42] Henson et al. (2000).
[43] Mehta and George (2003).
[44] UNCTAD (2012).
[45] E.g. Otsuki et al. (2001a, b), Wilson et al. (2003), Wilson and Otsuki (2004), Chen et al. (2008), Disdier and Marette (2010), Xiong and Beghin (2011), Drogué and DeMaria (2012), Melo et al. (2014).
[46] In line with Wacziarg (2001), countries' trade openness ratio is computed as the sum of domestic agri-food imports and exports compared to the annual GDP. Domestic agri-food imports and exports refer to product categories meat (02), fish (03), dairy produce (04), edible vegetables (07), edible fruit and nuts (08), cereals (10), oil seeds and oleaginous fruits (12), preparation of meat and fish (16).

SPSs for other products (i.e. dairy products, fruits, cereals, oil seeds, preparations of meat and fish) has remained stable[47].

[47] See trains.unctad.org/Forms/Analysis.aspx (last accessed 15 September 2017).

Figure 7. Trade intensity, imposed and undergone Sanitary and Phytosanitary Standards (SPSs): a comparison between 1995 and 2015.



Source: elaboration on UN Comtrade (2017), TRAINS NTMs: The Global Database on Non-Tariff Measures (UNCTAD, 2017), and Centre d'Études Prospectives et d'Informations Internationales (CEPII, 2017).

Notes:

[a] Countries, labelled according to the officially assigned ISO 3166-1 alpha-3 codes (UN Statistics Divisions, 2018), are as follows: Argentina (ARG), Australia (AUS), Plurinational State of Bolivia (BOL), Brazil (BRA), Canada (CAN), China (CHN), Congo (COG), Egypt (EGY), European Union (EUN), Indonesia (IDN), India (IND), Libya (LBY), Morocco (MAR), New Zealand (NZL), Peru (PER), Russian Federation (RUS), Tunisia (TUN), United States (USA), South Africa (ZAF).

[b] Product categories, coded according to the Harmonized System (HS) 2-Digit Chapter Headings, are as follows: (02) Meat; (03) Fish; (04) Dairy produce; (07) Edible vegetables; (08) Edible fruit and nuts; (10) Cereals; (12) Oil seeds and oleaginous fruits; (16) Preparation of meat, fish.

[c] Countries' trade openness ratio is computed as the sum of domestic agri-food imports and exports compared to the annual GDP. Data on GDP are not available for LBY and ZAF in 1995 and for LBY in 2015: thus, the trade openness ratio refers to 1998 and 2013 for LBY and to 2000 for ZAF.

[d] Countries' intensity of undergone SPSs is computed as the ratio between the number of SPSs undergone in a country and the total of undergone SPSs in the analysed sample.

4 The trade effect of non-tariff measures

4.1 A theoretical framework

The implicit comparison that frequently occurs between tariffs and non-tariff measures (NTMs) is not completely valid. Tariffs are protectionist by definition, and undermine the social welfare by crowding out trade[48]. NTMs may be protectionist or competitive for trade, and imply welfare redistributions by addressing market imperfections (asymmetric information, externalities)[49]. From a social perspective, while the optimal level of tariffs is zero, determining the optimal level of NTMs is a huge challenge for policymakers[50]: such a difficulty depends on the complex relationship existing between trade and social effects of NTMs[51].

In order to discriminate between catalyst and barrier effects of NTMs on trade, we suppose that a small open economy sets a NTM on a product category, produced in domestic market and also imported from country's trading partners. The aim of the policymaker is to maximise domestic welfare in terms of increase of consumers' surplus and producers' profits. In domestic market, the optimal level of a NTM results from the trade-off between the marginal utility gain for consumers and the marginal cost for producers. However, in a small open economy, the effects of a NTM on domestic welfare is influenced by the behaviour of trading partners: thus, a NTM determines potential trade effects. NTMs affect trade in all but one case, that is when the effects on domestic production exactly offset the effects on domestic consumption[52]. Given the existence of asymmetric information and/or externalities, attributing a catalyst or a barrier function to a NTM is a complex challenge. In general, by addressing market imperfections, NTMs are likely to influence incentive mechanisms and behaviours of consumers, producers, and trading partners.

From the perspective of consumers, a non-tariff policy is socially desirable and provides higher social well-being. By reducing asymmetric information and/or externalities, NTMs boost consumers' confidence in products under regulation, and reduces transaction costs[53]. The general effect is an increase in consumers' utility and a consequent demand-enhancing effect (with a rightward shift of demand, from D to D'). The growing demand and the higher costs of implementing the measure determine an equilibrium price higher than the pre-NTM price (from p to p'): the consequence is an increase in consumption expenditures. The net effect of NTMs on consumers' surplus depends on the magnitude of utility gain compared to the size of (negative) effect on consumption expenditures: the higher the consumers' utility, the higher the willingness to pay a higher price for products under regulation[54].

From the perspective of producers, a non-tariff policy implies higher costs of compliance, in terms of fixed costs (e.g. upgrade of practice codes and facilities, acquisition of certificates, conformity in marketing requirements) and variable costs (e.g. prolonged delivery time due to inspection and testing procedures at custom points, rejection of certain shipments, denial of entry of certain shipments)[55]. By

[48] Swinnen (2016).
[49] Xiong and Beghin (2014).
[50] Swinnen (2017).
[51] Sheldon (2012).
[52] Swinnen (2016).
[53] Xiong and Beghin (2014).
[54] Crivelli and Gröschl (2016), Swinnen (2016).
[55] Xiong and Beghin (2014), Crivelli and Gröschl (2016).

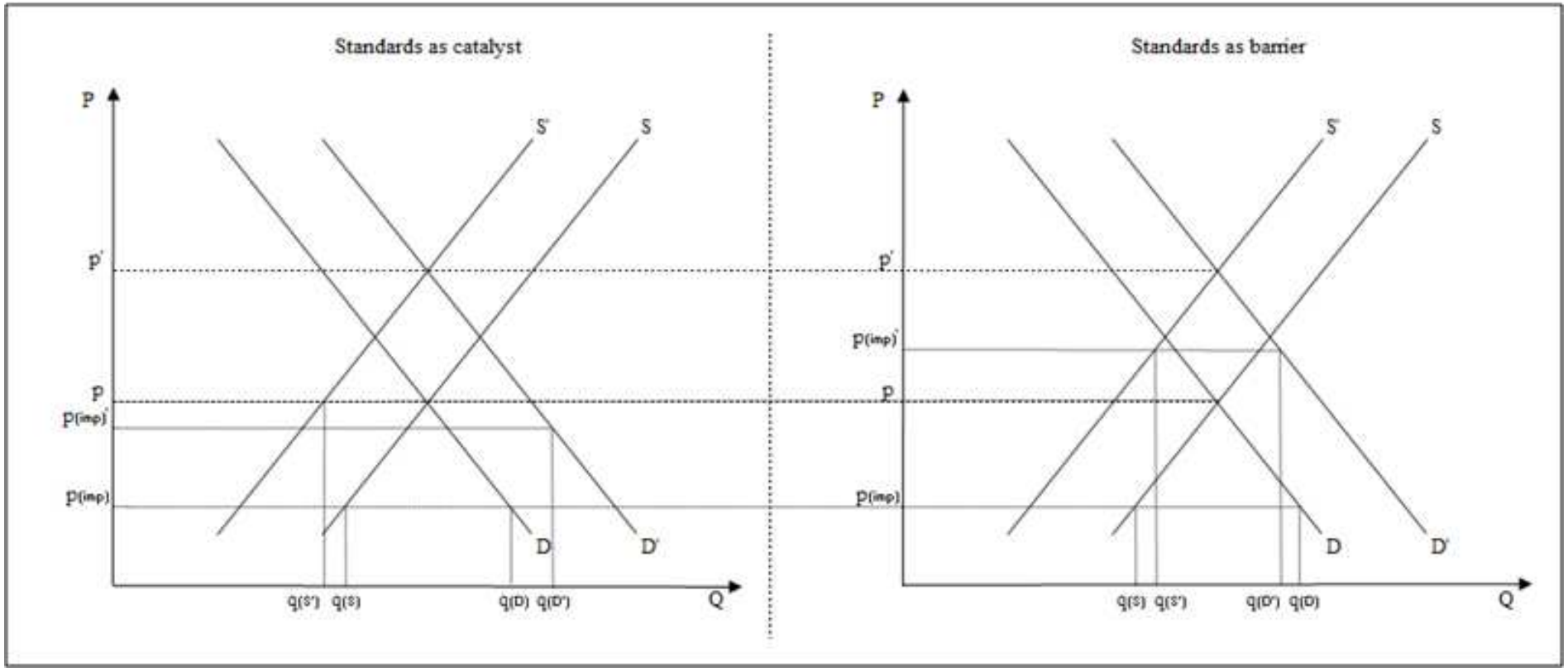
increasing the costs of implementing more stringent standards, NTMs reduce producers' profits. The consequence is a supply-contraction effect (with a leftward shift of supply, from S to S'). The reduced supply determines an equilibrium price higher than the pre-NTM price (from p to p'), and thus an increase in producers' revenue. The net effect of a NTM on producers' profits depends on the magnitude of gain in revenue compared to the size of (negative) implementation costs: the lower the implementation costs, the higher the gain in revenue for products under regulation[56].

For exporters, a non-tariff policy imposed in the destination country implies higher costs of compliance in order to meet the requirements, with a consequent increase in import price (from $p_{(imp)}$ to $p_{(imp)}$'). Given the increased consumers demand for products under regulation, if the difference between import price pre- and post-NTM ($p_{imp} - p'_{imp}$) is greater (lower) than the difference between domestic price pre- and post-NTM ($p - p'$), domestic producers face lower (greater) implementation costs and obtain higher (lower) profits than foreign producers. The NTM has a barrier (catalyst) effect on trade if determines a reduction (increase) in domestic imports[57].

$$\begin{gathered}\left(p_{imp} - p'_{imp}\right) < (p - p') \Rightarrow standard\ as\ catalyst \\ and \\ \left(p_{imp} - p'_{imp}\right) > (p - p') \Rightarrow standard\ as\ barrier\end{gathered} \quad (1)$$

[56] Swinnen (2016).
[57] Swinnen (2017).

Figure 8. “Standards as catalyst” vs. “Standards as barrier”: a theoretical framework.



Notes: D and D’ are domestic market demand pre- and post-standard; S and S’ are domestic market supply pre-and post-standard; p and p’ are equilibrium price in domestic market pre- and post-standard; $p_{(imp)}$ e $p_{(imp)}$’ are equilibrium import price pre- and post-standard; $q_{(D)}$ e $q_{(S)}$ are domestic demanded and supplied quantities pre-standard; $q_{(D)}$’ e $q_{(S)}$’ are domestic demanded and supplied quantities post-standard; $q_{(D)}$-$q_{(S)}$ and $q_{(D)}$’-$q_{(S)}$’ are imports pre- and post-standard.

4.2 Evidence from empirical literature

The extensive empirical literature on the nexus between non-tariff measures (NTMs) and trade provides contrasting evidence. A majority of researches suggests that NTMs hamper trade[58]. Other studies conclude that NTMs may have no impact[59] or tend to foster trade[60]. Several researches find both positive and negative effects of NTMs on trade[61]. The mixed evidence may be partly explained by the large heterogeneity in empirical studies: some analyses are global, others are regional; few researches focus on aggregate NTMs, while many studies focus on product-specific NTMs[62]. Heterogeneity is also due to a variety of methodological and empirical approaches: differences emerge in proxies used to measure NTMs, types of data, and estimators. In addition, the magnitude and the direction of NTM's trade effects tend to be sector- and/or product- specific[63]. To sum up, a direct comparison of results is not feasible. Only few studies provide a general overview on the trade effects of NTMs, and a remarkable case is Hoeckman and Nicita (2011) who suggest that NTMs are major frictions to trade of agri-food products.

As for the trade effects of NTMs on different geographic and economic areas, it seems that NTMs are barriers to trade[64]. Studies on trade between developed countries provide different conclusions: negative effects[65] and positive effects[66] of NTMs on trade are found. Trade among developing countries tends to be frictioned by NTMs[67].

If we focus on the trade effects of specific NTMs, Technical Barriers to Trade (TBTs) attend to be catalysts for trade[68], while Sanitary and Phytosanitary Standards (SPSs), may either hamper or facilitate trade. In fact, some studies support the "standards as barrier" view[69], while others provide mixed results. A plausible explanation of the heterogeneity in findings for SPSs may be the effect of regulations: "*there are specific measures that have a substantial positive impact and others with a significant negative impact. These effects can offset each other within a class*"[70]. As for product-specific measures, the Maximum Residue Levels (MRLs) tend to act as barrier to trade[71].

Considering the influence of proxies used for NTMs, the relationship between standards and trade tends to be negative if standards are proxied by *ad valorem equivalent* (AVE)[72], or by frequency index and/or coverage ratio[73]. Differently, if

[58] E.g. Cioffi et al. (2011), Santeramo and Cioffi (2012), Peterson et al. (2013), Dal Bianco et al. (2016).
[59] E.g. Sun et al. (2014), Shepotylo (2016).
[60] E.g. de Frahan and Vancauteren (2006), Cardamone (2011).
[61] E.g. Xiong and Beghin (2011), Beckman and Arita (2016).
[62] Santeramo (2017).
[63] Santeramo et al. (2018).
[64] E.g. Essaji (2008), Anders and Caswell (2009), Disdier and Marette (2010). Few exceptions are Wilson and Otsuki (2003), Chevassus-Lozza et al. (2008), and Shepherd and Wilson (2013), who provide mixed evidence on the trade effects of NTMs.
[65] E.g. Harrigan (1993), Fontagné et al. (2005), Yue and Beghin (2009), Beckman and Arita (2016).
[66] de Frahan and Vancauteren (2006).
[67] E.g. Schuster and Maertens (2013), Melo et al. (2014), Santeramo and Lamonaca (2018b).
[68] E.g. de Frahan and Vancauteren (2006).
[69] E.g. Jongwanich (2009), Jayasinghe et al. (2010), Peterson et al. (2013), Crivelli and Gröschl (2016).
[70] Schlueter et al. (2009, p. 1489).
[71] E.g. Otsuki et al. (2001a, b), Wilson and Otsuki (2003), Scheepers et al. (2007), Chen et al. (2008), Wei et al. (2012), Ferro et al. (2015).
[72] E.g. Olper and Raimondi (2008), Arita et al. (2017).
[73] E.g. Jongwanich (2009), Fernandes et al. (2017).

standards are proxied by dummy or count variables, the results may be positive[74] or negative[75].

5 Conclusions

The contribution investigates the evolution of trade in agri-food sector and the potential correlations between trade and levels of policy intervention.

Agri-food trade has assumed a great relevance over time, in terms of traded volumes and values, involved countries, and interested commodities. More importantly, there has been a trend reversal in trade patterns, with a remarkable growth in trade from developing countries.

Changes in agri-food trade are related to a plethora of determinants: economic globalisation, changes in the composition of trade, progressive trade liberalisation, growing trade agreements, reorganisation of policy interventions[76]. The joint influence of these factors has contributed to the development of new dynamics in agri-food trade. In particular, it is likely that the proliferation of non-tariff measures (NTMs) and changes in trade patterns are strictly related. NTMs are policy instruments capable to shape trade in the same way as traditional tariffs.

Since the negotiation of the World Trade Organisation (WTO), the number of NTMs has tripled. In particular, Sanitary and Phytosanitary Standards (SPSs) have grown exponentially, in terms of products coverage and number of implementing countries. SPSs are suitable to regulate trade of perishable agri-food products, such as meat-based and seafood products, fruits and vegetables, cereals, fats and oils[77]. In addition, immediately after the trade liberalisation (1995), implementing SPSs was a prerogative of developed countries. Nowadays, developing countries have become important players in the WTO consultations[78], although the United States remain the leader country.

Comparing the evolution of trade and of NTMs in agri-food sector, we observe that potential relationships "cause-effect" exist: growing trade flows may have stimulated the increase of trade policy measures; but, in their turn, NTMs may have shaped trade. The combination of greater trade openness and levels of protection has stimulated an interesting academic debate. The empirical evidence show that NTMs may be trade catalysts or trade barriers: in particular, the effects are country-, product-, and measure-specific[79].

By providing an overview of the dynamics in trade and NTMs, our contribution would be instrumental to the vivid debate on the role of NTMs in the agri-food sector.

[74] E.g. Cardamone (2011), Shepherd and Wilson (2013).
[75] E.g. Peterson et al. (2013), Dal Bianco et al. (2016).
[76] Henson and Loader (2001), Grant and Lambert (2008), Sun and Reed (2010), Arita et al. (2017).
[77] Dal Bianco et al. (2016), Grant and Arita (2017).
[78] Martin (2018).
[79] Santeramo (2017).

References

Anders S, Caswell JA (2009) Standards-as-barriers versus standards-as-catalysts: Assessing the impact of HACCP implementation on U.S. seafood imports. American Journal of Agricultural Economics 91(2):310–321

Anderson K, Martin W (2005) Agricultural trade reform and the Doha Development Agenda. The World Economy 28(9):1301-1327

Anderson K, Nelgen S (2012) Trade barrier volatility and agricultural price stabilization. World Development 40(1):36-48

Arita S, Beckman J, Mitchell L (2017) Reducing transatlantic barriers on US-EU agri-food trade: What are the possible gains?. Food Policy 68:233-247

Athukorala PC, Jayasuriya S (2003) Food safety issues, trade and WTO rules: a developing country perspective. The World Economy 26(9):1395-1416

Bagwell K, Staiger R (2011) What Do Trade Negotiators Negotiate About? Empirical Evidence from the World Trade Organization. American Economic Review 101(4):1238-73

Beckman J, Arita S (2016) Modeling the Interplay between Sanitary and Phytosanitary Measures and Tariff-rate Quotas under Partial Trade Liberalization. American Journal of Agricultural Economics 99(4):1078–1095

Cardamone P (2011) The effect of preferential trade agreements on monthly fruit exports to the European Union. European Review of Agricultural Economics 38(4):553-586

Chen C, Yang J, Findlay C (2008) Measuring the effect of food safety standards on China's agricultural exports. Review of World Economics 144(1):83–106

Chevassus-Lozza E, Latouche K, Majkovic D, Unguru M (2008) The importance of EU-15 borders for CEECs agri-food exports: The role of tariffs and non-tariff measures in the pre-accession period. Food Policy 33(6):595–606

Cioffi ., Santeramo FG, Vitale CD (2011) The price stabilization effects of the EU entry price scheme for fruit and vegetables. Agricultural Economics 42(3):405-418

Crivelli P, Gröschl J (2016) The impact of sanitary and phytosanitary measures on market entry and trade flows. The World Economy 39(3):444-473

Dal Bianco A, Boatto VL, Caracciolo F, Santeramo FG (2016) Tariffs and non-tariff frictions in the world wine trade. European Review of Agricultural Economics 43(1):31-57

de Frahan BH, Vancauteren M (2006) Harmonisation of food regulations and trade in the Single Market: evidence from disaggregated data. European Review of Agricultural Economics 33(3):337-360

Disdier AC, Fontagné L, Cadot O (2015) North-South standards harmonization and international trade. The World Bank Economic Review 29(2):327-352

Disdier AC, Marette S (2010) The combination of gravity and welfare approaches for evaluating non-tariff measures. American Journal of Agricultural Economics 92(3):713–726

Drogué S, DeMaria F (2012) Pesticide residues and trade, the apple of discord?. Food Policy 37(6):641-649

Essaji A (2008) Technical regulations and specialization in international trade. Journal of International Economics 76(2):166-176

Fernandes AM, Ferro E, Wilson JS (2017) Product Standards and Firms' Export Decisions. The World Bank Economic Review [in press]

Ferro E, Otsuki T, Wilson JS (2015) The effect of product standards on agricultural exports. Food Policy 50:68-79

Fontagné L, Mayer T, Zignago S (2005) Trade in the triad: How easy is the access to large markets? Canadian Journal of Economics 38(4):1401–1430

Grant JH, Arita S (2017) Sanitary and Phyto-Sanitary Measures: Assessment, Measurement, and Impact. IATRC Commissioned Paper, 21:1-53

Grant JH, Lambert DM (2008) Do regional trade agreements increase members' agricultural trade?. American journal of agricultural economics 90(3):765-782

Greenville J (2015) Issues in agricultural trade policy: An overview. In Issues in Agricultural Trade Policy: Proceedings of the 2014 OECD Global Forum on Agriculture, May

Harrigan J (1993) OECD imports and trade barriers in 1983. Journal of International Economics 34(1–2):91–111

Henson S, Brouder AM, Mitullah W (2000) Food safety requirements and food exports from developing countries: the case of fish exports from Kenya to the European Union. American Journal of Agricultural Economics 82(5):1159-1169

Henson S, Loader R (2001) Barriers to agricultural exports from developing countries: the role of sanitary and phytosanitary requirements. World development 29(1):85-102

Ivanic M, Martin W (2014) Implications of domestic price insulation for global food price behavior. Journal of International Money and Finance 42:272-288

Jayasinghe S, Beghin JC, Moschini GC (2010) Determinants of world demand for U.S. corn seeds: The role of trade costs. American Journal of Agricultural Economics 92(4):999–1010

Jongwanich J (2009) The impact of food safety standards on processed food exports from developing countries. Food Policy 34(5):447-457

Koo WW, Kennedy PL, Skripnitchenko A (2006) Regional preferential trade agreements: Trade creation and diversion effects. Applied Economic Perspectives and Policy 28(3):408-415

Lambert D, McKoy S (2009) Trade creation and diversion effects of preferential trade associations on agricultural and food trade. Journal of Agricultural Economics 60(1):17-39

Martin W (2018) A Research Agenda for International Agricultural Trade. Applied Economic Perspectives and Policy 40(1):155-173

Mehta R, George J (2003). Processed food products exports from India: an exploration with SPS regime. Country report prepared under the ACIAR Project, International Food Safety Regulation and Processed Food Export from Developing Countries, Delhi: Research Information Systems and the Australian National University

Melo O, Engler A, Nahuehual L, Cofre G, Barrena J (2014) Do sanitary, phytosanitary, and quality-related standards affect international trade? Evidence from Chilean fruit exports. World Development 54:350-359

OECD (2015) Regional trade agreements and agriculture. OECD Food, Agriculture and Fisheries Papers, No. 79, OECD Publishing, Paris

Olper A, Raimondi V (2008) Explaining national border effects in the QUAD food trade. Journal of Agricultural Economics 59(3):436–462

Otsuki T, Wilson JS, Sewadeh M (2001a) What price precaution? European harmonization of aflatoxin regulations and African groundnut exports. European Review of Agricultural Economics 28(2):263–283

Otsuki T, Wilson JS, Sewadeh M (2001b) Saving two in a billion: quantifying the trade effect of European food safety standards on African exports. Food policy 26(5):495-514

Peterson E, Grant JH, Roberts D, Karov V (2013) Evaluating the trade restrictiveness of phytosanitary measures on US fresh fruit and vegetable imports. American Journal of Agricultural Economics 95(4):842-858

Santeramo FG (2019) On Non-Tariff Measures and Changes in Trade Routes: From North-North to South-South Trade?. IATRC Commissioned Paper, No. 938-2019-1580

Santeramo FG, Cioffi A (2012) The entry price threshold in EU agriculture: Deterrent or barrier?. Journal of Policy Modeling 34(5):691-704

Santeramo FG, Guerrieri V, Lamonaca E (2019a) On the evolution of trade and sanitary and phytosanitary standards: The role of trade agreements. Agriculture 9(1): 2.

Santeramo FG, Lamonaca E (2019a) On the Drivers of Global Grain Price Volatility: an empirical investigation. Agricultural Economics (AGRIECON) 65(1):31-42

Santeramo FG, Lamonaca E (2019b) The Effects of Non-tariff Measures on Agri-food Trade: A Review and Meta-analysis of Empirical Evidence. Journal of Agricultural Economics 71(1) [in press]

Santeramo FG, Lamonaca E (2019c) On the impact of non-tariff measures on export performances of African agri-food sector. Agrekon 1-18

Santeramo FG, Lamonaca E, Contò F, Nardone G, Stasi A (2018) Drivers of grain price volatility: a cursory critical review. Agricultural Economics (AGRIECON) 64:347-356

Santeramo FG, Lamonaca E, Nardone G, Seccia A (2019b) The benefits of country-specific non-tariff measures in world wine trade. Wine Economics and Policy [in press]

Scheepers S, Jooste A, Alemu ZG (2007) Quantifying the impact of phytosanitary standards with specific reference to MRLs on the trade flow of South African avocados to the EU. Agrekon 46(2):260–273

Schuster M, Maertens M (2013) Do private standards create exclusive supply chains? New evidence from the Peruvian asparagus export sector. Food Policy 43:291-305

Sheldon I (2012) North–South trade and standards: what can general equilibrium analysis tell us?. World Trade Review 11(3):376-389

Shepherd B, Wilson NL (2013) Product standards and developing country agricultural exports: The case of the European Union. Food Policy 42:1-10

Shepotylo O (2016) Effect of non-tariff measures on extensive and intensive margins of exports in seafood trade. Marine Policy 68:47-54

Sun D, Huang J, Yang J (2014) Do China's food safety standards affect agricultural trade? The case of dairy products. China Agricultural Economic Review 6(1):21-37

Sun L, Reed MR (2010) Impacts of free trade agreements on agricultural trade creation and trade diversion. American Journal of Agricultural Economics 92(5):1351-1363

Swinnen J (2016) Economics and politics of food standards, trade, and development. Agricultural Economics 47(1) 7-19

Swinnen J (2017) Some dynamic aspects of food standards. American Journal of Agricultural Economics 99(2):321-338

Trebilcock M, Pue K (2015) The Puzzle of Agricultural Exceptionalism in International Trade Policy. Journal of International Economic Law 18:233-60

UNCTAD (2012) International Classification of Non-Tariff measures, February 2012 version (UNCTAD/DITC/TAB/2012/2). New York, Geneva: United Nations.

United Nations (2017) World Economic Situation and Prospects. United Nations New York.

Wacziarg R (2001) Measuring the dynamic gains from trade. The World Bank Economic Review 15(3):393-429

Wei G, Huang J, Yang J (2012) The impacts of food safety standards on China's tea exports. China Economic Review 23(2):253-264

Wilson JS, Otsuki T (2004) To spray or not to spray: Pesticides, banana exports, and food safety. Food Policy 29(2):131–146

Wilson JS, Otsuki T, Majumdsar B (2003) Balancing food safety and risk: do drug residue limits affect international trade in beef?. Journal of International Trade & Economic Development 12(4):377-402

Xiong B, Beghin JC (2011) Does European aflatoxin regulation hurt groundnut exporters from Africa?. European Review of Agricultural Economics 39(4):589-609

Xiong B, Beghin JC (2014) Disentangling Demand-Enhancing and Trade-Cost Effects of Maximum Residue Regulations. Economic Inquiry 52(3):1190-1203

Yue C, Beghin, JC (2009) Tariff equivalent and forgone trade effects of prohibitive technical barriers to trade. American Journal of Agricultural Economics 91(4):930-941