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# SANITARY AND PHYTO-SANITARY MEASURES: ASSESSMENT, MEASUREMENT AND IMPACT

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# Abstract

Although recent data collection have revealed a large and diverse universe of non-tariff measures (NTMs), identification and quantification of these measures remain elusive. While much has been written on the subject, the extant literature has been unable to effectively diagnose the most critical areas of NTM concern, sorting out how and to what extent the trade effects vary across different types of measures, and the development of a suitable framework to address these policies in multilateral and regional trade arenas. The purpose of this paper is to shed new light on the landscape of sanitary and phytosanitary (SPS) measures affecting agri-food trade by exploiting detailed information from the World Trade Organization's (WTO) SPS committee meeting minutes on specific trade concerns (STCs) as a way to 'reveal' major cross-cutting NTM concerns faced by exporters. We catalogue the nature and duration of these measures across countries, products and specific classes of NTMs for the period 1995-2014. Our analysis indicates that developed countries play a significant role notifying specific concerns, although developing country notifications are on the rise. The results suggest that the WTO's SPS trade concern discussion mechanism may facilitate the resolution of SPS concerns, with success often depending on the type of concern and the participation of Members as raising the issue or maintaining the measure. While most SPS concerns are resolved, the distribution of concerns exhibits sharp peaks and heavy right tails with some concerns lasting more than a decade. Animal diseases and tolerances are identified as recurring concerns in meat and fruit and vegetable trade, respectively, with concerns related to testing and quarantine, customs and administration procedures, certification and import permits also on the rise. A first-pass empirical assessment indicates that SPS concerns impart significant reductions to Members' agricultural exports. While the SPS trade effects are heterogeneous across types of measures, countries maintaining or raising the measure, and the product sectors considered, they are consistently negative and strikingly large in magnitude, even for some of the largest countries in global agri-food trade. Thus, the analysis and results have important policy implications in terms of targeting SPS areas for discussion.



Keywords: Non-tariff measures (NTMs), sanitary and phyto-sanitary (SPS) measures, SPS Agreement, technical barriers to trade (TBT), specific trade concerns, WTO

JEL Codes: F13, Q17, Q18

## Acronyms Used

| | |
|---|---|
| AH | Animal Health |
| APHIS | Animal and Plant Health Inspection Service |
| AVE | Ad-Valorem Equivalent |
| CAC | Codex Alimentaruis Commission |
| CGE | Computable General Equilibrium |
| COOL | Country of Origin Labelling |
| EU | European Union |
| FAO | Food and Agricultural Organization |
| FS | Food Safety |
| GAP | Good Agricultural Practices |
| GATT | General Agreement on Tariffs and Trade |
| IPPC | International Plant Protection Convention |
| ITC | International Trade Centre |
| I-TIP | Integrated Trade Intelligence Portal |
| MAST | Multi-Agency Support Team (on NTMs) |
| MFN | Most Favored Nation |
| MRL | Maximum Residue Limit |
| NTB | Non-Tariff Barrier |
| NTM | Non-Tariff Measure |
| OECD | Organization for Economic Cooperation and Development |
| OIE | World Organization for Animal Health |
| PH | Plant Health |
| RTA | Regional Trade Agreement |
| SPS | Sanitary and Phytosanitary |
| STC | Specific Trade Concerns |
| TBT | Technical Barriers to Trade |
| TRAINS | Trade Analysis and Information Systems |
| UNCTAD | United Nations Conference on Trade and Development |

| | |
|---|---|
| UNECE | United Nations Economic Commission for Europe |
| URAA | Uruguay Round Agreement on Agriculture |
| USTR | United States Trade Representative |
| WHO | World Health Organization |
| WTO | World Trade Organization |

# I. Introduction

Since the signing of the historic Uruguay Round Agreement on Agriculture (URAA) we have witnessed a significant shift in the focus of agricultural trade policy concerns from border related costs such as tariffs, quotas, and export subsidies that dominated much of the research and policy agenda in the lead up to the agreement, to non-tariff obstacles and a plethora of standards and 'behind-the-border' regulatory policies. Indeed, while tariffs remain high on a handful of agricultural sectors and tariff-rate quotas guarantee at least some access in certain markets, including country specific quota designations reserved under free trade agreements, most policymakers and agricultural economists agree that the new 21st century obstacles to trade are more obscure in nature and have the potential to be more trade distorting (Beghin, Maertens and Swinnen 2015; OECD 2005; WTO 2012). Thus, the ability of countries, both developed and developing, to secure agricultural market access with bilateral and multilateral partners depends increasingly on regulatory and product compliance issues that go beyond the traditional instruments of import protection. As Baldwin (1999) noted more than a decade ago: "the lowering of tariffs has, in effect, been like draining a swamp. The lower water level has revealed all the snags and stumps of non-tariff barriers that still have to be cleared away" (p. 237).

For agriculture, non-tariff measures (NTMs) is a term used to describe the universe of standards and regulatory policies adopted by governments to meet public policy objectives which include food safety and the protection of plant, animal and human health.[1] Through the adoption of rules and regulations, governments seek to ensure the safety of imported food products and to protect plants and animals from pest and disease risks as well as from the introduction of harmful non-indigenous species. In this way, countries use regulatory standards to ensure safe food supplies for consumers and to strengthen or relax existing regulations in response to improved science-based information or increasing public demands on the part of consumers who are willing to pay for more stringent regulatory oversight of food production processes and information containing labels as per-capita incomes grow (Lusk, et al., 2003; Tonsor, et al., 2005).

Broadly defined, NTMs are policy measures other than ordinary customs tariffs that can potentially have an economic effect on international trade in goods, changing quantities traded, prices, or both (UNCTAD 2010). These measures are often justified on the grounds that they are necessary to correct market failures that may arise due to the lack of sufficient monitoring and control of the quality, characteristics, and safety of imported agri-food products. While rules and regulations can facilitate and enhance trade by increasing consumers confidence, they can also deliberately or unintentionally restrict trade, particularly for exporters in countries that lack monitoring, testing, and certification infrastructure to demonstrate compliance with import requirements in high income markets or between highly developed markets where acceptable risk levels and interpretation of appropriate scientific evidence differs among policymakers. Because WTO

[1] In the past, economists and policymakers often used the term "non-tariff barriers" (NTBs) to describe these policies. However, the term originated because traditional non-tariff instruments used by governments were protectionist in intent including quotas and export restraints which by design represent "barriers" to trade. The new era of non-tariff policies includes a much larger and more diverse set of measures, some of which may facilitate trade by reducing transaction costs and serving as quality signals for consumers. Throughout, we follow UNCTAD (2013) and refer to these policies as measures as opposed to barriers, although we make distinctions where appropriate.

Members have considerable policy flexibility on the products and countries to which regulations apply, policymakers often fail to take account of the potential trade effects of these measures (Orden and Roberts 2006; Arita, Mitchell, and Beckman 2015; USTR 2014; Cadot, et al. 2015; Disdier, et al. 2008; Peterson, et al. 2013).

Among the list of NTMs affecting agricultural trade, Sanitary and Phytosanitary (SPS) measures occupy a special place in terms of prevalence, economic significance, and negotiating options for reform (Wolff 2010). First, SPS measures are pervasive in agri-food trade because of the sensitive nature of issues such as food safety and the protection of plant and animal health from pest and disease risks. Second, the WTO Agreement on the Application of SPS Measures permits countries to adopt their own standards provided these measures are based on a risk assessment, not discriminatory between countries with similar conditions, and are minimally trade distorting to prevent the disingenuous use of these measures as instruments of protectionism (Josling, Roberts and Orden, 2004). Third, SPS measures are the most frequently encountered NTMs in agri-food trade according to data collected from official sources such as the United Nations Conference on Trade and Development's (UNCTAD) Trade Analysis and Information System (TRAINS) and the WTO's new Integrated Trade Intelligence Portal (I-TIP). They are also considered among the most relevant impediments to exports, according to a small sample of NTM business surveys conducted by the World Bank and International Trade Centre (World Bank 2008; ITC 2011).

Despite their widespread use, how and to what extent SPS measures affect agri-food trade are generally not well understood (WTO 2012). A critical challenge is the lack of suitable data to examine these measures, how and when they are applied and on which country-commodity pairs (Grant, Peterson and Ramniceanu 2015). This is in part due to the vast number of SPS and TBT measures in place. For example, since 1995, over 18,000 SPS (and 26,000 Technical Barriers to Trade (TBT)) notifications have been reported to the WTO. These notifications include a diverse and heterogeneous array of policies and regulatory standards, from specific maximum residue limits for Sulphur dioxide on cinnamon exports by Sri Lanka to the European Union (EU) to somatic cell requirements in dairy products by the EU, to fumigation requirements for insects by USDA's Animal and Plant Health Inspection Service (APHIS).[2]

Researchers are often impaired by the inability to distinguish between measures that are of prime concern – those in which policy-makers have a vested interest in targeting resources to negotiate equivalency, reciprocity or harmonization - versus measures that are largely inconsequential for exporters. Unlike tariffs which are more easily observed and quantified, SPS measures are not always transparent and quantification of their trade effects typically must rely on an indirect approach to predict what trade would be in the absence of such measures (Disdier et al. 2008; Arita, Mitchell and Backman 2015). As a result, currently available data are limited in their ability to reveal the more significant measures impacting trade across a motely of different policies, markets, and commodities and identification of a set of cross-cutting areas to target for reform. Key policy questions include:

- What are the major cross-cutting SPS concerns on the global landscape?
- When is an SPS measure unjustified or a "barrier" to trade?

[2] Technical barriers to trade measures include requirements on labelling, marketing and distribution of products (Beghin, Disdier, and Marette 2012).

- How have these concerns changed over time?
- Which countries have maintained the most troublesome obstacles to trade?
- Which countries have complained most vocally about these measures?
- Which commodities have the largest recorded incidences of concerns?
- Are most concerns resolved through the WTO committees?
- How long does it take for SPS measures to get resolved?
- What are the economic costs of these concerns in terms of forgone trade?

In this paper, we attempt to shed new light on the landscape of SPS measures and their impacts on agri-food trade by considering a revealed concerns-based approach. More specifically, instead of relying on the vast notification-based data and attempting to tabulate and quantify the full spectrum of NTMs (see Disdier, et al. 2008; Bureau et al. 2014; Didier, Emlinger and Fouré 2016), we exploit information discussed and summarized in the SPS committee meetings over time as a way to 'reveal' the major cross-cutting concerns of exporters. The WTO's SPS committee is a venue by which exporters can voice specific trade concerns (STCs) deemed important enough to raise formally through committees where clarification or consultative resolutions are sought (WTO 2012). We compile and organize the rich information contained in these meetings, including exporter and importer representative comments documented in the minutes to the meetings, to develop a database on exporters' revealed concerns. The revealed concerns approach allows us to sort through SPS measures which likely constitute unjustified measures or significant "barriers", as opposed to justified measures which may be of little concern to exporters. Further, the approach is advantageous because policy-makers may have little incentive to notify their own SPS measures but all kinds of incentive to notify the unjustified "barriers" of their partners. Thus, our inventory of SPS concerns allows us to gain considerable insight as to the nature, size, shape and scope of these obstacles affecting agriculture and food trade. We note upfront that the discussion in this report is focused on SPS measures in agri-food trade. While TBT measures are also important and specific trade concerns associated with these measures are similarly summarized in the TBT Committee meeting minutes, the detailed information we have tabulated at this time relates to SPS measures. On a relative basis, SPS concerns are more prevalent in agri-food trade. For example, over the 1995-2015 period, over 400 SPS concerns have been officially raised by exporters impacting agri-food trade while only 172 such concerns pertaining to agri-food trade have been registered in the TBT Committee meetings.

This paper proceeds as follows. In section two, we provide an overview of the SPS Agreement and its key features. Section three reviews the literature on the subject to illustrate where we stand and the state of the art on various issues. In this review, we assess the use of notification-based data that has been employed in the literature and the findings that have emerged. Section four introduces the specific trade concerns data as a way to examine SPS measures and highlights some advantages of a revealed concerns-based approach. In section five, we conduct a qualitative analysis and tabulation of the revealed SPS concerns across countries, commodities, type of concerns, and time, as well as an empirical assessment of their trade impacts. The resulting analysis paints a global picture of past and present SPS issues as revealed by agricultural exporting countries. Finally, in section six we conclude by identifying policy prescriptions from this analysis and recommendations for fruitful research directions in this area.

# II. The SPS Agreement

Both the SPS and TBT agreements were designed to strike a balance between giving Members full regulatory autonomy to protect legitimate domestic producer and consumer interests through the use of technical regulations, quality standards, labelling, conformity assessment, quarantine measures, production and process requirements, on the one hand, and assuring that these policies do not present unnecessary obstacles to trade on the other. If SPS and TBT provisions were overly restrictive, oftentimes legitimate policy interests of WTO Members would be thwarted and a comprehensive agreement may never have been reached. Conversely, SPS and TBT agreements devoid of any multilateral and non-discrimination provisions may be used with protectionist intent potentially undermining the gains from trade that have been achieved through successive rounds of multilateral tariff reductions.[3] In many respects this dilemma reflects a common divide among developed and developing countries, whereby the former wish to institute legitimate food safety controls and the latter who view developed country regulatory standards as overly stringent with protectionist intent.

In what follows, we discuss highlights of the SPS agreement which were concluded during the Uruguay Round negotiations establishing the WTO. Some of the features of the SPS agreement are well known among the policy and academic communities while others are more subtle and have key implications as to how the agreement is implemented. In addition, we also discuss the role of private standards in international trade – a group of measures where oversight and transparency is even murkier than SPS or TBT measures.

*The Agreement on Sanitary and Phytosanitary Measures*

While the WTO's SPS and TBT Agreements were important milestones governing the use and application of NTMs, in principle, this issue was not new to the multilateral arena. Box 1 illustrates several highlights of the SPS agreement. Fundamentally, food safety and the protection of plant and animal health dates back to the early days of the GATT under the Most Favored Nation (MFN) (Article I) and National Treatment (Article II). Article I prescribes the framework for equal treatment of imports of similar products from different foreign suppliers, and Article II discusses the process by which Members should treat imported products no less favorably than similarly produced domestic products. The original intent of these measures applied not just to tariffs, quotas, and export subsidies, but also to SPS measures. Moreover, the importance of SPS issues dates back to 1950 and the origins of the Joint Food and Agricultural Organization (FAO) and World Health Organization (WHO) Expert Committee on Nutrition. In 1950, the first session of this committee stated:

*"Food regulations in different countries are often conflicting and contradictory. Legislation governing preservation, nomenclature and acceptable food standards often varies widely from country to country. New legislation not based on scientific knowledge is often introduced, and little account may be taken of nutritional principles in formulating regulations."*[4]

[3] There is an emerging literature on import tariff and NTM policy substitution. Although empirical evidence supporting NTMs as substitute protection in place of tariffs is tenuous to date, recent studies have found some correlation (see Orefice 2015; Beverelli, Boffa, and Keck 2014).

[4] See http://www.fao.org/fao-who-codexalimentarius/about-codex/codex-timeline/en/

The Committee noted that the conflicting nature of food regulations may pose an obstacle to trade and therefore the distribution of food and suggested the FAO and WHO study these problems more closely. Various committee meetings followed in the 1950s and 60s including the United Nations Economic Commission for Europe (UNECE) establishment of the draft Geneva Protocol in 1958 in which a harmonized layout for food commodity standards was proposed for Europe. The relevant working party in UNECE provided quality standards for fresh fruit and vegetables and other food commodities with the objective of preventing disputes over the handling of these products during transport. These standards still form the basis of many food commodity standards worldwide. The Agreement on TBTs — commonly referred to as the "Standards Code"— emerged after the Tokyo Round (1973-79). This agreement covers various aspects of Members' adoption of standards and technical regulations.

Thus, the GATT recognized, in its Article XX, that Members shall have authority to take the necessary measures regarding imports to protect human, animal and plant health and preservation. However, implementation of SPS protocols were limited for three reasons. First, the original GATT rules allowed for an important exception. Specifically, Article XX:b permitted members to take import measures necessary to protect plant, animal and human health, even if they were more stringent than comparable domestic measures. Second, the applicable GATT Articles for MFN and National Treatment did not formally oversee and make transparent Members' implementation of regulatory measures as they do today. Third, the original TBT agreement was signed by only 32 participating GATT countries, compared to the 90 Members that participated in the Standards Code of the Tokyo Round.[5]

The conclusion of the Uruguay Round Agreement on Agriculture (URAA) and the WTO's SPS Agreement made significant progress to fill these loopholes by overseeing the conditions under which national regulatory authorities set and enforce health and safety standards that directly or indirectly affect international trade. The Uruguay Round (1986-94) established the potentially negative impacts of NTMs on international trade as one of its primary subjects of negotiation, particularly for agriculture and food trade. The multilateral negotiations resulted in several agreements, including the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) and an augmented Agreement on the application of Technical Barriers to Trade. Key features of the SPS Agreement are summarized in Box 1, including scientific justification of measures, harmonization of measures, regionalization, equivalency, risk assessment, and transparency of measures.

Two points are worth emphasizing in Box 1. First, transparency of SPS measures is one of the key achievements of the SPS Agreement. Not only does it require Members to notify new or changed measures, Members must also establish enquiry points to respond to requests for more information. Thus, Members are given the opportunity to comment on measures and have their comments taken into account. Moreover, as discussed in section four, the WTO regularly holds formal SPS committee meetings (i.e., typically 3 times per year) to discuss trade concerns and to circumvent potential trade disputes. The transparency requirement of the SPS Agreement has stimulated an important and growing body of research that was not previously feasible due to recognized data limitations. Importantly, the availability of data on the types of measures countries notify has

[5] See https://www.wto.org/english/tratop_e/tbt_e/tbt_info_e.htm

**Box 1: The Agreement on the Application of Sanitary and Phytosanitary (SPS) Measures**

Food safety and animal and plant health regulation dates back to the GATT (1947). Article I, Most Favored Nation (MFN) clause obliges non-discriminatory treatment of imported products from different foreign suppliers and Article III (National Treatment) requires that imported products be treated no less favorably than domestic produced goods with respect to any laws or requirements affecting their sale. Such rules applied to application of SPS-related measures.

However, the GATT rules also contained an important exception: Article XX:b permitted countries to take measures necessary, even if they were more stringent than comparable domestic measures, on imported products to protect plant, animal and human health. The conclusion of the Uruguay Round Agreement on Agriculture (URAA) and the WTO's SPS Agreement sought to fill this loophole by overseeing the conditions under which national regulatory authorities may set and enforce health and safety standards that directly or indirectly affect international trade. In particular, it applies to any measure, regardless of the specific form it may take, adopted with the aim (SPS Annex A, para. 1(a), (b), (c) and (d)):

i. To protect human or animal life from risks arising from additives, contaminants, toxins, or disease causing organisms in food and feed
ii. To protect human life from plant or animal carrying disease
iii. To protect animal or plant life from pests, diseases, or disease-causing organisms
iv. To prevent other damages within the territory of the country from the entry, establishment or spread of pests
v. To protect health of fish and fauna as well as forests and wild flora

Several key features of the SPS Agreement include:

*a.* *Justification of Measures* – while the agreement permits countries to adopt their own national regulations and standards, measures shall be based on objective scientific data
b. *Harmonization* – Members are encouraged (although not obligated) to establish measures consistent with international standards, namely, those advocated by Codex Alimentarius Commission (Codex), the International Plant Protection Convention (IPPC), and the World Organisation for Animal Health (OIE). International standards are expected to be consistent with the SPS agreement and the process of adopting these standards is often referred to as the "harmonization" of standards.
c. *Regionalization* – SPS measures can vary depending on the country of origin or even regions within a country because of differences in climate, biological and existing pest and disease risks or food safety conditions
d. *Equivalency* – acceptable food, animal and plant health risk levels can be achieved in different ways. If partner countries can demonstrate that its measures ensure the same level of accepted risk, importing Members shall accept alternative measures as equivalent.
e. *Risk Assessment* – the SPS Agreement encourages the use of risk assessment appropriate to the circumstance and if requested to make known the risk assessment procedures and the level of acceptable risk. Risk assessment shall be required if standards exceed international standards.
f. *Transparency* – the Agreement requires Members to notify other countries of any new or modified SPS measure which may affect trade and establish enquiry points to respond to requests for more information. Members are allowed to comment and have their comments taken into account.
g. *Temporary 'provisional' Measures* – the SPS Agreement allows provisional measures when scientific evidence is insufficient, including immediate measures which can be taken in emergency situations. Members shall review the scientific basis of measures within a reasonable period of time.
h. *Dispute Settlement* –The provisions contained in the SPS Agreement shall be subject to Dispute Settlement.

stimulated a new wave of empirical research that has significantly advanced our understanding about the trade impacts of these measures.

Second, Members are allowed to erect temporary 'provisional' measures to protect plant, animal and human health in cases of scientific uncertainty. However, interpretation of the language of temporary and provisional measures has become a controversial issue in international trade, perhaps the most notable of which is the dispute involving the EU's restrictions on the use of beef hormones (WTO DS26). In this case the United States challenged the EU's restrictions on cattle raised for beef production. The EU implemented the ban in 1989 due to concerns that hormone-treated beef posed a potential human health risk while the United States viewed the ban as not scientifically justified and lacking adequate risk assessment. Ambiguity arises over language such as "available pertinent information," "reasonable period of time," and "insufficient relevant scientific evidence." From the EU's perspective, implementation of provisional measures applies not only in the management of the risk but also the assessment (WT/DS26/AB/R; WT/DS48/AB/R).

*A Note on Private Standards*

In recent years, private standards have grown in prominence as measures potentially affecting agri-food trade. Unlike SPS measures and other public standards which are implemented and enforced by regulatory authorities, private standards are operated by nongovernmental entities such as individual firms, retailers, producer organizations and trade cooperatives.

Compared to NTMs, private standards generally are more stringent (Fulponi, 2006) and may cover a wider variety of quality-related issues and environmental and labor standards. Proponents of private standards state that these measures increase the quality and demand for products and may improve performance of exporters that have achieved certification (Henson, et al. 2011; Henson and Loader 2001). Nevertheless, concerns have been raised that the requirements are both prescriptive and restrictive and impose significant barriers to market access (Marx, et al. 2012). Furthermore, private standards raise harmonization challenges of complying with multiple sets of standards by different private entities. Small-scale producers and those from developing countries are likely to be most negatively affected by the cost of private standards (Martinez and Poole, 2004). Although compliance with private standards is voluntary, when multiple retailers impose such standards, private standards may function as *de facto* requirements (Wolff, 2009).

Whether the existing set of WTO agreements covers private standards is a matter of debate. Concerns over private standards were first brought to the attention of the SPS Committee in 2005 as an STC (219) by St. Vincent and the Grenadines. This case covered the pesticide requirements of EurepGAP (now GlobalGap)[6] regarding the importation of bananas. St. Vincent and Grenadines, along with other developing Members, raised concerns that these standards were significantly higher than international standards and asked if these measures were subject to the

[6] GlobalGAP is a private standard for "Good Agricultural Practices" used to provide quality assurance for food safety, health, and environmental concerns. Originally developed by major European retailers (as EurepGAP), the standard has been adopted globally with the total number of certified GlobalGAP producers exceeding over 120,000 in 2012 (see www.globalgap.org).

SPS Agreement. The EU contended that as EurepGap was implemented by private retailers, the European Commission had no legislative authority over these measures. This disagreement may stem from different interpretations of the SPS Agreement's scope of application. Article 13 of that agreement notes that:

"*Members shall take such reasonable measures as may be available to them to ensure that non-governmental entities within their territories, as well as regional bodies in which relevant entities within their territories are members, comply with the relevant provisions of this Agreement.*"

The problem in part lies in the lack of a clear definition of the term 'non-governmental entities.' In 2013, the SPS Committee developed a working group to establish a formal definition of private standards. The group, co-stewarded by China and New Zealand, proposed the following (WTO 2015):

"*An SPS-related private standard is a written requirement or condition, or a set of written requirements or conditions, related to food safety, or animal or plant life or health that may be used in commercial transactions and that is applied by a non-governmental entity that is not exercising governmental authority*."[7]

However, some industrialized members, which have been more inclined to view private standards as being outside the purview of the WTO, had problems with the terms 'non-governmental entity' and 'requirement.' Major exporting developing members found it necessary to maintain these terms. To date, the discussions remain deadlocked. Until an explicit definition may be reached and the WTO's role clarified, trade issues concerning private standards will largely operate outside of its purview.

# III. NTM Data and Previous Literature

The challenges facing quantitative assessments of the effects of SPS measures are well documented (Deardorff and Stern 1997; Ferrantino 2006; Beghin and Bureau 2001; Beghin, Disdier, and Marette 2012; Winchester, et al. 2012). Unlike tariffs, SPS measures are not always transparent, directly quantifiable, and easily modeled. Moreover, data and information on specific types of measures, how and when they are applied, and on which countries and commodities have typically only been feasible through case-study approaches. Indirect estimation of SPS costs, or the *ad-valorem* equivalent for use in computable general equilibrium (CGE) models, is challenging because in many cases one does not observe the true counterfactual—that is, the value of trade that would have occurred had the measure not been in place (Peterson, et al. 2013; Arita, Mitchell, and Beckman 2015).

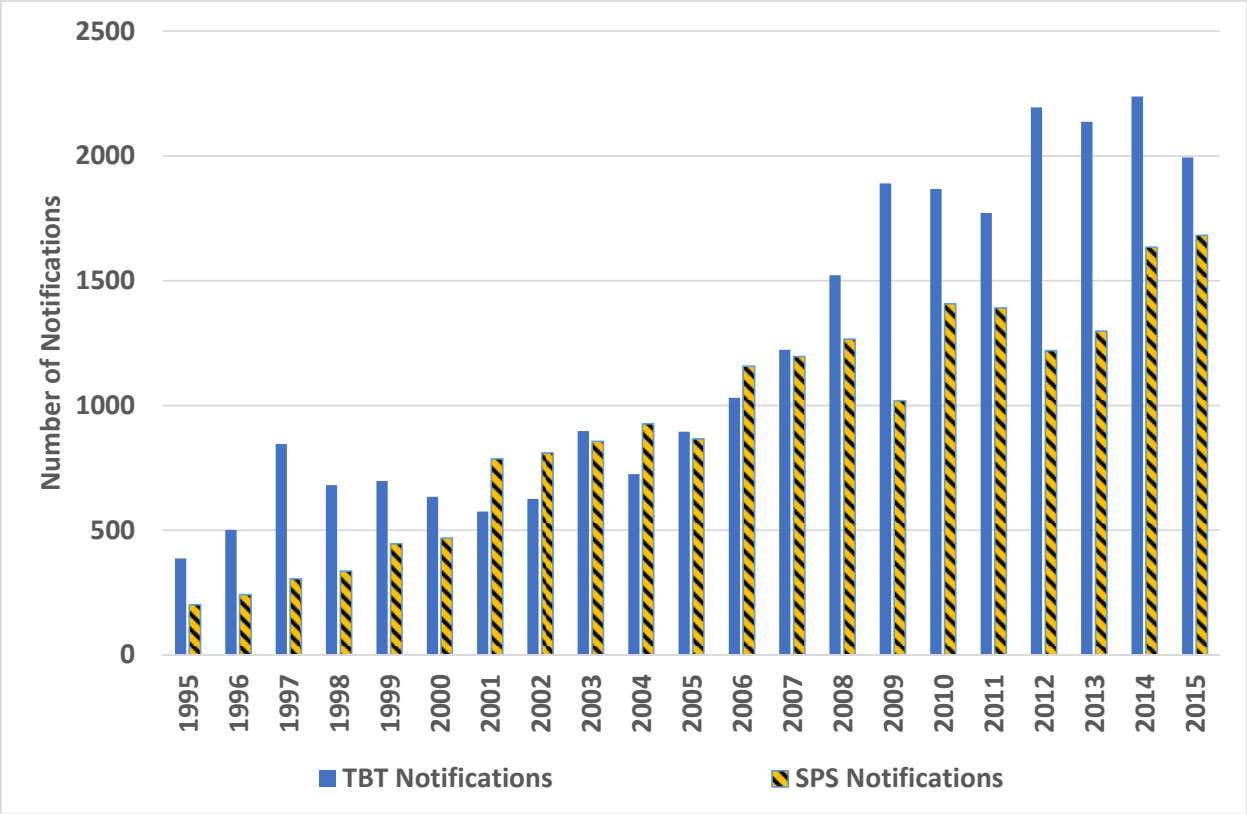
A critical issue underlying these challenges is the role of data. However, as illustrated below, the problem is not necessarily the lack of data. Rather, recent data collection efforts have systematically revealed a large and diverse universe of applicable measures. First, in 2012, the WTO released its Integrated Trade Intelligence Portal (I-TIP) database. This portal provides one of the largest repositories of non-tariff information, made possible by Members' requirement to

[7] See: http://www.puntofocal.gov.ar/doc/msf_w283.pdf

notify through the SPS and TBT Committees drafts of any regulation or measure including revisions or alternations (Addenda/Corrigenda) that can potentially effect trade.

Figure 1 illustrates the number of notifications of SPS and TBT measures through 2015. Since 1995, the WTO has received over 19,000 SPS and nearly 26,000 TBT notifications of measures maintained by Members. In 1995, 18 Members notified 201 SPS notifications to the WTO. Interestingly, the EU-15, United States, and Mexico accounted for over half of all SPS notifications in 1995 with 29, 20 and 87 measures notified, respectively. TBT notifications stood at 388 in 1995, nearly double the number of SPS notifications. Here, EU-15 countries made the largest number of TBT notifications at 119 accounting for 30 percent of all notifications received in 1995. The EU-15 is followed in notifications by Japan at 49 and the United States at 35.

**Figure 1. SPS and TBT Notifications to the WTO, 1995-2015**




Source: https://i-tip.wto.org/goods/

Through December 31, 2015, the WTO has logged 19,509 cumulative SPS and 25,325 TBT notifications. While these figures include revisions to existing measures over time, as Figure 1 illustrates, the universe of SPS and TBT measures continues to grow. With the exception of the 2001-06 period, TBT notifications have largely exceeded SPS notifications, owing to the fact that the former cover the full spectrum of goods, while the latter encompass mainly agricultural and food products.

Another point of emphasis in Figure 1 is that the upward trend in notifications of SPS and TBT measures does not necessarily reflect a rising number of notified measures. Instead, the trend reflects both the rising share of developing country notifications through time and the increasing membership in the WTO, in which 21 new countries have joined since 2000. For example, in 1995, just 17 (25) Members notified their SPS (TBT) measures, whereas in 2015, 55 and 67 Members made notifications of measures, respectively, including significant notifications from developing countries such as Ecuador (123 new TBT measures), Egypt (63 new TBT measures), China (over 300 new SPS measures),[8] and Brazil (88 new SPS measures). With the exception of the United States, which notified nearly 300 new TBT measures and 88 new SPS measures in 2015, compared to just 35 and 20 in 1995, the number of notifications by developed economies that notified in both 1995 and 2015 remained fairly constant. For example, the EU notified 80 new TBT measures in 2015, compared to 119 notifications in 1995, and 31 new SPS measures in 2015, compared to 29 in 1995.

Similar to the WTO's I-TIP database, UNCTAD's TRAINS database provides a comprehensive and widely used dataset for NTM assessment. In partnership with the WTO and other international organizations, UNCTAD has made great efforts to organize NTM information systematically by type of measures and has tabulated these measures at the HS-6 digit commodity code. TRAINS uses information collected through WTO notifications and complements it with information drawn from official government sources. However, given the enormous effort required to summarize countries' use of NTMs, the last recorded update of the TRAINS database prior to 2013 was in 2001. In 2013, the database was thoroughly updated to provide an improved classification system. The classification led by the Group of Eminent Persons on NTMs developed a tree/branch structure in which measures are categorized into chapters depending on their scope and design.

As discussed further below, because the TRAINS database is widely used by researchers to study the trade effects of NTMs and because we also use certain aspects of this taxonomy to classify specific SPS trade concerns, we illustrate UNCTAD's classification of measures (UNCTAD 2012). Table 1 first summarizes the general chapters of all measures and Box 2 describes the specific sub-chapters and types of measures classified under the SPS chapter. At the most aggregated level (Table 1), the classification of non-tariff measures contains 16 chapters ranging from Chapter A - SPS measures through Chapter P – Export-related measures. UNCTAD classifies Chapters A-C as technical measures because they include specific requirements for import such as restrictions or limits on substances, disease prevention treatments (Chapter A), TBT measures such as labelling and quality specifications (Chapter B), and customs formalities such as inspection and licensing requirements (Chapter C). Chapters D-O are often referred to as non-technical or "hard measures" because a number of these measures are a direct result of trade policy actions taken by governments such as contingent protection for unfair trading practices (Chapter D), price or quantity controls such as tariff rate quotas (TRQs) (Chapters E and F), or finance restrictions on import payments or measures affecting competition such as State Owned Enterprises (STEs) (Chapter G and H).

Focusing on SPS measures, Box 2 below lists the breakdown of UNCTAD's sub-chapters within

[8] China's SPS notifications in 2015 were significant and represented nearly one quarter of all SPS notifications received by the WTO that year.

Chapter A describing SPS measures. At the sub-chapter level of the taxonomy, UNCTAD divides measures into eight categories. Sub-chapters A1-A6 describe prohibitions (A1), tolerance limits (A2), labelling and marking requirements for SPS reasons (A3), Hygienic requirements (A4) pest mitigation treatments on plants and animals (A5), and other production or post-harvest regulations (A6). Sub-chapter A8 includes conformity assessment measures for SPS reasons and A9 is a catchall category for all other SPS measures not elsewhere specified. Further, each of the seven sub-chapters is further sub-divided into several more specific categories of measures such as maximum residue limit controls or food additives in food and feed processing (A21 vs A22) or specific types of treatments on products (A51-A53).

**Table 1. Classification of Non-Tariff Measures, UNCTAD**

| | | |
|---|---|---|
| Technical Measures | A | SPS measures |
| | B | Technical Barriers to Trade |
| | C | Pre-Shipment inspection and other formalities |
| Non-Technical Measures | D | Contingent trade-protective measures |
| | E | Non-automatic licensing, quotas, prohibitions and quantity-control measures other than for SPS or TBT reasons |
| | F | Price-control measures, including additional taxes and charges |
| | G | Finance measures |
| | H | Measures affecting competition |
| | I | Trade-related investment measures |
| | J | Distribution restrictions |
| | K | Restrictions on post-sales services |
| | L | Subsidies |
| | M | Government Procurement |
| | N | Intellectual property |
| | O | Rules of origin |
| | P | Export-related measures |

Source:http://unctad.org/en/Pages/DITC/Trade-Analysis/Non-Tariff-Measures/NTMs-Classification.aspx

*NTM Literature*

A growing body of empirical literature has emerged exploring the relationship between NTMs and international trade. Empirical investigations of NTMs can be classified in two categories:

1. Broad-based inventories which attempt to cover the widest possible scope of notified measures, or
2. Case studies, where better information is available for a single measure (say, aflatoxin limits) or a specific group of measures (i.e., maximum residue limits).

For broad-based assessment, several studies have employed the notification-based information from the TRAINS and I-TIP datasets to examine the trade effects of NTMs. Given the sheer

**Box 2. UNCTAD Classification of SPS Measures**

**A1 Prohibitions /Restriction of Imports for SPS Reasons**
- A11 Temporary geographic prohibitions for SPS reasons
- A12 Geographic restrictions on eligibility
- A13 Systems approaches
- A14 Special authorization requirement for SPS reasons
- A15 Registration requirement for imports
- A19 Prohibitions/restrictions of imports for SPS reasons, nes

**A2 Tolerance Limits for Residues and Restricted Use of Substances**
- A21 Tolerance limits for residues of or contamination by (non-microbiological) substances
- A22 Restricted use of substances in food and feed and their contact materials

**A3 Labelling, Marking and Packaging Requirements**
- A31 Labelling requirements
- A32 Marking requirements
- A33 Packaging requirements

**A4 Hygienic Requirements**
- A41 Microbiological criteria on final products
- A42 Hygienic practices during production
- A43 Hygienic requirements, nes

**A5 Treatments for Elimination of Plant & Animal Pests & Disease-Causing Organisms**
- A51 Cold/Heat treatment
- A52 Irradiation
- A53 Fumigation
- A50 Treatments for elimination of plant and animal pests, nes

**A6 Other Requirements on Production or Post-Production Processes**
- A61 Plan-growth processes
- A62 Animal raising or catching processes
- A63 Food and feed processing
- A64 storage and transport conditions
- A69 Other requirements on production or post-production processes, nes

**A8 Conformity Assessment related to SPS**
- A81 Production registration requirement
- A82 Testing requirement
- A83 Certification requirement
- A84 Inspection requirement
- A85 Traceability requirement
- A86 Quarantine requirement
- A89 Conformity assessment related to SPS, nes

**A9 SPS Measures, nes**

Source: UNCTAD (2012). Note that sub-chapter A7 was intentionally left out by UNCTAD.

number of measures included and the difficulty in organizing information, frequency indices and coverage ratios have been used in many of these studies. For instance, using frequency and coverage ratios for 61 product groups, including some agri-food commodities, Fontagné, Mimouni, and Pasteels (2005) find that SPS and TBT measures have a negative impact on agri-food trade but not necessarily on trade in industrial products. Disdier, et al. (2008) use notification frequencies of all measures catalogued in TRAINS and the *ad valorem* tariff-equivalents estimated by Kee, et al. (2009) to evaluate the impact of regulations in agri-food trade in greater detail. They estimate that NTMs have a negative influence on trade in cut flowers, processed food products (e.g., beverages), and meat, but a strong positive influence on trade in cereals, wool, and albuminoids/starch. Using the same dataset, Essaji (2008) finds a substantial negative effect of non-tariff measures on low income exporters reflecting the fact that these countries lack the capacity to meet burdensome technical regulations. Gourdon and Nicita (2012) employed the updated (2012) version of the TRAINS data to provide a descriptive analysis of the incidence of various types of NTMs both across countries and economic sectors using frequency indices and coverage ratios. UNCTAD (2013) estimated overall trade restrictiveness indices with the TRAINS data and found NTMs to be two to three times larger than tariffs in terms of their effects on agricultural trade.

The NTM-IMPACT project (see Orden, Beghin and Henry 2012 for a summary) also conducted a broad-based, empirical assessment of the trade effects of NTM regulatory heterogeneity. In this project, collaborators at 12 different institutions assembled a broad set of regulations and standards measured on a comparable basis for the EU and 9 of its trade partners. The vast array of NTMs covered by the project are technically complex and were difficult to evaluate, aggregate, and quantify. Winchester, et al. (2012) articulated these challenges and described the procedures used to develop a comprehensive snapshot of EU regulatory heterogeneity in 2008-09. This effort included measures for import requirements concerning food safety, animal and plant health, labeling, traceability, conformity assessment and certification requirements. Heterogeneity index of trade (HIT) regulations were computed and the project's research team concluded that regulatory differences in NTMs negatively affected EU trade.

Other studies have used the TRAINS and I-TIP databases to infer the height of the *ad valorem* equivalent (AVE) impact of NTMs by using a theoretically consistent gravity equation to predict what trade would be in the absence of the measures, or import demand specifications using total agricultural imports (i.e., eliminating the bilateral country-pair dimension) (i.e., Kee, et al. 2009). These AVEs are often used as intermediate inputs for large-scale computable general equilibrium (CGE) assessments of international trade agreements such as the Trans-Pacific Partnership (TPP) and the Trans-Atlantic Trade and Investment Partnership (T-TIP). Leading studies in this area include Kee, et al. (2009), Bureau, et al. (2014), Disdier, Emlinger, and Fouré (2016), and Arita, Mitchell and Beckman (2015). In a widely-cited study, Kee, et al. (2009) used the TRAINS data to estimate product-by-product the *ad valorem* equivalent effect of price control, quantity restrictions, monopolistic measures and technical regulations. They find that NTMs on average add 70 percent to the level of trade restrictiveness imposed by tariffs alone. They also find that the contribution of NTMs to overall protection is 30 percent higher in agriculture compared to manufacturing. Bureau, et al. (2014) and Disdier, Emlinger, and Fouré (2016) follow Kee, et al. (2009) to estimate AVEs, but focus on the universe of WTO notifications of SPS and TBT measures. Their findings suggest that nearly 80 percent of product lines at the HS-6 level are

affected by at least one SPS or TBT measure in the United States and that more than 95 percent of such product lines are affected by at least one SPS or TBT measure in the remaining TPP countries and in the EU. Disdier, Emlinger, and Fouré (2016) find that the overall AVE of SPS and TBT protection is 12.8 percent in the United States, 10 percent in the other TPP countries, and 15 percent in the EU. For agri-food trade, these AVEs numbers increase to 35.7 percent for the United States, 36.7 percent for the other TPP countries, and 40.1 percent for the EU, respectively, for agri-food trade.[9]

Arita, Mitchell, and Beckman (2015) employ a case-study approach to estimate AVEs of some well-known SPS and TBT issues in selected sectors between the United States and the EU. They develop a sector-based gravity equation with a bilateral dimension for 9 agricultural industries: beef, pork, poultry, corn, soybeans, wheat, fruit, vegetables, and tree nuts. This bilateral dimension allows the researchers to recover AVEs facing U.S. exports to the EU, as well as the AVEs affecting EU exports to the United States in two sectors: fruits and vegetables. Their results point to relatively high AVE of NTMs affecting U.S. poultry and pork exports estimated at an average of 102 percent and 81 percent, respectively. The study concludes that the high levels trade restrictions are the result of EU regulations on pathogen reduction treatments and beta-agonists. Soybeans recorded the lowest AVE from biotechnology restrictions at 17 percent.

Case studies have also been conducted on standards and residue limits related to food safety and plant health. Jayasinghe, Beghin, and Moschini (2009) depart from broad-based inventory approaches and focus on a particular product – U.S. corn seed exports. Making use of the EXCERPT (Export Certification Project) database, the authors utilize a count variable to determine the number of SPS measures affecting corn seed exports. They find that trade is decreasing in the number of foreign SPS/TBT standards required. Similarly, Peterson et al. (2013) and Grant, Peterson, and Ramniceanu (2015) focus on a particular type of SPS measure - phytosanitary treatments (i.e., methyl bromide, cold and refrigeration treatments, etc.) - affecting U.S. fresh fruit and vegetable trade. Both studies find that SPS measures tend to reduce U.S. trade initially. However, once exporters accumulate product treatment experience in the global market place, the negative phytosanitary trade effect vanishes.

The stringency of countries' maximum residue limits (MRLs) is another type of SPS measure that has received ample attention in the literature. In a widely cited study, Otsuki, Wilson and Sewadeh (2001) found that the implementation of a new aflatoxin standard in the EU negatively impacts African exports of cereals, dried fruits and nuts to Europe. The authors suggest that the new EU standard would reduce health risks by approximately 1.4 deaths per billion per year but would simultaneously curb African exports by 64% or US$ 670 million. Xiong and Beghin (2012) overturned the estimated effect in Otsuki, et al. (2001), by considering possible demand enhancing effects of SPS regulations. Other case studies tend to support the significant negative effects of MRL stringency on trade flows. Examples include: Wilson and Otsuki (2004) for MRLs on chlorpyrifos impacting banana exports; Wilson, et al. (2003) on the effect of residue limits on tetracycline in beef exports; Chen, et al. (2008) on food safety standards affecting China's exports of vegetables, fish, and aquatic products; Drogué and DeMaria (2012) on MRLs affecting apples and pears; and Disdier and Marette (2010) on antibiotics impacting crustacean exports. Evidence of the negative trade flow impact of these measures was recently corroborated in a meta-analysis

[9] For non-agricultural sectors, the average AVEs are less than 10 percent in all countries.

by Li and Beghin (2012). Controlling for differences in methodology and data sampling, the authors illustrate that SPS and TBT studies are more likely to find that SPS and TBT measures have an impeding rather than promoting effect on international trade.

While these studies have significantly advanced our understanding of the trade effects of NTMs, they have some important limitations. First, the TRAINS and I-TIP data rely predominately on self-reported notifications by importing authorities. While countries are obligated to notify their NTMs, countries often report thousands of NTMs, many of which have never been raised as an SPS or TBT concern by exporters or escalated to a formal trade dispute. As a group, self-reported notifications tend to be a "mixed bag" of measures with widely varying trade effects. This aspect of the notifications limits one's ability to use them to identify the policies that are of actual concern to exporters. Further, some measures are trade facilitating because they represent important quality and/or safety enhancements of the product (Xiong and Beghin 2014).

Second, there is a lack of consistency in reporting behavior. Countries are only obligated to report new measures, which limits the comparability of notification-based information and creates delays in cataloguing regulations. Third, the amount of information contained in these notifications is limited. Very little information exists describing the type of measure affecting trade and to which countries and products the measure applies. In particular, the TRAINS and I-TIP data do not contain a bilateral (i.e., country-pair) dimension, which means that researchers must assume that if an NTM measure is notified, it applies to all exporters. As demonstrated below, this is often not the case, particularly for SPS measures where the measure's application depends on the importer's assessment of the risks associated with production and export in the origin country.

Finally, the use of NTMs changes over time, as new types of measures appear when new ingredients or supplements are registered for use or cost saving input technologies such as new pesticides or animal productivity enhancing drugs become available. Thus, given the enormous data collection effort required, it often takes several years or even a decade before new measures or changes to existing measures are catalogued, and the country coverage is not comprehensive. For example, the newly updated TRAINS (2012 version) covers less than 65 countries, and the measures of many of these countries have not been updated in subsequent years.

In summary, while case-study approaches have the benefit of signaling out a specific regulation, it is difficult to compare across different SPS measures. Further, the findings from case studies do not easily lend themselves for use as inputs in large-scale simulation studies of NTM impacts in international trade agreements. On the other hand, broad-based approaches are useful for an overall picture, yet it is difficult to distinguish between important and unimportant measures.

To overcome some of these limitations and due to the bilateral country-pair dimension often needed to model the new wave of mega-regional trade deals, we propose a targeted approach using a database of the revealed concerns of exporters regarding SPS measures maintained by their importing partners. Specifically, we employ the specific trade concerns raised formally in the SPS committee meetings of the WTO as a way to identify details of the measures that are of most critical concern to agricultural exporters. While our assessment is not based on survey instruments or expert interviews, the aim of this report is to blend case-study and broad-based approaches by exploiting details of SPS trade concerns raised by exporters. Fontagné et al. (2015) similarly used

SPS specific trade concerns from 1995-2005 to evaluate the trading behavior of French firms and Crivelli and Groeschl (2016) used the data from 1995-2010 to evaluate the probability of exporting and the level of exports at the country level conditional on an active SPS trade concern. This study is similar in spirit but offers a more comprehensive look at the specific details of SPS trade concerns from 1995-2014 by considering the duration of SPS concerns, product sectors impacted, country participation as raising or supporting members versus countries most active in maintaining SPS measures of concern, the severity of the concern and the specific language used by exporters when raising concerns, among other details. We also evaluate their trade impacts across a number dimensions including the type of SPS concern, product sectors where concerns are most active, and countries.

# IV. SPS Specific Trade Concerns Database

The WTO SPS and TBT Agreements mandated the establishment of committees to provide a forum for consultations to carry out the objectives of the respective agreements. Committee meetings are held regularly and are intended to discuss SPS and TBT issues, monitor and advance harmonization efforts, and establish norms of the agreement. An important mechanism of the committees is the consideration of specific trade concerns (STCs) of exporters. Here, members can bring attention to, discuss, and potentially resolve STCs regarding applicable SPS and TBT measures. The committees, which typically meet 3 times annually, allow members to exchange information on STCs and discuss alleged inconsistencies associated with implementation of the agreements. STCs do not constitute formal trade disputes in any legal sense. In fact, they are not even a precursor. Since the WTO made available detailed information about STCs, only 43 concerns related to SPS measures and 57 concerns related to TBTs have escalated from being STCs to becoming the subject of formal dispute settlement proceedings. Rather, STC discussions are intended to resolve disagreements over various measures before they reach the formal dispute settlement process. For example, during the WTO SPS committee on March 16-17, 2016, STCs raised included the EU's concerns about India's revisions of its maximum levels for food additives, Chile's concerns about Australia's delays in approving the importation of Chilean poultry products, Chile's concerns about Vietnam's restrictions on Chilean fruit due to fruit flies, and China's suspension of bovine meat imports from the EU over concerns about the Schmallenburg virus in sheep, cattle and goats. Other concerns were reported as resolved. For example, Nigeria's concern over excessive plant certification delays of hibiscus flowers commonly used in beverages and imported by Mexico was reported as resolved.

Importantly, there is no obligation for WTO Members to raise STCs. Thus, STCs solve potential moral hazard problems associated with delays in self-notification. Moreover, STCs provide a strong signal that if exporters are concerned enough to raise an issue in the formal committee meetings, they must have reasons to believe that their partners' policies are unduly restricting trade or violating the SPS Agreement. This type of 'revealed concern' approach allows us to focus on areas more likely to be targeted for reform.

The STC database includes a rich set of information that lends itself for merging with international trade data for empirical or quantitative assessments. Information compiled includes the year a concern was raised and resolved, specific products affected, parties involved in the concern, the number of times a concern was subsequently raised, duration of the concern, and other information.

**Table 2. Specific Trade Concern Information Related to SPS Measures**

| Variable | Description |
|---|---|
| STC Number | WTO Identification number |
| HS Code | HS4- or HS6-dgit product code affected by the concern |
| Status | Current status of the STC: resolved, partially resolved, ongoing, not reported |
| Year Raised | First year STC was raised in SPS Committee |
| Year Resolved | Ending year if STC reported as resolved |
| Last Year Raised | Last year STC was raised in SPS meeting |
| Times Raised | Number of times STC was subsequently raised |
| Member(s) Maintaining | Importing country(ies) maintaining the SPS measure |
| Member(s) Raising | Exporting country(ies) raising the concern |
| Member(s) Supporting | Exporting country(ies) supporting the concern |
| Times Raised | Number of times STC was subsequently raised |
| Formal Dispute | Indicator if concern escalated to formal WTO dispute settlement |
| Raising Member | Indicator for raising vs. supporting members |
| Duration | Number of years concern was active |
| WTO Subject | Animal Health (AH), Plant Health (PH), Food Safety (FS) |
| UNCTAD NTM Classification | UNCTAD TRAINS NTM classification code (i.e., A1 (Prohibitions) through A9 (SPS measures, not elsewhere specified (nes)) |
| UNCTAD NTM Sub-Classification | UNCTAD TRAINS NTM sub-classification code (i.e., A11, etc.) |
| NTM Type (authors' additional classifications) | Animal disease related (ADR), conformity and risk assessment (CRA), food additives (FAD), microbial (MICRO), phytosanitary treatments (PHT), plant contaminants(PLCT), production and process requirements (PPR), tolerances (TOL), customs procedures and certification (CPC) |
| Implemented | Indicator for concerns that were active when raised vs. concerns about proposed measure(s) |
| Exporter Language | Language exporting country(ies) used when raising STC: ban, prohibition, restriction, unnecessary barrier, excessive delay, new regulation, proposed measure, other |

Source: Authors tabulations of SPS specific trade concerns: http://spsims.wto.org/en/SpecificTradeConcerns/Search http://unctad.org/en/PublicationsLibrary/ditctab20122_en.pdf (pg. 3)

Table 2 describes the variables that we have constructed, along with their description for each SPS concern raised over the period 1995-2014. In addition to the country, product, and duration of SPS concerns, several additional variables have been tabulated to reflect the nature of the STC. First, each concern is classified into one of four WTO subject codes: Animal Health (AH), Plant Health (PH), Food Safety (FS) or Other (Oth). Second, we map each concern to one of UNCTAD's TRAINS nine broad SPS chapter headings and the applicable sub-heading as discussed in the previous section (Chapters A1-A9) (see Box 2). Third, because the TRAINS taxonomy is somewhat broad, we also created nine of our own more specific classifications to better reflect the nature of the SPS concern (Table 3 below). While UNCTAD's (2012) taxonomy includes sub-headings for SPS measures (for instance, A11 – Temporary Geographic Prohibitions for SPS

reasons), it does not tell us whether the prohibitions concerned animal diseases, plant health, or food safety. Thus, in our view, it was necessary to create more specific indicators of NTM types in order to make these distinctions. Finally, the dataset records the specific language used by exporting nations to describe the trade impacts of the measure the exporting country is said to have been experiencing and a separate indicator of whether the concern is related to an already implemented and active measure or whether the concern is about a proposed (i.e., new) measure that has been released for the typical 60 day SPS comment period.

It should be pointed out that differences in some SPS sub-headings in UNCTAD's taxonomy is sometimes subtle and can lead to problems in mapping classifications to the specific trade concerns database. This is because it depends on whether we record the nature of the SPS concern or the policy action by governments. Two examples help to clarify this point. First, STC 14, raised orally by the United States in 2001, deals with Brazil's import restrictions on wheat, rye and triticale related to Karnal bunt. Second, in STC 175, raised orally in 2008 by the United States and supported by Canada, the sanitary issue was Taiwan's import ban of the beta-agonist Ractopamine, a drug used in cattle and hog production to promote weight gain before slaughtering and to reduce the fat content of the resulting beef and pork. This issue is of concern because a certain fraction of the drug can remain in processed meat cuts. Some countries have argued that small amounts of residue (10 ppb) are harmless, while other countries such as the EU, China, and Taiwan have suggested that the scientific evidence at the time did not favor any amounts of ractopamine residue.

While these two trade concerns may seem easy enough to record, the UNCTAD classification is not as straightforward because it depends on whether we record the nature of the concern or the policy response. On the one hand, Brazil's strictly low tolerance related to fungi in cereal shipments could be recorded as "A41 – microbiological material on products reflecting the nature of the concern." On the other hand, the same concern could be recorded as "A11 – temporary ban due to SPS reasons" reflecting Brazil's policy ban on U.S. wheat shipments. Our approach to coding STCs is to organize concerns according to the nature of the concern and allow the trade data to tell us whether the policy response affects trade volumes.

Table 3 below lists the 9 categories and examples of each category of our own SPS classification scheme, based on the nature of concerns as revealed in the minutes and discussion notes of the WTO's STC database.

*Mapping Specific Trade Concerns to Bilateral Trade Data*

After removing a few SPS concerns related to non-agricultural products, the resulting database is a panel of agricultural and food products comprising 381 STCs related to SPS measures over the period 1995-2014.[10] During this period, 100 countries were involved in either raising, maintaining, or supporting an STC, and products corresponding to a total of 140 HS-4 product codes were affected by at least one STC over the sample period. This is over half of the 220 total HS-4 codes in the Harmonized System that correspond to agricultural and food products and suggests a

[10] As the data were being assembled for this project, the matrix of bilateral trade flows for all countries available from the UN Comtrade database was not complete for the year 2015. Thus, in order to merge the two with a consistent sample period, we focus on STCs matched to trade data through the end of 2014.

**Table 3. SPS Classification of Specific Trade Concerns**

| NTM | Abbreviation | Description/Example |
|---|---|---|
| 1. Animal Disease Related | ADR | FMD, BSE, and applications of waste from infected animals on other sectors |
| 2. Customs, Procedures, Certification, Licensing | CPR | Discretionary import licensing problems; Certification procedures; Excessive comment periods for new regulations |
| 3. Conformity Standards & Risk Assessment | CRA | Mandatory risk assessment before entry of queen bees |
| 4. Food Additives & Alterations | FAD | Restrictions on ingredients and substances added to food |
| 5. Microbiological related | MICB | Salmonella, Campylobacter, listeria, etc. |
| 6. Treatments | PHT | Cold& heat treatment, fumigation, pest-free zones, systems approaches to pest risk |
| 7. Plant Contamination | PLCT | Diseases on plant parts, noxious weed seeds, pests |
| 8. Production & Process Requirements | PPR | Hygiene requirements, Grade A facilities, restrictions on hormones/beta agonists |
| 9. Tolerances and Limits | TOL | Maximum residue limits, tolerances, international standards |

Source: Author's categories based on specific trade concern discussion and meeting minutes.

reasonably broad incidence of product concern. The STC database contains a total of 28,361 country-pair-by-HS4-code combinations with at least one active trade concern.

The next step in assembling the data was to merge the STC database by country-pair-and-product code with a dataset of bilateral trade flows covering the same period, countries, and products. For each observed country-pair and product combination, we expanded the trade data to include all active and inactive STC years during 1995-2014. Because future research using this data is likely to compare agricultural trade flows for a given country-pair and product triplet when an STC is active with corresponding flows when the STC was not active (i.e., estimation of average treatment effects), we felt it advantageous to expand the trade data in this way.

Bilateral agricultural trade data covering 100 countries during 1995-2014 are retrieved from countries' reported import statistics contained in the United Nations' Commodity Trade Statistics (Comtrade) using the 1992 Revision of the Harmonized System (HS) of product codes. Reported import statistics are used whenever they are available. Following Feenstra, et al. (2005), mirrored import flows, defined as the corresponding exports reported by the exporting country, are

employed if the reporting countries' imports are missing and the exporter's statistics are non-zero. The WTO's Multilateral Trade Negotiation (MTN) categories are used to classify agricultural goods.[11] Appendix B provides a mapping of HS codes into the 10 MTN agricultural and food product categories. This mapping is also contained in the database to permit evaluation at a broader sector level if one is interested.

The resulting dataset is an unbalanced panel containing 93,620 observations, inclusive of observations where the level of trade equals zero. As mentioned above, 28,361 observations (30 percent of the total) include at least one active SPS trade concern. Zero trade flows are included because of their critical role in the study of non-tariff SPS and TBT measures. To illustrate the potential selection bias of ignoring zero trade flows, consider a stringent SPS policy such as STC 251, in which the issue raised by the United States in 2007 was China's unrealistic zero tolerance for pathogens on raw meat and poultry, or STC 328, in which the issue raised by India and New Zealand in 2014 was the strict U.S. default MRL on certain varieties of rice. If these policies temporarily suspend trade resulting in zero trade, then the omission of such observations by taking the logarithm of the dependent variable – typically the value of trade - will underestimate the true impact of the SPS measure. That is, the omission of zero trade flows eliminates important information regarding the SPS trade concerns of the United States, Indian, and New Zealand. This example illustrates why zeros exist in the trade data, but not for random reasons.

Finally, it must be recognized that the STC dataset is intended to represent only a sample of the universe of SPS concerns. A potential shortcoming of this database is that the countries represented are predominantly middle- and high-income countries with the technical and financial capacity to have representation at the SPS committee meetings and to monitor and document SPS concerns impacting exports. While this may cause some selection bias in the countries represented in our data, it is worth noting that the countries represented in our dataset are comparable to the recent release of the updated TRAINS data which catalogues NTM data for 65 countries compared to 100 countries we have in the database of SPS concerns.

# V. Assessment – STC Trends and Trade Impacts

In this section, we present an analysis of SPS trade concerns as revealed by exporters across a number of dimensions in the data. Our discussion and analysis is organized as follows. First we highlight several descriptive tabulations of the STC information collected. In this regard, we begin by illustrating overall trends in notifications of specific trade concerns similar in spirit to those depicted in the WTO (2012) report but updated through 2015. Second, we then take a deeper dive into the various dimensions of the STC data. The goal is to shed new light on both the landscape of SPS measures impacting agri-food trade and key policy questions outlined in the introduction of this report regarding:

(i) The number of concerns that have been raised since 1995
(ii) The number and makeup of countries participating in concerns

[11] The WTO's MTN categories for agriculture are: (1) animal and meat products; (2) dairy; (3) fruits, vegetables and plants; (4) coffee, tea, and spices; (5) cereals and preparations; (6) oilseeds, fats and oils; (7) sugar; (8) beverages and tobacco; (9) cotton; and (10) other agriculture (confectionary products, hides and skins, etc.). See http://www.wto.org/english/res_e/booksp_e/tariff_profiles06_e.pdf (pgs. 24-25) for more details.

(iii) The product and sector incidence of trade concerns
(iv) The makeup of concerns by type and across markets
(v) Identification of cross-cutting SPS concerns that have become stumbling blocks in regional and multilateral negotiations, and
(vi) The duration and resolution of concerns

In the final section, we empirically analyze the trade impacts of these concerns. Here, we focus specific attention on differences in bilateral agricultural trade flows with and without an active specific trade concern. As discussed below, this differencing procedure allows us to focus on a given country-pair and product code as opposed to comparing across heterogeneous countries and/or product codes that may not comprise the specific trade concerns of exporters. This "within" comparison sheds some light on the degree to which SPS concerns affect agricultural trade.

*Specific Trade Concerns since 1995*

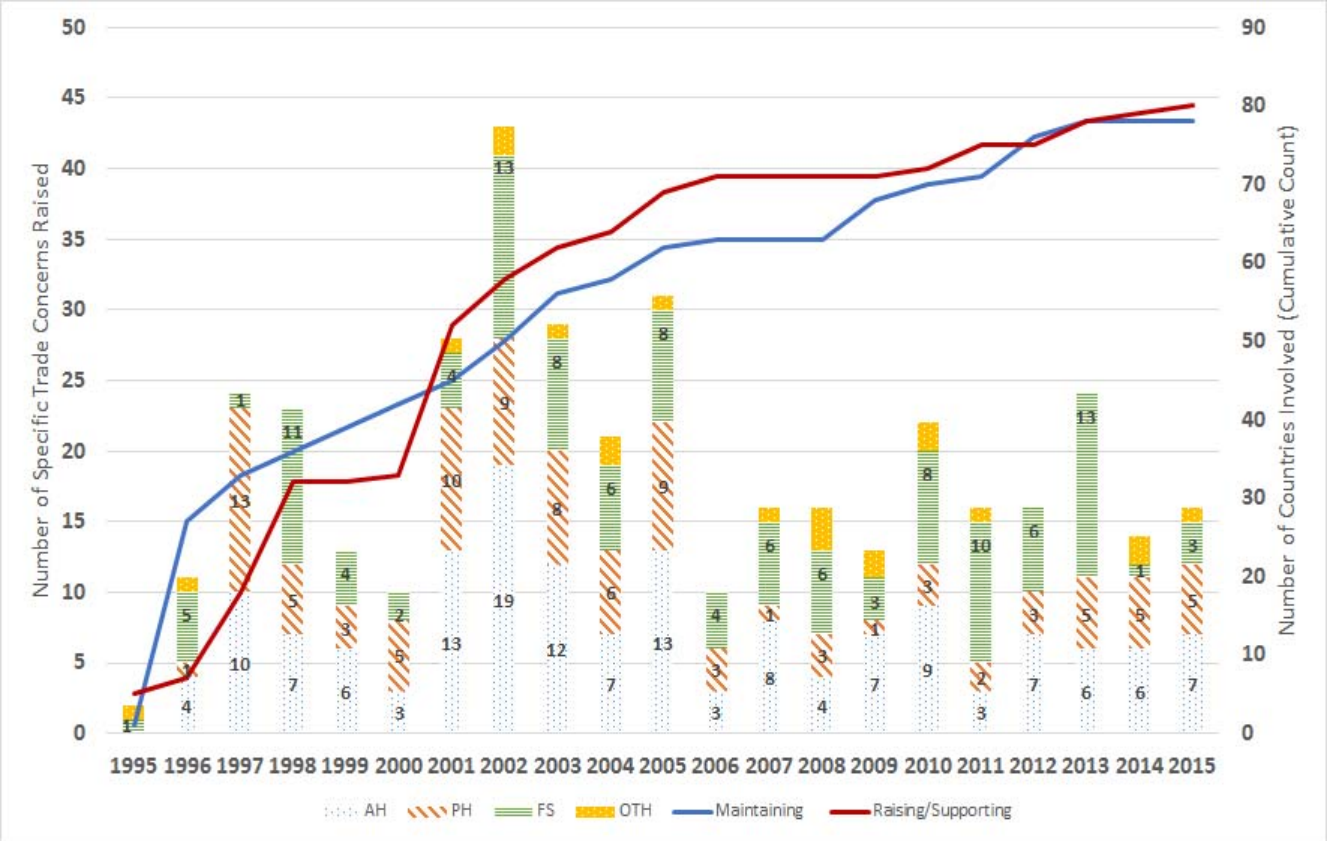
We begin by examining SPS-related STCs from 1995-2015, broken down by four WTO subject categories – Animal Health (AH) concerns, Plant Health (PH) concerns, Food Safety (FS) concerns, and other concerns (OTH) not elsewhere specified. Figure 2 plots the number of new SPS-related STCs raised each year (left axis) as well as the number of countries maintaining the measures (importing countries) and the number of countries raising or supporting the measure of concern (exporting countries) (right axis) over the 1995-2015 period. In total, there were 398 SPS specific trade concerns raised through the end of 2015 as recorded in our database. Animal Health related concerns make up the largest cumulative total with 154 concerns raised in this area, or 39 percent of all concerns, followed closely by 123 concerns for food safety (31 percent), 100 concerns for plant health (25 percent), and 21 for other (5 percent).

With the exception of the initial year and the period 2001-05, exporting WTO Members raised an average of 16 STCs per year related to SPS measures maintained by their importing partners. However, this number roughly doubled to 30 per year during the period 2001-05, reflecting a raising trend in animal health related concerns. For example, in 2002, 19 animal health related trade concerns were raised, compared to 13 for food safety, 9 for plant health, and 2 for other concerns. By comparison, the 19 animal health concerns raised in 2002 is the largest of any category for all years considered. The 19 STCs raised in 2002 reflect the international policy response to animal disease outbreaks in Argentina and Brazil. For example, eight of 19 concerns raised in 2002 relate to import restrictions targeting foot-and-mouth (FMD) disease. The remaining 11 concerns reflect exporters' concerns over animal disease related import restrictions such as Bovine Spongiform Encephalopathy (BSE), African Swine Fever, Avian Influenza (AI), Newcastle Disease, and animal traceability requirements.

Several other concerns raised in 2002 do not directly involve live animal trade but rather trade in processed animal products. For example, in 2002, Indonesia imposed an import ban on processed dairy products from Brazil and Argentina due to FMD, Argentina raised concerns over Chile's import restrictions on pet food derived from animal products, and the EU raised a concern over China's import restrictions affecting its exports of cosmetics derived from animal products. The total also includes a concern raised by Switzerland against the United States over cross-hauling. In this concern, the United States placed a ban on processed meat imports from Switzerland

because the unprocessed meat imported by Switzerland originated in FMD-affected areas in Brazil and Argentina.

**Figure 2. SPS Specific Trade Concerns Raised and Cumulative Number of Countries Involved, 1995-2014**



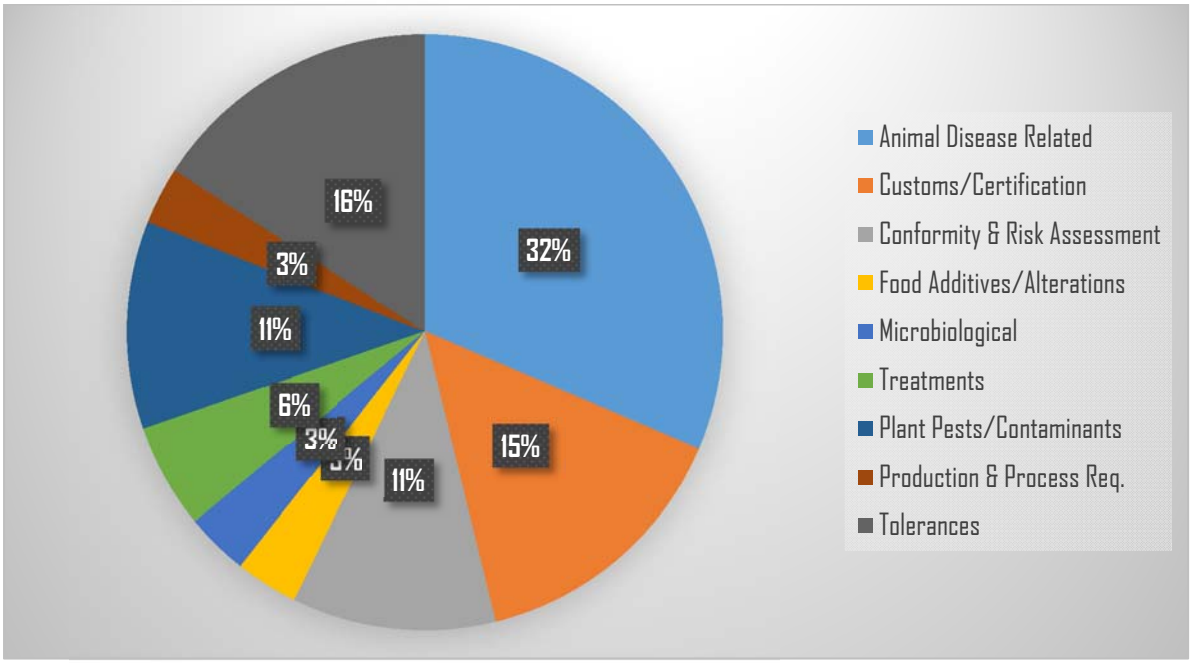

Source: Authors calculations. AH, PH, FS and OTH denote concerns related to Animal Health, Plant Health, Food Safety and Other concerns not elsewhere specified, respectively. Maintaining and Raising/Supporting refer to countries.

Also plotted in Figure 2 on the secondary (right) axis is a cumulative count of the number of countries involved in specific trade concerns over time. In 1995, the first year of implementation of the SPS Agreement, only two STCs were raised, and both criticized Korea's government-mandated short-period shelf-life requirements and import clearance measures (STCs 1 and 2, respectively). It is interesting to note that while few STCs related to SPS measures escalate to a formal request for dispute settlement consultations, the WTO's SPS Committee was faced with such a situation right out of the gate. On March 5, 1995, the United States requested formal consultations regarding Korea's shelf-life requirements for frozen and processed meats and on August 11, 1995, Canada requested formal consultations on the same issue for bottled water. Australia also shared the U.S. and Canadian concern, and Argentina and the EU supported it. The shelf-life issue was resolved in 1996 for Canada and in 2001 for the United States. STC 2 was raised by the United States against Korea over the latter's lengthy SPS inspection and testing procedures for imports and took five rounds of dispute settlement consultations starting in 1996 before a mutually agreeable solution was reached in 2001. Resolution of this dispute required a complete overhaul of Korea's testing, inspection and quarantine procedures for SPS reasons.

Over the next 10 years (1996-2006), many more countries began participating in the informal STC discussions, including developing countries. As Figure 2 demonstrates, the sharp rise in the number of participating members between 1996 and 2006 likely reflects the benefits perceived by Members of being able to discuss and resolve SPS trade concerns about measures maintained by their importing partners. By 2006, 71 exporting countries had participated at least once in raising or supporting and 63 importing Members were involved in at least one concern maintaining SPS measures that were deemed problematic by exporters.[12]

Figure 3 presents a breakdown of the different types of concerns using the taxonomy described in table 3. Consistent with the discussion above, animal disease related measures make up the largest source of SPS issues at 32 percent of all concerns raised since 1995. ADR is followed by tolerances which includes MRLs (16 percent) and customs, procedures, certification, and licensing measures (15 percent), and conformity and risk assessment and plant pest/contaminant measures (11 percent). Concerns related to production & process requirements, microbiological, and food additives make up a smaller share—often less than 5 percent of all concerns.

**Figure 3: Percentage breakdown of SPS STCs by Type (1995-2015)**



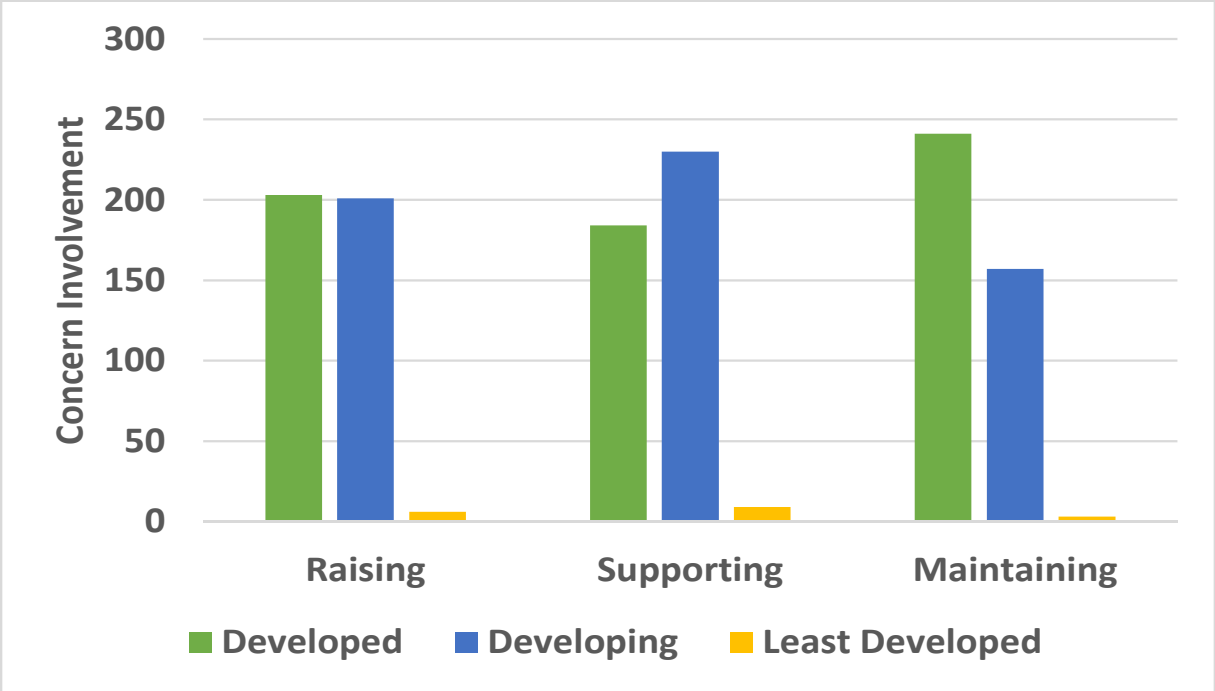

Source: Author's Calculations

It is also interesting to note the composition and involvement of WTO Members either maintaining, raising or supporting SPS trade concerns. Figure 4 below plots the number of participants in concerns by developed, developing and least-developed countries as either raising, supporting or maintaining SPS trade concerns. Because the figure considers not only the number of STCs but also the country dimension to the concerns, and because multiple countries can participate in any given STC, the cumulative total across raising, supporting and maintaining categories reflects a larger number of observations compared to simply counting the number of

[12] We count members of the EU as a single country unless individual members are explicitly referred to in the concern.

concerns since 1995. The least developed countries (LDCs) participate very little in SPS trade concerns. This could reflect the lack of technical and financial capacity of low-income countries to obtain representation at the meetings and in identifying, documenting and articulating concerns in their export markets. Only eight LDCs have participated in STCs since 1995—Benin, Gambia, Madagascar, Senegal, Sierra Leone, Tanzania, Burkina Faso, and Zambia-- and most participation is as a supporting or raising Member. The only LDC that maintained SPS measures that were the subject of concern by exporters was Senegal in STC 303 regarding Brazil's complaint over unnecessary restrictions related to AI for poultry exports.

**Figure 4. Specific Trade Concern Involvement by Development Status, 1995-2015**

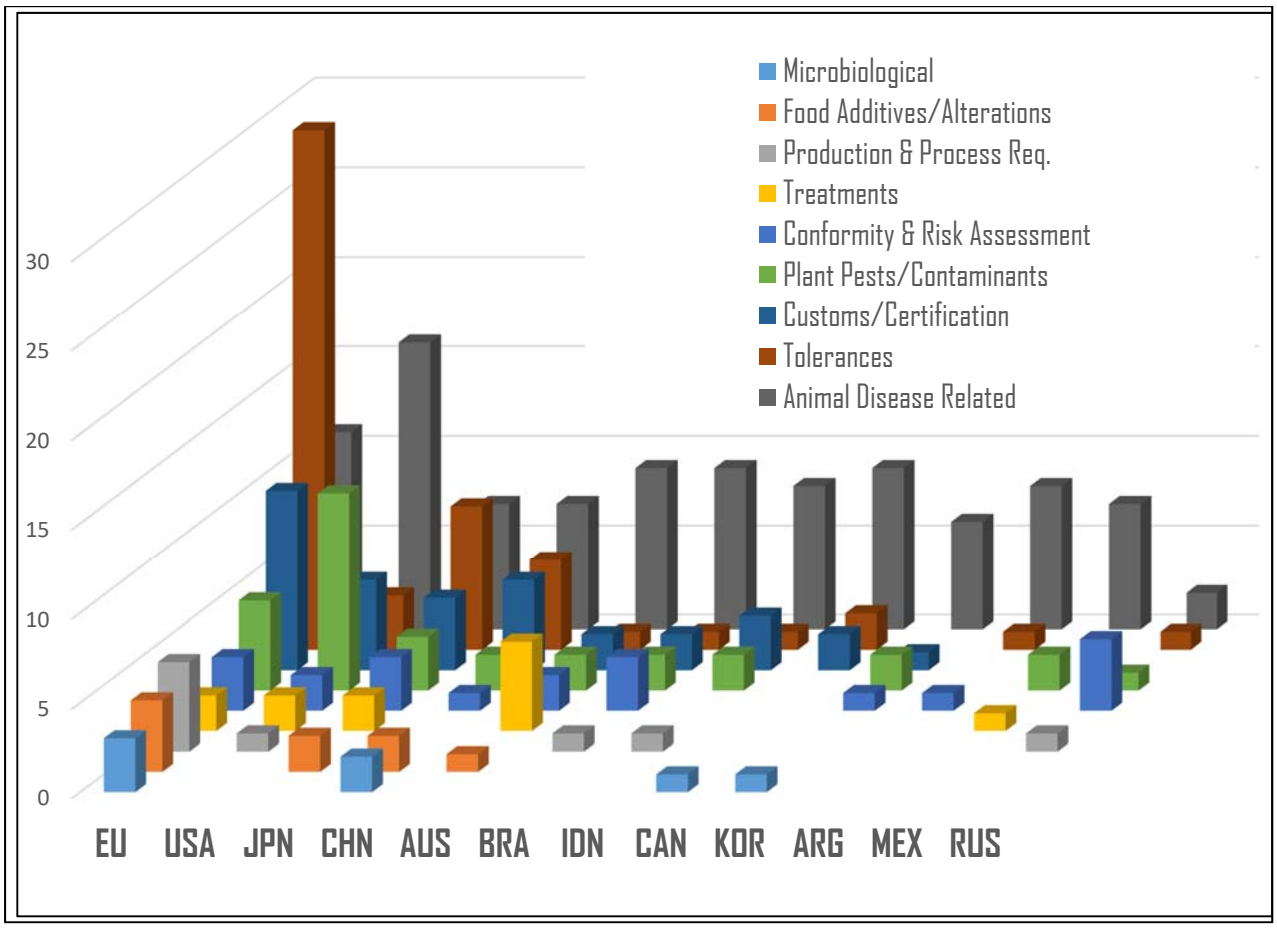



Source: Authors calculations

Participation by developed and developing countries across the three categories of concern, in contrast, has been roughly equal in terms of raising SPS concerns at 203 and 201 concerns, respectively. Comparing supporting versus maintaining participation by Members for the period analyzed, developing countries are more likely to support an SPS concern than to maintain one, while developed countries are more likely to maintain an SPS concern than to support one. Of the 398 concerns catalogued for maintaining countries through the end of 2015, developed countries maintaining SPS measures of concern outnumber developing countries by a factor of 1.5 (241 concerns to 157 concerns). For developing and developed countries supporting SPS concerns, however, the numbers flip, with developing countries supporting 230 concerns compared to 184 by developed countries.

Figure 5 examines the type of SPS concerns across selected import markets. Animal disease measures are a relatively consistent and higher frequency concern across many markets, while other concerns are highly concentrated in a few markets. For example, concerns over tolerances

**Figure 5: SPS Specific Trade Concerns by Type for Selected Markets**




Source: Author's calculations

and residue limits are concentrated in the EU market. In fact, concerns raised over EU tolerances accounts for the largest number of recorded concerns in any one country-by-SPS category. The EU is followed by Japan, a distant second with less than 10 concerns related to SPS tolerances. Tolerance concerns include MRLs on fruit and vegetables that are more stringent than international standards and as result have been raised as concerns by many developing countries.

Customs, procedures, certification, and licensing requirements and conformity measures are relatively higher on developed compared to developing country markets. These measures include standards on meat products that are more stringent than those established by the OIE. Of the developing countries, China has had an increasing number of its food safety related risk assessment and certification measures raised as concerns. Additionally, China's zero-tolerance measures on pathogens has been a long-standing concern by a number of countries including the United States.

Russia also has implemented several conformity and risk assessment measures that several countries including the Ukraine have raised as concerns. Australia has had several of its pest treatment measures on fruit products raised as concerns and many of these have since been resolved. Concerns on plant contamination measures are highest on the EU and United States.

For a given country we can also tabulate specific trade concerns across WTO subject categories of SPS concerns. Table 4 furnishes information on 5 individual countries and 3 types of measures being raised, supported or maintained. The 5 countries – US, EU, China, Japan, and India – are selected because of their importance in world agri-food trade. The WTO classifies each concern into one of four broad categories of SPS measures:

a. *Animal Health*: import measures to circumvent animal health and disease issues,
b. *Plant Health*: import measures to address the transmission of plant health and disease issues
c. *Food Safety*: import measures to address concerns about the safety of food supplied by foreign countries, and
d. *Other Concerns*: concerns not elsewhere specified such as certification and import permit requirements, licensing, and testing requirements.

Several interesting trends among the countries listed in Table 4 are apparent. First, the EU and the United States are easily the largest participants in SPS trade concerns. However, note that their relatively higher involvement in SPS concerns does not imply that the US and EU are more protectionist in the application of SPS measures. Rather, the concern numbers reflect relatively higher participation rates by the EU and United States across a broad range of SPS concerns. With participation in 202 concerns, the EU has participated in nearly half of all SPS trade concerns raised since 1995. The United States, with 162 SPS-related concerns, has participated in nearly 40 percent of all SPS concerns. However, because both countries are often involved in the same STC, either together as supporting or raising members against a third country's import measures or apart in opposition to each other's SPS measures, we cannot simply add the 202 concerns of the EU to the 162 concerns of the United States and conclude that together the two countries have participated in 90 percent of all STCs raised since 1995. The actual number of concerns involving both the EU and the United States is 264, just over half of the total number of concerns raised since 1995.[13]

Second, relative to the EU and United States, Japan, China, and India participate in fewer concerns, with 72, 39, and 42 concerns, respectively. This statement holds true for most other countries when judged relative to the EU and United States. Some of this reflects the fact that countries such as China joined the WTO later (2001) than most other Members and thus was not required to notify its measures prior to accession. Along with China, Argentina and Brazil are the other leading developing country participants in SPS trade concerns with 77 and 71 concerns, respectively. Canada (71) and Switzerland (59) are examples of other developed countries with relatively high participation rates.

Third, we can evaluate the column totals for a given country across maintaining, raising or supporting categories of specific trade concerns to get a sense of which side of the table a country is more likely to sit for a given category of SPS issues (Table 4). For example, for animal health and disease issues, the US is more than twice as likely to raise or support a given animal health

[13] It is interesting to note the dynamics among concerns between the United States and the EU when the two countries are on opposite sides of the table (i.e., one as raising/supporting Member the other as maintaining the measures). The United States has raised or supported 31 STCs against the EU since 1995, whereas the EU has raised just 14 concerns against the United States.

**Table 4. Specific Trade Concern Involvement by SPS Issue, Selected Countries, 1995-2010**

| | Animal Health | Plan Health | Food Safety | Other | Total |
|---|---|---|---|---|---|
| **USA** | | | | | |
| Maintaining | 11 | 18 | 10 | 1 | *40* |
| Raising | 27 | 22 | 31 | 3 | *83* |
| Supporting | 24 | 7 | 7 | 1 | *39* |
| *Total* | *62* | *47* | *48* | *5* | *162* |
| **EU** | | | | | |
| Maintaining | 25 | 13 | 40 | 1 | *79* |
| Raising | 44 | 14 | 21 | 3 | *82* |
| Supporting | 15 | 14 | 10 | 2 | *41* |
| *Total* | *84* | *41* | *71* | *6* | *202* |
| **China** | | | | | |
| Maintaining | 12 | 3 | 11 | 1 | *27* |
| Raising | 7 | 7 | 18 | 0 | *32* |
| Supporting | 3 | 3 | 7 | 0 | *13* |
| Total | *22* | *13* | *36* | *1* | *72* |
| **Japan** | | | | | |
| Maintaining | 8 | 9 | 10 | 2 | *29* |
| Raising | 0 | 0 | 4 | 0 | *4* |
| Supporting | 0 | 3 | 3 | 0 | *6* |
| Total | *8* | *12* | *17* | *2* | *39* |
| **India** | | | | | |
| Maintaining | 5 | 4 | 3 | 0 | *12* |
| Raising | 7 | 4 | 10 | 0 | *21* |
| Supporting | 0 | 3 | 6 | 0 | *9* |
| Total | *12* | *11* | *19* | *0* | *42* |

Source: Authors calculations

concern (27 and 24 cases) than it is to maintain SPS restrictions (11 cases raised against US) that are of concern to exporters. For food safety issues, the United States is 3 times as likely to raise an SPS concern as it is to maintain measures that are of concern. The EU's trade concern profile is similar to the U.S. profile with respect to animal health issues, but very different for food safety measures. Of the 71 food safety concerns involving the EU, 40 concerns (56 percent) had the EU maintaining measures on its agri-food imports that were of concern to exporters, and 13 of the 40 concerns were raised or supported by the United States. Conversely, China and Japan are more likely to maintain SPS measures that are deemed problematic by exporters with respect to animal health compared to their involvement in the raising or supporting of concerns. For example, all of Japan's involvement in 8 animal health concerns is as a maintaining country and China's involvement as a maintaining country in animal health concerns exceeds its total involvement as a raising or supporting member.

Finally, we can evaluate the row totals in Table 4 to get a sense of the countries' involvement in STCs across WTO SPS subject categories. Comparing across these categories for a given country

furnishes information about whether countries are systematically more concerned, or maintain measures about animal, plant, or food safety issues. For example, while the United States is actively involved in raising or supporting the SPS measures of concern in third-country import markets, it is nearly twice as likely to maintain SPS measures with respect to plant health that are of concern to other exporters. With 40 total STCs raised against the United States as a maintaining country, almost half of these (18) involve plant health SPS measures. The EU, on the other hand, was involved in 79 concerns as a maintaining country, over half (40) of which were about food safety issues. Similarly, China's concerns as a maintaining country are skewed towards animal health and food safety issues (12 and 11 concerns, respectively), whereas concerns about Japan's maintenance of SPS measures are roughly equal across all 3 categories.

*Product Incidence of SPS Trade Concerns*

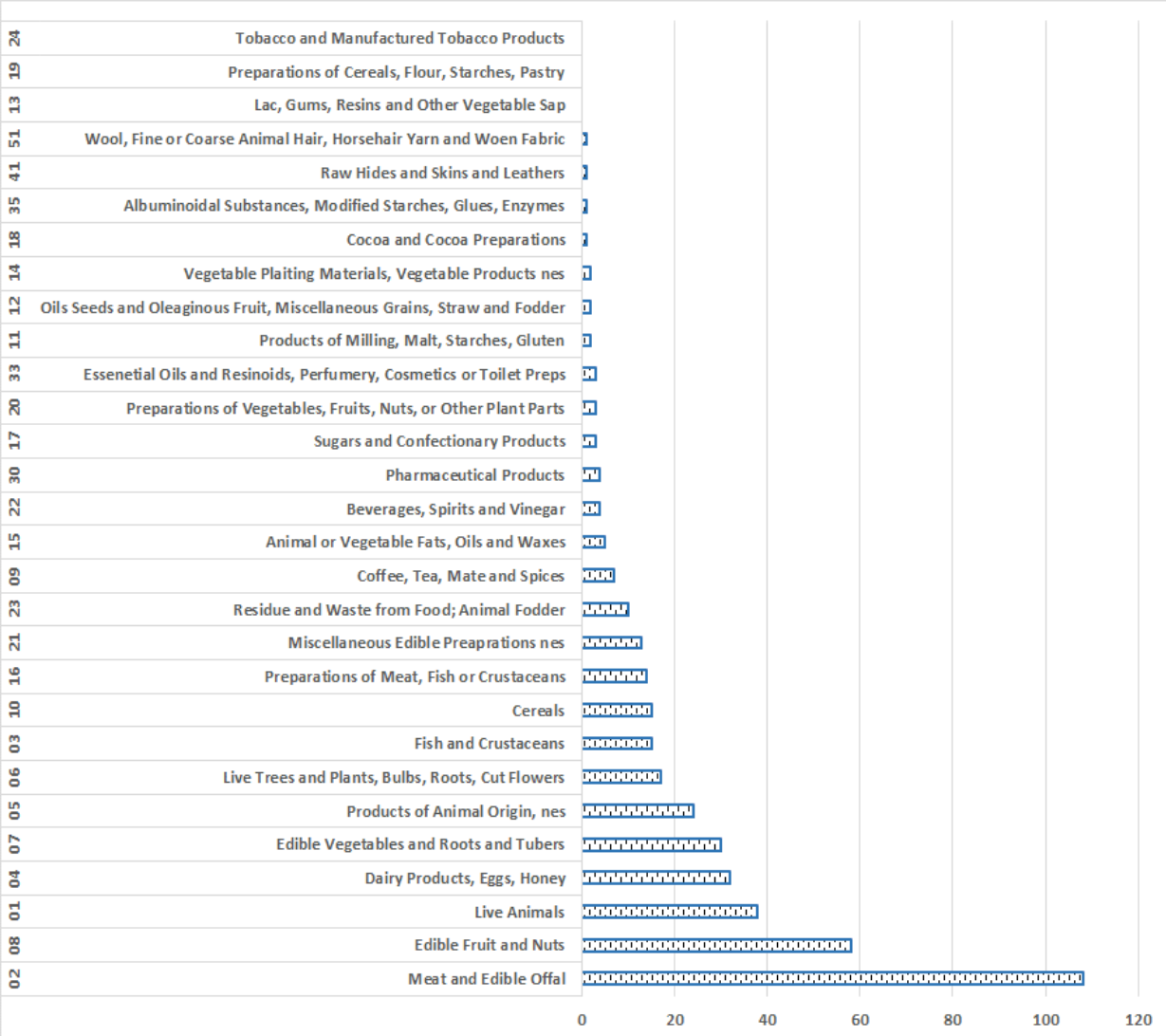
Another important dimension of SPS-related STCs is the number of agri-food products affected. Figure 6 ranks each HS-2 chapter based on a simple count of the STCs affecting the sector. Chapter 02 (Meat and Edible Offal) contains the highest number of recorded STCs (108 concerns) or roughly one quarter of all concerns raised since 1995. Rounding out the top 5 product sectors affected by SPS concerns are: Chapter 08 (Fresh Fruits and Nuts, 58 concerns), Chapter 01 (Live Animals, 38 concerns), Chapter 04 (Dairy Products, 32 concerns), and Chapter 07 (Edible Vegetables, Roots and Tubers, 30 concerns). Together these 5 chapters accounted for 64 percent of all SPS concerns initiated since 1995. At the other end of the spectrum, there are many agri-food chapters with 5 or fewer concerns since 1995, such as Chapter 15 (Animal or Vegetable Fats, Oils and Waxes). WTO Members did not raise any SPS-related STCs for products in Chapter 13 (Lac, Gums, Resins and Other Vegetable Sap), Chapter 19 (Preparations of Cereals, Flour, Starches, Pastry), and Chapter 24 (Tobacco and Manufactured Tobacco Products).

While useful, Figure 6 does not reflect the full dimensionality of SPS trade concerns. First, many concerns spill over to multiple product sectors. For example, some concerns raised over BSE restrictions spill into the dairy sector, despite the conclusion of the OIE and WHO that dairy products pose no risks from BSE. At the extreme, a small number of trade concerns cover the full spectrum of agricultural and food products.

Second, most STCs involve multiple countries either maintaining, raising or supporting the concern. Thus, to paint a more complete picture of the product sectors affected by specific trade concerns, we need to expand the database to include not only the importing and exporting countries involved but also the product sectors affected. Below, we summarize the product and sector incidence of SPS-related STCs using an expanded version of the database to incorporate both a country-pair and HS-4 sector dimension. As described in the data section, expanding the dataset along these dimensions produces 28,361 observations for which at least one STC was active during the period 1995-2014.

Table 5 illustrates the incidence of SPS-related STCs across 10 agricultural sectors and 15 importing countries most active in maintaining SPS measures of concern. Admittedly, this omits a number of countries in the database that have maintained a sizable number of such measures.

**Figure 6. The Incidence of Specific Trade Concerns on HS2-Digit Chapter Headings**




Source: Authors' calculations

Examples of these countries include Switzerland (297 concerns observed), Chile (219), Israel (210), Singapore (298), Thailand (292), and Turkey (253).[14] However, to keep the results manageable, we focus on the top 15 importing countries with concern observations exceeding 300. Further, because 140 HS-4 product codes are affected by STCs, we map the HS-4 product codes into one of ten Multilateral Trade Negotiating (MTN) sectors as defined by the WTO to summarize results (see footnote to Table 5 and Appendix B).

The results highlight several interesting trends. First, as noted in previous discussions, the majority of trade concerns raised against importing countries are concentrated among the 15 maintaining countries listed in Table 5. At the bottom of Table 5, we report the sub-total of STC observations involving the 15 countries, the total number of STC observations for all countries,

[14] Other Members such as Croatia (not part of the EU-15), Malaysia, New Zealand, Philippines, Russia, Taiwan and South Africa maintained concerns involving 118, 148, 178, 174, 171, 192, 114 observations, respectively.

**Table 5. Product Incidence of SPS Specific Trade Concerns**

| Maintaining Country | BT | CER | CTS | DAIRY | FV | ANML | OILS | SFD | SGR | OTH | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | 0 | 96 | 0 | 222 | 4 | 281 | 0 | 0 | 0 | 24 | 627 |
| Australia | 0 | 10 | 0 | 240 | 378 | 254 | 0 | 124 | 0 | 55 | 1,061 |
| Brazil | 18 | 5 | 0 | 164 | 126 | 188 | 0 | 13 | 0 | 59 | 573 |
| Canada | 0 | 0 | 0 | 158 | 39 | 145 | 0 | 0 | 0 | 5 | 347 |
| China | 32 | 91 | 7 | 157 | 22 | 252 | 38 | 82 | 2 | 110 | 793 |
| EU-15[a] | 138 | 4,396 | 855 | 216 | 4,202 | 620 | 365 | 203 | 2 | 286 | 11,283 |
| Indonesia | 0 | 8 | 0 | 6 | 928 | 312 | 0 | 0 | 0 | 0 | 1,254 |
| India | 0 | 16 | 0 | 110 | 168 | 125 | 10 | 0 | 0 | 35 | 464 |
| Japan | 22 | 296 | 260 | 230 | 1,731 | 385 | 151 | 7 | 4 | 138 | 3,224 |
| Korea | 5 | 220 | 0 | 182 | 1,056 | 214 | 0 | 0 | 0 | 50 | 1,727 |
| Panama | 0 | 53 | 0 | 54 | 93 | 518 | 0 | 0 | 0 | 0 | 718 |
| Romania | 0 | 48 | 0 | 80 | 0 | 196 | 0 | 0 | 0 | 0 | 324 |
| Ukraine | 0 | 70 | 0 | 158 | 20 | 278 | 150 | 80 | 10 | 239 | 1,005 |
| US | 0 | 71 | 0 | 185 | 472 | 262 | 0 | 0 | 0 | 0 | 990 |
| Venezuela | 0 | 48 | 0 | 0 | 110 | 324 | 0 | 0 | 0 | 0 | 482 |
| Subtotal | 215 | 5,428 | 1,122 | 2,162 | 9,349 | 4,354 | 714 | 509 | 18 | 1,001 | 24,872 |
| Sector Rank | 9 | 3 | 6 | 4 | 1 | 2 | 7 | 8 | 10 | 5 | ---- |
| Total Obs. | 223 | 5,798 | 1,129 | 2,891 | 9,856 | 5,948 | 813 | 516 | 28 | 1,159 | 28,361 |
| Share | 0.96 | 0.94 | 0.99 | 0.75 | 0.95 | 0.73 | 0.88 | 0.98 | 0.64 | 0.86 | 0.87 |
| Share EU | 0.62 | 0.76 | 0.76 | 0.07 | 0.43 | 0.10 | 0.45 | 0.39 | 0.07 | 0.25 | 0.40 |
| Share US | 0.00 | 0.01 | 0.00 | 0.06 | 0.05 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 |

Source: Authors calculations

Notes: column abbreviations are as follows: BT = beverages and tobacco codes, CER = cereals and preparations, CTS = coffee, tea, mate and spices, DAIRY = dairy products, FV = fruits, vegetables and plants, ANML = animal and meat products, OILS = oilseeds, fats and oils, SFD = seafood and fish products, SGR = sugar and confectionary products, OTH = other agricultural products. See appendix B for mapping of HS codes into MTN sectors.

[a/] EU-15 numbers include all specific trade concerns targeted at the EU as a group or any of its individual members.

and the share of the 15 country total in the total for all countries. Across sectors, the selected importing countries in Table 5 represent anywhere from a low of 64 percent of all concerns in sugar and confectionary products (SGR) to a high of 99 percent of concerns in the coffee, tea, mate and spices sector (CTS). The average across all sectors is 87 percent, suggesting a high coverage of concerns among the maintaining countries selected.

Second, also reported at the bottom of Table 5 are the shares of EU and U.S. participation in concern observations. Here, the evidence supports our analysis of the data presented in Table 4 and the previous figures. Clearly, the EU is much more active in STCs as a country maintaining measures compared to the United States, which is more active as raising or supporting concerns. However, here we can evaluate the sectors in which these two countries maintain SPS concerns more intensively. The two sectors with the highest trade concern participation by the United States as maintaining measures are dairy (6 percent of all STC observations) and fruits, vegetables and plant products (FV, 5 percent). For dairy, this share includes the concern raised by the EU against the United States in 2008 against the United States over dairy product market access due to U.S. “Grade A” facilities and Pasteurized Milk Ordinances.

The EU's participation in STCs as a country maintaining SPS measures of concern is much higher than that of the United States. For example, in cereals and coffee, tea, and spice sectors, concerns raised against EU measures represent 76 percent of all observations in these sectors. While the coffee, tea, and spice sector ranks sixth in terms of the incidence of concerns affecting these products, the cereal sector is ranked third. Perhaps not surprisingly, animal products and fruit and vegetable sectors rank one and two respectively in terms of having the highest recorded incidence of STCs across MTN sectors. Here the EU accounts for a lower share of SPS measures maintained in the animal product sector at 10 percent but a higher share of fruit and vegetable SPS measures at 43 percent of the total for this sector. Overall, the high share of concern observations against the EU in fruits, vegetable and plant sectors corroborates the evidence in Figure 5 whereby tolerances and MRLs were the single most frequent SPS concern type raised against the EU. It could also reflect the fact that EU standards and regulatory measures comprise a larger number of products and often involve multiple raising and supporting countries against EU concerns.

Third, Japan and Korea have the third and fourth highest recorded number of STCs against its measures at 3,224 and 1,727 STC observations, respectively. In both countries, fruit and vegetable products are most impacted by concerns raised against their SPS measures. For developing countries, the results are more mixed. Trade concerns against Argentina and Brazil are concentrated in Dairy, fruits and vegetables and animal sectors, whereas measures by Panama, Romania, Ukraine and Venezuela are concentrated mainly in animal products.

*Specific Trade Concern Resolution, Duration and Trade Impacts*

In addition to country, SPS concern type, and product impacts, three important policy questions remain:

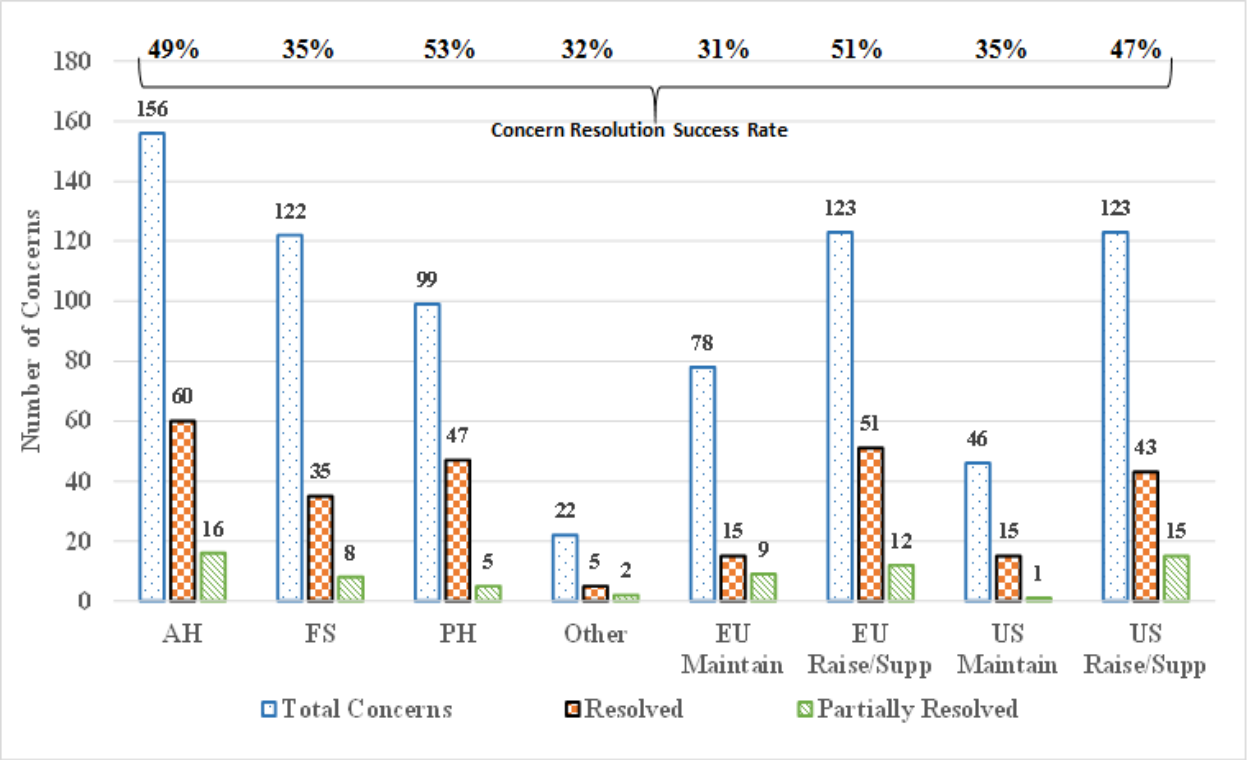
1. What proportion of SPS-related STCs are resolved?
2. How long does it take to resolve such concerns?
3. What are the trade impacts of these concerns?

These questions are arguably some of the most important on a global scale because if the WTO process works in the sense that concerns are resolved and SPS measures are made more transparent, then policymakers and trade negotiators would be well served by furthering their participation in the multilateral process. However, if concerns are protracted and become gridlocked because of deep-rooted differences amongst Members regarding their SPS regulations, then there may be scope to enhance negotiations at the bilateral or regional level vis à vis trade agreements. Moreover, whether STCs actually disrupt trade remains to be seen and may further catalyze negotiations. In what follows, we attempt to address these questions.

*What proportion of SPS-related STCs are resolved?*

Figure 7 below is similar to Figure 2 in that it plots the total number of STCs raised in any given category since 1995, but it also adds the number of concerns that are resolved and partially resolved. The plots are broken down by WTO subject category (animal health (AH), food safety (FS), plant health (PH) and other concerns (Other)) as well as for the EU and United States (right-

**Figure 7. Specific Trade Concern Resolution and Success Rates**




Source: Authors Calculations

Notes: AH, FS, PH and Other are categories denoting animal health, food safety, plant health and other specific trade concerns. Concern resolution success rate refers to the share of resolved plus partially resolved concerns in the total number of concerns. The two categories for the EU and United States refer to situations when each country is maintaining SPS measures of concern (Maintain) and when each country is raising or supporting (Raise/Supp) SPS measures of concern in other partner countries.

half of Figure 7), both as maintaining members of SPS measures and as raising or supporting members of concerns regarding the SPS measures of other countries. For each category, we then calculate the concern resolution success rate, plotted across the top, defined as the number of resolved and partially resolved concerns divided by the total number of concerns raised in any one category.

Figure 7 illustrates that the rate at which concerns are resolved depends on both the category of the concern and whether individual countries are maintaining the measure of concern or raising the concern itself. First, across categories of concerns, AH and PH concerns appear to have the best resolution rates at 49 and 53 percent, respectively. SPS issues falling under measures to protect food safety and concerns related to other types of SPS measures (i.e., testing, certification, licensing, and inspection) have a much smaller likelihood of being resolved or partially resolved. Here, the concern resolution success rates are 35 and 32 percent, respectively. Second, when we focus on concerns involving the EU and United States, both countries have higher success rates of resolving SPS concerns. The EU's concern resolution success rate is 51 percent when it raises or supports the concern compared to just 31 percent success when it is maintaining the measure. For the United States, these success rates are 47 and 35 percent, respectively.

It is important to note that across all 4 WTO SPS subject categories, the concern weighted average successful resolution rate is 45 percent. However, this does not necessarily imply that there is a less than 50 percent chance that a particular concern will get resolved. This is because in all categories of trade concerns, there are a significant number of cases that remain outstanding (i.e., unresolved) or go unreported. While ongoing concerns do not pose a problem in the database and we observe and record the number of times the concern is subsequently raised, still there remain a number of unreported outcomes. In these situations, it is difficult to determine whether the issue is no longer of concern to exporters or whether little progress was made to resolve it. We have made some progress on unreported concerns in the database by evaluating the minute notes that accompany concerns. As one example, consider STC 163 raised by the EU against measures maintained by Mexico in regards to FMD concerns in Austria:

> "The European Communities stated that France, Ireland, the Netherlands and the United Kingdom had officially regained their OIE FMD-free status without vaccination after the 2001 outbreak. However, Mexico continued trade restrictions against Austrian animal products, despite the fact that Austria had not had a FMD outbreak since 1991. Austria had applied to be recognized as FMD-free by the Mexican authorities. Mexico indicated that Austria failed to meet certain requirements to be recognized as FMD-free and encouraged the Austrian authorities to complete a second questionnaire requesting more details. In June 2003, the European Communities reported that bilateral consultations had been held, and Mexico confirmed that it expected the issue to be resolved soon."

In this example, the concern was raised in April 2003, and in June 2003, the issue was expected to be resolved soon. Thus, the likely outcome of this concern is a successful resolution lasting roughly one year. However, the outcome of the concern is officially recorded as not reported. There are other concerns of this nature and future updates to our database will attempt to refine cases where there seems to be a clear path to resolving the concern.

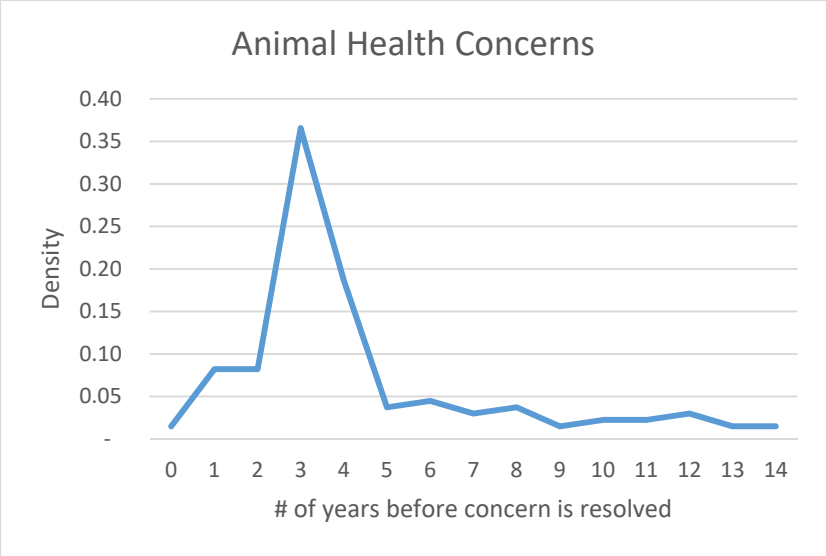
*How long does it take to resolve such concerns?*

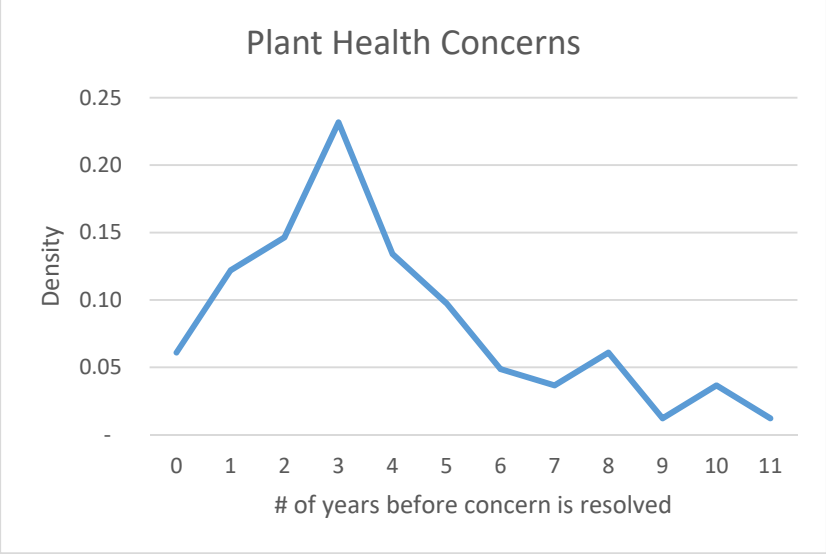
Another important policy dimension of the data is the duration of concerns. That is, in cases where we observe a successful resolution of an SPS concern, how long does it take to get resolved? The three panels in Figure 8 below provide a density plot of concern duration across each of the WTO subject categories of SPS concerns. The figure shows that most concerns are resolved within 3 years in the case of plant and animal health concerns and within 4 years in the case of food safety concerns. The peak of the density plots illustrates that over 35 percent of animal health concerns and nearly one-quarter of plant health SPS concerns are resolved in 3 years. Food safety issues generally take longer, as indicated by a higher kurtosis around the mean of 4 years, compared to the sharper peaks observed in animal and plant health concerns.

Interestingly, all the categories of concerns have a heavy right-hand-side tail, implying that animal, plant and food safety concerns have at least some possibility of lasting more than 10 years. Notable among long-lived SPS trade concerns is STC 193 raised by the United States and EU in 2004 (and supported by Canada, Switzerland and Uruguay) over BSE import restrictions imposed by a number of WTO Members. This concern was raised 26 times and lasted 10 years before being partially resolved with certain members in 2013.

Two other examples include STCs 185 and 238. STC 185 was first raised in 2004 by the United States and EU and supported by Australia, Canada and China on India's non-notified restrictions

**Figure 8. Specific Trade Concern Duration (source: authors' calculations)**

on live birds, swine and fresh poultry meat products due to concerns over high and low pathological Avian Influenza. India's measures were intended to protect farmers for whom poultry production was an essential source of income because information on AI outbreaks was often delayed and in some cases the infected birds and the virus itself do not always exhibit clinical signs of the disease. This concern was raised an additional 17 times through 2011 before escalating to a formal dispute settlement as requested by the United States in March 2012. The Appellate Body and Panel reports were adopted on June 19, 2015 and found that India's import restrictions were inconsistent with the SPS Agreement and the level of risk associated with the disease.[15]

In STC 238, Columbia, Ecuador, and Peru, with support from 20 other Central and South American countries, raised a concern in 2006 over EU SPS regulations of novel foods. The countries raising or supporting the concern viewed these regulations as constituting a significant barrier to Central and South American exporters, despite the fact that exports of novel foods had already been marketed and sold in the U.S. and Japanese markets for a number of years. This concern was subsequently raised an additional 20 times and remains ongoing and unresolved after nearly 11 years of STC consultations.

It is once again interesting to compare the duration of STCs between the EU and United States since these two countries are the most active participants in STCs. The average duration of concerns before being resolved involving the United States as a maintaining country is 2.4 years with a median of 2. For the EU, concerns tend to last longer than the United States, averaging 5.28 years with a median of 4 years. Interestingly, for both countries, the category of "other" concerns, which deals with customs procedures, had the longest average duration of STCs at 6.18 years for the EU and 4 years for the United States.

*What are the trade impacts of these concerns?*

The final and perhaps most important policy question around the revealed SPS trade concerns is: What are the trade effects of these concerns? To shed light on this question, we again make use of the expanded database matched to bilateral trade flows between maintaining and raising/supporting countries, products and covering the period 1995-2014. A key issue in this assessment as discussed previously is whether we compare trade flows with and without an active STC for a given country-pair and HS-4 product category or whether we compare all countries involved in STCs with those that are not in any given year. We argue that the former is a more relevant comparison because of selection issues associated with the size of the economies most actively involved in STCs (i.e., the United States and EU). That is, if we compared U.S. and EU trade during an STC to the trade of other countries in the database not involved in an active STC, we find that in many cases U.S. and EU trade values are still higher than other less developed countries even with (without) an active STC operating in the former (latter).

Thus, our strategy is to compute the mean percentage difference (i.e., log difference) between trade flows for a given country-pair and HS-4 product category. Obviously, this omits a small share of observations in cases where an STC was active over the entire sample period for a given country-

[15] In July 2016, India revised its import measures, claiming that the revision complies with the recommendations of the dispute panel. However, the United States disputes India's claim that the revised measure resolves the SPS issue and trade discussions remain ongoing.

pair and product sector. However, the vast majority of observations contain enough years of active and inactive STCs to permit identification of average trade flow differences. It should be mentioned that we do not attempt in this report to use an econometric approach such as a gravity equation to control for other natural and manmade policy factors either promoting or impeding bilateral trade. Thus, no causal relationship may be established.[16] Nevertheless, we note that by examining the within country-pair and product sector variation, the presented differences control for much of the time-invariant factors behind trade patterns and provide a useful point of departure to gauge the STC SPS effect.

Table 6 below reports the results of our trade flow analysis of SPS-related STCs. Six scenarios are reported. In scenario 1 (All Concerns), we compute the percentage difference between trade flows with and without an active STC and average these differences across all country-pair-by-product identifiers. In scenario 2 (WTO Subject) and scenario 3 (SPS taxonomy) we average the percentage differences by WTO subject category or type of SPS concerns based on our own taxonomy described in Table 2. Scenario 4 does the same by raising and supporting members and the status of the concern (resolved (R), partially resolved (PR) and not reported or unresolved (NR)). Scenarios 5 and 6 compute the average percentage differences in trade flows by agricultural MTN sector and by selected individual importing countries maintaining the measures, respectively.

The results are striking and cast a rather dim light on SPS measures maintained by importers and raised as concerns by exporters. Looking across all scenarios, we find that no matter how we slice the data, the average percentage trade difference that compares trade flows with and without an active STC for a given country-pair by product is negative. In scenario 1, we average across all concerns in the database and find that Members' trade is on average 41 percent lower when an STC is active compared to when it is not. However, this average masks some important differences across subject categories. In scenario 2, we find that animal health related concerns are associated with the most significant change in Members' trade flows at 54 percent lower on average. Trade occurring with active Plant Health and Food safety concerns, on the other hand, are on average lower by 34 and 39 percent, respectively, compared to years when these types of STCs were not active.

Scenario 3 decomposes the measures into the SPS taxonomy described in Table 2. Microbiological related concerns are found to have the most significant effect on trade: trade is virtually prohibited when such concerns are active. Plant contamination and animal disease related concerns are also associated with larger deleterious effects on trade (75 and 52 percent lower on average). Conformity standards and phytosanitary treatment concerns are found to have average differences similar to the overall average, with reductions of 42 percent and 43 percent, respectively. The rest of the measures have relatively lower average differences. However, because all types of concerns are found to be significantly associated with lower levels of trade, the averages thus provide a

[16] In its basic form, the gravity model predicts that bilateral trade flows are increasing in the sizes of the trading partners and decreasing in trade costs which can take a number of forms. In applications to NTMs, the standard gravity equation is augmented to include the non-tariff policy as an additional variable to explain bilateral trade. For an application using different data, see Grant, Peterson and Ramniceanu (2015) for US exports of fruits and vegetables, Arita, Beckman and Mitchell (2016) for US and EU trade in nine agri-food commodities, and Disdier Fontagne and Mimouni (2008) for all agricultural products.

**Table 6. Trade Flow Impacts (Percentage Differences) of SPS Specific Trade Concerns**

| | (1) All Concerns | (2) WTO Subject | (3) SPS Taxonomy | (4) Raising, Supporting & Status | (5) MTN Sectors | (6) Importing Country |
|---|---|---|---|---|---|---|
| All | -41% | | | | | |
| | | | | | | |
| AH | | -54% | | | | |
| PH | | -34% | | | | |
| FS | | -39% | | | | |
| Other | | -30% | | | | |
| | | | | | | |
| ADR | | | -52% | | | |
| CPCL | | | -24% | | | |
| CRA | | | -42% | | | |
| FAD | | | -18% | | | |
| MICROB | | | -99% | | | |
| PHT | | | -43% | | | |
| PLC | | | -75% | | | |
| PPR | | | -15% | | | |
| TOL | | | -24% | | | |
| Raising – R | | | | -73% | | |
| Raising – PR | | | | -59% | | |
| Raising – NR | | | | -30% | | |
| Supporting – R | | | | -29% | | |
| Supporting – PR | | | | -29% | | |
| Supporting – NR | | | | -32% | | |
| | | | | | | |
| ANML | | | | | -72% | |
| OILS | | | | | -52% | |
| OTH | | | | | -45% | |
| DAIRY | | | | | -44% | |
| SFD | | | | | -43% | |
| CER | | | | | -29% | |
| FV | | | | | -28% | |
| CTS | | | | | -19% | |
| BT | | | | | -7% | |
| | | | | | | |
| EU | | | | | | -28% |
| US | | | | | | -21% |
| Japan | | | | | | -46% |
| China | | | | | | -75% |
| India | | | | | | -47% |

Source: Authors' calculations

Notes: all values are average percentage changes in bilateral trade flows across country-pair-by-product observations when a specific trade concern is and is not occurring.

strong indication that the measures brought up during SPS committees are indeed valid concerns for Members' agri-food exports.

Another interesting dimension is to compare raising versus supporting member concerns as well as the status of the concern. Here the results for the trade effects of SPS-related STCs are what we might expect. Exporting countries raising a concern that is eventually resolved (R) see their trade drop by the largest margin—73 percent on average—when the STC is active. PR and NR concerns decrease Members' trade but by smaller magnitudes, with reductions of 59 and 30 percent, respectively. Supporting Members see their trade drop by less than half the amount of a raising country with a resolved or partially resolved concern. Thus, raising Members appear to have legitimate concerns about their trade flows and the most at stake compared to supporting countries.

Scenario 5 compares the percentage trade differences with and without STCs across 9 MTN agricultural sectors. Consistent with previous findings regarding animal disease concerns, we find that animal products (ANML) are the most affected sector in terms of trade declines averaging 72 percent. ANML is followed by oilseeds (OILS), other agricultural products (OTH), and dairy and seafood and fish products (SFD) rounding out the top 5. What is also significant about the sector-based trade results is fruits and vegetables (FV)—a sector that accounted for the largest share of STCs affecting any one sector-- ranks seventh out of the 9 MTN agri-food sectors considered. Thus, while the incidence of concerns falling on FVs is the largest out of all sectors, the trade impact of these concerns is among the smallest.

In the final scenario, we consider trade impacts of SPS trade concerns across 5 major countries maintaining SPS measures: the EU, United States, Japan, China, and India. Across all 5 countries, SPS concerns are associated with significantly lower levels of trade when the concern is active compared to when it is not. The average level of reduction, however, varies substantially. The average difference for the EU and United States is relatively low, at 28 and 21 percent, respectively. This compares to 75 and 47 percent for measures of concern in China and India. For the EU, the lower average may be in part due to the high number of tolerance-related concerns and measures that affect fruit and vegetables—concerns which are associated with lower levels of reductions. Nevertheless, the U.S. STCs are largely made up of animal disease and plant contaminant concerns—STCs that are on average associated with relatively larger reductions in trade. Thus, there may be significant unobservable country level heterogeneity behind each of the STC effects. More research is needed to examine why some countries' measures which are raised as concerns have a more pernicious effect on trade.

# VI. Concluding Remarks

In this paper, we examine the landscape of SPS measures and how they have affected agri-food trade by considering a novel revealed concerns-based approach. Instead of relying on notification-based data, we exploit information contained in the SPS committee as a way to 'reveal' the major SPS concerns of exporters by delving into the heterogeneous nature of these measures.

Analysis of the SPS trade concerns reveals a considerable amount of insight into the major cross-cutting issues of exporters. Animal health concerns due to disease outbreaks, food safety

concerns over tolerance limits, and pest-control related concerns make up the largest share of concerns for agricultural trade. Measures applied on meat and edible offal and fruits had the highest incidences of concerns. The level, type, and product composition of concerns vary significantly across markets. The EU and United States have participated in the largest number of SPS trade concerns. Our results find that the United States is more active in raising or supporting concerns compared to the EU which is more active as maintaining SPS measures of concern to exporters. Fewer concerns have been raised against measures maintained by developing countries; this finding is likely in part due to the smaller size of these import markets. However, more recently, we find that developing countries participate in raising and supporting concerns on a frequency consistent with their developed country counterparts.

Across all measures, specific trade concerns last an average of 3-4 years. However, the resolution and duration varies significantly across concerns. Compared to concerns over plant and animal measures, food safety SPS concerns appear the most difficult to resolve, carrying the lowest resolution rate and generally lasting the longest. While most concerns are resolved in 3 years or less, other measures persist over a decade and require dispute settlement resolution. Overall, however, it appears that the STC mechanism used in the SPS committee has helped facilitate trade discussions and in a large number of cases has avoided costlier dispute settlement proceedings.

Linking STC information to trade data, we provide an initial empirical assessment. The trade flow effects of SPS concerns averaged over types of concerns, product sectors and countries are pronounced and striking. Agricultural trade flows between two countries are on average 41 percent lower when an STC concern is active compared to when it is not. The significance of these differences holds across different types of measures, across countries and products, and whether or not the measures are resolved. For example, the average effect is larger for microbiological and animal disease related concerns compared to tolerances and customs and certification related measures. Animal products suffer larger reductions in trade than fruit, vegetables, and cereals. SPS measures of concern in developed countries have, on average, a lower effect on trade than on developing countries, and resolved concerns appear to have larger reductions initially owing to the fact that Members likely have more incentives to resolve concerns that impact trade relatively more.

Thus, this study illustrates how information contained in specific trade concerns related to SPS measures can be assembled to inform the policy debate over these measures and provide a useful platform for future research. The initial empirical analysis conducted in this study points to the need for econometric methods to identify more explicitly the quantitative effects of SPS concerns and opens up several outstanding questions of interest. Why are some measures of concern brought up in the SPS committee and others not? Why do some concerns have more pernicious trade effects than others? What policies help to facilitate the resolution of concerns to prevent them from becoming protracted? Do free trade agreements help address SPS concerns by lessening their impact and shortening their duration? We leave these questions and much more as fruitful areas of future research.

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# Appendix A: Specific Trade Concern Participating Countries

| Country | ISO Code | Raising/Supporting | Maintaining |
|---|---|---|---|
| Albania | ALB | | X |
| Argentina | ARG | X | X |
| Armenia | ARM | | X |
| Australia | AUS | X | X |
| Austria | AUT | | X |
| Bahrain | BHR | | X |
| Barbados | BRB | | X |
| Belgium-Luxembourg | BLX | | X |
| Belize | BLZ | X | X |
| Benin | BEN | X | X |
| Bolivia | BOL | X | X |
| Brazil | BRA | X | X |
| Bulgaria | BGR | X | X |
| Cameroon | CMR | X | X |
| Canada | CAN | X | X |
| Chile | CHL | X | X |
| China | CHN | X | X |
| Columbia | COL | X | X |
| Costa Rica | CRI | X | X |
| Cote D'Ivoire | CIV | X | X |
| Croatia | HRV | X | X |
| Cuba | CUB | X | X |
| Czech Republic | CZE | X | X |
| Dominica | DMA | X | X |
| Dominican Republic | DOM | X | X |
| Ecuador | ECU | X | X |
| Egypt | EGY | X | X |
| El Salvadore | SLV | X | X |
| Estonia | EST | X | X |
| European Union | EU | X | X |
| Fiji | FJI | X | X |
| France | FRA | | X |
| Gabon | GAB | | X |
| Gambia | GMB | X | X |
| Germany | DEU | | X |
| Ghana | GHA | X | X |
| Guatemala | GTM | X | X |
| Honduras | HND | X | X |

## Appendix A, continued

| Country | ISO Code | Raising/Supporting | Maintaining |
|---|---|---|---|
| Hong Kong | HKG | | X |
| Hungary | HUN | X | X |
| Iceland | ISL | X | X |
| India | IND | X | X |
| Indonesia | IDN | X | X |
| Israel | ISR | X | X |
| Italy | ITA | | X |
| Jamaica | JAM | X | X |
| Japan | JPN | X | X |
| Jordan | JOR | X | X |
| Kenya | KEN | X | X |
| Korea | KOR | X | X |
| Kuwait | KWT | | X |
| Latvia | LVA | X | X |
| Malaysia | MYS | X | X |
| Mexico | MEX | X | X |
| Moldova | MDA | X | X |
| Morocco | MAR | X | X |
| Netherlands | NLD | | X |
| New Zealand | NZL | X | X |
| Nicaragua | NIC | X | X |
| Nigeria | NGA | X | X |
| Norway | NOR | X | X |
| Oman | OMN | | X |
| Pakistan | PAK | X | X |
| Panama | PAN | X | X |
| Papua New Guinea | PNG | X | X |
| Paraguay | PRY | X | X |
| Peru | PER | X | X |
| Philippines | PHL | X | X |
| Poland | POL | X | X |
| Qatar | QAT | | X |
| Romania | ROM | X | X |
| Russia | RUS | X | X |
| Saint Vincent and Grenadines | VCT | X | X |
| Saudi Arabia | SAU | | X |
| Senegal | SEN | X | X |
| Singapore | SGP | X | X |

| Country | ISO Code | Raising/Supporting | Maintaining |
|---|---|---|---|
| Slovakia | SVK | X | X |
| Slovenia | SVN | X | X |
| South Africa | ZAF | X | X |
| Spain | ESP | | X |
| Sri Lanka | LKA | X | X |
| Suriname | SUR | | X |
| Switzerland | CHE | X | X |
| Taiwan | TWN | X | X |
| Tanzania | TZA | X | X |
| Thailand | THA | X | X |
| Trinidad & Tobago | TTO | | X |
| Turkey | TUR | X | X |
| Ukraine | UKR | X | X |
| United Arab Emirates | ARE | | X |
| United Kingdom | GBR | | X |
| United State of America | USA | X | X |
| Uruguay | URY | X | X |
| Venezuela | VEN | X | X |
| Vietnam | VNM | X | X |

# Appendix B. HS Codes to MTN Sector Mapping

| MTN Category | Abbreviation | HS Code, Mapping based on HS 2007 |
|---|---|---|
| *Animal Products* | *ANML* | 01, 02, 1601-1602 |
| *Dairy Products* | *DAIRY* | 0401 - 0406 |
| *Fruits, Veg., and Plants* | *FV* | 07, 08, 1105-1106, 2001-2008, 0601-0603, 1211, 13, 14 |
| *Coffee, Tea, Mate and Spices* | *CTS* | 0901-0903, 18 (except 1802), 2101 |
| *Cereals & Preparations* | *CER* | 0407-0410, 10, 1101-1104, 1107-1109, 19, 2102-2106, 2209 |
| *Oilseeds, Fats, & Oils* | *OILS* | 1201-1208, 15 (except 1504), 2304-2306, 3823 |
| *Sugars & Confectionary* | *SGR* | 17 |
| *Beverages & Tobacco* | *B_T* | 2009, 2201-2208, 24 |
| *Other Ag.* | *OTH* | 0904-0910, 05, 0604, 1209-1210, 1212-1214, 1802, 230110, 2302-2303, 2307-2309, 290543-290545, 3301, 3501-3505, 380910, 382460, 4101-4103, 4301, 5001-5003, 5301-5302 |
| *Fish & Fish Products* | *SFD* | 03, 1504, 1603-1605, 230120 |

**Source:** https://www.wto.org/english/res_e/booksp_e/tariff_profiles08_e.pdf, **pg. 24.**