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TRADE AND ECONOMIC EFFECTS OF IRC: FURTHER EMPIRICAL EVIDENCE FROM SPS AND TBT PROVISIONS

Anne-Celia Disdier (Paris School of Economics)
Susan F. Stone and Frank van Tongeren (OECD)

Cutting trade costs, especially those stemming from non-tariff measures, is a growing priority for policy makers. One way to achieve this is for countries to improve their co-operation on regulatory matters. An avenue open to governments is to include provisions related to international regulatory co-operation (IRC) into preferential trade agreements (PTAs). However, there exists little empirical evidence of the benefits of these co-operative mechanisms. This paper provides this evidence, in the context of Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT) provisions. It measures the effect of IRC mechanisms on trade flows using the latest developments in the gravity literature and the most recent data sources. The work distinguishes between different forms of co-operation implemented between countries within PTAs while also accounting for the level of commitment between partners. The estimation results suggest that PTAs including SPS and TBT measures have a significant and positive effect on trade flows, with the legal enforceability of IRC mechanisms having the strongest and most robust impact on trade flows. This result holds even when WTO-related provisions and dispute settlement procedures are controlled for, implying that binding commitments are important in maximizing post-PTA trade flows. The work shows that transparency and co-operation are significant and robust factors in increasing trade. It also reinforces the view that the impact takes some time to materialise, which is important when evaluating the effectiveness of deep IRC mechanisms.

Keywords: Trade; international regulation co-operation; trade agreements; gravity equation, Sanitary and Phytosanitary; technical barriers to trade

JEL Classification: F13, F14, F15, F53, F55, C54

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Executive Summary

The paper presents a quantitative analysis of the effect of International Regulatory Co-operation mechanisms (IRC) on trade flows, using the latest developments in the gravity literature and the most recent data sources on non-tariff measures (NTMs) and IRC mechanisms. This is an advancement on previous studies, leading to more robust conclusions that help shed light on what mechanisms within Preferential Trade Agreements (PTAs) have the largest impact on bilateral trade flows. The work distinguishes between different forms of co-operation implemented between countries within PTAs as well as accounting for the level of commitment between partners.

The estimation results suggest that PTAs are signed between countries that already have significant trade between them. Legal enforceability of IRC mechanisms has the strongest and most robust impact on trade flows. This result holds even when World Trade Organization (WTO)-related provisions and dispute settlement procedures are controlled for, implying that binding commitments are important in maximizing post-PTA trade flows. The trade effects of sanitary and phytosanitary (SPS)-related IRC mechanisms are more significant than the ones observed for technical barriers to trade (TBT)-related IRC mechanisms. This outcome likely relates to the fact that SPS measures have a direct influence on the actual and perceived quality of imported food, which leads to a relatively stronger positive effect on demand.

The results offer evidence of strong phasing-in effects in PTAs and in IRC mechanisms. Different reasons may explain this. First, it could be related to the delay in the implementation of some provisions included in the PTAs. Second, it may also be linked to use of the IRC mechanisms by firms, which may take place only few years after the entry into force of the agreement. The disentangling between these explanations is left to future research.

The IRC mechanisms examined in this paper tend to have a greater impact on agri-food trade than on manufacturing flows. The impact of SPS-related IRC mechanisms on trade flows of some manufacturing products (e.g. leather, wood, paper, textile and clothing, footwear, metals) is easily understandable, if one keeps in mind the degree to which SPS measures can affect such products.

Several conclusions can be derived from the estimation results. First, it should be noted that PTAs are more likely to be entered into by countries already having strong trade linkages. Thus, most modern studies find this variable insignificant once it has been controlled for. Second, transparency mechanisms, and to a lesser extent provisions on the mutual recognition of TBT conformity assessment procedures, have significant, positive and rather strong trade effects. One reason for this result may be that such regulatory mechanisms are rather simple to implement and represent the easiest first-step toward co-ordination of SPS and TBT measures. Finally, phasing-in effects are also observed for these deep IRC mechanisms – even for mutual recognition and harmonisation of TBT measures when they are analysed.

This paper is an important first step in quantifying provisions within PTAs that most affect trade flows between partner countries. It shows that transparency and co-operation are significant and robust factors in increasing trade. It also reinforces the view that the impact takes some time to materialise, which is important when evaluating the effectiveness of deep IRC mechanisms.

1. Introduction

In parallel to the multilateral processes at the World Trade Organization (WTO), Preferential Trade Agreements (PTAs) have provided an avenue for countries to further reduce trade barriers and promote co-operation among trading nations. Over time, these agreements have expanded in both breadth and depth, incorporating many issues outside the traditional areas of border measures such as tariffs and quotas. The OECD, along with others, has tracked these developments through a number of papers.[1] More recently, preferential trade agreements have begun to deal directly with issues surrounding regulation.

When regulatory measures affect international trade they are typically classified as Non-Tariff Measures (NTMs), and a growing number of which have been notified to the WTO by developed and developing countries. NTMs generally aim to address market failures related, for example, to consumer health or environmental protection, and most of them are not protectionist *per se*. However, by directly or indirectly affecting the costs for producers and traders of products and services, these measures affect international trade flows as well as other economic outcomes, such as industry concentration and new technological development. An important factor that contributes to trade costs is the differences in regulations between jurisdictions, even if they address essentially the same type of regulatory issues.

Various International Regulatory Co-operation (IRC) mechanisms can reduce the trade costs associated with regulatory heterogeneity and are increasingly used by countries. IRC can be undertaken at three different levels (OECD, 2017b). First, policymakers can unilaterally enforce internationally recognised good regulatory practices (GRPs) in their countries' regulatory system. GRPs include such processes as accountability and transparency; engagement with stakeholders; preventing undue influence and maintaining trust in the system (OECD, 2014). Countries can also unilaterally accept the regulatory settings or standards of another country, or unilaterally recognise the outcomes of the regulatory system of another country. Second, countries can pursue regulatory co-operation at a bilateral or plurilateral level. Such co-operation – focusing for example on transparency, mutual recognition, or regulatory harmonisation – is often undertaken within PTAs. Trading partners can also co-operate on a more informal basis outside the PTA structure. Finally, international organisations, in particular those setting standards, can promote regulatory co-operation at a multilateral level.

The empirical work undertaken for this paper aims at improving the quantitative understanding of reducing regulatory heterogeneity across countries through IRC mechanisms. The paper focuses on IRC mechanisms in order to isolate and measure the additional impacts these provisions have on trade flows. It is in this way that policymakers will better understand which approaches to co-operation negotiated within trade agreements significantly affect trade between partners. In this sense, it does not attempt to measure other forms of co-operation such as through international standard setting. This equally important topic is left to future research.

Among the different types of IRC mechanisms, the analysis looks at efforts at the bilateral or plurilateral level between a pair or group of countries. The sample is drawn from all PTAs notified to the WTO and currently in force. In order to ensure a significant sample

[1] Two recent examples being Lejárraga (2014) and NBTS (2018).

size with a sufficient amount of quantitative information, the investigation is restricted to IRC mechanisms related to sanitary and phytosanitary measures (SPS) and technical barriers to trade (TBT).[2]

The analysis relies on econometric methods and provides an ex-post assessment of IRC mechanisms. The trade effects of these mechanisms are quantified through the estimation of a structural gravity equation. The sample includes OECD countries, as well as APEC countries and main emerging economies. While generally looking at trade in goods, a specific focus is put on trade in agricultural products, where SPS measures play a particularly important role.

The contributions of this work to the existing literature are threefold. First, this study provides a quantitative analysis of the effect of IRC mechanisms on trade flows, while the existing work mainly offers theoretical study or qualitative analysis. In a review of empirical studies on PTAs, the Swedish Board of Trade (NTBS, 2018) show that PTAs have significant and positive impact on trade flows between participants. However, the study also points out that the "black box" of what, exactly, is driving these gains, needs to be better understood. The work presented here is one attempt to shed some light into this box.

The second contribution of the work is to distinguish between different forms of co-operation (reference to the WTO rules, transparency, mutual recognition or harmonisation of NTMs, conformity assessment procedures) implemented between countries within PTAs, as well as the level of commitment (legal enforceability and dispute settlement).

Finally, the quantification uses the latest developments in the gravity literature and the most recent data sources on NTMs and IRC mechanisms in order to obtain reliable estimates. This overcomes many shortfalls of previous studies, leading to more robust conclusions.

The estimation results suggest that transparency and mutual recognition of conformity assessment procedures have a positive and significant impact on trade flows, especially of agri-food products. Legal enforceability of provisions is found to be crucial for the positive potential of IRC mechanisms to materialise.

This work builds on previous work on IRC mechanisms conducted at the OECD. The promotion of transparency in PTAs is further investigated by Lejárraga (2013), while Correia de Brito et al. (2016) examine the Mutual Recognition Agreements (MRAs) and Basedow and Kauffmann (2016) focus on good regulatory practices. Moreover, trade costs related to regulatory divergence are explored by OECD (2017b). On the theoretical side, OECD (2017a) provides an analytical framework which helps to understand the trade-offs between trade costs and domestic regulatory objectives. Finally, OECD (2016c) studies the contribution of 50 international organisations to IRC mechanisms. Specific reviews are also conducted with partner organisations (e.g. OECD/FAO, 2016; OECD/ISO, 2016; OECD/WHO, 2016). However, the impact of IRC mechanisms has never been explicitly measured in PTAs until now.

This paper is structured as follows. Section 2 reviews the state of the art on IRC mechanisms. Section 3 outlines the data and their sources used in the empirical analysis, while Section 4 presents the econometric methodology and the estimated equations. Section 5 describes the results. Concluding remarks are put forward in Section 6.

[2] Procedures included under the broad concept of regulatory co-operation are included in both SPS and TBT Agreements under the WTO.

2. State of the art[3]

As highlighted by OECD (2016a), three types of costs can be distinguished when examining regulatory structures: i) specification costs (e.g. costs induced by the enforcement of requirements and adaptation of products and production processes); ii) conformity assessment costs (e.g. costs imposed by the need to demonstrate compliance with requirements); and iii) information costs (e.g. costs for getting information on the regulatory requirements defined in the different destination markets). Research has shown that IRC mechanisms help to reduce trade costs associated with regulatory divergence across countries across all three types of costs.

At the bilateral or plurilateral level, regulatory co-operation can be conducted within PTAs in a number of ways, both binding and non-binding. This paper examines three main IRC mechanisms favoured by countries:

- The harmonisation mechanism, where a common regulation is adopted by all parties. This common regulation can be based on an international standard defined by an international standard-setting organisation or the national standard in force in one member country;
- The mutual recognition or equivalence mechanism, where each party keeps its own regulations and legal decisions but recognises and upholds regulations and legal decisions taken by other partners. Parties can mutually recognise or consider as equivalent i) the regulation itself, ii) the compliance techniques and/or conformity assessment procedures, as well as their results, or iii) the regulation's enforcement through the recognition of judgements and arbitral awards;
- The transparency mechanism, where parties commit to publish information about their regulations, develop open and participatory policy-making process, ensure predictability in the application and enforcement of regulations, and minimise corruption and bribery.

Each IRC mechanism has different trade effects. Indeed, the distribution of costs and benefits among members are likely to be different for each mechanism. By allowing the realisation of scale economies and a more efficient resource allocation, both harmonisation and mutual recognition are typically assumed to be trade-enhancing (Chen and Mattoo, 2008). However, harmonisation is expected to boost trade more than mutual recognition (Orefice et al., 2012; Baller, 2007). Indeed, a common regulation increases the homogeneity and substitutability between products, lowers information costs, and increases trust in imported products' quality. Nevertheless, harmonisation, by potentially reducing the number of product varieties available on the market and generating compliance costs that vary across countries, may impede exports of some countries, and thus its gains are not equally distributed among trading partners (Cadot et al., 2018). Harmonisation of an existing 'stock' of regulations may also be prohibitively costly for regulatory systems and hence difficulty to achieve in practice (Zezza et al., 2018).[4] Such negative effects can be

[3] This section briefly presents the current research on IRC mechanisms implemented at the bilateral or plurilateral level, as well as their trade and price effects.

[4] Regulations and standards all involve some level of enforcement and compliance costs. These have to be offset against the benefits from the regulation, such as increased protection of human health or environmental benefits. This work focuses on the way these regulations are implemented across

avoided with mutual recognition, which does not induce large adaptation costs and which can provide a more equal distribution of gains from reducing trade costs related to NTMs among countries. However, the actual outcome depends on existing number of varieties and type of standards.

Quantifications of the trade effects of IRC mechanisms in the context of PTAs have been performed only recently. Most of the literature focuses on the average trade effects of regulations across PTAs – often distinguishing between country-specific and internationally harmonised standards – but does not examine whether these effects relate to the presence of PTAs. However, the few existing quantification exercises highlight that IRC provisions increase flows between members, but often at the expense of trade with third countries (Baller, 2007; Chen and Mattoo, 2008; Lejárraga et al., 2013; Disdier et al., 2015). In that latter case, two types of effects are likely to be at play: i) trade diversion occurs when imports from third countries are replaced by imports from other PTA members, and ii) trade deflection occurs when exports of PTA members to third countries are negatively impacted by the IRC mechanisms. For example, standards harmonisation is costly, potentially raising the price of products, which could then price them out of some destination markets.

The trade impact of IRC mechanisms can also be measured indirectly through price variations. Cadot and Gourdon (2016) show that deep integration (through PTAs and NTM coordination) dampens price-raising effects of NTMs. Furthermore, they show that mutual recognition of conformity assessment – which is arguably a relatively easy step towards co-operation – has a stronger cost-reducing effect than harmonisation. Three channels are likely to be at play here. First, NTM convergence within PTAs induces a decrease in compliance costs (Cadestin et al., 2016). Second, PTAs tend to reduce the home bias among member countries and provide better information to consumers. This translates into an increase in the demand for PTA products and lowers the price impact of NTMs. Finally, PTAs can reduce protectionist-motivated distortions in the design of NTMs.

While regulatory co-operation within PTAs can be binding for member countries, some IRC mechanisms defined at the plurilateral level can also be implemented on a voluntary basis by countries. As highlighted by OECD (2016b and 2016c), international organisations can play a key role in the development of IRC. They may facilitate the dialogue between their members and thus the development of common regulatory practices, by providing an adequate framework for defining, implementing and legal enforcement of regulations. The "Recommendation L" of the United Nations Economic Commission for Europe (UNECE), the OECD Environment, Health and Safety (EHS) programme, and the OECD Seeds Schemes are good examples of this voluntary supra-national co-operation.

countries noting the trade enhancing effects that can be had when done in a co-operative manner. For a study of the broader welfare impacts of standards see van Tongeren et al. (2009) and Swinnen et al. (2015).

3. Data

3.1. Data and statistical sources

Trade flows: Trade data is taken from the CEPII (BACI database).[5] The CEPII applies original procedures to harmonise the UN COMTRADE data (evaluation of the quality of country declarations to average mirror flows, evaluation of cost, insurance and freight rates to reconcile import and export declarations, etc.). BACI data are available at the product level (HS 6-digit) and for all countries since 1995, allowing consistent analysis over the two last decades.

PTAs: All PTAs notified to the WTO and in force as of December 2015, as listed by Hofmann et al. (2017) are considered. Their database includes 279 PTAs signed by 189 countries between 1958 and 2015. All PTA members and the date of entry into force of each agreement are reported. The original source of information used by Hofmann et al. (2017) is the WTO Regional Trade Agreements Information System (RTA-IS).[6] Partial scope agreements are excluded from the analysis. More recent agreements such as CETA are not included in this analysis due to insufficient post-agreement trade flows data.

IRC mechanisms within PTAs: IRC, for these purposes, is any mechanism through which countries can cooperate in the development, implementation and enforcement of regulation. It can be broadly defined to include policy instruments and standards developed by international organisations. The OECD (2013, 2016b) discusses 11 approaches to IRC including collaborative initiatives under various inter-governmental institutions. This paper focuses on co-operative mechanisms as they are applied in SPS and TBT provisions of trade agreements.

IRC mechanisms involving trading partners can be defined at the bilateral, plurilateral or multilateral level. At the bilateral and plurilateral level, regulatory co-operation is often achieved within PTAs. This work examines SPS and TBT provisions in so far as they support the regulatory co-operation process. Only SPS and TBT provisions in PTAs officially notified to the WTO and currently in force are considered. Informal co-operation between trading partners on SPS and TBTs is not included. Information on these provisions is gathered from two sources.

First, the recent database provided by Hofmann et al. (2017), detailing the content of PTAs is used.[7] This database expands the work conducted by Horn et al. (2010) to all PTAs in force and notified up to 2015 to the WTO. The authors explore 52 policy areas (such as SPS and TBT measures, customs administration, export taxes, public procurement, labour market regulations, etc.) and their legal enforceability. Hofmann et al. (2017) first investigate whether the provisions for each policy area fall under, but go beyond, the current mandate ("WTO plus" or "WTO+") or are outside the WTO mandate ("WTO extra" or "WTO-X"). Provisions in PTAs that cover SPS and TBT measures are categorised as WTO+. Then, the authors examine which policy areas are covered by each agreement. They

[5] http://www.cepii.fr/anglaisgraph/bdd/baci.htm.

[6] http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx. If the date of entry into force of the agreement differs between goods and services, the one for goods is considered.

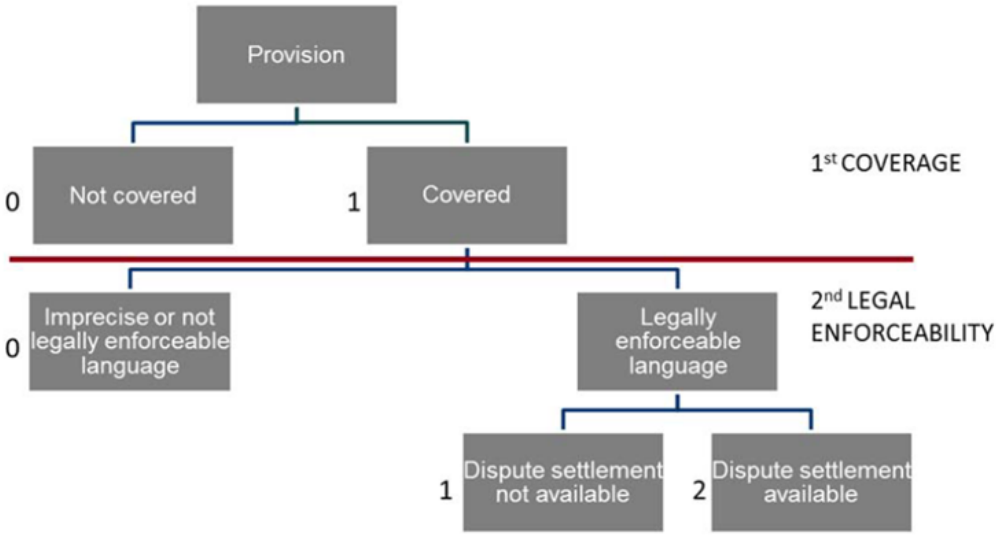
[7] https://data.worldbank.org/data-catalog/deep-trade-agreements.

assume that a policy area is covered if the agreement contains an article, chapter or provision, providing for some form of undertaking in this field.

In a second step, Hofmann et al. (2017) analyse whether provisions are legally enforceable. A provision is legally enforceable "if the language used in the Agreement's text is sufficiently precise and committing and if it has not been excluded from dispute settlement procedures under the PTA", Hofmann et al. (2017). Furthermore, for those agreements that include legally enforceable language, the paper examines whether a dispute settlement procedures is available under the PTA.[8]

Figure 1 summarises the approach used by Hofmann et al. (2017) and applied here to assess legal enforceability of provisions. Agreements that do not include legally binding language are, by default, voluntary efforts.

Figure 1. Assessment of legal enforceability



Source: Hofmann et al. (2017).

One example of provisions classified as legally enforceable in their database is the EU-Korea PTA. Here the official text states that: "Neither Party may maintain or institute any duties, taxes or other fees and charges imposed on, or in connection with, the exportation of goods to the other Party, or any internal taxes, fees and charges on goods exported to the other Party that are in excess of those imposed on like goods destined for internal sale."

By contrast, an example of provision classified as not legally enforceable can be found in the EFTA-Chile PTA. Here the text of the Agreement stipulates: "The Parties shall strengthen their co-operation in the field of technical regulations, standards and conformity assessment, with a view to increasing the mutual understanding of their respective systems and facilitating access to their respective markets."

[8] Hofmann et al. (2017) analyse only the settlement of disputes under the PTA. If there is no dispute settlement available under the PTA or if the PTA relies to national or international legislation to solve trade disputes, a provision is not necessarily less likely to be implemented in practice.

The second source of information, gathered from the WTO PTA database, details information on the content of SPS and TBT provisions included in PTAs.[9] The database catalogues the most frequent provisions included in each agreement. Transparency obligations for SPS and TBT provisions are reported. In addition for TBTs, the WTO provides information on the mandatory recognition of conformity assessment results and technical regulations as well as on the harmonisation of technical regulations at the bilateral or regional level. Box 3.1 described the approach implemented by the WTO to determine whether a PTA contains the provisions identified.

Gravity data

The usual gravity variables (e.g. geographical distance, common language, common border, etc.) are extracted from the CEPII database on gravity variables.[10]

Box 3.1. Content of SPS and TBT provisions included in PTAs (WTO)

Provisions on SPS measures

The PTA contains provisions on SPS measures. This includes a general statement on co-operation in SPS areas such as inspection, quarantine, or capacity building for implementation of SPS measures or that the parties respect each other's legislation on SPS measures.

- Transparency obligations

The PTA contains transparency obligations, including through the creation of a Committee.

Provisions on TBT measures

The PTA contains provisions on standards, technical regulations or conformity assessment procedures.

- Transparency obligations

The PTA contains transparency obligations, including through the creation of a Committee or the exchange of information. Provisions on co-operation between the Parties are not considered to be transparency obligations.

- Mandatory recognition of conformity assessment results

The PTA contains provisions on mandatory recognition of conformity assessment results; best-endeavour provisions are not included.

- Mandatory recognition of technical regulations

The PTA provides for mandatory recognition of technical regulations. It does not include cases which call for positive consideration to be given for recognition of technical regulations by any of the Parties.

- Harmonisation/alignment of TBT measures at the bilateral/regional level

The PTA provides for (or encourages) the harmonisation of standards, technical regulations and/or conformity assessment procedures between the Parties. PTAs that refer to the alignment, compatibility, or approximation of TBT measures, are also considered to provide for the harmonisation of these measures.

Source: https://rtais.wto.org/USERGUIDE/MainTopics_USER_GUIDE_EN.html#_Toc503431726.

[9] https://rtais.wto.org/USERGUIDE/MainTopics_USER_GUIDE_EN.html.

[10] The CEPII database on gravity variables and the World Bank's World Development Indicators provide the required information underpinning the general gravity equations (e.g. geographical distance, common language, common border, GDP and GDP per capita. In addition and if required, data on administrative environments, legal systems and corruption could be obtained from the Doing Business and the Worldwide Governance Indicators projects. See http://www.cepii.fr/CEPII/en/bdd_modele/bdd.asp.

3.2. Descriptive statistics

The sample covers 59 countries (which are exporters and importers). These countries include OECD members, as well as additional countries from Asia-Pacific Economic Co-operation (APEC), the European Union and MERCOSUR and the BRICS economies. In terms of time coverage and based on data availability, the trade effects of IRC mechanisms are investigated over the 1995-2015 period. Table 1 lists the countries included in the sample.

Table 1. Countries included (as exporter and importer) in the sample

Argentina	Malaysia	Finland	Slovak Republic
Australia	Malta	France	Slovenia
Austria	Mexico	Germany	South Africa
Belgium-Luxembourg	Netherlands	Greece	Korea
Brazil	New Zealand	Hong Kong, China	Spain
Brunei Darussalam	Norway	Hungary	Sweden
Bulgaria	Papua New Guinea	Iceland	Switzerland
Canada	Paraguay	India	Thailand
Chile	Peru	Indonesia	Turkey
China	Philippines	Ireland	United Kingdom
Croatia	Poland	Israel	United States
Cyprus[1]	Portugal	Italy	Uruguay
Czech Republic	Romania	Japan	Venezuela
Denmark	Russian Federation	Latvia	Viet Nam
Estonia	Singapore	Lithuania	

1. **Note by Turkey*: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".
**Note by all the European Union Member States of the OECD and the European Union*: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

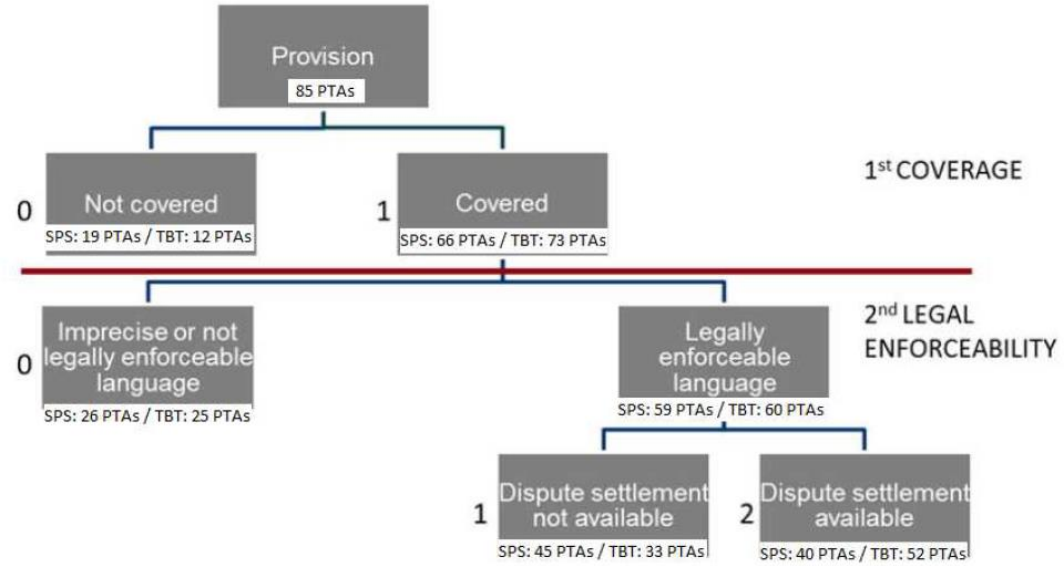
A total of 85 PTAs notified to the WTO are in force in the sample over the 1995-2015 period (Table 2). Each of the EU enlargement agreements is included separately to control for the enlargement process. Figure 2 provides descriptive statistics on the coverage of SPS and TBT provisions and their legal enforceability as defined by Hofmann et al. (2017). There are 66 PTAs that include SPS provisions and 73 that include TBT provisions. SPS provisions are legally enforceable in 59 PTAs, while the legal enforcement of TBT provisions is observed in 60 PTAs. Dispute settlement is available in 40 PTAs for SPS provisions and in 52 PTAs for TBT provisions.

Table 2. PTAs included in the sample[1]

ASEAN - Australia - New Zealand	EU - South Africa
ASEAN - China	EU - Switzerland - Liechtenstein
ASEAN - India	EU - Turkey
ASEAN - Japan	European Free Trade Association (EFTA)
ASEAN - Korea	Hong Kong, China - New Zealand
ASEAN Free Trade Area (AFTA)	India - Japan
Andean Community (CAN)	India - Malaysia
Australia - Chile	India - Singapore
Australia - New Zealand Closer Economic Relations Trade Agreement (ANZCERTA)	Israel - Mexico
Australia - Papua New Guinea (PATCRA)	Japan - Indonesia
Canada - Chile	Japan - Malaysia
Canada - Israel	Japan - Mexico
Canada - Peru	Japan - Peru
Chile - China	Japan - Singapore
Chile - Japan	Japan - Switzerland
Chile - Malaysia	Japan - Thailand
Chile - Mexico	Japan - Viet Nam
China - Hong Kong, China	Korea - Chile
China - New Zealand	Korea - India
China - Singapore	Korea - Singapore
EC (15) Enlargement	Korea - Turkey
EC (25) Enlargement	Korea - United States
EC (27) Enlargement	Malaysia - Australia
EC (28) Enlargement	Mexico - Uruguay
EFTA - Canada	New Zealand - Singapore
EFTA - Chile	North American Free Trade Agreement (NAFTA)
EFTA - Hong Kong, China	Peru - Chile
EFTA - Israel	Peru - China
EFTA - Korea	Peru - Koreaf
EFTA – Mexico	Peru - Mexico
EFTA - Peru	Peru - Singapore
EFTA - SACU	Singapore - Australia
EFTA - Singapore	Southern Common Market (MERCOSUR)
EFTA - Turkey	Thailand - Australia
EU - Chile	Thailand - New Zealand
EU - Colombia and Peru and Ecuador	Trans-Pacific Strategic Economic Partnership
EU - Iceland	Turkey - Chile
EU - Israel	Turkey - Israel
EU - Korea	United States - Australia
EU - Mexico	United States - Chile
EU - Norway	United States - Israel
EU - Papua New Guinea / Fiji	United States - Peru
	United States - Singapore

1. For more details on the SPS and TBT provisions included in these agreements, see https://rtais.wto.org/UI/PublicAllRTAList.aspx

Figure 2. SPS and TBT provisions within PTAs and their legal enforceability



Among the 85 PTAs included in the sample, 64 contain transparency obligations for SPS measures and 66 for TBTs. The mandatory recognition of TBT conformity assessment results is found in 17 PTAs. There are ten PTAs stipulating mandatory recognition of TBT measures, while 12 PTAs involve the harmonisation of these measures at the bilateral or regional level.

4. Empirical methodology

4.1. Structural gravity estimation: challenges

To explore the impact of IRC mechanisms on trade flows, a structural gravity equation is estimated. This model is generally considered the 'workhorse' of trade estimations (see, for example, Head and Mayer (2014) and NBTS (2018)). This equation provides a measure of the expected bilateral trade given the size the bilateral transaction costs of partner economies. The comparison between expected and real trade offers a quantification of the trade effect of IRC mechanisms.

The theoretical foundations of the gravity equation have been widely discussed in the trade literature (e.g. Anderson 1979; Bergstrand 1985; Anderson and van Wincoop, 2003). This work adopts the standard new trade monopolistic competition-constant elasticity of substitution (CES) demand-Iceberg costs model introduced by Krugman (1980), where consumers are assumed to have a preference for variety of products and where trade costs are represented as losses between exports and imports. Producers in each country operate under increasing returns to scale and produce differentiated varieties, which are shipped with a cost to consumers in all countries.

Several developments have been recently suggested in the trade literature regarding the estimation of gravity equations. The main challenges and how they are addressed when estimating the trade impact of IRC mechanisms are explained below. The main points of

the methodology follow the recommendations of Yotov et al. (2016), who highlight best practices for estimating structural gravity equations.

Trade policy changes and trade flows adjustment

New IRC mechanisms within PTAs or at the multilateral level, may be implemented over time and trade flows may adjust in response to these trade policy changes, as well as to other changes in trade costs. To capture this dynamic, Yotov et al. (2016) suggest using panel data with intervals. Their recommendations are incorporated by considering trade flows over the 1995-2015 period and 3-years interval data (i.e. for years 1995, 1998, 2001, 2004, 2007, 2010, and 2013).

Unobserved prices and multilateral resistance terms

Relative prices must be controlled for when it comes to explaining bilateral trade (Anderson and van Wincoop, 2003) but these prices are not directly observed. Bilateral trade costs used as regressors in the gravity-like trade equation are indeed correlated with these unobserved prices as trade costs influence prices. This issue is referred as the "the gold medal of classic gravity model mistakes" by Baldwin and Taglioni (2006). The solution generally adopted is to rely on fixed effects by country. These fixed effects incorporate size effects, but also the price and number of varieties of the exporting country in addition to the size of demand and the price index of the importing country. However in the empirical analysis, relative prices will vary over time, hence, exporter-year and importer-year fixed effects should be used instead. In addition, relative prices may also vary across sector. Thus, exporter-year and importer-year fixed effects should be interacted with sector dummies in the estimations based on sector data to better control for this omitted variable bias.

Endogeneity of trade policy

A third issue is the potential endogeneity of IRC mechanisms, especially those included in PTAs. To address this issue, instrumental-variable (IV) techniques may be used. However, relevant instruments, which should be correlated with the probability of an IRC mechanism between two countries but uncorrelated with their bilateral trade flows, are not easily available. In their study using disaggregated data, Chen and Mattoo (2008) use standards harmonisation in adjacent industries (i.e. industries classified in the same two-digit sector) as an instrument. However, for estimations conducted at the aggregated and not at the sector level, the definition of instruments is more complex. Alternatives to IV estimation have therefore been suggested in the literature. Baier and Bergstrand (2007) and Anderson and Yotov (2016) recommend the use of country-pair fixed effects to control for the potential endogeneity of PTAs and IRC mechanisms. Although this approach may not eliminate all of the potential endogeneity bias, it is intuitively plausible that standards harmonisation correlates positively with trade flows, biasing coefficients upward. Thus, the inclusion of country-pair fixed effects in the estimations should largely account for this potential endogeneity bias.

Heteroskedasticity of trade data

The fourth issue is the potential bias in the parameters of log-linearised models estimated by ordinary least squares (OLS) in the presence of heteroskedasticity (Santos Silva and Tenreyro, 2006). The authors suggest using the Poisson pseudo-maximum likelihood (PPML) method to estimate multiplicative equations. In their specification, the dependent

variable is measured in levels. However, this specification provides estimates that are comparable to elasticity estimates from the standard linear-in-logs specification.

Zero trade flows

Trade statistics are characterised by the presence of zeros. In other words, some bilateral trade relationships, especially at a disaggregated level, do not exist. However, these non-existing flows contain information per se and their exclusion from the estimations may bias the results. One advantage of the above-mentioned PPML specification is to deal adequately with zero-value observations. When trade flows are aggregated at the country-pair level, the presence of zeros is very limited (less than 2% of the observations). However, their share becomes more significant when working with HS2-digit sector data (37%). However, given that Yotov et al. (2016) and others argue that PPML is the preferred estimation procedure, regardless of the share of zeros in the dataset, it is applied to both datasets.[11]

Bilateral trade costs

The structural gravity equation includes a bilateral trade cost term, which should be adequately proxied in the empirical analysis. To do so, the most widely used gravity proxies, e.g. bilateral geographic distance, contiguity, common language, colonial links and PTA membership, are utilised. It should be mentioned that all of these proxies (except PTAs) are time-invariant and will therefore be dropped in the estimations with country-pair fixed effects accounting for trade policy endogeneity.

Potential dependence between some PTAs

An additional issue is linked to the potential dependence between some PTAs. Although the diversity in IRC mechanisms included in PTAs is likely to limit this source of bias, the issue will be controlled for in the empirical analysis by clustering errors at the country-pair level.

Yotov et al. (2016) also suggest including intra-national trade flows in addition to international ones when estimating the gravity equation. This inclusion should ensure consistency with the gravity theory, provide consistent identification of the effects of bilateral trade policies and capture the effects of globalization on international trade (which otherwise may be – at least partially – captured by PTA variables). However to be consistent, intra-national trade flows must be computed using gross production value data. The unavailability of such data for many countries and years precludes the inclusions of these intra-national flows in the estimations.[12]

A last challenge refers to the use of aggregated versus disaggregated data. As noted by Yotov et al. (2016), many trade policy instruments are defined at the sector level (tariffs, quotas, etc.). In that case and to prevent biases, empirical analyses should be conducted at the level of aggregation targeted by the trade policy. Since the focus on the IRC mechanisms included in PTAs negotiated is at the country-level, the empirical estimations could be performed at the aggregate level. However, some sectors are more affected by

[11] There are several other papers recommending the PPML method of gravity estimation, including Santos and Tenreyro (2011), Head and Mayer (2014) and Egger and Staud (2016).

[12] Typically, aggregate production is usually measured in value added terms (GDPs), while trade flows are reported as gross value.

NTMs and consequently by IRC mechanisms than others. Similarly, the enforcement of such mechanisms may also be more complex in some sectors. Thus, to highlight some potential heterogeneity in the trade impact of IRC mechanisms across sectors, their effects using sector (HS2-digit level) trade data is also estimated. Therefore two different samples are considered. In the first one, trade flows are aggregated at the country-pair level, while the second one keeps a sector dimension, with bilateral trade flows computed at the HS2-digit level.[13]

4.2. Estimated equation

Accounting for all the challenges above-listed, the trade effects of IRC mechanisms at the aggregated level (country-pair) are estimated as follows:

$$x_{ijt} = \exp(\delta_{it} + \delta_{jt} + \delta_{ij} + \beta_1 \text{PTA}_{ijt} + \beta_2 \mathbf{IRC}_{ijt} + \beta_3 \text{PTA}_{ijt} * \mathbf{IRC}_{ijt}) + \varepsilon_{ij} \quad (1)$$

where x_{ijt} is the value of country *j*'s imports from country *i* in year *t*, δ_{it} and δ_{jt} are exporter-time and importer-time fixed effects. δ_{ij} are country-pair fixed effects controlling for the potential endogeneity of the trade policy. Following their inclusion, all time-invariant dyadic controls (e.g. distance) are absorbed and not separately included in the estimation. The ε_{ijt} is the error term. Focusing on the main variables of interest, PTA_{ijt} is a dummy set to one if both trading partners are members of the same PTA in year *t*, 0 otherwise. IRC mechanisms included into PTAs (e.g. reference to WTO SPS and TBT agreements, legal enforceability of SPS and TBT provisions, mutual recognition/harmonisation of regulations and conformity assessment procedures, transparency requirements) are captured by the vector IRC_{ijt}. To disentangle the trade impact of the PTA as such from the inclusion of IRC mechanisms, interaction terms between PTA and IRC mechanisms are incorporated into the estimated equation (PTA_{ijt} * $\mathbf{IRC}_{ijt}$). Given that the IRC term is perfectly collinear with the interaction term, it is dropped from the estimation and what is left is:

$$x_{ijt} = \exp(\delta_{it} + \delta_{jt} + \delta_{ij} + \beta_1 \text{PTA}_{ijt} + \beta_2 \text{PTA}_{ijt} * \mathbf{IRC}_{ijt}) + \varepsilon_{ij} \quad (2)$$

Estimated effects can therefore be interpreted as follows. The coefficient on the PTA variable shows the trade effects induced by a PTA without IRC provisions. The trade impact of deeper integration – through the presence of IRC mechanisms within PTAs – is captured by the interaction terms between PTA and IRC variables.[14] To illustrate the point, consider a three-way interaction between PTA, SPS provision and its legal enforcement. In this example, the coefficient on PTA measures the trade effects of a PTA without a legally enforceable SPS provision. The coefficient on the two-way interaction between PTA and

[13] For technical reasons (related to computation capacity), a lower level of disaggregation (HS4 or HS6-digit level) cannot be retained. However, considering the higher variance of SPS and TBT measures at a higher disaggregation level, any change in trade regarding single products may produce different results from the ones estimated across the average.

[14] The analysis focuses on the trade effects of IRC mechanisms included in PTAs. Therefore, the estimation of the trade impact of IRC provisions when there is not PTA (coefficient on the IRC variable alone) is not relevant in this case.

SPS shows the trade effect of a SPS provision included in a PTA but not legally enforceable. Finally, the estimated coefficient on the interacted term between PTA, SPS provision and legal enforcement captures the specific trade impact related to the legal enforcement of the provision.

The sample is characterised by strong correlations between the IRC mechanisms related to SPS and to TBT measures. To avoid potential biases in the estimations, the trade effects of SPS-related and TBT-related IRC mechanisms are estimated separately.

5. Results

5.1. Trade effects of IRC mechanisms: country-level analysis

The trade effects of IRC mechanisms on trade flows are first investigated at the country-level. As previously noted, PTAs and their provisions are negotiated at the country-level and estimations could therefore be performed at this aggregate level. All estimations rely on the PPML estimator, which controls for zero trade flows and heteroscedasticity. In addition, the WTO in its Guide to Structural Gravity Modelling (Yotov et al., 2016) recommends using this method as the best performing of the gravity estimation. Furthermore, they are based on three-year interval data (1995, 1998, 2001, 2004, 2007, 2010, and 2013) to capture the dynamics in the adjustment of flows to trade policy changes.[15]

The initial focus is on three levels of IRC mechanisms (steps 1 and 2 of Figure 1): i) the inclusion of WTO-related SPS and TBT provisions in the PTA, ii) their legal enforceability, and iii) the availability of dispute settlement under the PTA. Table 3 provides the results of the gravity estimation controlling for multilateral resistance terms through the inclusion of exporter-year and importer-year fixed effects (Anderson and van Wincoop, 2003), as well as for the potential endogeneity of IRC mechanisms through the use of country-pair fixed effects (Baier and Bergstrand, 2007; Anderson and Yotov, 2016).[16] Table 4 investigates potential phasing-in process in the trade effects of IRC mechanisms. The total trade effects of IRC mechanisms can then be obtained by summing the estimated coefficients on the current and lagged terms.

Estimations reported in Tables 3 and 4 proceed as follows. The trade impact of the PTA, without controlling for IRC mechanisms, is presented in column 1. The following columns show the effects of IRC mechanisms related to SPS (columns 2-4) and TBT provisions (columns 5-7). The use of interaction terms between PTA and regulatory mechanisms disentangles the effect of the PTA as such, from the inclusion of IRC provisions.[17] The following investigations are conducted:

[15] The inclusion of time fixed effects accounts for those events which are a common shock across all countries such as the Financial Crisis.

[16] Following the inclusion of country-pair fixed effects, usual gravity variables (distance, contiguity, common language) are dropped from the estimation. Estimated coefficients on these variables (obtained through the estimation of a basic gravity equation not controlling for endogeneity) are available upon request.

[17] IRC variables are collinear with the set of fixed effects and therefore not reported in the results.

- Trade effects linked to the inclusion of WTO-related SPS and TBT provisions in the PTA (column 2 for SPS and column 5 for TBT);
- Trade effects of legal enforceability of regulatory provisions on SPS (column 3) and on TBT (column 6), once the trade effects related to their inclusion are accounted for; and
- Trade effects of dispute settlement procedures for SPS (column 4) and for TBT (column 7), once the trade effects of the inclusion and legal enforceability of SPS and TBT provisions are controlled for.

Tables A.1 and A.2 in the Annex explore the trade effects of legal enforceability and dispute settlement procedures without controlling for the specific impact of other IRC mechanisms included in the PTA.

The following conclusions can be drawn from Tables 3 and 4. First, when adding all the significant effects, the results show that most PTAs with deep SPS and TBT provisions have a positive impact on bilateral trade (first line in tables). However, in many cases, PTAs are signed between countries which already have significant trade between them, so that the marginal trade effect of the PTA is not significant (at the 10% level) once this endogeneity is controlled for. Similarly, estimated coefficients on IRC mechanisms are significant but at the 5% or 10% level. Such provisions seem therefore to be included in PTAs signed with main trading partners, which limits their marginal effect on trade flows. That is to say, they are shown have little impact on bilateral trade other than what can be expected outside a PTA. Second, legal enforceability of IRC mechanisms has the strongest and most robust impact on trade flows. The two other mechanisms – presence of WTO-related provisions and dispute settlement mechanisms – have significant trade effects when they are investigated alone (columns 2 and 5 of Table 3 and Table A.1 in the Annex). However, their effects disappear when legal enforceability is taken into account. By contrast, the legal enforceability mechanisms still impact trade when WTO-related provisions and dispute settlement procedures are controlled for (columns 4 and 7 of Table 3). Third, overall the trade effects of SPS-related IRC mechanisms are more significant than the ones observed for TBT-related IRC mechanisms. This outcome likely relates to the fact that SPS measures have a direct influence on the actual and perceived quality of imported food, which leads to a positive effect on demand.[18]

[18] For a discussion of potential demand enhancing effects of SPS measures see Cadot et al. (2018). This work estimates separately price and volume effects of NTMs, and finds many instances in which SPS measures shift demand while prices are found to increase. This effect appears to be les strong in the TBT area.

Table 3. Trade impact of IRC mechanisms within PTAs: coverage and legal enforceability of SPS and TBT provisions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Total % impact on bilateral trade*	***0***	***19.12***	***28.27***	***24.48***	***2.84***	***0***	***28.53***
1 if PTA	-0.015	-0.135	-0.133	-0.129	-0.168c	-0.163	-0.165
	(0.050)	(0.083)	(0.083)	(0.084)	(0.101)	(0.101)	(0.101)
PTA X SPS provision		0.175[b]	-0.067	-0.070			
		(0.082)	(0.123)	(0.123)			
PTA X SPS provision X SPS legal enforcement			0.249[b]	0.219[b]			
			(0.105)	(0.107)			
PTA X SPS prov. X SPS legal enforc. X SPS dispute				0.044			
				(0.064)			
PTA X TBT provision					0.196[c]	0.057	0.057
					(0.102)	(0.162)	(0.162)
PTA X TBT provision X TBT legal enforcement						0.153	0.251[c]
						(0.137)	(0.145)
PTA X TBT prov. X TBT legal enforc. X TBT dispute							-0.106
							(0.077)
Observations	23 926	23 926	23 926	23 926	23 926	23 926	23 926
R2	0.978	0.978	0.978	0.978	0.978	0.978	0.978
Fixed effects	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij

Note: The dependent variable is the total value (levels) of exports of *i*, destination *j* in year *t*. 3-years interval data (1995, 1998, 2001, 2004, 2007, 2010, and 2013). Robust standard errors in parentheses clustered by trading pair. [b] and [c] denote significance at the 5% and 10% level respectively.*Provides the total impact of significant coefficients on bilateral trade.

The results offer evidence of strong phasing-in effects in PTAs and in IRC mechanisms. In Table 4, estimated coefficients on lag terms are usually more significant than the ones on current terms, mainly for SPS provisions. Different reasons may explain these strong phasing-in effects. First, it could be related to the delay in the implementation of some provisions included in the PTAs. Second, it may also be linked to use of the IRC mechanisms by firms, which may take place only few years after the entry into force of the agreement. Unfortunately, the current analysis does not allow disentangling between these explanations.

There are several instances where the PTA coefficients are shown to be significant (at the 5% or 10% level only) and negative. These only occur when the specification includes PTA interacted with a variable of interest. Thus, the coefficient on the PTA without any interaction should be interpreted as the degree to which an agreement adds to bilateral trade, beyond that explained by the presence of an IRC mechanism in the agreement, and beyond what would be expected between the two countries outside of such an agreement. In other words, the PTA coefficient in that case accounts for the trade effect of basic integration induced by the PTA, while coefficients on the interaction terms capture the trade effects of deep integration (through the IRC mechanism). In most cases, PTAs add no additional information on explaining increases in trade flows for these economies.

Table 4. Trade impact of IRC mechanisms within PTAs: coverage and legal enforceability of SPS and TBT provisions & phasing-in process

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Total % impact on bilateral trade*	***0***	***14.11***	***1.81***	***1.11***	***15.60***	***-9.78***	***13.43***
1 if PTA	0.001	-0.082	-0.080	-0.076	-0.114	-0.108	-0.111
	(0.047)	(0.065)	(0.065)	(0.067)	(0.078)	(0.078)	(0.078)
1 if PTA (lag)	-0.030	-0.091[b]	-0.090[b]	-0.092[b]	-0.102[c]	-0.103[c]	-0.101[c]
	(0.034)	(0.045)	(0.045)	(0.046)	(0.056)	(0.057)	(0.057)
PTA X SPS provision		0.124[c]	0.044	0.040			
		(0.071)	(0.117)	(0.117)			
PTA X SPS provision (lag)		0.099[a]	-0.136[c]	-0.135[c]			
		(0.037)	(0.074)	(0.074)			
PTA X SPS prov. X SPS legal enforc.			0.082	0.056			
			(0.110)	(0.109)			
PTA X SPS prov. X SPS legal enforc. (lag)			0.244[a]	0.238[a]			
			(0.066)	(0.084)			
PTA X SPS prov. X SPS legal enf. X SPS dispute				0.042			
				(0.070)			
PTA X SPS prov. X SPS legal enf. X SPS dispute (lag)				0.003			
				(0.064)			
PTA X TBT provision					0.148[c]	0.038	0.040
					(0.084)	(0.129)	(0.128)
PTA X TBT provision (lag)					0.099[b]	0.051	0.049
					(0.048)	(0.075)	(0.075)
PTA X TBT prov. X TBT legal enforcement						0.118	0.227[c]
						(0.116)	(0.120)
PTA X TBT prov. X TBT legal enforcement (lag)						0.058	0.029
						(0.057)	(0.069)
PTA X TBT prov. X TBT legal enf. X TBT dispute							-0.118
							(0.072)
PTA X TBT prov. X TBT legal enf. X TBT dispute (lag)							0.033
							(0.054)
Observations	23 926	23 926	23 926	23 926	23 926	23 926	23 926
R2	0.978	0.978	0.978	0.978	0.978	0.978	0.978
Fixed effects	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij

Note: The dependent variable is the total value (levels) of exports of *i*, destination *j* in year *t*. 3-years interval data (1995, 1998, 2001, 2004, 2007, 2010, and 2013). Robust standard errors in parentheses clustered by trading pair. [a], [b] and [c] denote significance at the 1%, 5% and 10% level respectively. *Provides the total impact of significant coefficients on bilateral trade.

These results allow for the determination of what specific factors account for the PTA-related increases in trade flows often found in the literature (NBT 2018). It shows that deep provisions appear to be driving the gains from trade from PTAs. Thus, it is not the existence of a PTA *per se* that leads to increases in trade flows, but the quality of the provisions within it. While this paper examines specific aspects of SPS and TBT provisions, most PTAs that include deep provisions in these two areas, include deep provisions in other areas of the agreement as well. Thus, the SPS and TBT provisions, as measured in this work, may act as a proxy for deep provisions more generally. More research is needed to tease out these details.

Tables 5 and 6 go one step further and investigate the trade effects of specific methods used in IRC mechanisms: i) transparency provisions, ii) mutual recognition of TBT conformity assessment procedures, and iii) mutual recognition and/or harmonisation of TBT measures.

As previously, estimations first explore the trade effects for the current period (Table 5).[19] The phasing-in process is then investigated (Table 6). The trade effects of PTAs are first explored (column 1), followed by the impact of SPS and TBT transparency provisions (respectively in columns 2 and 3). Column 4 deals with the effect of the mutual recognition of TBT conformity assessment procedures. The trade consequences of the mutual recognition of TBT measures are studied in column 7, while column 8 focuses on the impact of their harmonisation. Finally, column 9 includes simultaneously TBT mutual recognition and harmonisation mechanisms.

Table 5. Trade impact of IRC mechanisms within PTAs: Transparency, mutual recognition and harmonisation provisions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Total % impact on bilateral trade*	***0***	***6.50***	***4.39***	***12.75***	***0***	***0***	***0***
1 if PTA	-0.015	-0.173[b]	-0.180[b]	-0.051	-0.035	-0.034	-0.038
	(0.050)	(0.081)	(0.089)	(0.060)	(0.058)	(0.057)	(0.059)
PTA X SPS transparency		0.236[a]					
		(0.085)					
PTA X TBT transparency			0.223[b]				
			(0.094)				
PTA X mutual recognition of TBT conformity assessment procedures				0.120[b]			
				(0.061)			
PTA X TBT mutual recognition					0.086		0.042
					(0.065)		(0.078)
PTA X TBT harmonisation						0.096	0.066
						(0.066)	(0.077)
Observations	23 926	23 926	23 926	23 926	23 926	23 926	23 926
R2	0.978	0.978	0.978	0.978	0.978	0.978	0.978
Fixed effects	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij

Note: The dependent variable is the total value (levels) of exports of *i*, destination *j* in year *t*. 3-years interval data (1995, 1998, 2001, 2004, 2007, 2010, and 2013). Robust standard errors in parentheses clustered by trading pair. [a] and [b] denote significance at the 1% and 5% level respectively. *Provides the total impact of significant coefficients on bilateral trade.

[19] Estimation results without controlling for endogeneity are available upon request.

Table 6. Trade impact of IRC mechanisms within PTAs: Transparency, mutual recognition and harmonisation provisions and phasing-in process

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Total % impact on bilateral trade*	***0***	***8.98***	***15.60***	***5.02***	***1.21***	***0***	***0***
1 if PTA	0.001	-0.102[c]	-0.087	-0.008	-0.001	0.009	0.007
	(0.047)	(0.061)	(0.068)	(0.059)	(0.057)	(0.055)	(0.059)
1 if PTA (lag)	-0.030	-0.118[b]	-0.148[a]	-0.077[c]	-0.058	-0.072	-0.072
	(0.034)	(0.046)	(0.050)	(0.045)	(0.044)	(0.046)	(0.047)
PTA X SPS transparency		0.167[b]					
		(0.071)					
PTA X SPS transparency (lag)		0.139[a]					
		(0.041)					
PTA X TBT transparency			0.128[c]				
			(0.077)				
PTA X TBT transparency (lag)			0.165[a]				
			(0.040)				
PTA X mutual recognition of TBT conformity assessment procedures				0.050			
				(0.060)			
PTA X mutual recognition of TBT conformity assessment proc. (lag)				0.126[a]			
				(0.049)			
PTA X TBT mutual recognition					0.031		0.011
					(0.067)		(0.080)
PTA X TBT mutual recognition (lag)					0.012[b]		-0.000
					(0.051)		(0.074)
PTA X TBT harmonisation						0.029	0.022
						(0.065)	(0.075)
PTA X TBT harmonisation (lag)						0.123	0.122
						(0.053)	(0.080)
Observations	23 926	23 926	23 926	23 926	23 926	23 926	23 926
R2	0.978	0.978	0.978	0.978	0.978	0.978	0.978
Fixed effects	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij

Note: The dependent variable is the total value (levels) of exports of *i*, destination *j* in year *t*. 3-years interval data (1995, 1998, 2001, 2004, 2007, 2010, and 2013). Robust standard errors in parentheses clustered by trading pair. [a], [b] and [c] denote significance at the 1%, 5% and 10% level respectively. *Provides the total impact of significant coefficients on bilateral trade.

Several conclusions can be derived from the estimation results. First, and as previously stated, PTAs and their provisions are likely to be endogenous: countries already having strong trade linkages are more likely to enter into PTA amongst them. This endogeneity bias strongly affects provisions on TBT mutual recognition and harmonisation. When endogeneity is controlled for, their marginal trade effects are not significant (columns 5-7 of Table 5). Second, transparency mechanisms, and to a lesser extent provisions on the mutual recognition of TBT conformity assessment procedures, have significant, positive and rather strong trade effects (columns 2-4 of Table 5). One reason for this result may be that such regulatory mechanisms are rather simple to implement and represent the easiest step toward co-ordination of SPS and TBT measures. Thus, their marginal trade effects are likely to be large. A similar conclusion is reached by Cadot and Gourdon (2016). By contrast, the mandatory recognition of technical regulations or their harmonisation are much more costly, and are therefore less likely to be implemented by countries. This may explain the insignificant trade effects observed for these mechanisms. However, this outcome implies nothing about the long run efficiency of mutual recognition versus

harmonisation approaches.[20] Finally, phasing-in effects are also observed for these deep IRC mechanisms – even for mutual recognition and harmonisation of TBT measures when they are analysed separately (columns 5 and 6 of Table 6).

5.2. Trade effects of IRC mechanisms: Sectoral heterogeneity

This subsection outlines how the heterogeneity across sectors in the trade effects of deep IRC mechanisms (transparency, mutual recognition of TBT conformity assessment procedures, mutual recognition or harmonisation of TBT measures observed across products) is controlled for. To do so, bilateral trade flows data are computed at the HS2-digit level. To adequately control for relative prices – which may vary across sector – exporter-year and importer-year fixed effects are interacted with HS2 sector dummies in the estimations.

The main results from the previous estimations (columns 2-6 of Table 5) are presented first (Table 7), distinguishing between agri-food (HS01-HS24) versus manufactured products (HS25-HS96). One finding that stands out is that IRC mechanisms tend to have a greater impact on agri-food trade than on manufacturing flows. Estimated coefficients in column 1 of Table 7 have a stronger magnitude and are more significant than in column 2. Furthermore, all IRC estimates are significant in column 1, even those for TBT mutual recognition or TBT harmonisation.

The results for each HS chapter separately are presented at the two digit level in Table 8). The previous results for agri-food products are still present (columns 1-4). However, results by HS chapter provide more detailed information. Transparency provisions strongly affect trade flows of vegetables (column 2) and beverages and tobacco (column 4), while mutual recognition of conformity assessment procedures also impact trade of animal products (column 1). Provisions on TBT measures (mutual recognition or harmonisation) have strong and significant trade effects for animals (column 1), fats and oils (column 3), and beverages and tobacco (column 4). Regarding manufacturing products, a significant impact of SPS and TBT transparency provisions mechanisms on trade flows can be observed in leather (column 8), wood products (column 9), paper (column 10), textile and clothing (column 11), footwear (column 12) and metals (column 15). Mutual recognition of TBT conformity assessment procedures also influence trade in these sectors (except wood products) and in addition flows of minerals (column 5) and chemicals (column 6). Finally, mutual recognition and harmonisation of TBT measures have effects on trade of chemicals (column 6), plastics (column 7), and paper (column 10).

The impact of SPS-related IRC mechanisms on trade flows of some manufacturing products (e.g. leather, wood, paper, textile and clothing, footwear, metals) is easily understandable, if one keeps in mind that SPS measures can affect such products. Typically, any measure concerning diseases carried by plants or animals are classified as SPS, regardless if they are used in an agro-food sector or in manufacturing. Regulations addressing microbiological contamination of food, defining allowable levels of pesticide or veterinary drug residues, or identifying permitted food additives, are also covered by the WTO SPS Agreement. Similarly, packaging and labelling requirements directly related to the safety of the food fall under the SPS Agreement.[21]

[20] For a more detailed discussion, see (Chen and Mattoo, 2008).

[21] https://www.wto.org/english/tratop_e/sps_e/spsund_e.htm#Q&A.

Table 7. Trade impact of IRC mechanisms within PTAs: transparency, mutual recognition and harmonisation provisions: Agri-food versus manufacturing products

	(1)	(2)
PTA	-0.082c	-0.143c
	(0.048)	(0.076)
PTA X SPS transparency	0.250[a]	0.170[b]
	(0.050)	(0.072)
Observations	501 951	1 504 035
R2	0.976	0.974
PTA	-0.121[b]	-0.173[b]
	(0.054)	(0.080)
PTA X TBT transparency	0.293[a]	0.191[b]
	(0.056)	(0.076)
Observations	501 951	1 504 035
R2	0.976	0.974
PTA	-0.012	-0.066
	(0.030)	(0.046)
PTA X mutual recognition of TBT conformity assessment procedures	0.426[a]	0.122[b]
	(0.050)	(0.049)
Observations	501 951	1 504 035
R2	0.976	0.974
PTA	0.012	-0.043
	(0.031)	(0.045)
PTA X TBT mutual recognition	0.436[a]	0.058
	(0.084)	(0.050)
Observations	501 951	1 504 035
R2	0.975	0.974
PTA	0.018	-0.040
	(0.032)	(0.043)
PTA X TBT harmonisation	0.370[a]	0.055
	(0.088)	(0.049)
Observations	501 951	1 504 035
R2	0.975	0.974

Note: The dependent variable is the value (in levels) of exports of origin *i* to destination *j* for HS2-digit sector *k* in year *t*. 3-years interval data (1995, 1998, 2001, 2004, 2007, 2010, and 2013). Estimations include the following set of fixed effects: iHS2t, jHS2t, ijHS2. Robust standard errors in parentheses clustered by trading pair. [a], [b] and [c] denote significance at the 1%, 5% and 10% level respectively. Estimations performed for two subsamples: (1): Agri-food products (hs2: 01-24); (2): Manufacturing products (hs2: 25-96).

As noted above, another explanation for the results presented on specific sectors is the fact that the deep provisions being measured through SPS and TBT may also pick up other deep provisions in the agreement. Generally, agreements that include deep SPS and TBT provisions also incorporate deep provisions in other areas (such as IPR, labour markets, public procurement, etc.). Thus, the SPS and TBT parameter may be picking up the existence of these other deep provisions. To the extent they are, one would expect to find significant results of SPS measures on manufacturing sectors and TBT on agro-food sectors. Given the co-linearity of these various deep provisions, teasing out there relative influence on any one agreement is a task left to future research.

Table 8. Trade impact of IRC mechanisms within PTAs: Transparency, mutual recognition and harmonisation provisions by HS chapter

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
PTA	0.044	-0.083	0.033	-0.200[a]	-0.065	-0.056	-0.037	-0.511[a]	-0.527[c]	-0.266[a]	-0.515[a]	-0.660[a]	-0.144	0.106	-0.030	-0.173	-0.115	0.014	0.093	-0.491[b]
	(0.112)	(0.076)	(0.126)	(0.051)	(0.101)	(0.063)	(0.084)	(0.100)	(0.279)	(0.099)	(0.129)	(0.220)	(0.113)	(0.136)	(0.060)	(0.117)	(0.094)	(0.063)	(0.240)	(0.211)
PTA X SPS	0.160	0.206[b]	0.027	0.391[a]	0.171	0.072	0.153[c]	0.606[a]	0.733[b]	0.311[a]	0.644[a]	0.808[a]	0.144	0.000	0.193[a]	0.090	0.272[b]	0.041	0.090	0.477[b]
transparency	(0.115)	(0.087)	(0.143)	(0.058)	(0.110)	(0.066)	(0.079)	(0.115)	(0.311)	(0.102)	(0.136)	(0.232)	(0.116)	(0.208)	(0.062)	(0.108)	(0.107)	(0.076)	(0.277)	(0.199)
Observations	102 734	181 529	21 967	195 721	62 093	239 191	46 760	62 720	55 733	64 014	295 059	79 858	67 656	21 994	222 385	47 404	85 757	65 693	19 020	68 698
R2	0.969	0.985	0.964	0.966	0.975	0.921	0.971	0.979	0.988	0.990	0.988	0.991	0.961	0.901	0.973	0.975	0.989	0.937	0.918	0.995
PTA	0.011	-0.140[c]	-0.053	-0.234[a]	-0.094	-0.089	-0.072	-0.507[a]	-0.442[c]	-0.293[a]	-0.366[a]	-0.616[a]	-0.204[c]	0.055	-0.022	-0.233[c]	0.090	-0.040	0.507[a]	-0.488[b]
	(0.124)	(0.080)	(0.124)	(0.063)	(0.103)	(0.073)	(0.093)	(0.099)	(0.253)	(0.107)	(0.121)	(0.213)	(0.113)	(0.158)	(0.065)	(0.129)	(0.134)	(0.073)	(0.170)	(0.318)
PTA X TBT	0.196	0.281[a]	0.164	0.411[a]	0.207[b]	0.107	0.186[b]	0.597[a]	0.602[b]	0.326[a]	0.406[a]	0.725[a]	0.216[c]	0.065	0.169[a]	0.154	0.019	0 109	-0.491[b]	0.443[b]
transparency	(0.125)	(0.090)	(0.143)	(0.073)	(0.103)	(0.073)	(0.088)	(0.113)	(0.272)	(0.105)	(0.117)	(0.217)	(0.112)	(0.216)	(0.065)	(0.120)	(0.143)	(0.083)	(0.208)	(0.197)
Observations	102 734	181 529	21 967	195 721	62 093	239 191	46 760	62 720	55 733	64 014	295 059	79 858	67 656	21 994	222 385	47 404	85 757	65 693	19 020	68 698
R2	0.969	0.985	0.964	0.966	0.975	0.921	0.971	0.979	0.988	0.990	0.987	0.991	0.961	0.901	0.973	0.976	0.989	0.937	0.918	0.995
PTA	0.075	-0.070	0.020	-0.049	-0.035	-0.069[b]	0.049	-0.229[b]	-0.019	-0.106[c]	-0.211[b]	-0.269[c]	-0.052	0.091	0.072[c]	-0.147[c]	0.092	0.059	0.207	-0.263[c]
	(0.059)	(0.057)	(0.087)	(0.042)	(0.072)	(0.032)	(0.057)	(0.095)	(0.134)	(0.058)	(0.089)	(0.164)	(0.070)	(0.140)	(0.038)	(0.077)	(0.066)	(0.045)	(0.135)	(0.137)
PTA X MR TBT	0.370[a]	0.591[a]	0.219	0.408[a]	0.416[b]	0.216[a]	0.048	0.250[b]	-0.046	0.168[b]	0.297[a]	0.316[c]	0.026	0.127	0.117[b]	0.093	0.041	-0.059	-0.149	0.227[c]
Conf. assessm.	(0.091)	(0.084)	(0.162)	(0.074)	(0.172)	(0.048)	(0.060)	(0.118)	(0.134)	(0.071)	(0.094)	(0.182)	(0.084)	(0.204)	(0.048)	(0.083)	(0.080)	(0.089)	(0.181)	(0.118)
Observations	102 734	181 529	21 967	195 721	62 093	239 191	46 760	62 720	55 733	64 014	295 059	79 858	67 656	21 994	222 385	47 404	85 757	65 693	19 020	68 698
R2	0.969	0.985	0.965	0.966	0.975	0.921	0.971	0.978	0.987	0.990	0.987	0.991	0.961	0.901	0.973	0.976	0.989	0.937	0.918	0.995
PTA	0.071	0.002	-0.013	-0.023	0.005	-0.041	0.015	-0.192[b]	0.013	-0.105[c]	-0.147[c]	-0.242	-0.048	0.088	0.097[a]	-0.106	0.076	0.049	0.103	-0.228[c]
	(0.058)	(0.047)	(0.083)	(0.040)	(0.007)	(0.035)	(0.051)	(0.096)	(0.130)	(0.056)	(0.085)	(0.157)	(0.069)	(0.133)	(0.036)	(0.075)	(0.065)	(0.044)	(0.123)	(0.135)
PTA X TBT MR	0.488[a]	0.294[c]	0.589[a]	0.489[a]	0.313	0.150[b]	0.197[a]	0.135	-0.204	0.179[b]	0.103	0.255	0.020	0.290	0.052	-0.056	0.085	-0.026	0.230	0.145
	(0.110)	(0.159)	(0.190)	(0.082)	(0.204)	(0.058)	(0.060)	(0.115)	(0.127)	(0.074)	(0.080)	(0.180)	(0.079)	(0.246)	(0.048)	(0.084)	(0.085)	(0.093)	(0.271)	(0.129)
Observations	102 734	181 529	21 967	195 721	62 093	239 191	46 760	62 720	55 733	64 014	295 059	79 858	67 656	21 994	222 385	47 404	85 757	65 693	19 020	68 698
R2	0.969	0.984	0.965	0.966	0.975	0.921	0.971	0.978	0.987	0.990	0.987	0.991	0.961	0.901	0.973	0.975	0.989	0.937	0.918	0.995

PTA	0.077	0.020	-0.003	-0.024	0.062	-0.040	0.020	-0.175[c]	0.021	-0.114[b]	-0.156[c]	-0.203	-0.064	0.097	0.094[a]	-0.115	-0.065	0.062	0.085	-0.217
	(0.058)	(0.049)	(0.088)	(0.041)	(0.073)	(0.035)	(0.050)	(0.097)	(0.131)	(0.057)	(0.089)	(0.160)	(0.067)	(0.133)	(0.036)	(0.070)	(0.059)	(0.046)	(0.125)	(0.133)
PTA X TBT	0.446[a]	0.181	0.362[c]	0.467[a]	-0.014	0.182[a]	0.217[a]	0.077	-0.243[c]	0.218[a]	0.129	0.124	0.075	0.148	0.073	-0.020	0.144[c]	-0.125	0.241	0.114
Harm.	(0.111)	(0.155)	(0.195)	(0.089)	(0.191)	(0.070)	(0.056)	(0.119)	(0.136)	(0.076)	(0.095)	(0.186)	(0.079)	(0.267)	(0.050)	(0.079)	(0.079)	(0.077)	(0.202)	(0.126)
Observations	102 734	181 529	21 967	195 721	62 093	239 191	46 760	62 720	55 733	64 014	295 059	79 858	67 656	21 994	222 385	47 404	85 757	65 693	19 020	68 698
R2	0.969	0.985	0.965	0.966	0.975	0.921	0.971	0.978	0.987	0.990	0.987	0.991	0.961	0.901	0.973	0.975	0.989	0.937	0.918	0.995

Note: The dependent variable is the value (in levels) of exports of origin i to destination j for HS2-digit sector k in year t. 3-years interval data (1995, 1998, 2001, 2004, 2007, 2010, and 2013). Estimations include the following set of fixed effects: iHS2t, jHS2t, ijHS2. Robust standard errors in parentheses clustered by trading pair. a, b and c denote significance at the 1%, 5% and 10% level respectively. Estimations performed for each HS Chapter separately. (1): Animals (hs2: 01-05); (2): Vegetables (hs2: 06-14); (3): Fats and oils (hs2 15); (4): Beverages and Tobacco (hs2: 16-24); (5): Minerals (hs2: 25-27); (6): Chemicals (hs2: 28-38); (7): Plastics (hs2: 39-40); (8): Leather (hs2: 41-43); (9): Wood products (hs2: 44-46); (10): Paper (hs2: 47-49); (11): Textile and clothing (hs2: 50-63); (12): Footwear (hs2: 64-67); (13): Stone and glass (hs2: 68-70); (14): Pearls (hs2: 71); (15): Metals (hs2: 72-83); (16): Machinery (hs2: 84-85); (17): Vehicles (hs2: 86-89); (18): Optical and med. instr. (hs2 90-92); (19): Arms (hs2: 93); (20): Misc. (hs2: 94-96).

6. Concluding remarks

This paper attempts to isolate the trade effects of IRC mechanisms included within PTAs. Different mechanisms (i.e. references to SPS and TBT WTO agreement) are measured across levels of co-operation (i.e. transparency, mutual recognition of conformity assessment procedures, mutual recognition and harmonisation of technical regulations) and levels of enforceability (the degree of legal enforceability and subject to dispute settlement procedures). The analysis focuses on OECD, APEC and main emerging economies and covers the period 1995-2015. Structural gravity estimations are conducted at the country- and sector-level. Several strong conclusions can be derived from the results which show that the details of PTAs matter.

First, PTAs and IRC mechanisms are negotiated between countries which are already established trading partners. Second, transparency mechanisms, and to a lesser extent mutual recognition of TBT conformity assessment procedures have strong and robust effects on trade flows especially when they are legally enforceable. These mechanisms are relatively easy to implement and represent a first step toward co-ordination of SPS and TBT measures. Third, the SPS-related IRC mechanisms have more significant trade effects than TBT-related IRC mechanisms, and sector estimations suggest that IRC mechanisms across this sample impact more agri-food trade than manufacturing flows. This could be due to the more direct impact of SPS measures on food demand through improving quality and safety, and signalling to consumers.

IRC mechanisms take some time to become effective, and trade impacts are visible only after a phasing-in period.

This work is an important early step in the unbundling of effective IRC trade provisions on trade flows. Future work in this area could take on a number of issues not directly addressed in this analysis. For example, the impact of unilateral action in adopting WTO measures and Good Regulatory Practices; ; the specific characteristics of IRC mechanisms and SPS measures that are found to be trade enhancing; further investigation of IRC and TBT measures and their impact on the trade in manufactured goods; and finally, the degree to which more disaggregated data may impact on the results presented in this work, noting that such disaggregation would necessarily reduce the possible number of countries, years examined.

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Annex A. Additional estimation results

Table A.1. Trade impact of IRC mechanisms within PTAs: Coverage and legal enforceability of SPS and TBT provisions (additional estimations)

	(1)	(2)	(3)	(4)
1 if PTA	-0.137[c]	-0.074	-0.146[c]	-0.106
	(0.078)	(0.056)	(0.085)	(0.078)
PTA X SPS legal enforcement	0.186[b]			
	(0.079)			
PTA X SPS dispute settlement		0.139[b]		
		(0.065)		
PTA X TBT legal enforcement			0.192[b]	
			(0.087)	
PTA X TBT dispute settlement				0.145[c]
				(0.082)
Observations	23 926	23 926	23 926	23 926
R2	0.978	0.978	0.978	0.978
Fixed effects	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij

Note: The dependent variable is the total value (levels) of exports of *i*, destination *j* in year *t*. 3-years interval data (1995, 1998, 2001, 2004, 2007, 2010, and 2013). Robust standard errors in parentheses clustered by trading pair. [b] and [c] denote significance at the 5% and 10% level respectively.

Table A.2. Trade impact of IRC mechanisms within PTAs: Coverage and legal enforceability of SPS and TBT provisions and phasing-in process (additional estimations)

	(1)	(2)	(3)	(4)
1 if PTA	-0.080	-0.031	-0.093	-0.055
	(0.061)	(0.044)	(0.067)	(0.061)
1 if PTA (lag)	-0.097[b]	-0.085[b]	-0.090[b]	-0.088[b]
	(0.043)	(0.042)	(0.046)	(0.044)
PTA X SPS legal enforcement	0.127[c]			
	(0.069)			
PTA X SPS legal enforcement (lag)	0.114[a]			
	(0.036)			
PTA X SPS dispute settlement		0.098		
		(0.065)		
PTA X SPS dispute settlement (lag)		0.094[a]		
		(0.033)		
PTA X TBT legal enforcement			0.141[c]	
			(0.076)	
PTA X TBT legal enforcement (lag)			0.096[b]	
			(0.039)	
PTA X TBT dispute settlement				0.096
				(0.072)
PTA X TBT dispute settlement (lag)				0.094[b]
				(0.037)
Observations	23 926	23 926	23 926	23 926
R2	0.978	0.978	0.978	0.978
Fixed effects	it, jt, ij	it, jt, ij	it, jt, ij	it, jt, ij

Note: The dependent variable is the total value (levels) of exports of *i*, destination *j* in year *t*. 3-years interval data (1995, 1998, 2001, 2004, 2007, 2010, and 2013). Robust standard errors in parentheses clustered by trading pair. [a], [b] and [c] denote significance at the 1%, 5% and 10% level respectively.