# The heterogeneity of standards in services and agri-food trade

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**Abstract**

This paper examines the effects of restrictions in banking and transport sector on agri-food trade. Based on a gravity model with panel data from 2014 to 2017 for 36 countries, we use both country restriction indices and regulatory heterogeneity indices for pairs of countries to capture the level of restrictions in these sectors. Our results suggest that the regulatory disparities between countries, as well as restrictions imposed by each country, have significant negative impacts on trade in food products. However, the effects can be reduced by the harmonization of these restrictive policies. Further, we find that regulatory heterogeneity has a larger trade impact when the level of trade restrictiveness is low.

**Keywords**: Agri-food trade,heterogeneity of standards, gravity model.

JEL Categories: F13, Q17, F11, F14.

# 1 Introduction

After the GATT agreements in 1948 (Agreement on Tariffs and Trade), the observation is that customs tariffs have fallen sharply in world trade. In addition, for years, a high customs duty was the main barrier to trade. But with the many trade agreements (multilateral, bilateral and regional) of recent years, tariffs have fallen to a low level (the simple average world tariff rate fell from 10.13% in 2000 to less than 7% in 2015)[1]. At the same time, we are witnessing an unprecedented increase in non-tariff barriers (NTBs), particularly production standards, which today represent the main obstacle to global economic growth, IMF (2017).

Considered as publications that establish production characteristics and procedures, they are intended to optimize product reliability. The most restrictive of these types of standards remain the SPS and TBT measures, which considerably affect agricultural production. Indeed, when each nation imposes access standards on its market, exporters and suppliers must comply with them or they will lose significant market shares. However, complying with these technical, health and quality regulations in most cases generates high fixed costs (product adaptation costs), WTO (2005). In this case, it is no longer just a question of adapting products, but also have the necessary equipment, technology and skills. So, the existence of fixed costs can have an impact on the decision to export firms and some will be withdrawn from the market (in part small exporting firms), Riker, D (2014). For some authors, the level or restrictiveness of the standard is in no way an obstacle to the exporter, but the heterogeneity between countries' standards emerges as restrictive, Kox and Nordàs (2007). In other words, it is not the level of regulation that discourages foreign suppliers, but rather the difference in regulation with the country on which we want to sell our goods and services. So that the additional compliance costs when setting up a business in a foreign country would be minimal if standards and qualifications were recognized in the country of origin.

In the field of services, the consequences of this disparity remain very significant and affect the sector, UNCTAD (2010). Indeed, the analysis of the regulatory framework in the service sector leaves a highly regulated sector even more to face increased competition in the markets. As in the goods sector, services are also affected by national regulations and trade in services is more affected by these restrictions than trade in goods, Kox and Nordàs (2007). In addition, for goods and com-

[1]Data provided by the World Bank through the World Integrated Trade Solution database

modities, the production and quality requirements only apply to the good in question, however, in the case of the provision of services, this includes the supplier and its foreign personnel and equipment. Moreover, this regulatory restriction on services not only prevents foreign suppliers from accessing domestic service markets, but may also deter them from undertaking other investment activities once they have established themselves in the market, known as **behind-the-border regulation**. Regulatory divergence between nations in this sector generates not only fixed market entry costs but also market maintenance costs or operational restrictions[2]. In short, the difference in standards between nations forces service providers to adapt their economic model in each export market and since the company's economic model is often the vector for its competitiveness, these regulatory obstacles are a excessive cost for firms.

In this paper we examine the different effects of restrictions in services on trade flows. We are looking at whether the hypothesis that the restrictive impact of standards in services is always verified and if so how to mitigate these restrictive effects. Our study contributes to the literature on the impacts of non-tariff barriers on international trade. It thus differs from the studies done so far, because we confine ourselves to the consequences of restrictions in the banking and transport sector on agri-food exports, through two different types of regression. In this study, we are also trying to quantify the tariff equivalent associated with this regulatory heterogeneity on agri-food trade, which has not yet been studied in the literature. Indeed, these two types of sectors, considered as service providers, also have a close and strong link in the export of agricultural goods. To conduct this study, we will start from a gravity model based on aggregate data from the 36 OECD countries and use the restrictiveness index set up by the OECD, which measures the recent level of restrictiveness of policies in services. It is a robust measure compared to the World Bank index because it remains a sectoral index (covering 22 sectors in 44 countries), while the World Bank's includes 6 service sectors in 103 countries. At the end of our study we find that the country's individual restrictions have significant and negative effects on exports. However, the regulatory disparity between OECD countries has negative and significant impacts on trade, more marked by heterogeneity in the banking sector. Moreover, these effects can be limited through the harmonization of policies in services. We have therefore concluded that regulatory heterogeneity is neutral if the restrictive policies of the importing country are stringent.

[2]Maintenance costs include: costs related to the tax burden, the social security system, limiting the variety of services, imposing fixed prices for certain services

The remainder of the paper is structured as follows: in the first part we will report on the literature review of the impacts of these restrictive measures on trade flows. In the second section we will describe in detail the OECD restrictiveness index implemented in 2014, the next section will describe our econometric model in which we will expose our data, the different sources and the type of regression used (OLS and PPML). Finally, this fourth part will present our different results, which we will compare with the literature. We are also trying to quantify in this section the tariff equivalent associated with this regulatory heterogeneity.

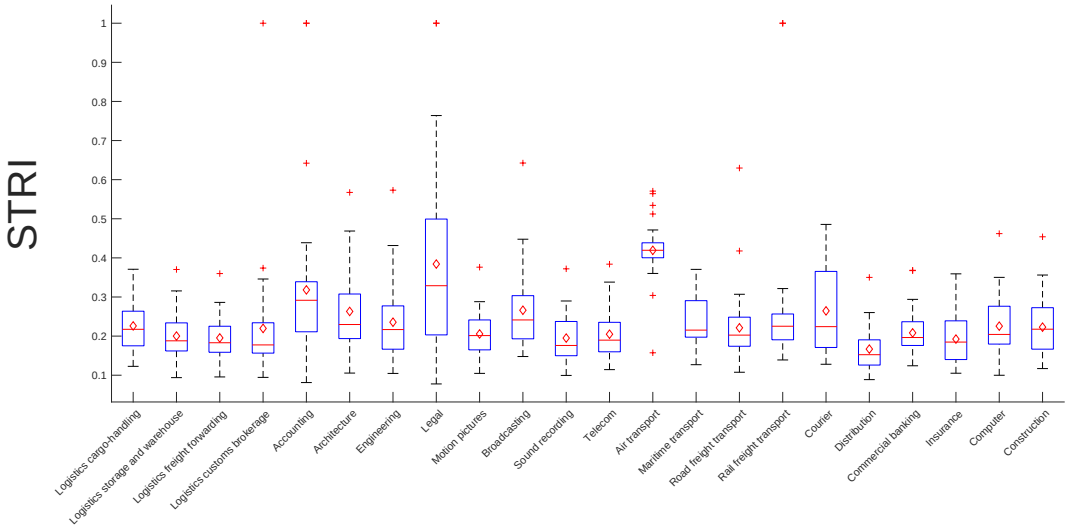



Figure 1: OECD countries' sectoral STRIs in 2017

# 2 Literature review

Studies that examined the impact of restrictive policies on international trade used two essential methods: the analysis on restriction indices and the analysis on tariff equivalents. Indeed, the economic literature that has studied the impact of standards in services on trade flows, use the indices of trade restrictiveness in services developed by the OECD and the World Bank, and on the computation of tariff equivalent.

## 2.1 Services Restrictiveness Index (STRI) and international trade: Gravity Analysis

To evaluate the effects of regulatory barriers in services on international trade as measured by sectoral STRI indices, we use gravity models. Although specific to trade flows in goods and commodities, some authors have applied it to services through impact analyses and found it adapted to trade in services, Head and al, 2009. They used the gravity model to analyze the impacts of STRI indices and the regulatory heterogeneity index on international trade are Nordàs and Rouzet (2015); Nordàs (2016). Using a gravity model with aggregate data and the PPML (Pseudo-Maximum Likelihood Estimator) as the estimation method, they find that the most restrictive countries in the service sector import and export significantly less services. In addition, the negative impact of restrictions in services on exports is about twice as large as on imports. The sectors most affected are the banking, financial and transport sectors, as they are considered as service providers. Considering the regulatory disparity between countries, Nordàs (2016) finds that regulatory heterogeneity in services has negative impacts on cross-border trade in services. In this case, countries trade more with partners with similar regulations. A low heterogeneity index (which requires harmonization or convergence of regulations) is associated with a strong stimulation of trade in services. For him , if the STRI of importing and exporting countries are low, the harmonization boosts trade in services, while at the same time, if the STRI are high, harmonization attempts to limit trade.

Another approach that differs from the first is the analysis of Ingo and al.(2012), they use the restrictiveness index of trade in services developed by the World Bank, and not that of the OECD, to measure the impact of regulatory policies on trade in services[3] . Through the PPML estimate, they find that higher levels of STRI discourage investment. Van der Marel and Shepherd (2013) in his analysis (very similar to the previous one) also finds a negative relationship between the World Bank's bilateral restrictiveness indices and cross-border trade in transport and financial services. Riker, D (2014) in his study highlights the impact of restrictions on foreign suppliers (import restrictiveness index) and cross-border trade in services. It also finds negative effects of the latter on cross-border trade in services. To go far in its logic, it simulates the effect on U.S. financial services exports by estimating the effect on U.S. financial services exports if its trading partner

[3]Foreign investment inflows and access to financial services through the provision of bank credit

eliminated restrictions on these imports from all countries. He notes that while China and India do not apply any barriers to market entry, the United States is recording a sharp increase in their exports of financial services, both in dollars ($186.0 million and $42.2 million) and in the rate of change (10.14% and 3.76%). On the other hand, in a country like Germany, US exports have increased slightly (7.7 million dollars or 0.23%). Indeed, according to them, in the financial services sector, Germany is a relatively important export market for the United States, after the United Kingdom, but the impact on trade is less, because the level of restrictiveness in this country is relatively low compared to countries like China or India. However, Schwellnus (2007) in his study highlights a small but significant elasticity between compliance with imposed regulation and bilateral trade in services.

Another type of analysis that is very different from those mentioned above and that is part of our paper remains that of Ariu, A and al (2018). They explore the interaction between international trade in goods and restrictions on services. Based on data from Belgian firms from 1995 to 2005, data on PMR indice(Product Market Regulation) and customs duties on goods and services, the latter come to the following conclusion: when barriers to the import of goods and merchandise are increased, this leads to a decrease in imports of services by firms and vice versa. In addition, to conduct an in-depth analysis, these authors use their findings to quantify the impacts of the reduction of barriers to goods and services between the US and the EU on their trade (TTIP agreement). They find that liberalization of services sector has direct and significant effects on trade in goods. Shepherd (2015) in their study through the gravity equation show that reducing restrictions on trade in services leads to an increase in trade in manufactured goods.

## 2.2 Tariff equivalent analysis of restrictive policies in services

The literature formarly discussed shows that the regulation of services has negative effects on international trade. However, but we do not specify the transmission channels through which these negative effects work . At this level, we assume that all restrictions on trade in services can be converted into tariff equivalents, Whalley (2004).

The first authors to focus on computation of the tariff equivalents of service restrictions relied on the gravity equation. Indeed in this section, two methodologies are used : the analysis by the residues ob-

tained from the gravity equation, Park (2000) and the fixed effects method of importing countries [4], Fontagne, Guillin and Mitaritonna (2011) and Fontagne, Mitaritonna and Signoret (2016). Moreover, for them, the difference in trade flows between the presence of market entry restrictions and so-called "Benchmark" restrictions [5] explains these tariffs. In other words, tariff equivalents are deducted by comparing the fixed effects of the importing country or the residues for each country with those of a reference country. At the end of their study, they come to the same conclusion that developed countries have low levels of restrictions in their markets and that developing and emerging countries apply high tariffs on services. Although this methodology has data advantages (to fill data gaps), it does not take into account important theoretical elements of the model: depending on the model, the difference in trade flows between the predicted values and the model values explains trade barriers, while importing countries demand factors such as price indices are not considered in the model, which may constitute a fundamental limitation Deardorff and Stern (2008). Similarly, the computation of tariff equivalents using the importing country's fixed effects not reflect the correct tariff computation because the latter covers all unobservable events and not just restrictions. From this point of view, it is preferable to use the residual method.

In order to provide solutions to omitted variables in previous analyses, Gooris and Mitaritonna (2015) start add the variables of the price index of the importing country to the classical variables. They compute the tariff equivalents by assessing the ratio of service flows at a given restrictiveness level over benchmark flows with no import restrictions.

The second-analysis of the computation of tariff equivalents, which differs from the first, is based on a standard econometric model. They compute the tariff equivalents of restrictive policies through a price-cost margin analysis of foreign firms. Authors such as Jafari and Tarr (2015), Rouzet and Spinelli (2016) and Khachaturian, T (2015), use the price performance index as a variable to capture tariffs for restrictive policies in services. According to their interpretation, a positive impact increasing the price-cost margin is considered as a consumption tax (paid by the consumer and seen as a rent for the producer) and a negative coefficient of our STRI indices on the margin is seen as a production tax, borne by the producer and not passed on to the consumer, which is not beneficial to the producer. In addition, once

[4] extension of Park (2002)

[5] The "benchmark" restrictions are compared to countries with the largest positive difference between the average effective value of imports and the average expected value

the econometric analysis is done, they compute the tariff equivalent of the regulation in question by the differentiation between the price with the restriction and the price without the restriction . As a result, they find that in all sectors, high-income countries have lower tariff equivalents than emerging and least developed countries. However, the analysis of the computation of the tariff equivalent by prices is very limited, because it is necessary to identify the appropriate prices to use and this is likely to be problematic. While it is fairly easy to obtain information on the price paid by the importers of a good, it might become difficult to obtain the corresponding price prevailing in the domestic market especially at a fairly disaggregated level [6].

The review's analysis shows a negative impact of STRI indices in services on trade flows, and significantly affects the banking and transport sectors. The divergence of regulations between countries also has a considerable negative impact on trade. Our work is a continuation of previous studies that have addressed the issue of standards in international trade.

# 3 Presentation of the OCDE's Trade restrictiveness index for services (STRI)

To analyze the impacts of service sector regulation on trade, we focus on the heterogeneity index of trade in services, a diagnostic tool developed by the OECD. It is a database-based analytical tool (STRI database)[7] that reports on laws and regulations (more than 16,000) affecting trade in services in 22 sectors and 44 countries, representing more than 80% of global trade in services[8]. Initiated in 2014 with an annual update, it provides a comprehensive overview of global trends in services sector regulation. It, which differs from other traditional types, makes it possible to identify through this index the measures that limit or facilitate trade in services between nations. For each sector, the regulations in force are grouped into five categories of measures:

**Market entry restrictions**: include all information related to the

[6] This becomes even more difficult if data collection has to be done for a large set of countries

[7] Database of the Restrictivity Index to Trade in Services: From a list of questions asked about countries' regulatory measures, the responses collected are quantified and serve as a basis for countries' laws and regulations.

[8] 36 OECD member countries as well as Brazil, China, Colombia, Costa Rica, India, Indonesia, Lithuania, Russian Federation and South Africa

limitation of foreign participation in the acquisition of domestic capital. Such requirements impose the management or board of directors must be nationals or residents, restrictions on cross-border mergers and acquisitions, capital controls and a number of sector-specific measures. of sector-specific measures..

**Restrictions on the movement of persons**: refer to the quotas and length of stay of foreigner natural persons providing services in a host country, contractual service providers or independent service providers. These categories have in common that natural persons do not seek employment in the host country. This category also contains information on the recognition of foreign qualifications in regulated professions.

**Discriminatory measures**: include discrimination against foreign suppliers, e.g. taxes, subsidies and access to public procurement; and cases where national standards differ from international standards.

**Obstacles to competition**: information on antitrust policy, all measures in which local companies benefit from privileges and are exempt from competition policy and regulations.

**Regulatory Transparency**: This category of measure highlights information on publications before laws and regulations come into effect. It also records information on administrative procedures related to setting up a company, obtaining a license or a visa.

## 3.1 Individual STRI index by country

### 3.1.1 The scoring and weighting of individual restrictions

To define the individual indices constituting the STRI, it is necessary to proceed in two steps:

in the first phase, the scoring of individual restrictions: it consists first in assigning scores to the different measures constituting each category of restrictions. Each category of restriction is structured into sub-measures. In fact, these sub-measures in our database must be grouped together to form a composite restrictive measure. Each rule is assigned a score of 0 or 1, and the approach would be to transform qualitative information about the regulation into a binary variable. To evaluate the restrictive nature, a measure is considered restrictive if it takes note of 1 and 0 if it facilitates the flow of trade between coun-

tries.

Then, the five areas relating to our different categories of restrictions are weighted according to their relative importance ( based on their contribution to trade costs). For this purpose, the weighting system is based on expert judgement (see Table A.1). Indeed, they allocate 100 points among the five categories of measures, according to their relative importance for each sector.

### 3.1.2 Weighting of individual restrictions in STRI

This section consists of weighting the individual restrictions into a STRI index. Indeed, at this level, it is necessary to translate these points and scores into weight by assigning the number of points assigned to the measure as well as the score assigned, while correcting any differences that may exist between the number of measures in each category, Geloso Grosso and al.(2015).
The STRI formulation for each measure j under category i is as follows:

$$STRI_j = score_j w_i \sum_{i=1}^{5} n_i w_i \tag{1}$$

Where $n_i$ is the number of measures in category i and $w_i$ is the share of the total number of points allocated to policy area i by the experts.

## 3.2 The aggregation of individual restrictions in global STRI index

Once the individual weighting has been done, the individual indices are aggregated into a global index of category i. To do this, the indices of all the measures in the category must be added together, Geloso Grosso and al.(2015):

$$STRI_i = \sum_{j=1}^{n} score_j w_i \sum_{i=1}^{5} n_i w_i \tag{2}$$

where

$$STRI_i = \sum_{j=1}^{n} STRI_j \tag{3}$$

## 3.3 The aggegation of global STRI indices by sector.

In order to have the overall sectoral STRI; we must add all $STRI_i$ indices of the five categories of measurement, Gelosso Grosso and al.(2015):

$$STRI_s = \sum_{i=1}^{5} STRI_i \tag{4}$$

With $STRI_s$ = Sector restrictiveness index S(global STRI of sector s). In short, the measures or sectors with the highest restrictiveness indices (close to 1) are those that constitute the most restrictive measures to trade in services.

## 3.4 The heterogeneity index STRI (by country pair)

Considered as bilateral measures of regulatory heterogeneity, this index captures the regulatory disparity between countries taken two by two per sector. It is estimated by country pair for each measure taken with reference to detailed information from the OECD's STRI database. Indeed, like the STRI indices, the regulatory heterogeneity indices are first rated with values between zero and one. If two countries have the same response for the same measure, the bilateral index score is zero, if they have a different response to the measure, they have a heterogeneity index of one. The indices are available by country pair, sector and year and are distributed from homogeneous country pairs (index 0) to heterogeneous country pairs (index equal to 1).
For each country pair and sector, the index represents the (weighted) share of measures for which the two countries have different regulations. Two versions of the regulatory heterogeneity index are calculated, one based on qualitative responses in the STRI database, the other on scores. The score represents the weighted share of the total number of measures to which the country pair has different responses. The approach consists of comparing countries by country, sector by

sector and measures by measures. To this end, based on the information from the STRI database of countries, we must build a matrix containing the response to a measure by our country peer. To do this we assign symbols i, j to countries and m to measurements. In this case, each constructed matrix contains the response to measure m of countries i and j. If the country pair has the same response to the measurement, the matrix takes zero. If the two countries have a different answer, it is noted as one (for more details see Table 1 in the Appendix).

# 4 Gravity model of bilateral trade

In an order to conduct an empirical analysis of the effects of restrictive measures on trade flows, we consider the gravity model defined by Anderson (1979). In addition, he remains the first to have provided a theoretical basis for the gravity equation. It is based on the context that products are differentiated according to the country of origin, i.e. according to the location (Armington hypothesis) where consumers have defined preferences for these differentiated products. Under this assumption, each country can acquire a good from another country regardless of the market price, in which case all goods are traded, all countries trade and in balance, national income is the sum of domestic and foreign demand for the single good produced. In his model he considers commercial costs, which he materializes in transport costs. After Anderson's theoretical framework (1979), authors started from commercial theories to find a theoretical framework of the gravity equation Bergstrand (1989) shows that a gravity equation remains a direct implication of a trade model based on monopolistic competition by Paul Krugman (1980). In their logic, identical countries manage to exchange differentiated goods because consumers prefer variety. According to the concept of monopolistic competition, it is not the location of firms that determines trade in differentiated goods but the preference of consumers for variety. Eaton and Kortum (2002) derive a gravitational equation from a Ricardian model, and Helpman and al (2008); Chaney, T (2008) obtained it from a theoretical model of international trade in goods differentiated with firm heterogeneity .
The general shape of the gravity equation is as follows:

$$X_{ij}=GS_iM_j\Phi_{ij}$$

Where $X_{ij}$ is the value of exports from country i to country j, $M_j$ represents the demand of the importing country (the GDP of the im-

porting country), $S_i$ is the value of the GDP of the exporting country, G is a variable that does not depend on i or j and represents the level of global liberalization; $_{ij}$ here represents the ease of access by exporter i to market j (materialized here by the inverse of bilateral trade costs).

The contribution of Anderson and van Wincoop's (2003) remains a major contribution in order to have a theoretical framework for deriving the gravity equation. Indeed, the latter show that the control of commercial costs remains crucial in order to properly specify the gravity equation. However, trade costs are very important for the gravity equation. According to them, two countries will trade less if they were separated by an ocean or by vast stretches of deserts and mountains. To this end, trade between two nations is determined by relative trade costs, i.e. trade costs between the two nations (absolute costs) and trade costs between the country (importer, exporter) and the rest of the world, which will be called the MTR (Multilateral Trade-Resistance). However, the term multilateral resistance can be controlled through the fixed time effects of the importing and exporting country, Anderson and Yotov, (2012) or using a proxy.
Starting from Anderson and Wincoop's (2003) equation, in order to estimate such a equation we must proceed to its linearization; while taking the logarithm of each variable composing the model in order to have a log-linear equation which will be easily estimated by the OLS. So the equation becomes:

$$LnX_{ij} = a_0 + a_1 lnY_i + a_2 lnY_j + a_3 lnt_{ij} + a_4 ln\Phi_i + a_5 lnP_j + \epsilon_{ij} (5)$$

Where $a_0$ is the constant, and $\epsilon_{ij}$ is the error term. In practice, the gravity equation links the logarithm of the monetary value of trade between two countries to the logarithm of their respective GDPs, a composite term measuring barriers and incentives to trade between them, and terms measuring barriers to trade between the countries under consideration and the rest of the world.

# 5 Estimation issues and data sources

Using Anderson and Van Wincoop's (2003) contribution, our gravity model is as follows:

$$X_{ijst}=\alpha_0+\alpha_1 lnGDP_{it}+\alpha_2\ lnGDP_{jt}+\alpha_3\ lnDist_{ij}+\sum_{s=1}^{2}\alpha_4\ STRI_{its} + \sum_{s=1}^{2}\alpha_5\ STRI_{jts}+\sum_{s=1}^{2}\alpha_6\ HI_{ijts}+\sum_{s=1}^{2}\alpha_7(STRI_{its}{*}HI_{ijts}) + \sum_{s=1}^{2}\alpha_8(STRI_{jts}{*}\mathrm{HI}_{ijts})+\sum_{l=1}^{3}\alpha_9\ I_l+\Phi_{it}+\mu_{jt}+\epsilon_{ij} \tag{6}$$

With $I_l$ a vector of bilateral control variables(common border, common language, being part of the same regional trade agreement[9] ). The left hand side $X_{ijst}$ represents the dependent variable for agri-food exports in value terms from country i to country j in sector s at time t. From classical variables to gravity model such as GDP in value of the importing and exporting country [10], $GDP_{jt}$, $GDP_{it}$. Bilateral cost variables such as distance $Dist_{ij}$. The explanatory variables of interest are $STRI_{it}$, $STRI_{jt}$ that capture the level of policy restrictiveness in country i, and j on the two sector(s=1,2). $HI_{ijt}$ is our regulatory heterogeneity variables between pairs of countries in the banking sector and road transport respectively [11]. we also have our interaction terms that take into account both individual restrictions by country and regulatory heterogeneity by country pair ($STRI_{its}{*}HI_{ijts}$), ($STRI_{jts}{*}HI_{ijts}$). Finally, we end our model by integrating exporter-time and importer-time fixed effects; and an error term($\mu_{jt}$,$\Phi_{it}$ , $\epsilon$).

As mentioned above, our paper attempts to analyse the effects of restrictive measures in services on agri-food trade flows. In fact, we use panel data on trade in agri-food products between the 36 OECD countries (bilateral trade between countries) from 2014 to 2017. Indeed, panel data have the advantage of reducing the bias generated by heterogeneity between countries. While in a cross-section, trade between pairs of countries can only be controlled by the observed characteristics of the country pairs (such as common language, common border), in a panel the heterogeneity of country pairs can be controlled using fixed country time effects. The choice of such a sampling is necessary because services in OECD countries represent nearly 2/3 of world GDP and account for nearly 80% of total employment, also these countries stand out as the most restrictive in these sectors. The data for 2014-2017 are based on the implementation and evolution of the STRI index

[9]Set to equal 1 if countries share a common border, comman language, same regional trade and 0 otherwise.

[10]Baldwin and al(2005)

[11]we take into account the index based on qualitative responses that we believe capture the level of regulatory disparity between a pair of countries

in these years. We start from trade in agri-food goods because of our objective of having the impacts of restrictions in services on trade in agri-food goods, which is a new field in the literature and also it is the sector most affected by the production standards. These bilateral trade data were collected on the UNCTADstat (United Nations Trade and Development Database) database. we consider that banking sector and transport sector because of its importance in the movement of goods and the commercial presence Ariu, A and al (2018). We also introduce an index that captures regulatory heterogeneity across country pairs to see if these effects are more important than the STRI indices taken per country. Data from these indices are available on the OECD STRI database[12]. In addition, there are the traditional country-specific variables: the GDP of the importing and exporting country (WORLD BANK database on development indicators). Bilateral resistance variables such as the bilateral distance between the two capitals (CEPII database)[13], binary variables that materialize regional and also bilateral trade agreements[14] (WTO,RTA database), the common border, the common language (CEPII database). The last terms of our gravity equation represent the fixed country-time effects (importer, exporter), and fixed-time effects that capture all unobservable variables by country[15], plus an error term. According to the economic literature, the effects on trade flows of these different variables are distributed as follows.

| Variables | Effects on agri-food exports |
|---|---|
| GDP (exporter and importer) | positive |
| Distance | negative |
| Trade agreements, common language, common border | positive |
| Individual restrictiveness index | negative |
| Regulatory heterogeneity index | negative |

# 6 Econometric specifications

The Estimation of our equation will initially be done the OLS estimator. Basic estimation for the linear model. However, the results of

[12] https://stats.oecd.org/Index.aspx?DataSetCode=STRI

[13] Mayer, T. and Zignago, S. (2011)

[14] At this level we use trade agreements on both goods and services, as we study the effects of restrictions in services on agri-food goods

[15] more precisely the production level of the exporting and importing country and the production prices

this estimator may constitute a bias in the presence of "Zero trade" also in the presence of heteroskedasticity, OLS estimation may not be consistent. Indeed, the estimator aims at not considering countries that do not trade in goods, which can compromise our results, because zero trade reveals crucial information (lack of information, high transport costs, landlocked countries) so omitting it can constitute a considerable bias in our results[16]. Therefore, the appropriate estimator to solve this constraint is to consider the PPML estimator, Silva and Tenreyro (2006). The PPML is used in our case in order to face the constraints of zero trade between States, it also makes it possible to estimate the non-linear shape of the gravity model in the presence of heteroscedasticity. However, important assumption of PPMLs estimator is equi-dispersion, which means the conditional variance of dependent variable and its conditional mean are equal.

Another way to deal with zeroes is the Heckman selection model, Heckman, (1979). This two-stage model applied to trade flows first estimates the probability of trade between the two countries, and then estimates its value when it occurs. A critical assumption related to these models is exclusion restrictions (e.g. an instrument which simultaneously predicts the existence of trade but is not related to the value of strictly positive flows). for this reason, we prefer the PPML and OLS specification for our estimations.

# 7 Estimate results and interpretation

In the different regressions, we find the following effects: country-specific variables such as the GDP of the importing and exporting country have positive and significant effects on bilateral trade flows(in accordance with the literature). Through the OLS regression, a 1% increase in the GDP of the importing country leads to an increase in trade in food goods of nearly 1%. Our dummy variables representing the common language, common border and trade agreements have positive and significant impacts on food trade between OECD member countries. Bilateral distance, on the other hand, has limiting effects on trade flows, as it is considered as bilateral costs (significant result).

If we take our control variables that measure the level of restrictiveness of standards in services, country-specific restrictions in banking and transport sectors have negative effects on trade in food products. In addition, the index representing the regulatory disparity between

[16]Indeed, zero commerce is associated with high bilateral fixed costs of trade

nations severely limits bilateral flows compared to individual country restrictions, impacts much more marked by restrictions on the banking sector[17]. In addition, a 0.05 point reduction in the regulatory heterogeneity index in the road transport and banking sector is associated with an increase in bilateral trade flows of 1% and 2% respectively on average. On the other hand, these consequences of regulatory divergence on trade flows can be mitigated through the liberalization of these sectors. In effect, the regression of our interaction terms (trade agreements and regulatory heterogeneity index) has produced positive and significant results on trade flows between OECD countries. However, a deregulation of these sectors between these countries and EU Member States stimulates more trade flows of food products, reflecting the importance of the vaste european market and the harmonization of market entry standards. In sum, banking activity has a very key role in the export of agri-food products through commercial presence. In other words, exporters have less incentives to establish themselves in an area where there are still huge restrictions in the banking sector. This interpretation is due to the fact that too many restrictions in the banking sector in OECD countries impede the funding of export activities. In this situation the loan provided becomes expensive, restrictions can affect the exchange rate between currencies and therefore do not permit the establishment of a commercial presence abroad. In the last part of our study, we critique previous studies on the effects of regulatory divergence on trade. Indeed, for us the commercial effect of regulatory heterogeneity can vary according to the level of regulation in the exporting and importing country. In addition, regulatory disparity between countries may not be significant if the market is completely closed to foreign exporters; or may be significant if there are few or no such differences. In this case, the negative effect of this regulatory heterogeneity can be questioned. In our latest regression, we start from an interaction between the regulatory heterogeneity between pairs of countries and the individual restrictions of importing and exporting countries in the banking sector that we estimate through the PPML. We finally find that the negative effects of this regulatory divergence disappeared and on the contrary, boosted trade more (positive and significant result). Indeed, it is not only the disparity in standards between countries that affects trade flows, but also the individual restrictions of each country. The positive effects of our interaction terms can be explained by the fact that if two countries have very low levels of individual restrictions in the banking sector, the regulatory difference between countries has a greater marginal impact

[17]the restrictions in the banking sector constitute fixed costs that are very significant and affect exports of agri-food products

on trade flows.

we will consider the concept implemented by Nordàs (2016):

$$\triangle of\ export\ in\ \% = -[exp\,(0.05(\alpha_1 + \alpha_2 STRI_i + \alpha_3 STRI_j) - 1] * 100.$$

.

With $\alpha_1$, the coefficient of regulatory heterogeneity in the estimate, $\alpha_2$ the coefficient of the interaction term "regulatory heterogeneity index and STRI of the exporting country", and $\alpha_3$ the coefficient resulting from the interaction "heterogeneity index and STRI of the importing country". The regression through the PPML gives us:

$$\triangle of\ export\ in\ \% = -[exp\,(0.05(-9.278 + 10.564 * STRI_i + 11.157 * STRI_j) - 1)] * 100.$$

.

Assuming that importing and exporting countries have the same levels of individual restrictions, it can be found that more the level of restrictiveness is low, more the regulatory heterogeneity increases trade flows. In this particular case, regulatory divergences have a significant impact on trade flows. But as restrictions become stricter, trade flows decline, reflecting the ineffectiveness of trade-related regulatory divergences in the banking sector. In this situation, the foreign exporter no more considers the divergence of regulations between his home country and the foreign country, but is looking at more restrictions in the export market.

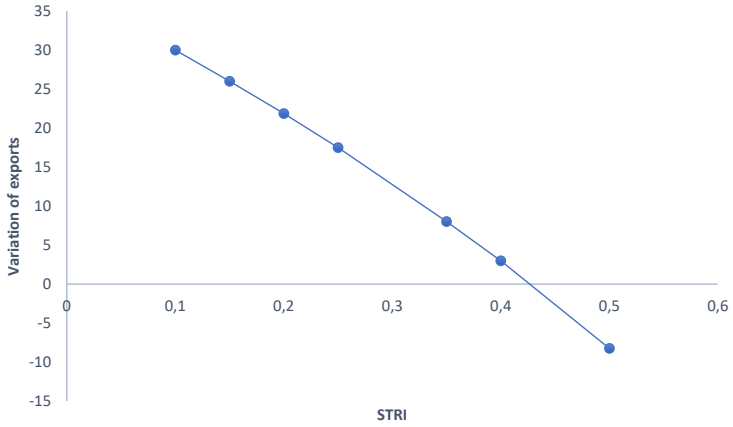



Figure 2: bilateral exports from reducing the regulatory index

# 8 Robustness check

To confirm our results, we will consider the GPML(Gamma pseudo-maximum likelihood estimator) as the estimation method. However, Martìnez-Zarzoso and al. (2007) compute the performance of this estimator, finding it to be adequate in the presence of heteroskedasticity, although it shows less accuracy when zero trade values are present. After estimation, we find the individual restrictions by country and regulatory heterogeneity have significant negative effects on trade in agri-food products.

Table 1: Gravity Estimation Results Using GPML robust with individual STRI and regulatory index

| | GPML robust 1 | GPML robust 2 |
|---|---|---|
| Ln GDP exporter | 1.531*** | 1.606*** |
| | (0.05) | (0.05) |
| Ln GDP importer | 1.729*** | 1.881*** |
| | (0.06) | (0.06) |
| Dummy:Common language | 0.0190 | -0.0980 |
| | (0.10) | (0.09) |
| Dummy:Common border | 0.926*** | 1.024*** |
| | (0.10) | (0.10) |
| Ln distance | -1.371*** | -0.951*** |
| | (0.09) | (0.09) |
| RTA | 0.659*** | 0.716*** |
| | (0.10) | (0.10) |
| STRI importer country(bank) | -0.0695 | |
| | (0.85) | |
| STRI exporter country(bank) | -2.041*** | |
| | (0.64) | |
| STRI importer country(maritime) | -0.166 *** | |
| | (0.03) | |
| STRI importer country(road transp) | 0.988** | |
| | (0.40) | |
| Heterogeneity index (Bank) | | -3.984*** |
| | | (0.80) |
| Heterogeneity index (road transp) | | -1.279* |
| | | (0.67) |
| Exporter year fixed effect | Yes | Yes |
| importer year fixed effect | Yes | Yes |
| Year fixed effect | Yes | Yes |
| Observations | 4191 | 5025 |

Note: Stars indicate the sign level of the related estimates

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

# 9 Compute the tariff equivalent of the regulatory heterogeneity

Assessing the tariff equivalent of regulatory heterogeneity is crucial in studying the impact of standards on trade. If regulatory heterogeneity between countries has restrictive effects on trade flows, it has a direct impact on the price of the imported food product. Indeed, these restrictions on the service sector represent compliance costs and therefore have an impact on the price of the imported product. To compute the tariff equivalent of restrictions in services on agri-food trade, we will consider the regulatory heterogeneity between pairs of countries. Two essential methods we have developed to compute the tariff equivalent of regulations in services.

In the first methodology, we compute the tariff equivalent of regulatory heterogeneity using a gravity equation, to which we add a variable on the tariffs applied*(1+t)* on the food products by the importing country. Although the gravity equation is typically used to measure the impact of trade costs on bilateral trade flows, it can also be used in reverse to measure bilateral trade costs and to decompose trade costs into a tariff and non-tariff component Jacks and al., (2008); Novy, (2009). The idea is to solve a theoretical gravity equation for the trade costs term instead of trade flows and to express these costs as a function of the observable trade data. The equation to be estimated is as follows:

$$X_{ijst}=\alpha_0+\alpha_1 lnGDP_{it}+\alpha_2\ lnGDP_{jt}+\alpha_3\ lnDist_{ij}+\alpha_4\ ln(1+t) + \sum_{s=1}^{2}\alpha_5\ \ln HI_{ijt}+\sum_{l=1}^{3}\alpha_6\ I_l+\Phi_{it}+\mu_{jt}+\epsilon_{ij} \quad (7)$$

Through an OLS estimate, we derive the price elasticity to trade, income elasticity of food consumption, the elasticity of food Trade and from there, we can relate the tariff equivalent of heterogeneity of standards. Thus, the predicted difference in trade between a country pair with a restriction and the same country pair without the restrictions[18] would be.

$$Ln(\widehat{X}_{ijt,HI\neq 0})\text{-}Ln(\widehat{X}_{ijt,HI=0})=\sum_{n\neq 5}\widehat{\alpha}_{nn}Z_{ijnt}+\widehat{\alpha_5}(HI\neq 0)-[\sum_{n\neq 5}\widehat{\alpha}_{nn}Z_{ijnt}+\widehat{\alpha_5}(HI=0)]=\widehat{\alpha_5} \quad (8)$$

$Z_{ijnt}$ is the explanatory variables other than the heterogeneity index

[18] the zero restriction is used as the baseline of estimation

and HI the heterogeneity index.

we do a similar calculation for the customs tariffs :

$$Ln(\widehat{X}_{ijt,t\neq 0})\text{-}Ln(\widehat{X}_{ijt,t\neq 0}) = \sum_{l\neq 4} \widehat{\alpha}_l Z_{ijlt} + \widehat{\alpha_4}(t\neq 0) - [\sum_{l\neq 4} \widehat{\alpha}_l Z_{ijlt} + \widehat{\alpha_4}(t=0)] = \widehat{\alpha_4} ln(1+t) \tag{9}$$

$Z_{ijlt}$ is the explanatory variables other than the tariff and tariff represents tariff equivalent in our model.

A tariff equivalent of heterogeneity of standards is a tariff that has the same effect on trade flows. This is equivalent to equating the left-hand sides of (8) and (9):

$$\widehat{\alpha_5} = \widehat{\alpha_4} ln(1+t)$$

the tariff equivalent of restrictions in services is :

$$Tariff equivalent = (exp(\widehat{\alpha_5}/\widehat{\alpha_4}) \text{ -1} \tag{10}$$

After estimation we note that the tariffs of the regulations subject to the banking market are more relevant than the tariff equivalents of the restrictive policies on the transport market.

Table 2: Computation of the equivalent tariff through the OLS

| | OLS1 | OLS2 |
|---|---|---|
| Ln GDP exporter | 0.825 *** | 0.813*** |
| | (0.02) | (0.02) |
| Ln GDP importer | 0.953*** | 0.940*** |
| | (0.02) | (0.02) |
| Dummy:Common language | 0.261*** | 0.271*** |
| | (0.05) | (0.05) |
| Dummy:Common border | 0.460*** | 0.444*** |
| | (0.05) | (0.05) |
| Ln distance | -0.717*** | -0.756*** |
| | (0.03) | (0.03) |
| RTA | 0.334*** | 0.296*** |
| | (0.03) | (0.03) |
| EU | 0.226*** | 0.225*** |
| | (0.03) | (0.04) |
| Ln(1+tariff) | -0.338*** | -0.332*** |
| | (0.09) | (0.09) |
| Ln Bank heterogeneity index | -1.099*** | |
| | (0.136) | |
| Ln transport heterogeneity index | | -0.453 *** |
| | | (0.113) |
| Exporter year fixed effect | Yes | Yes |
| importer year fixed effect | Yes | Yes |
| Year fixed effect | Yes | Yes |
| $R^2$ | 0.602 | 0.598 |
| Observations | 5009 | 5009 |
| Implied tariff equivalent in % | 24.89731 | 2.914499 |

Note: Stars indicate the sign. level of the related estimates

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The second method is based on analysis of Julien Gooris and Cristina Mitaritonna (2015). Starting with a producerâs price $p_i^k$ for the domestic marketAnderson and Van Wincoop (2003), we can express the cost of providing the good k by a producer from country i to a destination j in the following multiplicative form:

$$P_{ij}^k = \Lambda_{ij}^k (1 + \Psi_{ij}^k) P_i^s \tag{11}$$

Where $\Lambda_{ij}^k (\geq 1)$ is the trade cost factor plus the customs tariffs, $\Psi_{ij}^k$ ($\geq 0$ and $=0$), the restrictions in sector service.

Following Anderson and van Wincoop (2004)[19], we use a traditional CES-based demand structure which gives the flows of agri-food that cross the border from i to :

$$X_{ij}^k = \left( \frac{P_{ij}^k}{P_j^k} \right)^{1-\sigma_k} E_j^k \tag{12}$$

With $E_j^k$, the expenditure allocations, $P_k^j$ refers to the price index of the demand function with an elasticity of substitution $\sigma_k$ between the varieties within the type of good k[20]:

$$P_j^k = \left[ \sum_i (P_{ij}^k)^{1-\sigma_k} \right]^{\frac{1}{1-\sigma_k}} \tag{13}$$

We have the value produced by country i which equals the sum of the bilateral flows from i to all destinations (including i for the internal absorption) for markets to clear:

$$Y_i^k = \sum_j X_{ij}^k \tag{14}$$

Solving for $P_i$ in (14), we obtain:

[19] According to these authors bilateral trade is determined in conditional general equilibrium whereby product markets for each good (each brand) produced in each country clear conditional on the allocations

[20] it also reflects the inward multilateral resistance

$$\left(P_{ij}^{k}\right)^{\sigma_k - 1} = \frac{Y_w^k}{Y_i^k}\left(\Pi_i^k\right)^{1-\sigma_k} \tag{15}$$

with

$$\left(\Pi_i^k\right)^{1-\sigma_k} = \sum_j \left(\frac{\Lambda_{ij}^k(1+\Psi_{ij}^k}{P_i^k}\right)\frac{E_j^k}{Y_w^k} \tag{16}$$

$\Pi_i^k$ transmits the effect of an increase in the level of in import restrictiveness for non-j agri-food importers which would stimulate flows from i to j. It represents the outward multilateral resistance.

We substitute the previous in (11) and (12), which yields the value of the bilateral agri-food flows in function of the regulatory frictions, trade cost, and the price index which can be summarized as:

$$X_{ij}^k = \left(\frac{\Lambda_{ij}^k(1+\Psi_{ij}^k)}{\Pi_i^k P_i^k}\right)^{1-\sigma_k}\frac{E_j^k Y_k^k}{Y_w^k} \tag{17}$$

in order to compute the tariff equivalent in this theoretical aspect, we evaluate the ratio of agri-food flows at a given restrictiveness evel over benchmark flows with no import restrictions. The restriction baseline used as benchmark to evaluate the tariff equivalents corresponds to a restriction-free import environment, We then identify the tariff equivalent term such that the ratio $\frac{X_{ijt}^k}{X_ijt,free}^k$ , (notice that $\sigma_k$=1 in absence of trade barriers). On the theoretical side, we assume that the change in restrictions from restriction-free to another level has a negligible impact on $\Pi_i{}^k and \mathrm{P}_j^k$ . This assumption remains realistic to the extent that, $\Pi_i^k$ and $P_j^k$ , the weight of the origin country relative to th world production in sector k and the weight of the destination country expenditure in k over the world production, are limited. Since $\Lambda_{ij,free}^k$=0, we obtain from Equation which gives us:

$$\frac{X_{ijt}^k}{X_{ijt,free}^k} = (1+\Psi_{ij}^k) \tag{18}$$

With $\Psi_{ij}^k$: the the tariff equivalent of the regulatory heterogeneity on sector k.

We reproduce this evaluation for the empirical expression of trade flows:

$$lnX_{ijst} = \alpha_0 + \alpha_1 lnGDP_{it} + \alpha_2 lnGDP_{jt} + \alpha_3 lnDist_{ij} + \alpha_4 ln(1+t) + \sum_{s=1}^{2} \alpha_5 lnHI_{ijt} + \sum_{l=1}^{3} \alpha_6 I_l + \Phi_{it} + \mu_{jt} + \epsilon_{ij} \quad (19)$$

On the empirical side we have:

$$E(\widehat{X_{ijt}^k})/E(\widehat{X_{ijt,free}^k}) = exp(\widehat{\alpha_5} HI) \quad (20)$$

In this case, free-restrictions" No restrictions" as the estimation baseline

To identify the tariff equivalent term, we set the theoretical trade ratio equal to its empirical counterpart(equation 18 equal to 20) and obtain:

$$\left(1 + \Psi_{ij}^k\right)^{1-\sigma_k} = exp(\widehat{\alpha_5} HI) \quad (21)$$

and which gives us

$$\Psi_{ij}^k = exp\left(\widehat{\alpha_5} HI / 1 - \sigma_k\right) \quad (22)$$

With $\sigma_k = 5{,}6$, Park (2000). After the estimation we have:

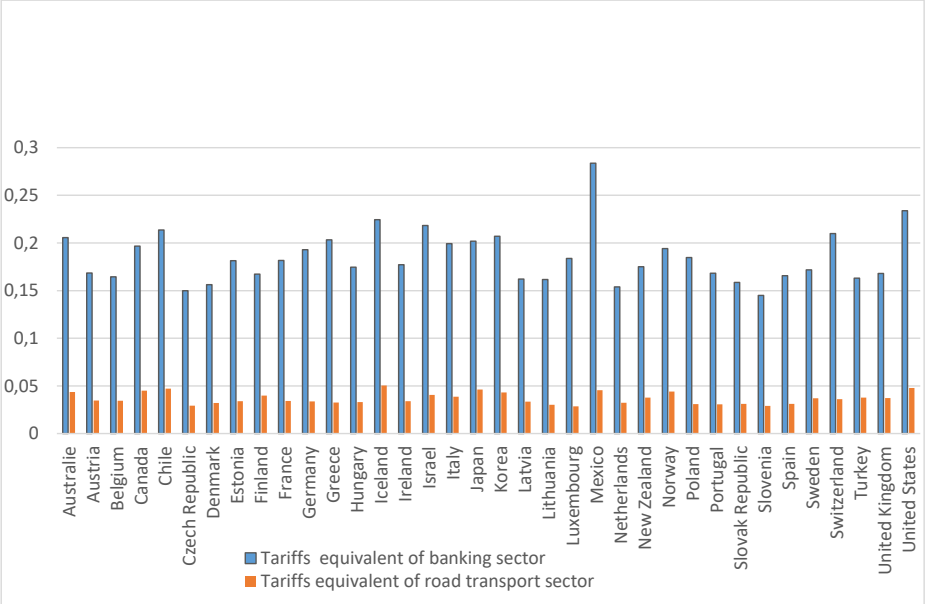



Figure 3: Tariff equivalents of regulatory heterogeneity between OECD countries

# 10 Conclusion

Our paper, which aims to study the impacts of service standards on agri-food trade flows, presented a tool for quantifying regulatory heterogeneity in the service sector and evaluated these effects on trade flows. In order to carry out this study, we started from a gravity modeling using panel data on bilateral trade in food goods between OECD countries from 2014-2017. Through two types of estimation, we found that: individual restrictions on the banking and transport sector had restrictive effects on trade. These consequences became more significant if there was a regulatory disparity between countries. Also, to export his food product to a foreign country, the exporter takes into account not only the regulatory difference between his country and the foreign one but also the individual restrictions in his country and the foreign one. We found that where foreign restrictions were very high, regulatory divergence between countries had a negligible effect on trade flows. Finally, the tariff equivalent associated with these service regulations showed that tariffs on the banking sector were much higher than those on road transport.

Our paper is presented as an original study through the methodology used, in fact, starting from a gravity model to which we have used two types of robust estimates, we have computed the tariff equivalent associated with these restrictions in two different ways (in a sectoral and per country way). However, we could have improved our study by considering several types of disaggregated and non-aggregated sectors in order to see the real effects on each type of sector, we also think that taking into account sectoral GDP as a independent variable instead of overall GDP could help to strengthen the robustness of our study.

From this study on the impact of restrictions in services on food goods, it emerges that regulatory cooperation between countries has become an increasingly important element in regional trade agreements. The harmonization of rules across economic areas of integration or the mutual recognition of foreign rules significantly boost trade and improve the well-being of the population through product diversification.

## A. Appendix

Table A.1: Weighting in (%) of restriction categories by expert judgments.

| Sectors | Market entry restrictions | Restriction on the Movement of Persons | Other Discriminatory Measures | Barriers to competition | Regulatory transparency |
|---|---|---|---|---|---|
| Broadcasting | 39.67 | 12.00 | 17.33 | 17.67 | 13.33 |
| Motion | 27.27 | 21.24 | 19.24 | 13.44 | 18.24 |
| Sound | 12.00 | 17.00 | 23.00 | 27.00 | 21.00 |
| Construction | 21.97 | 16.87 | 22.07 | 18.57 | 20.53 |
| Courier | 27.20 | 12.20 | 19.20 | 21.00 | 20.40 |
| Computer | 17.44 | 20.84 | 17.73 | 20.23 | 23.76 |
| Distribution | 30.11 | 10.28 | 17.67 | 21.94 | 20.00 |
| Commercial banking | 26.27 | 12.13 | 18.67 | 20.83 | 23.76 |
| Insurance | 31.00 | 13.80 | 16.00 | 19.13 | 20.07 |
| Accounting | 24.97 | 22.26 | 15.72 | 17.11 | 19.93 |
| Architecture | 18.61 | 25.62 | 17.11 | 16.49 | 22.17 |
| Engineering | 19.47 | 26.58 | 15.58 | 15.55 | 22.82 |
| Legal | 22.28 | 29.76 | 15.90 | 14.41 | 17.66 |
| Telecommunications | 24.89 | 13.07 | 15.44 | 26.31 | 20.29 |
| Air transport | 24.50 | 14.00 | 23.75 | 20.00 | 17.75 |
| Maritime transport | 35.00 | 25.00 | 12.50 | 14.50 | 13.00 |
| Rail transport | 24.89 | 13.07 | 15.44 | 26.31 | 20.29 |
| Road transport | 35.00 | 15.00 | 25.00 | 20.00 | 5.00 |

Table A. 2.a : Creation of the heterogeneity index.

| | | | country i | | |
|---|---|---|---|---|---|
| | Measures | m1 | m2 | ... | mn |
| | m1 | **(m1,m1)** | m1,m2 | ... | m1, mn |
| country j | m2 | m2, m1 | **(m2,m2)** | ... | m2, mn |
| | ... | ... | ... | ... | ... |
| | mn | mn, m1 | mn,m2 | ... | **(mn, mn)** |

The most important in this table is the cell that forms the diagonal in our matrix. They represent the response (or score) of country i and j on the same measure. For each matrix of country pairs, the diagonal is extracted and each diagonal is a column vector as shown in the table below.

Table A.2.b : Creation of the heterogeneity index by pair of countries.

| | | | | country i | | | | |
|---|---|---|---|---|---|---|---|---|
| Measures | aa | ab | ... | aj | ba | ... | bj | ij |
| 1 | m1,m1 | m1,m1 | ... | m1,m1 | m1,m1 | ... | m1,m1 | m1,m1 |
| 2 | m2,m2 | m2,m2 | ... | m2,m2 | m2,m2 | ... | m2,m2, | m2,m2 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... |
| n | mn,mn | mn,mn | ... | mn,mn | mn,mn | ... | mn,mn | mn,mn |

For each cell in this matrix, a value of 0 is given if the two data are identical, 1 if they are different. Let SCn,ijk, the score on the measure n in sector k of country pair ij. The heterogeneity index for country pair ij in sector k is then defined as :

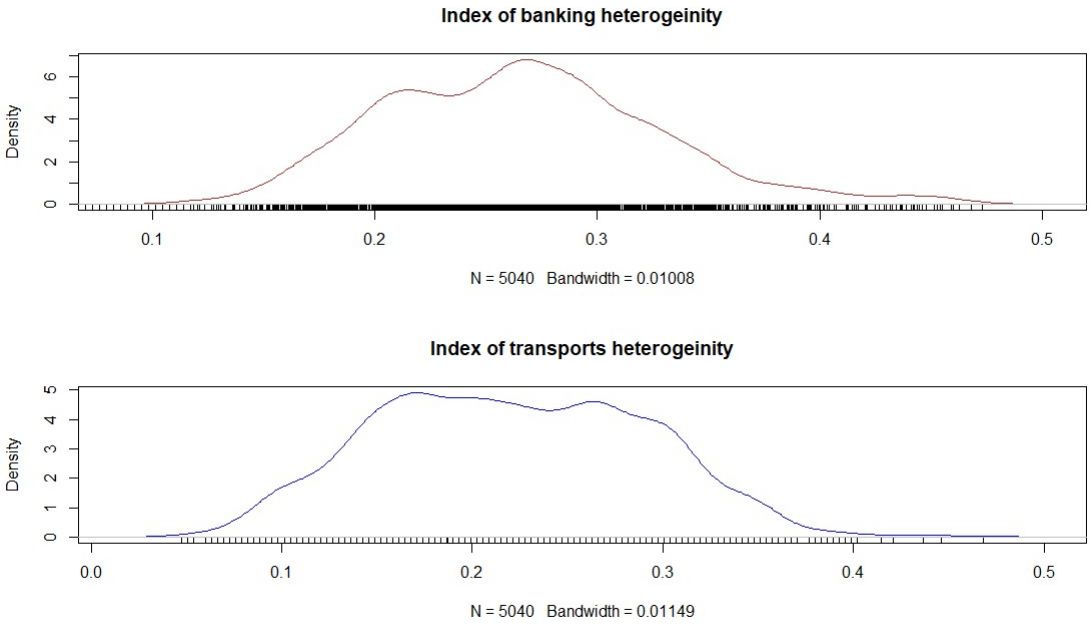
$$IH_{k,ij} = \sum_{n=1}^{m} S_{n,ij}^{k} W_{n}^{k} \tag{23}$$

where w is the assigned weight measurement n in the area as in the case of the STRI of individual restrictions.

Table A.3: Basic statistics of the main control variables used in the estimated model.

| Variables | N | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| STRI bank of importing country | 5,040 | 0.2079965 | 0.0531576 | 0.1241488 | 0.3795677 |
| STRI bank of exporting country | 5,040 | 0.2080044 | 0.0531725 | 0.1241488 | 0.3795677 |
| STRI maritime importing country | 4,201 | 0.2510167 | 0.4533702 | 0.1269136 | 0.2934 |
| HI bank country pair | 5,040 | 0.2654645 | 0.0615928 | 0.1137238 | 0.4729715 |
| HI road transport country pair | 5,040 | 0.2210506 | 0.0702067 | 0.0474684 | 0.4683544 |

Graph A.1: Distribution of OECD countries' banking restriction indices and road transport



Graph A.2: Correlation of the export variable with GDP and regulatory heterogeneity indices.

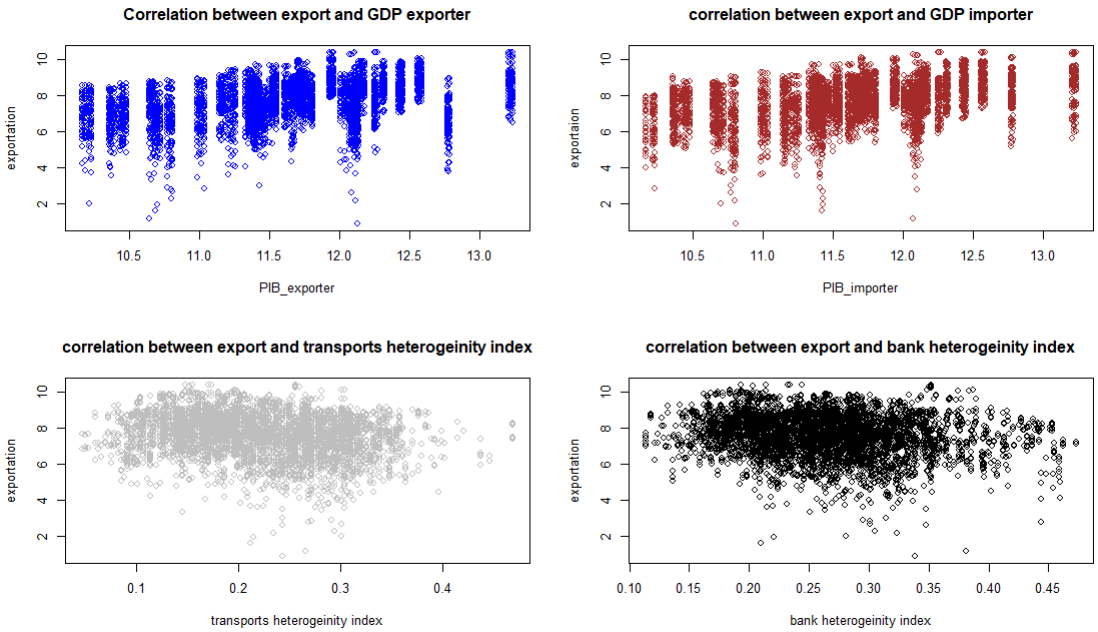


Table A.4: Gravity Estimation Results Using OLS, PPML with individual STRI and regulatory index.

| | OLS 1 | PPML 1 | OLS 2 | PPML 2 |
|---|---|---|---|---|
| Ln GDP exporter | 0.811 *** | 1.543*** | 0.817*** | 1.606*** |
| | (0.02) | (0.05) | (0.02) | (0.05) |
| Ln GDP importer | 0.812*** | 1.748*** | 0.948*** | 1.881*** |
| | (0.02) | (0.06) | (0.02) | (0.06) |
| Dummy: Common language | 0.417*** | -0.0251 | 0.233*** | -0.0980 |
| | (0.05) | (0.10) | (0.05) | (0.09) |
| Dummy: common border | 0.333*** | 0.974*** | 0.465*** | 1.024*** |
| | (0.05) | (0.10) | (0.05) | (0.10) |
| Ln distance | -0.942 *** | -1.326*** | -0.748*** | -0.951*** |
| | (0.03) | (0.09) | (0.03) | (0.09) |
| RTA | 0.291*** | 0.726*** | 0.280*** | 0.716*** |
| | (0.03) | (0.09) | (0.03) | (0.10) |
| STRI importer country (bank) | -0.807*** | 0.741 | | |
| | (0.30) | (0.99) | | |
| STRI exporter country (bank) | 0.266 | -1.407 | | |
| | (0.21) | (0.96) | | |
| STRI importer country(maritime) | -0.108*** | -0.153*** | | |
| | (0.02) | (0.03) | | |
| STRI importer country(road transp) | -1.044*** | -0.623 | | |
| | (0.18) | (0.69) | | |
| Bank heterogeneity | | | -2.009*** | -3.984*** |
| | | | (0.25) | (0.80) |
| Road transport heterogeneity | | | -1.101*** | -1.279* |
| | | | (0.23) | (0.67) |
| Exporter year fixed effect | Yes | Yes | Yes | Yes |
| Importer year fixed effect | Yes | Yes | Yes | Yes |
| Year fixed effect | Yes | Yes | Yes | Yes |
| $R^2$ | 0.613 | 0.696 | 0.590 | 0.699 |
| Observations | 4184 | 4191 | 5010 | 5025 |

Note: Stars indicate the sign level of the related estimates
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.5: Gravity Estimation Results Using OLS and PPML with our interaction terms.

| | OLS1 | OLS2 | PPML1 | PPML2 | PPML3 |
|---|---|---|---|---|---|
| Ln GDP exporter | 0.763*** | 0.761*** | 1.523*** | 1.548*** | 1.710*** |
| | (0.02) | (0.02) | (0.05) | (0.04) | (0.04) |
| Ln GDP importer | 0.896*** | 0.894*** | 1.780*** | 1.813*** | 1.992*** |
| | (0.02) | (0.02) | (0.05) | (0.05) | (0.05) |
| Dummy: Common language | 0.304*** | 0.298*** | 0.132 | 0.110 | 0.169** |
| | (0.05) | (0.05) | (0.09) | (0.08) | (0.07) |
| Dummy: Common border | 0.479*** | 0.512*** | 0.987*** | 0.113*** | 0.994*** |
| | (0.05) | (0.05) | (0.10) | (0.10) | (0.08) |
| Ln distance | -0.816*** | -0.803*** | -1.337*** | -1.176*** | –0.736*** |
| | (0.03) | (0.03) | (0.09) | (0.09) | (0.08) |
| RTA∗Bank heterogeneity | 0.167* | | 0.816** | | |
| | (0.09) | | (0.34) | | |
| EU∗Bank heterogeneity | 1.645*** | | 1.994*** | | |
| | (0.13) | | (0.24) | | |
| RTA∗transport heterogeneity | | 0.303*** | | 1.205*** | |
| | | (0.11) | | (0.35) | |
| EU∗transport heterogeneity | | 2.272*** | | 3.781*** | |
| | | (0.17) | | (0.31) | |
| RTA | | | | | 0.488*** |
| | | | | | (0.10) |
| EU | | | | | 0.816*** |
| | | | | | (0.06) |
| Bank heterogeneity | | | | | -9.279*** |
| | | | | | (1.21) |
| Bank heterogeneity ∗STRi | | | | | 10.56*** |
| | | | | | (2.17) |
| Bank heterogeneity∗STRj | | | | | 11.16*** |
| | | | | | (2.51) |
| Exporter year fixed effect | Yes | Yes | Yes | Yes | Yes |
| Importer year fixed effect | Yes | Yes | Yes | Yes | Yes |
| Year fixed effect | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.584 | 0.585 | 0.693 | 0.722 | 0.768 |
| Observations | 5009 | 5009 | 5024 | 5024 | 5024 |

Note: Stars indicate the sign level of the related estimates
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

# References


[1] **Anderson, J. E. and Van Wincoop, E**. 2003. "Gravity with gravitas: A solution to the border puzzle". *T*he American Economic Review.

[2] **Anderson, J. E. and Van Wincoop, E**. 2004. "Trade costs". *Journal of Economic Literature.*

[3] **Anderson, J. E. and Yotov, Y. V**. 2012. "Gold standard gravity". Technical report, *National Bureau of Economic Research.*

[4] **Ariu, A. Mayneris, F. and Parenti, M**. 2018. "One way to the top: How services boost the demand for goods". Technical report, *CEPR Discussion Papers.*

[5] **Baldwin, R., Skudelny, F. and Taglioni, D**. 2005. "Trade Effects of the Euro, Evidence from Sectoral Data". *Frankfurt am Main: European Central Bank*

[6] **Benz, S**. 2017. "Services trade costs : tariff equivalents of services trade restrictions using gravity estimation". *OECD Working Paper on Trade Policy, No. 196, OECD Publishing, Paris.*

[7] **Bertho, F .Borchert, I. and Aaditya, M**. 2014. "The Trade-Reducing Effects of Restrictions on Liner Shipping". *Policy Research Working Paper.*

[8] **Borchert, I. Batshur, G. and Aaditya, M.** 2012. "Guide to the Services Trade Restrictions Database". *World Bank Policy Research Working Paper WPS6108,.*

[9] **Chaney, T**. 2008. "Distorted Gravity: The Intensive and Extensive Margins of International Trade" . *American Economic Review 2008*, 98:4,1707 â 1721.

[10] **CEPII**. 2005. "Geographic and Bilateral Distance Database". Paris: Centre dâEtudes Prospectives et dâInformations Internationales.

[11] **Deardorff, Alan V. and Robert M, Stern**. 2008. "Empirical Analysis of Barriers to International Services Transactions and the Consequences of Liberalization", in a Handbook of International Trade in Services, *ed. by Aaditya Mattoo, Robert M. Stern, and Gianni Zanini (New York: Oxford University Press).*

[12] **Eaton, J and Kortum, S**. 2002. "Technology, Geography, and Trade". *Econometrica* ,vol.70, NÂ°5, 1741-1779.

[13] **Fontagne Lionel, Amelie Guillin and Cristina Mitaritonna**. 2011. "Estimation of Tariff Equivalents for the Services Sectors" . *CEPII working paper* NÂ°2011-24.

[14] **Fontagne, L. Mitaritonna, C. and Signoret, J**. 2016. "Estimated Tariff Equivalents of Services NTMs". *CEPII Working Paper.*

[15] **Fukunari KimuraHyun-Hoon Lee**. 2006. "The Gravity Equation in International Trade in Services". *Review of World Economics,* Volume 142, pp 92 - 121.

[16] **Geloso Grosso M. and al**. 2015. " Services Trade Restrictiveness Index (STRI): Scoring and Weighting Methodology ". OECD Working Papers on Trade Policy, NÂ°177, *OECD Publishing*, Paris.

[17] **Gooris, J and Mitaritonna, C** .2015. "Which import restrictions matter for trade in services ?". *CEPII Working Paper*, NÂ°2015-33, december 2015.

[18] **Head, K. Mayer, T. Ries, J.** 2009. "How remote is the offshoring threat?". *European Economic Review* 53(4), 429-444.

[19] **Heckman J.** 1979: "Sample Selection Bias as a Specification Error ", Econometrica, 47(1): 153-161.

[20] **Helpman, E., Melitz, M., and Rubinstein, Y.** 2008. "Estimating trade flows: Trading partners and trading volumes". *The Quarterly Journal of Economics* , 123(2):441487.

[21] **Hoekman, B. and Shepherd, B**. 2015. "Services, firm performance, and exports. The case of the East African Community". *International Growth Centre*, Working paper.

[22] **Ingo, B. Batshur, G and Aaditya, M**. 2012. "Policy Barriers to International Trade in Services" . *OECD Publishing.*

[23] **IMF**. 2017. "Promoting Inclusive Growth". IMF Annual Report 2017.

[24] **Jacks, D. S., Meissner, C. M. and Novy, D**. 2008. "Trade costs, 1870-2000". *American Economic Review: Papers and Proceedings 98(2): 529â34.*

[25] **Jafari, Y and Tarr, D.** 2014. "Estimates of ad valorem equivalents of barriers against foreign suppliers of services in eleven services sectors and 103 countries ". *Policy Research Working Paper.*

[26] **James E. Anderson**. 1979. "A Theoretical Foundation for Gravity Equation". *American Economic Review* 69(1):106-16.

[27] **Jeffrey Bergstrand**. 1989. "The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade". *The Review of Economics and Statistics*, vol. 71, issue 1, 143-53.

[28] **Kox, Henk L.M. and Nordàs, Hildegunn Kyvik**. 2007. "Services trade and domestic regulation" MPRA Paper 2116, *University Library of Munich*, Germany.

[29] **Krugman, P**. 1980. "Scale Economies, Product Differentiation, and the Pattern of Trade". *The American Economic Review*, Vol. 70, NÂ°5, pp. 950-959.

[30] **Martìnez-Zarzoso I, Nowak-Lehmann F, Vollmer S**. (2007). "The log of gravity revisited (in revision)". *CEGE Discussion Paper 64, University of Gottingen.*

[31] **Mayer, T and Zignago, S**. 2011. "Notes on CEPII's distances measures: The GeoDist database". *CEPII, Working Paper* ,2011-25.

[32] **Nordàs, HK and Rouzet, D**. 2015. "The Impact of Services Trade Restrictiveness on Trade Flows". *OECD Publishing.*

[33] **Nordàs, HK**. 2016. "Services Trade Restrictiveness Index (STRI): The Trade Effect of Regulatory Differences". OECD Trade Policy Papers, NÂ°189, *OECD Publishing*, Paris.

[34] **Novy, D**. 2009. "Gravity redux: measuring international trade costs with panel data". *University of Warwick.*

[35] **Park, S.C**. 2002. "Measuring Tariff Equivalents in Cross-Border Trade in Services". Trade Working Papers no. 353. *East Asian Bureau of Economic Research.*

[36] **Riker, D**. 2015. "Domestic Regulations and U.S. Exports". U.S. International Trade Commission, *Office of Economics, Research Division.*

[37] **Rouzet, D. and F. Spinelli**. 2016. "Services Trade Restrictiveness, Mark-Ups and Competition". OECD Trade Policy Papers, No. 194. *OECD Publishing, Paris.*

[38] **Rouzet, D and al**. 2014. "Services Trade Restrictiveness Index (STRI)"w: Financial Services. *OECD Publishing.*

[39] **Santos Silva, J and Silvana Tenreyro**. 2006. "The Log of Gravity". *The Review of Economics and Statistics*, 88(4): 6416-658.

[40] **Schwellnus C**. 2007. "The Effect of Domestic Regulation on Services Trade Revisited". *CEPII Working Papers* nÂ°2007-08, mai, 39 p.

[41] **Tamar Khachaturian**. 2015. " Services Trade Restrictions and Company Profits: Telecommunications". *United States International Trade Commission: Office of Industries Working Paper* ID-042 November 2015.

[42] **Tamar Khachaturian**. 2018. "Trade Restrictions and Modes of Supply in Services Trade". *Office of Industries Working Paper* ID-05.

[43] **UNCTAD**. 2010. "Employment, globalization and development". Trade and development report, United Nations.

[44] **UNCTAD**. 2013. "Non-Tariff Measures to Trade: Economic and Policy Issues for Developing Countries". New York and Geneva: United Nations.

[45] **Van der Marel, Erik and Shepherd Ben**. 2013. "Services Trade, Regulation and Regional Integration: Evidence from Sectoral Data". *World Economy* 36, nÂ° 11 (2013): 1393-1405.

[46] **Whalley, J**. 2004. "Assessing the Benefits to Developing Countries of Liberalisation in Services Trade". *The World Economy.*

[47] **World Trade Organization** . 2005. "Analysis of the links between trade, trade standards and the WTO". *World Trade Report, WTO.*