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Please cite this paper as:

Nordås, H. (2016-05-13), "Services Trade Restrictiveness Index (STRI): The Trade Effect of Regulatory Differences", *OECD Trade Policy Papers*, No. 189, OECD Publishing, Paris. http://dx.doi.org/10.1787/5jlz9z022plp-en



OECD Trade Policy Papers No. 189

Services Trade Restrictiveness Index (STRI): The Trade Effect of Regulatory Differences

Hildegunn Kyvik Nordås



OECD TRADE POLICY PAPERS

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SERVICES TRADE RESTRICTIVENESS INDEX: THE TRADE EFFECT OF REGULATORY DIFFERENCES

Hildegunn Kyvik Nordås, OECD

This paper presents indices of regulatory heterogeneity based on the rich information in the STRI regulatory database. The indices are built from assessing – for each country pair and each measure – whether or not the countries have the same regulation. For each country pair and each sector, the indices reflect the (weighted) share of measures for which the two countries have different regulation. Estimates of the relationship between regulatory heterogeneity and trade shows that on average a reduction in the regulatory heterogeneity by 0.05 points is associated with 2.5% higher services exports and that the impact is larger the lower the level of trade restring regulation. The trade costs associated with the average score on the regulatory heterogeneity index (0.26) amounts to an ad valorem equivalent trade cost of between 20 and 75% at low levels of the STRI. Regulation has become slightly more similar from 2014 to 2015 in telecommunications. For the other sectors, countries have become slightly less similar over the same period.

Keywords: Regulatory cooperation, trade in services, trade costs

JEL: F13, F15, F42, F53

Acknowledgments

The author would like to thank Sebastian Benz, Carmel Cahill, John Drummond, Peter Egger, Henk Kox, Håkan Nordstrøm, Dorothée Rouzet and Frank van Tongeren for useful comments and inputs. The paper benefitted from discussions in the OECD Working Party of the Trade Committee, which has agreed to make the study more widely available through declassification on its responsibility

Table of contents

Executive summary 4
Introduction 4
Relation to previous work 6
Methodology 7
The impact of regulatory heterogeneity on trade and investment flows 13
Concluding remarks 20
References 22
Annex: The heterogeneity indices 23

Tables

Table 1. Summary statistics, regulatory heterogeneity 11
Table 2. Services exports by partner and regulatory levels and heterogeneity, pooled all sectors 16
Table 3. Regulatory heterogeneity and trade by sector 20
Table A1a. Creating the heterogeneity indices 23
Table A1b. Creating the heterogeneity indices 23
Table A3. Countries included in the FDI gravity regressions 24

Figures

Figure 1. STRI by sector 7
Figure 2. STRI Architecture: Australia and Latvia 10
Figure 3. Marginal effect of policy change 17

Executive summary

This paper presents indices of regulatory heterogeneity and estimates of the trade costs associated with regulatory heterogeneity.

As explicit barriers to trade in services come down, trade agreements increasingly focus on behind the border barriers to trade and investment and on regulatory cooperation. Quantifying the impact of such provisions is more challenging than past agreements that aimed at bringing down tariffs and other border measures. New policy questions require new tools and this study proposes a methodology for analysing the impact of regulatory cooperation.

The tool is based on the rich information in the Services Trade Restrictiveness Index (STRI) regulatory database and captures the underlying variation in the STRIs in an intuitive way. For each country pair and each sector in the STRI database a regulatory heterogeneity index is calculated on the basis of the share of measures for which the two countries have the same regulation. Two versions of the regulatory heterogeneity index are calculated, one based on the qualitative answers in the STRI database, the other on the scores.

Like the STRI indices, the regulatory heterogeneity indices take values between zero and one. If two countries have the same answer on all the measures, their bilateral heterogeneity index is zero, if they have different answer to all measures they have a heterogeneity index of one. Note that it does not matter whether the answers imply a trade restriction or not. Thus, a country pair where both countries are completely closed to foreign trade may have a heterogeneity index of zero. This adds a new dimension to trade policy analysis and facilitates the quantification of regulatory cooperation also when the level of trade restrictiveness is not changed.

Fist estimates of the relationship between regulatory heterogeneity and trade shows that regulatory heterogeneity has a negative impact on services trade flows, over and above the impact of services trade restrictions. On average a reduction in the regulatory heterogeneity by 0.05 points is associated with 2.5% higher services exports.

Further, improved regulatory coherence has a larger trade impact when the level of trade restrictiveness is low. However, harmonising on a high level of regulation could curtail trade. The trade costs associated with the average score on the regulatory heterogeneity index (0.26) amounts to an ad valorem equivalent of between 20 and 75% at low levels of the STRI.

It is concluded that trade agreements are most likely to stimulate services trade when: i) the parties have a similar regulatory framework; ii) the first step of implementation is to reduce the level of trade restrictiveness to significantly below 0.4 where such high levels of restrictiveness exist; iii) reducing the level of restrictions goes hand in hand with forward-looking regulatory cooperation; iv) regulatory cooperation becomes more prominent as the level of trade restricting regulations comes down; and v) ways are found to make sure that regulatory cooperation successfully eliminates duplication of regulatory compliance costs for exporters in the areas covered by the agreement.

Introduction

Services trade restrictions are largely behind the border and in many cases apply to local as well as foreign firms. Examples of such regulations are requirements that board members must be residents, firms must have a certain organisational form, or the criteria for obtaining a license may implicitly or explicitly favour local firms or individuals. In the event of different regulations, enterprises servicing multiple markets need to comply with different requirements and procedures and duplicate compliance costs in each market, even when the regulation per se may not be a concern. In the worst case scenario, complying with regulation of one country may break the law in another country.

Recognising that SMEs in particular can ill afford multiple compliance costs, there is increasing focus on regulatory cooperation with the objective of, at a minimum, avoiding unnecessary divergence in future regulation. Some 21st century trade and investment agreements have chapters on mutual recognition of qualifications, compliance assessments and regulatory cooperation in specific areas. For instance, the statement after the 11th round of negotiation in TTIP by the European chief negotiators affirms the importance of regulatory cooperation to simplify the life of companies, particularly the small ones. It is also emphasised that regulatory cooperation does not imply reducing the level of consumer protection and the independence of regulators, but rather the objective is to help regulators to become more efficient.[1]

The recently concluded Trans Pacific Partnership also has a chapter on regulatory coherence, defined as …"*the use of good regulatory practices in the process of planning, designing, issuing, implementing and reviewing regulatory measures in order to facilitate achievement of domestic policy objectives, and in efforts across governments to enhance regulatory cooperation in order to further those objectives and promote international trade and investment, economic growth and employment"*[Article 25.2.1].

Regulatory cooperation across international borders is not new. For instance financial market stability and safety in aviation have been subject to regulatory cooperation for decades and there is a host of regulatory initiatives across the globe. An OECD synthesis report (OECD, 2013) identifies a ladder of international cooperation of increasing ambition. It has 12 rungs from non-binding and loose mechanisms such as exchange of information among regulatory bodies at the bottom to binding agreements at the top. Regulatory cooperation also takes place at the OECD, for instance through its Regulatory Policy Committee, with renewed attention to international regulatory cooperation following the economic crisis staring in 2008. The trade dimension – looking at regulatory cooperation as an instrument for better functioning international markets, avoiding unnecessary compliance costs of operating in several markets – have also become more prominent over time, as reflected by the joint meeting of the Regulatory Policy Committee and the Trade Committee in November 2015.

Little systematic analysis of the economic effect of international regulatory cooperation has taken place hitherto. This study contributes to filling this gap by proposing a methodology for quantifying regulatory heterogeneity and demonstrating how it can be used for estimating the gains from regulatory cooperation, using the raw data contained in the Service Trade Restrictiveness (STRI) database. [2] The study presents and describes bilateral indicators of regulatory heterogeneity and provides a first assessment of how regulatory differences contribute to trade costs in their own right. This aspect has become essential in evaluating the impact on 21st century trade agreements. Moreover, as the border restrictions on services trade and investment come down, regulatory cooperation could make the most significant contribution to reducing services trade costs going forward.

1. See http://trade.ec.europa.eu/doclib/press/index.cfm?id=1389.

2. The STRI database, indices, methodology, country notes, sector notes etc. are available at http://oe.cd/stri.

The rest of the study is organised as follows: Section 2 provides a brief background. Section 3 presents the methodology for calculating the regulatory heterogeneity indices in a non-technical way, and Section 4 describes the indices. Section 5 presents estimates of the trade effect of regulatory heterogeneity conditioned on the level of regulation while Section 6 concludes.

Relation to previous work

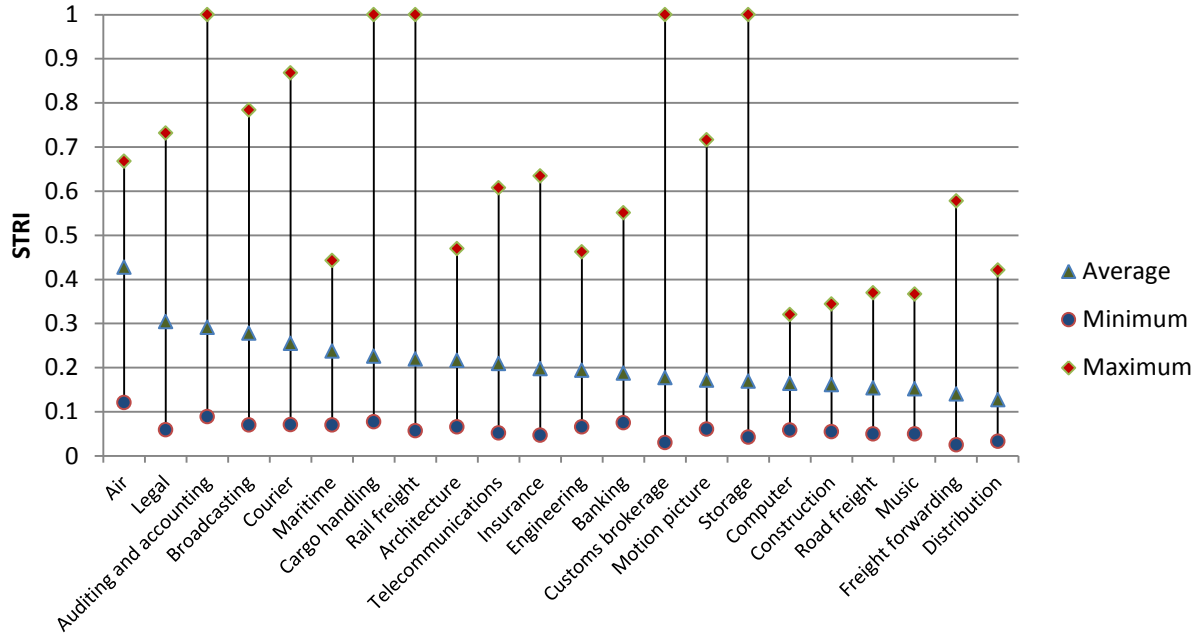
The regulatory heterogeneity indices are developed from the OECD STRI database. The STRIs reflect de jure services trade restrictions which are catalogued, scored and weighted to produce composite indices taking values between zero and one. Zero represents a fully open sector and one a completely closed market. The indices are calculated for 22 services sectors for the 34 OECD member countries plus Brazil, China, Colombia, India, Indonesia, Latvia, Russia and South Africa, 42 countries in all. The measures in the database are organised under five policy headings:

- ***Restrictions on foreign entry*** include information on foreign equity limitations, requirements that management or the board of directors must be nationals or residents, foreign investment screening, restrictions on cross-border mergers and acquisitions, capital controls and a number of sector-specific measures.
- ***Restrictions on movement of people*** include information on quotas, labour market tests and duration of stay for foreign natural persons providing services as intra-corporate transferees, contractual services suppliers or independent service suppliers. These categories are covered by the GATS and have in common that the natural persons do not seek employment in the host country. This policy area also contains information on recognition of foreign qualifications in regulated professions.
- ***Other discriminatory measures*** include discrimination of foreign services suppliers e.g. as far as taxes, subsidies and access to public procurement are concerned; and instances where national standards differ from international standards where relevant.
- ***Barriers to competition*** include information on anti-trust policy, government ownership and the extent to which government owned enterprises enjoy privileges and are exempted from competition laws and regulations. Sector-specific pro-competitive regulation in network industries also falls under this category.
- ***Regulatory transparency*** includes information on consultations and publications prior to entering into force of laws and regulations. It also records information on administrative procedures related to establishing a company, obtaining a license or a visa.

Figure 1 shows the mean, maximum and minimum STRIs where sectors are ranked by the sample mean. Sectors not only vary in terms of the average restrictiveness, but also as far the dispersion of restrictiveness is concerned. The average score is the highest in air transport services and the lowest in distribution services. Computer services are the sector with the lowest dispersion. In four sectors one or more countries are completely closed to foreign services providers, with a score of one. These sectors, auditing and accounting, cargo handling, customs brokerage, storage and warehousing, and rail freight services, have the highest dispersion on the STRI. The regulatory heterogeneity index shows that there is also a wide dispersion in the composition of the indices, and that such dispersion signifies a different dimension only weakly related to the dispersion of the overall STRI indices.

Figure 1. STRI by sector

Minimum, mean and maximum scores



Source: OECD STRI database for 42 countries.

The first study to develop regulatory heterogeneity indices analysed the impact of the European Union services directive (Kox and Lejour, 2006). It used the OECD Product Market Regulation (PMR) survey to calculate heterogeneity indices by establishing for each country pair and each measure whether or not the two countries had the same answer. The study found that the services directive would increase intra-EU services trade by 30-62% and intra-EU services FDI by 18-32%. Most of the gains would come from harmonisation of regulation, particularly in the areas of barriers to competition and barriers to trade and investment.

These estimates were based on an early draft of the services directive, which envisaged that, with few exceptions, licenses, permits and standards in the home country of the services provider would be valid across the single market for all the sectors covered by the directive. This so-called country of origin principle met strong resistance and was dropped from the final directive. A subsequent study removing the country-of-origin element reduced the impact of the services directive by approximately a third compared to the original estimate (De Bruijn et al. 2008).

Twenty-first century trade agreements increasingly aim at reducing regulatory barriers to trade both in goods and services. The most common approaches are mutual recognition of qualifications, standards and licenses, regulatory equivalence, regulatory cooperation, particularly in a forward looking setting aiming at convergence in future regulation. As noted, it has not been possible to quantify the impact of such provisions, which are mainly negotiated bilaterally or regionally. The methodology developed here, creating indices of bilateral dissimilarities, will help to fill this gap.

Methodology

The STRI database records information on regulation relevant for services trade in great detail for 22 services sectors in 42 countries. It is organised into a list of standardised questions or measures to which answers are found in the laws and regulations of the countries. Great care has been taken to ensure that the questions are interpreted the same way across countries with different legal systems

and a different overall regulatory framework that may affect the interpretation of individual measures. Having collected detailed and standardised information on each country and sector, mapping of regulatory differences and similarities can readily be done.

A bottom up approach to analysing regulatory heterogeneity is to compare countries pairwise, measure by measure and sector by sector. For this purpose a matrix where each cell contains the answer to a specific measure in the STRI database for a pair of countries is created. The symbols *i* and *j* are assigned to the countries and *m* to the measures. Each cell in the matrix contains the answer to measure *m* of countries *i* and *j*. If the country pair has the same answer to the measure, the cell is scored zero. If the two countries have a different answer, the cell is scored one.

To give an example, consider the measure "Board of directors: majority must be residents"; and consider four countries: Australia, Austria, Iceland and Norway. Australia and Austria do not have this requirement, while Iceland and Norway do. The heterogeneity index will score the country pairs Australia and Austria, and Iceland and Norway zero on this measure, since they have the same answer, while Austria and Norway, Australia and Norway, Austria and Iceland, and Australia and Iceland will be scored one since they have different answers.

For each country pair and each sector the heterogeneity index is created by calculating a weighted average of these scores, assigning the same weight to each measure as in the STRI indices. This procedure produces 41 indices for each country and sector – one bilateral index for each of the other countries in the database. The total number of heterogeneity indices for each sector is 861 i.e. (42*(42-1)/2).[3] Summary results are presented here, while the bilateral indices can be downloaded from the OECD trade portal.

The heterogeneity indices can also be based on the scores assigned to each measure. They are calculated the same way as the answer-based indices with the only difference being that if the country pair in the cell has the same *score* on measure *m,* the cell is scored zero, otherwise it is scored one. Although closely related, the two methodologies are not the same. In the example above, Austria and Australia have a score of zero on the board of directors measure, while Iceland and Norway have a score of one. In this case the heterogeneity indices are the same whether based on the qualitative information or the score.

There are, however, many cases where countries have the same answer, but still a different score on a measure, or vice versa, due to differences in market structure or the overall regulatory framework. For example, in telecommunications, ex ante regulation is considered best practice in markets dominated by a supplier with significant market power. In such cases, imposing access obligations at regulated prices on firms with significant market power, and transparency measures to ensure that the regulation can be enforced eases the entry of new firms and is scored zero, and lack of such procompetitive regulation is scored one. In competitive markets, on the other hand, ex-ante regulation is unnecessary and a burden on firms. Lack of ex-ante pro-competitive regulation is scored zero under this scenario. Heterogeneity indices based on scores will not record the difference in regulation in these two scenarios, while a heterogeneity index based on answers will.

Even if both regulatory stances are considered best practice under the circumstances, the difference in regulation may still add compliance costs for telecommunications firms operating in two markets. Consider for instance a company operating in a competitive environment with no ex-ante regulation in its home country. If this company wants to enter a foreign market subject to ex ante regulation it may need to provide the regulator with cost accounting and/or separate accounts for network and services, a practice that it may have had little experience with in its home market.

3. Since the heterogeneity indices are symmetric, e.g. the index is the same for Australia and Austria as for Austria and Australia, the total number of unique heterogeneity indices reflect the number of cells below the diagonal in a 42*42 country matrix. The STRI for maritime transport services includes 36 countries as landlocked countries are not included.

The heterogeneity indices based on answers and scores also differ significantly in cases where the STRI hierarchy scoring system kicks in.[4] Some examples illustrate the point. Luxembourg and Poland both have nationality requirements for obtaining a license for lawyers and in addition only licensed lawyers may provide legal services and own shares in law firms. For this reason alone, they are completely closed to foreign lawyers.[5] Since all measures are automatically scored one in this case, the heterogeneity index based on scores is zero. However, the two countries have quite different regulations on other measures, and the regulatory heterogeneity index based on answers is 0.285.

Another example is Israel and India in the rail freight sector. Both countries have a state monopoly in the sector and neither offer transit rights. Therefore, the STRI is one for both countries, and the heterogeneity index based on scores is zero. However, looking at the details, railways are regulated quite differently in the two countries and the heterogeneity index is 0.226 based on the answers. In such extreme cases the heterogeneity index based on answers are better at picking up the nuances than those based on scores.

Behind the border regulatory nuances may not matter if foreign suppliers cannot enter the market in the first place. However, should countries embark on unilateral liberalisation or enter into RTAs eliminating the most significant barriers to trade and investment, the regulatory differences become relevant and can be readily assessed using the STRI answer-based heterogeneity indices. This will also help assess to what extent additional reforms are needed to gain meaningful market access if the main restriction is removed.

In the less extreme cases where the hierarchy scoring kicks in for a limited set of measures, the heterogeneity indices based on scoring may pick up the nuances better than those based on answers. Consider for example a country that does not allow majority foreign equity in a sector. This will trigger scoring of one on a number of measures related to foreign establishment through a subsidiary whether or not these are explicitly mentioned in laws and regulations. For instance, the question whether the majority of the board members need to be residents becomes redundant, since local owners appoint the majority of board members anyway.[6] When there are no explicit additional restrictions on foreign entry, the qualitative answers will only capture the differences in foreign equity limitation.

To further illustrate how the heterogeneity indices work, consider the example of Australia and Latvia in architectural services. The two countries have about the same STRI value (0.1574 and 0.1575 respectively). Architects are a regulated profession in both countries. Figure 2 shows, however, that they have quite different regulatory profiles. In Latvia *Regulatory transparency* contributes significantly to the index, while this policy area has no restrictions in Australia, which has more restrictions under *Restrictions on foreign entry* and *Restrictions on movement of people*. Looking further into the details, the two countries have different answers to 14 out of 63 measures which give a regulatory heterogeneity index of 0.33 based on answers and 0.25 based on scores. Half of the measures on which the two countries have different scores are under *Restrictions to movement of people*.[7] For instance Australia requires a local exam and local practice to obtain a license to work as

4. See Geloso Grosso et al. (2015) for a description of the scoring methodology.

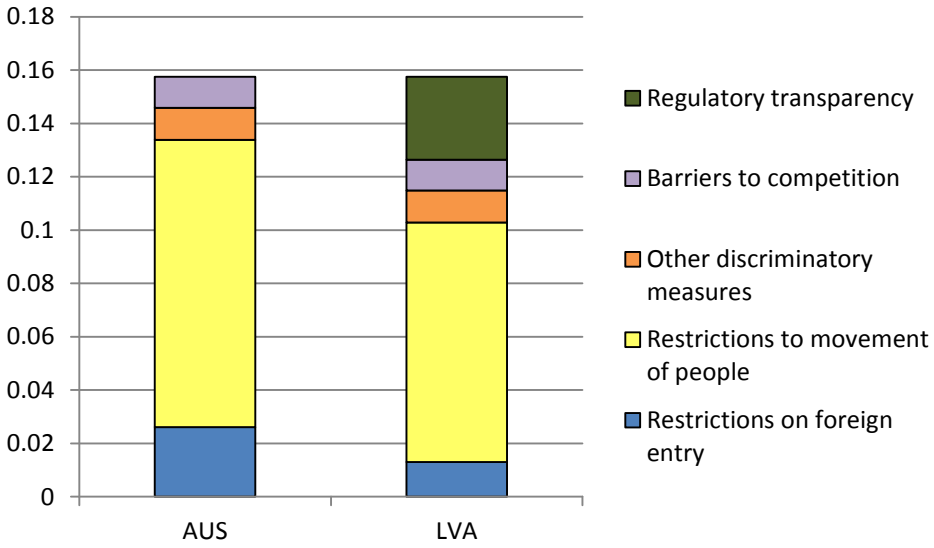
5. Both Luxembourg and Poland have procedures in place for recognising the qualifications and issue licenses to lawyers from other EEA countries, but since the STRI database is based on MFN regulations, it is not reflected in the indices.

6. Also local owners may want to appoint non-resident board members, but this is not taken into account in the scoring system.

7. Being a skilled labour-intensive sector, restrictions on movement of people are assigned a relatively high weight in the STRI indices for architecture. This explains why the regulatory heterogeneity index is higher than the un-weighted share of measures on which the two countries have different answers or scores (14 out of 63 account for 22%).

an architect. Once a license is obtained a foreign architect may join the local professional organisation. A temporary license is also available for foreign architects. Latvia, in contrast, does not require a local exam or local practice, but a license does not automatically give the right to join the local professional organisation and a temporary licence is not available. On the other hand, foreign architects can use the title "architect" in Latvia, but not in Australia. Under barriers to competition Australia limits foreign architects' advertising, while Latvia regulates fees. This example shows that having the same value on the STRI may conceal quite different underlying regulation and thus that the heterogeneity indices provide useful additional information.

Figure 2. STRI Architecture - Australia and Latvia



A final refinement could take into account preferential agreements. Recall that the discriminatory measures in the STRI database are based on regulations that apply on an MFN basis. This is the only practical and consistent way of creating country-specific indices. The regulatory heterogeneity indices, in contrast, record information at a country pair level, which opens the possibility for capturing preferential agreements. To do so, detailed information on the commitments in RTAs is needed, but as has been documented in several studies (Adlung and Morris, 2010; Adlung and Miroudot, 2012) RTAs typically do not go beyond, at best, binding existing levels of openness. Using existing regulation that applies on an MFN basis should therefore give a fairly accurate description of both the level and the differences in services trade restrictions.[8]

8. The European Union is however an exception. The single market in principle eliminates most discriminatory measures between EU and mostly also EEA members. More careful analysis could be undertaken to determine which measures in the STRI are covered by EC regulation, which are covered by EC directives leaving space for individual country adjustments and which are under the auspices of individual governments. A separate paper would be needed to do justice to this perspective. For now, intra-EU liberalisation is captured in the impact analysis by introducing an EU dummy.

Results

The heterogeneity indices can be understood as the proportion of the STRI measures, weighted by the importance of the policy area under which they fall, for which a country pair has different regulation. The average for all country pairs by sector is presented in Table 1. At the moment of writing the STRI indices are available for 2014 and 2015 for seven sectors and for 2014 only for the other sectors.[9] Panel A present the indices for 2015 for the updated sectors, and Panel B shows the heterogeneity indices for 2014 for the sectors not yet fully updated. On average heterogeneity indices based on scores are slightly lower than those based on answers, but the standard deviation is higher, the minimum lower and the maximum larger.

Table 1. Summary statistics, regulatory heterogeneity, latest available data

Panel A. calculated on regulation updated to 2015

	Based on answers				Based on scores			
	Mean	Std. Dev	Min	Max	Mean	Std. Dev	Min	Max
Construction	0.275	0.075	0.090	0.536	0.246	0.080	0.065	0.522
Computer services	0.319	0.072	0.094	0.585	0.255	0.076	0.052	0.564
Accounting	0.289	0.073	0.111	0.563	0.322	0.146	0.052	0.857
Architecture	0.314	0.067	0.092	0.556	0.296	0.090	0.027	0.605
Engineering	0.296	0.065	0.090	0.522	0.281	0.088	0.047	0.555
Legal services	0.318	0.062	0.114	0.502	0.392	0.174	0.000	0.872
Telecommunications	0.288	0.094	0.092	0.585	0.301	0.114	0.048	0.627

Panel B. calculated on regulation in force in 2014

	Based on answers				Based on scores			
	Mean	Std. Dev	Min	Max	Mean	Std. Dev	Min	Max
Broadcasting	0.322	0.115	0.095	0.688	0.341	0.139	0.056	0.766
Motion pictures	0.267	0.076	0.057	0.514	0.256	0.120	0.059	0.718
Sound recording	0.277	0.071	0.062	0.489	0.237	0.071	0.047	0.470
Courier	0.266	0.072	0.088	0.461	0.245	0.099	0.069	0.646
Distribution	0.208	0.084	0.048	0.460	0.183	0.081	0.022	0.418
Commercial banking	0.279	0.105	0.116	0.604	0.252	0.111	0.062	0.557
Insurance	0.252	0.131	0.064	0.667	0.248	0.125	0.041	0.656
Cargo handling	0.253	0.068	0.097	0.476	0.234	0.094	0.049	0.515
Customs brokerage	0.265	0.068	0.075	0.462	0.252	0.156	0.054	0.946
Freight forwarding	0.232	0.062	0.073	0.419	0.205	0.096	0.045	0.595
Storage and warehousing	0.235	0.067	0.067	0.480	0.210	0.086	0.042	0.562
Air transport	0.211	0.110	0.039	0.511	0.247	0.144	0.024	0.648
Maritime transport	0.291	0.077	0.096	0.563	0.309	0.092	0.090	0.643
Rail freight	0.239	0.084	0.049	0.470	0.264	0.179	0.000	0.955
Road freight	0.195	0.067	0.032	0.426	0.197	0.097	0.022	0.574

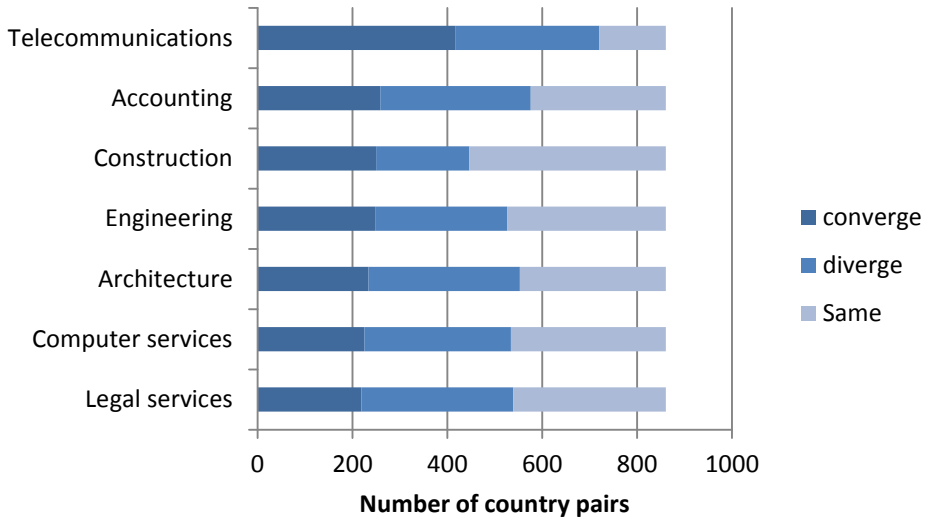
Notes: The number of observations on bilateral heterogeneity is n(n-1). Landlocked countries are not included in the maritime index, Iceland and Colombia are not included in the rail transport index. The correlation coefficient between the heterogeneity index based on answers and scores is 0.73, significant at a 0.1% level. The highest correlation is for cargo handling at 0.88 and the lowest for customs brokerage at 0.51.

9. Indicators for the years 2014, 2015 and 2016 will be available for all sectors by the end of 2016.

The three highest average indices of regulatory heterogeneity are found in broadcasting, legal services and computer services for answer-based indices. Recall from Figure 1 that computer services is the sector with the lowest dispersion of the overall STRI index, underscoring that regulatory heterogeneity captures a completely different dimension. For the scores-based heterogeneity indices, legal services, broadcasting and maritime transport have the most heterogeneous regulation. The lowest average heterogeneity indices are found in road transport and distribution services, two sectors that also have low average STRI indices. Note, however, that also air transport is subject to relatively similar trade policy measures although this is the on average most restrictive services sector included in the STRI database.[10]

Regulatory cooperation is introduced in a number of recent trade agreements and agreements currently under negotiations, aiming at easing the burden of complying with different regulations across countries for exporters. The STRI regulatory heterogeneity indices can be used for monitoring progress in this area. Figure 3 tracks the changes in regulatory heterogeneity from 2014 to 2015 for the sectors where information for two years is available. From a regulatory coherence point of view the development seems to be going in the wrong direction. On average a larger number of country pairs have become less similar than more similar. The notable exception is telecommunications where regulations have converged for about half the country pairs.[11]

Figure 3. Regulatory convergence from 2014 to 2015



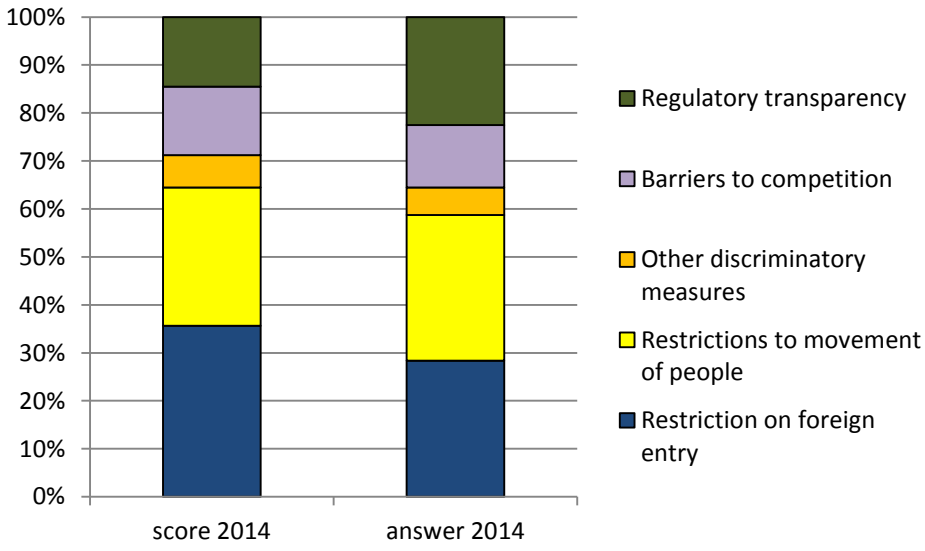
Note: There are 861 unique country pairs in the STRI database. In total for the seven sectors, 31% of the country pairs converge, 34% diverge and 35% stay the same. The chart represents the answer-based STRI indices.

As for the STRI indices, the regulatory heterogeneity indices can be broken down on policy area. Figure 4 shows the contribution from each policy area to regulatory differences. It is noted that *Restrictions on foreign entry* and *Restrictions on movement of people* together account for about 60% of the total variation in regulation across countries. These two policy areas relate to market access and national treatment through all modes of supply. It is also noted that the regulatory differences under *Other discriminatory measures* are modest, reflecting that few countries discriminate foreign owned companies as far as taxation or subsidies are concerned. Conversely most countries limit access to the public procurement market.

10 . The STRI on air and road transport covers commercial presence only.

11 . With each update of the STRI database, the regulatory heterogeneity indices will be calculated for the new vintage and convergence/divergence monitored.

Figure 4. Regulatory heterogeneity by policy area, average all sectors



Some sectors deviate significantly from the averages depicted in Figure 4. In the professional services more than half of the heterogeneity comes from restrictions on movement of people, while in broadcasting and television two thirds come from restrictions on foreign entry. In telecommunications about 45% come from barriers to competition.[12]

Regulatory heterogeneity is expected to have a negative effect on bilateral trade, but the opposite cannot be ruled out a priori. Firms may have a stronger propensity to commit resources in countries with a familiar regulatory regime. Where firms can chose between servicing a foreign market through establishing a commercial presence or engaging in cross-border trade, regulatory similarities could shift the balance towards the former. This is an empirical question to which the next section returns.

The impact of regulatory heterogeneity on trade

The gravity equation is the workhorse methodology for estimating the relationship between bilateral trade and trade frictions. We use a standard specification augmented by the level and heterogeneity of trade restrictions as measured by the STRIs and the regulatory heterogeneity indices presented above as follows:

$$X_{ijkt} = exp\left[\alpha_0 + \alpha_1 STRIhet_{ijk} + \alpha_2 STRIhet_{ijk} * STRI_{ik} + \alpha_3 STRIhet_{ijk} * STRI_{jk} + \gamma Z_{ij} + s_k + \varphi_{it} + \mu_{jt} + \varepsilon_{ijkt}\right]$$

The left hand side represents exports from country *i* to country *j* in sector *k* at time *t*. The explanatory variables of interest are the STRI heterogeneity index, and the interaction terms between the heterogeneity index and the STRI index in the exporting country *i*, and the importing country *j* for sector *k*. A vector of bilateral control variables is represented by Z_{ij} (common border, common language, common legal origin, being part of the same regional trade agreement, having shared a colonial history or having been, in the past, the same country). The last four terms represent sector, exporter-time and importer-time fixed effects; and an error term. This regression equation predicts bilateral trade flows in an unbiased and consistent manner when run on a balanced panel of

12 . All these examples refer to score-based regulatory heterogeneity indices.

observations. Box 1 explains some of the challenges of estimating the trade impact of policy variables using the gravity equation.

Box 1. Policy measures in the gravity model

As amply documented in the literature, bilateral trade between two countries is determined not only by the market opportunities and the trade costs between the two countries, but also by the outside options to trade with third countries. Simply put, an importer will browse the global market and source from the supplier with the best offer. By the same token, an exporter will target the markets with the best opportunities for growth and profits. Technically, such third country effects are captured by what has been coined outward and inward multilateral resistance. Outward resistance aggregates the trade costs that a country's exports face in all other counties into one index. Similarly the inward multilateral resistance aggregates the trade cost of importing from all countries in the world into one index. A vast literature documents that the gravity model, appropriately specified and estimated explains bilateral trade in a consistent and unbiased way, and that a proper specification include multilateral resistance terms.[1]

Multilateral resistance is country-specific and difficult to measure. The most common way of capturing it is to introduce country fixed effects if such variables are constant over time or country-time fixed effects if they vary over time. This solves the technical problem of generating consistent and unbiased estimates. However, researchers are often interested in quantifying the trade impact of country-specific policy measures such as the STRI and these cannot be distinguished from other country-specific variables in a properly specified gravity model.

One solution is to drop the fixed effects and include in the regression the country-specific policy measures of interest, controlling for known and measurable country-specific factors.[2] This gives a good estimate of the correlation between trade and the policy variable of interest, but we cannot be sure whether the correlation is spurious or reflects a causal relationship.

Another solution is to construct bilateral variables from country-specific information. Many of the standard gravity variables are created this way, capturing differences or communalities between country pairs, for instance sharing a common language, a common legal origin or common religion. Such bilateral variables build upon the idea that country characteristics affect trade mainly when they differ across countries. For instance, English-speaking countries may not be more open to trade than others, but sharing the English language reduces transaction costs among them, resulting in more trade. By the same token, countries where common law constitutes the legal origin may not be more open to trade than other countries, but entering and enforcing contracts with suppliers or customers in countries sharing a legal origin may be easier than contemplating a less familiar setting, resulting in more trade.

The STRI regulatory heterogeneity indices are similar to common legal origin in the sense that differences create real trade costs in their own right and that they are truly bilateral. Their impact on trade can therefore be consistently estimated using the gravity equation. However, as opposed to language and legal origin, the country-specific *level* of regulation also matters for trade costs. Moreover, the trade effect of regulatory heterogeneity may vary with the level of regulation in the exporting and importing country. For instance it is quite intuitive that regulatory differences may not matter much if the market is completely closed to foreign suppliers; or that it may matter a lot when there are few, if any explicit barriers to trade.

Conditioning the impact of regulatory heterogeneity on the level or regulation can be done by using interaction terms. It is still not possible to establish the direct impact of the level of the STRI on trade flows, since all country-specific variables are absorbed by the country-year fixed effects.

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1. See for instance Head and Mayer (2014) for a recent survey.

2. The classical, naive gravity equation includes market size for each country and bilateral trade costs as the only explanatory variables.

The lack of a time dimension in the STRIs means that the regressions must either be run on a cross-section (for 2013) or to assume that the regulations were roughly constant over a period of 3-5 years before 2014.[13] If information on bilateral trade for all 42 countries included in the STRI database was available, there would be 1722 observations per sector per year. However, the number of observations per sector varies from 727 for maritime transport to 1191 for commercial banking in 2013. A cross-section regression for 2013 by sector is therefore unlikely to yield unbiased results. For the three years from 2011 to 2013 the number of observations per sector ranges between 2346 for engineering to 4322 for commercial banking. Given these data limitations the regression is run using a panel for the three years 2011-2013, pooling all the sectors into one regression and adding sector fixed effects.[14]

The results are reported in Table 2. The first column represents the baseline standard gravity equation where the core variables take the expected sign and values. However, having a common border or a common language are not statistically significant. Having been part of the same country, sharing a common colonial past or having a common legal origin capture different aspects of institutional commonalities and have a relatively strong and statistically significant positive impact on services trade. Each of these three institutional factors is associated with about a 30-35% more services trade on average. Note that these factors accumulate, so if a country pair has both a common legal origin and a common colonial history, the model predicts that they would trade about 60% more with each other, all else equal. Finally, country pairs where both are members of the European Union trade about 70% more with each other than they would otherwise do.[15]

As noted the first column in Table 2 explains bilateral trade as a function of geographical distance, commonalities on a host of institutional factors, the single European market and all possible country specific variables. The second and third columns add the answer-based and the score-based regulatory heterogeneity indices respectively. Note that the coefficient on these variables captures the effect of regulatory heterogeneity on top of all the institutional and country specific variables already included in the first regression. Both coefficients take a negative sign, but only the score-based indicator is statistically significant. This result suggests that regulatory heterogeneity is indeed negatively associated with cross-border services trade, and that the score-based index captures the trade costs associated with regulatory heterogeneity better than the answer-based. The result implies that a 0.05 point lower scores-based index is associated with 2.5% more trade on average across all sectors.

13. At the time of writing services trade data for 2014 is available only for a few countries and a few sectors. The update of the STRI database to 2015 and the comparison of the regulatory heterogeneity between 2014 and 2015 depicted in Figure 3 shows that regulation does change over time, in most cases not very dramatically, but some countries have implemented significant reforms. For instance Mexico's STRI in telecommunications has come down by as much as 50% between 2014 and 2015 and South Africa's liberalisation of movement of people for the purpose of providing services has brought down their index significantly in all sectors.

14. Pooling all sectors into one regression implicitly assumes that the marginal effect of changes to the regulatory heterogeneity index is the same across sectors, which may be a strong assumption. This is to some extent mitigated through the interaction term with the STRI levels, since these differ across sectors and affect the marginal impact of regulatory cooperation.

15. The effects are calculated by taking the exponential of the coefficient for each variable in the first column of Table 2.

Table 2. Services exports by partner and regulatory levels and heterogeneity, pooled all sectors

	(1)	(2)	(3)	(4)	(5)
Ln distance	-0.417***	-0.412***	-0.410***	-0.402***	-0.400***
	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)
Common border	0.057	0.053	0.065	0.036	0.083
	(0.109)	(0.108)	(0.107)	(0.107)	(0.106)
Common language	0.183	0.183*	0.175	0.180*	0.156
	(0.112)	(0.110)	(0.111)	(0.108)	(0.110)
Colony	0.264**	0.255**	0.253**	0.221**	0.224**
	(0.109)	(0.106)	(0.105)	(0.103)	(0.101)
Same country	0.308*	0.312*	0.314*	0.323*	0.320*
	(0.176)	(0.174)	(0.172)	(0.171)	(0.166)
Common legal origin	0.275***	0.271***	0.270***	0.263***	0.254***
	(0.071)	(0.070)	(0.070)	(0.069)	(0.071)
Both EU	0.549***	0.541***	0.515***	0.470***	0.465***
	(0.151)	(0.150)	(0.149)	(0.154)	(0.149)
Heterogeneity answer		-0.55		-3.558***	
		(0.434)		(0.983)	
Heterogeneity score			-0.586**		-2.987***
			(0.298)		(0.811)
Heterogeneity answer x				2.432*	
STRI exporter				(1.362)	
Heterogeneity score x					2.306**
STRI exporter					(0.970)
Heterogeneity answer x				4.706***	
STRI importer				(1.355)	
Heterogeneity score x					3.522***
STRI importer					(0.901)
Pseudo R^2	0.709	0.709	0.709	0.712	0.711
N	52699	52699	52699	52699	52699
Sector fixed effects	Yes	Yes	Yes	Yes	Yes
Exporter year fixed effects	Yes	Yes	Yes	Yes	Yes
Importer year fixed effects	Yes	Yes	Yes	Yes	Yes

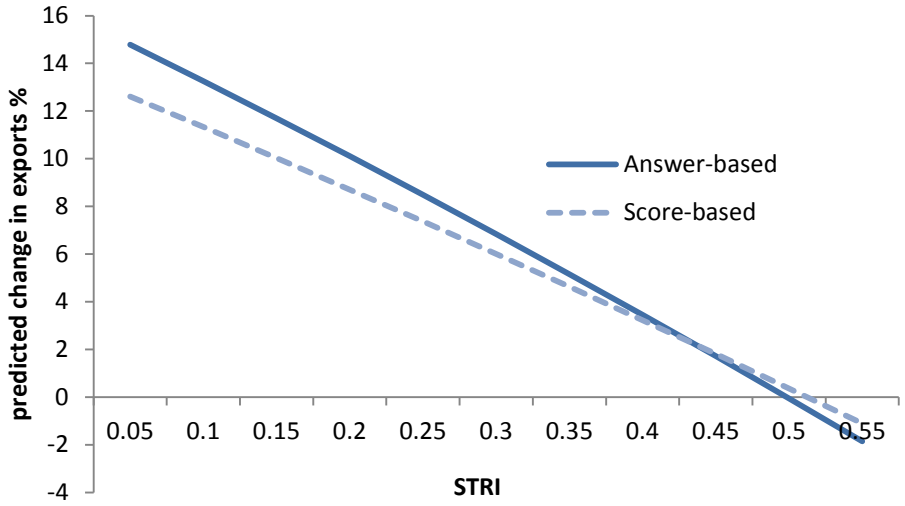
Note: The regressions are run using the Poisson Maximum Likelihood estimators for the period 2011-2013. Robust standard errors clustered on country pairs are presented in parentheses where ***, ** and * signify statistical significance at a 1, 5 and 10% level respectively. Sectors included are accounting, architecture, audio-visual services, computer services, commercial banking, construction, courier services, engineering, insurance, legal services, telecommunications and transport (air, maritime, rail and road).

The next two regressions add the level of the STRI for both exporter and importer interacted with the heterogeneity index. They reveal that the average conceals substantial variation and complexity. When allowing for different marginal effects depending on the level of heterogeneity, both the heterogeneity index and the interaction terms become statistically significant. The combination of a negative coefficient on the regulatory heterogeneity index and a positive coefficient on the interaction term suggests that regulatory differences have a larger marginal impact on trade flows the lower the level of trade restrictiveness both in the exporting and importing country. This is illustrated in Figure 5, which shows how the marginal impact of regulatory heterogeneity on services exports varies

with the level of the STRI index. For simplicity the chart is drawn for instances where the exporter and importer have the same level of regulation.[16]

Figure 5. Predicted change in bilateral exports from reducing the regulatory heterogeneity index by 0.05 points

At different levels of trade restrictiveness



Note: The graph is based on predicted average bilateral exports from the regressions depicted in Table 2, columns 4 and 5. Exporter and importer STRI levels are the same in the simulations, depicted on the horizontal axis.

Consider three relatively liberal countries denoted A, B and C. All three have scores on the STRI indices around 0.05. Further, assume that country A is more similar to country B than to country C, reflected in a regulatory heterogeneity indices of 0.10 for AB and 0.15 for AC. The results depicted in Figure 4 imply that country A's exports to country B is about 13% higher than its exports to country C. Consider also three relatively restrictive countries, D, E and F, with STRI scores around 0.4. In this case D is more similar to E than to F, with heterogeneity indices of 0.20 and 0.25 respectively for DE and DF. At this level of restrictiveness heterogeneity matters less for trade and country D exports only 3% more to E than to F.

As mentioned above, the STRI regulatory heterogeneity indices are calculated based on MFN barriers to entry and national treatments as well as a number of behind the border non-discriminatory measures. It was argued that with the main exception of the European Union, few regional or preferential trade agreements bind measures below applied MFN regulation. The inclusion of a dummy variable that captures whether or not a country pair is members of the European Union controls for the harmonization of regulation and all other commonalities and benefits that come with EU membership for exporters. It is noted that the coefficient on the EU dummy is somewhat lower

16. The percentage change in exports from a 0.05 points reduction in the STRI heterogeneity index is $-\left[exp\left(0.05*\left(-3.558+2.432*STRI_i+4.706*STRI_j\right)\right)-1\right]*100$ and $\left[exp\left(0.05*\left(-2.987+2.306*STRI_i+3.522*STRI_j\right)\right)-1\right]*100$ respectively for the answer and score-based indices.

after having included the regulatory heterogeneity indices and interaction terms with the STRI level, suggesting that the heterogeneity index to some extent capture intra-EU commonalities.[17]

Figure 4 shows the contribution of each policy area to total regulatory heterogeneity. This break-down on the regulatory heterogeneity index was introduced in the gravity regression to explore whether some policy areas are more important than others in generating trade costs from differences in regulation. No robust results could be discerned from these regressions, indicating that the overall index captures the essence of regulatory differences better than the sum of its parts.

Tentative estimates of iceberg trade costs

Estimating tariff equivalent trade costs from the regression results presented in Table 2 is straight forward from a technical point of view.[18] Some conceptual issues are nevertheless worth bearing in mind. First, strictly speaking an ad valorem tariff equivalent represents an increase in the price of the imported product. An *ad valorem* tariff of 5%, for instance, implies that if the c.i.f. price of a product is one dollar, the tariff-inclusive import price will be 1.05 dollar. For services, specific units, let alone unit prices can often not be observed, and tariff equivalent trade costs may not be a meaningful concept. An alternative is to think of services trade costs as so-called iceberg costs. The iceberg metaphor alludes to the idea that some of the value of the product melts away during the journey from the exporter to the importer. The additional cost of modifying services so that they comply with foreign regulations may not add to their market value, and the resources spent on compliance is similar to what melts away in the iceberg cost metaphor.

Second, some services trade flows are poorly and inconsistently measured in the balance of payment registers the financial transactions, which may be different for the same flow of services, depending on the contractual relationships between firms or individuals. Third, the model used for estimating the regressions presented in Table 2 assumes that trade costs are symmetrical, which may or may not be the case. Bearing in mind these caveats, Figure 6 depicts the average iceberg trade costs at the mean of the regulatory heterogeneity index, which is about 0.26 both for the score-based and the answer-based indices calculated over all sectors.

Clearly there are substantial uncertainties related to the estimated trade cost equivalent. In particular, the estimates are very sensitive to the trade cost elasticity. Nevertheless, the true value is likely to lie within the range presented in Figure 6 and for low levels of the STRI the trade cost equivalent of regulatory heterogeneity is between 20 and 75%. The results do not imply that trade costs are higher when the STRI scores are low, which a casual reading may suggest. Rather, when the STRI score is high, the level of restrictiveness completely dominates regulatory differences. Thus, when foreign suppliers can enter the market only through minority shares in local companies or in a few unregulated activities within a broader sector, differences in regulation may not matter much. As such major discriminatory entry barriers come down, however, regulatory heterogeneity becomes the main constraint facing exporters.

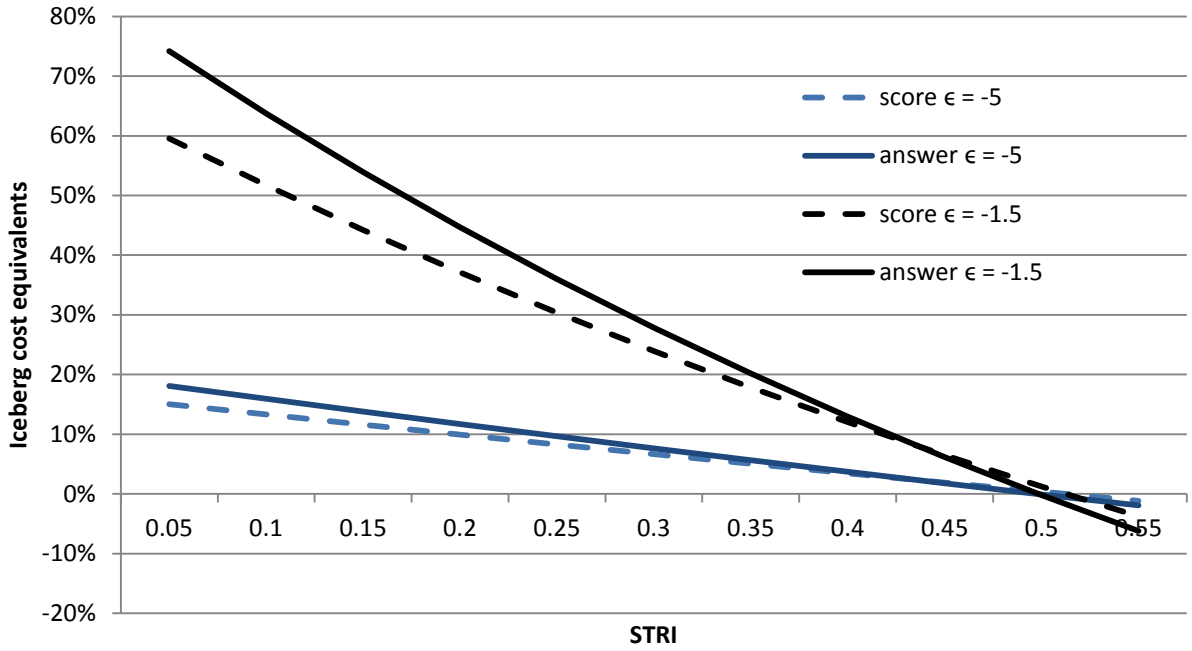
Finally, the gravity regression as specified above was run sector by sector. As noted earlier, there is large variability in data quality and availability across sectors and data for some of the 42 countries

17. A broader measure of RTAs has also been tested in the regressions. It has a positive and statistically significant effect on bilateral trade, but the coefficient is about 0.37, significantly smaller than for the EU dummy. Since EU is captured in the broader RTA dummy, this suggests that the RTA dummy is driven by the European Union.

18. If the trade costs elasticity is known, the tariff equivalent can be estimated as $\tau = [\exp(hg(\alpha_1 + \alpha_2 STRI_i + \alpha_3 STRI_j)/\epsilon) - 1]$ where *hg* is the heterogeneity index, ϵ is the trade cost elasticity and the alfas correspond to the parameters in the regression equation. Estimates of the trade cost elasticity vary in the literature, but values between -1.5 and -5 have been suggested. See for instance Head and Mayer (2014) for a review.

included in the database are completely missing at the sector level. The sector-level regressions are therefore less robust than the pooled regressions. The results are presented in Table 3. The sectors in which the trade effect of regulatory heterogeneity could be reasonably robustly measured are computer services, commercial banking, architecture, legal services and telecommunications. The most consistent results were obtained for commercial banking, but the coefficient seems to be on the high side, indicating that a 0.05 point lower heterogeneity index is associated with about 20% less trade. Interaction terms with the level of regulation did not add insight to these regressions and were dropped from the regression equation.

Figure 5. Estimated iceberg equivalent trade costs of a regulatory heterogeneity index at the mean at different levels of the STRI



Note: The iceberg cost equivalents are calculated on the basis of the formula in footnote 17, where the parameters are the estimates presented in columns 4 and 5 in Table 2. Exporters and importers have the same STRI scores depicted on the horizontal axis.

The regressions at sector level indicate that the overall pooled regression results could be driven by a few large sectors, including commercial banking and professional services. This will be further explored as new vintages of the STRI and services trade data become available.

Table 2. Regulatory heterogeneity and trade by sector

	Computer services		Commerical banking		Architecture		Legal services		Telecommunications	
	Answer	Score	Answer	Score	Answer	Score	Answer	Score	Answer	Score
Ln distance	-0.378***	-0.352***	-0.586***	-0.619***	-0.712***	-0.701***	-0.408***	-0.404***	-0.828***	-0.829***
	(0.075)	(0.081)	(0.080)	(0.079)	(0.078)	(0.080)	(0.098)	(0.096)	(0.102)	(0.101)
Common border	-0.065	0.011	-0.248	-0.149	-0.279**	-0.203	0.044	0.103	-0.017	0.004
	(0.155)	(0.153)	(0.169)	(0.177)	(0.131)	(0.129)	(0.180)	(0.185)	(0.148)	(0.146)
Common language	-0.138	-0.121	0.482***	0.426**	-0.019	-0.056	-0.012	-0.064	0.133	0.133
	(0.215)	(0.209)	(0.163)	(0.173)	(0.170)	(0.171)	(0.140)	(0.142)	(0.161)	(0.160)
Colony	-0.063	-0.109	-0.104	-0.097	0.131	0.177	-0.045	0.008	0.142	0.103
	(0.231)	(0.219)	(0.153)	(0.151)	(0.180)	(0.170)	(0.181)	(0.180)	(0.163)	(0.167)
Same country	0.601***	0.611***	0.137	0.133	0.731***	0.651**	0.370*	0.435**	0.121	0.108
	(0.202)	(0.203)	(0.333)	(0.342)	(0.263)	(0.253)	(0.201)	(0.203)	(0.223)	(0.219)
Common legal origin	0.462***	0.450***	0.125	0.11	0.464***	0.484***	0.307***	0.309***	0.236*	0.212*
	(0.120)	(0.123)	(0.135)	(0.142)	(0.089)	(0.093)	(0.107)	(0.108)	(0.125)	(0.128)
Both EU	1.178***	1.156***	0.138	0.068	0.327	0.33	0.528**	0.514*	0.07	0.087
	(0.334)	(0.330)	(0.210)	(0.208)	(0.222)	(0.230)	(0.264)	(0.268)	(0.249)	(0.239)
Regulatory heterogeneity	-1.283	-1.604**	-4.596***	-4.207***	-2.214**	-0.926	-2.305***	-0.851***	-1.7	-2.031**
	(0.903)	(0.773)	(1.529)	(1.112)	(0.908)	(0.622)	(0.754)	(0.284)	(1.048)	(0.853)
Pseudo R^2	0.875	0.876	0.934	0.934	0.84	0.839	0.902	0.901	0.841	0.841
N	3862	3862	4322	4322	3583	3583	3593	3593	3552	3552
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: The regressions are run using the Poisson Maximum Likelihood estimators for the period 2011-2013. Robust standard errors clustered on country pairs are presented in parentheses where ***, ** and * signify statistical significance at a 1, 5 and 10% level respectively

Concluding remarks

This study has presented a tool for quantifying regulatory heterogeneity that can be used for monitoring regulatory convergence over time and assessing the trade impact of regulatory cooperation that aims at improving regulatory coherence. Regulatory cooperation has become an increasingly important part of regional trade agreements, and an impact analysis of such agreements would not be complete without an assessment of the impact of regulatory cooperation.

Fist estimates shows clearly that regulatory heterogeneity has a negative impact on services trade flows, over and above the impact of services trade restrictions. They also suggest that unilateral trade liberalisation shifts trade towards countries to which the regulatory environment is more similar. The econometric results reported in the study can be summarised as follows:

- Countries trade more with partners with similar regulation. On average, 0.05 points lower score on the regulatory heterogeneity index is associated with 2.5% more trade.
- The trade effect of regulatory heterogeneity is higher the less trade restrictive are the countries: Harmonising at a low level of restrictiveness is associated with a large boost to services trade; harmonising at STRI levels around 0.4 yields only a small effect on trade; harmonising at STRI levels above 0.5 in contrast is associated with less trade.
- Trade agreements are likely to have the largest effect on trade when:
  - The parties are relatively similar in terms of approaches to regulation and the regulatory framework;
  - The first step is to reduce the level of trade restrictiveness to significantly below 0.4 where such high levels of restrictiveness exist;
  - Reducing the level of restrictions goes hand in hand with forward-looking regulatory cooperation;
  - Regulatory cooperation becomes more prominent as the level of trade restricting regulations comes down;
  - Regulatory cooperation successfully eliminates duplication of regulatory compliance costs for exporters.

Finally, it should be noted that a significant part of the restrictions recorded in the STRI database mainly apply to commercial establishment. To get the full picture of the impact of regulatory heterogeneity the effect on foreign direct investment and the choice of mode exporters make when entering a foreign market should also be taken into account. This, and further sector-specific analysis is left to future research.

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Annex

The Heterogeneity Indices

The regulatory heterogeneity indices are calculated starting with the matrix below for each country pair. Each cell in the matrix represents the answer (or the score) of country b and country a on the measure indicated by the row and column heading.

Table A1a. Creating the heterogeneity indices

		Country a				
	Measures	m1	m2	m3	……	mn
Country b	m1	m1,m1	m1,m2	m1,m3	……..	m1,mn
	m2	m2,m1	m2,m2	m2,m3	……..	m2,mn
	m3	m3, m1	m3,m2	m3,m3	…….	m3,mn
	……	…..	…..	…..	…..	
	mn	mn1	mn2	mn3	…..	mn, mn

The cells of interest for the next step are the cells that form the diagonal in this matrix. They represent the answer (or score) of country a and b on the same measure. For each country pair matrix, the diagonal is extracted and each diagonal constitute a column vector as illustrated in the table below.

Table A1b. Creating the heterogeneity indices

	Country pairs									
Measures	aa	ab	…..	aj	ba	bb	….	bj	…	lj
1	m1,m1	m1,m1	…..	m1,m1	m1,m1	m1,m1	…..	m1,m1		m1,m1
3	m3,m3	m3,m3	…..	m3,m3	m3,m3	m3,m3	…..	m3,m3		m3,m3
…..	…..	…..	…..	…..	…..	…..	…..	…..	…..	…..
n	mn, mn	mn,mn	…..	mn,mn	mn,mn	mn,mn		mn,mn		mn,mn

Each cell in this matrix is assigned a value of 0 if the two entries are the same, 1 if they are different. Let $s^k_{n,ij}$ represent the score on measure *n* in sector *k* of country pair *ij*. The heterogeneity index for country pair *ij* in sector k is then defined as $HG_{k,ij} = \sum_n s^k_{n,ij}\, w^k_n$ where w^k_n is the weight of measure n in sector *k*, and is the same as the weights used for calculating the STRIs.

Table A3. Correlation matrix, regression variables

	Score-based HG	Answer-based HG	RTA	Common border	Common language	Colony	Same country	Both EU
Score-based HG	1							
Answer-based HG	0.729	1						
RTA	-0.327	-0.373	1					
Common border	-0.085	-0.103	0.11	1				
Common language	-0.053	-0.044	-0.04	0.282	1			
Colony	-0.016	-0.025	-0.03	0.315	0.226	1		
Same country	-0.082	-0.114	0.09	0.360	0.062	0.193	1	
Both EU	-0.395	-0.472	0.56	0.153	-0.047	-0.011	0.182	1