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Services Trade Restrictiveness Index (STRI): Computer and Related Services

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JEL Classification: F13, F14, K33, L86

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Abstract

SERVICES TRADE RESTRICTIVENESS INDEX (STRI): COMPUTER AND RELATED SERVICES

by

Hildegunn Kyvik Nordås, Massimo Geloso Grosso, Frederic Gonzales, Iza Lejarraga, Sébastien Miroudot, Asako Ueno and Dorothée Rouzet

This paper presents the services trade restrictiveness indices (STRIs) for computer services. The STRIs are composite indices taking values between zero and one, zero representing an open market and one a market completely closed to foreign services providers. The indices are calculated for 40 countries, the 34 OECD members and Brazil, China, India, Indonesia, Russia and South Africa. The STRIs capture de jure restrictions. This report presents the first vintage of indicators for computer services and captures regulations in force in 2013. The scores range between 0.08 and 0.34, with a sample average of 0.18. Explicit barriers to trade in computer services are rare, but the sector is subject to a number of economy-wide restrictions facing all sectors. Among these, restrictions on movement of people (mode 4 in GATS terminology) make the largest contribution to the index value, followed by regulatory transparency issues. The paper presents the list of measures included in the indices, the scoring and weighting system for calculating the indices and an analysis of the results.

Keywords: Services trade, services trade restrictions, computer services, regulation

JEL classification: F13, F14, K33, L86

Acknowledgements

The STRI project for computer services started with an expert meeting where the list of measures was discussed. The STRI team is grateful for the insights and advice that the participants brought to the meeting. The STRI database has been put together by going through laws and regulation in each of the 40 countries included. Each entry is documented by the source and a web link to the law or regulation and each government has fact-checked the database. Needless to say this has been an enormous task and the OECD Secretariat would like to thank Member governments for reviewing and peer reviewing the databases. We will also like to thank Mariam Abdova, Beatriz Cano Buchholz, Ekaterina Burdina, Stellina Galitopoulou, Ahmet Gulsen, Dora Hajdu, Anthony Halley, Anna Jankowska, Gimin Kang, Fatma Kayhan, Yunhee Kim, Maria Kopyta, Hendric Richter, Humberto Lopez Rizzo, Baron Sacharidis, Katharina Sass, Jonathan Senft, Marie Sudreau, Lucie Vondrackova, Jozefien Willemen and Aviad Ben Yehuda who provided excellent research assistance in creating the database. Also thanks to the University of Adelaide and project managers Christopher Findlay and Uwe Kaufman for creating the database for Key Partners. Special thanks to Rainer Lanz and Alexander Ragoussis for their contribution to the design of the STRI methodology. The weighting scheme for the STRI indices is derived from an online survey. Thanks to everybody that took time to do the survey. Finally, the authors would like to thank Dale Andrew, Crawford Falconer and Raed Safadi 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.

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Executive summary

This paper presents the Services Trade Restrictiveness Indices (STRIs) for the OECD countries and Key Partners (Brazil, the People's Republic of China, India, Indonesia, the Russian Federation and South Africa) for computer services. Computer services are among the most dynamic services sectors and their share of total services trade has increased rapidly, albeit from a low basis. Their share of total services exports stood at about 6.8% in 2010. Computer services are traded through all modes of supply. Major exporters are India, Ireland and Germany. Cross-border supply dominated in the 1990s, but as the sector has matured, the relative importance of commercial presence has increased.

The STRIs take values between zero and one, one representing a totally closed and zero a fully open sector. It records restrictions that apply on a most favoured nation (MFN) basis and does not consider preferential trade agreements. The scores in the computer services sector range between 0.08 and 0.34. The results are driven by restrictions and administrative burdens related to the movement of people. First, restrictions related to the temporary movement of people as defined in General Agreement on Trade in Services (GATS) Mode 4 contribute significantly to the STRI in all countries included in the index, although there are large variations among countries. Second, the restrictions observed under the policy area *Restrictions on foreign entry* mostly concern residency requirements for board members and the manager of a firm. Third, under the policy area *Regulatory transparency*, visa processing time contributes to the restrictiveness in some countries.

It is, however, important to notice that restrictions and administrative burden related to the movement of people are not particularly high in the computer services sector. The reason why such restrictions dominate the STRIs is rather that there are few restrictions in other areas. Furthermore, computer services are skilled labour-intensive and experts assigned a relatively high weight to restrictions on movement of people in this sector.

The STRI also categorises indices according to which mode of supply they apply to, and measures that fall under market access or national treatment as defined in the GATS are distinguished from restrictions that do not have to be scheduled in the GATS. In most countries measures that apply to Mode 4 and belong to the market access or national treatment category dominate the index.

The indices also show the contribution of discriminatory versus non-discriminatory measures. Here discriminatory measures dominate, driven by restrictions related to Mode 4 movements of people. Another useful classification of the measures is whether they apply to the establishment or the operations of services suppliers. Here measures related to establishment dominate in most countries.

Many countries have an uneven regulatory profile, with most restrictions concentrated in two or three policy areas. Therefore, the index values of these countries are somewhat sensitive to the weighting system, as one would expect.

1. Introduction

The OECD Services Trade Restrictiveness Index (STRI) project was launched by the Trade Committee in June 2007 as a tool for quantifying barriers to trade in services at the sector level (OECD, 2007). The major outputs from the project are:

- A regulatory database, providing detailed information on current laws and regulations affecting international trade in services
- Trade restrictiveness indices which provide a snapshot of the trade policy stance at a particular point in time.

The STRI database contains information on market access, national treatment, relevant domestic regulation and administrative procedures in all the OECD Member countries and the Key Partners (Brazil, China, India, Indonesia, Russian Federation and South Africa). The database records measures applied on a most-favoured-nation (MFN) basis, and does not consider preferential treatment entailed in regional trade agreements (RTAs).[1] The sources of information for the database are laws and regulation in each Member country. Each entry is documented by reference to the source. Members have verified their data and subsequently the database has been subject to peer review assessing their factual accuracy.

The STRIs transform the qualitative information contained in the database to numerical values that can be used for quantitative policy analysis, including impact assessment of policy reforms. The methodology for calculating the indices is described in a separate document (OECD, 2011). This paper presents the indices for computer services.

The Australian Productivity Commission pioneered services trade indices in the late 1990s. A number of institutions, including the OECD (Dihel and Shepherd, 2007) and the World Bank (Borchert et al., 2012) have developed services trade restrictiveness indices since then. However, so far such indices have been published only for one year and for a limited number of countries and sectors. To our knowledge, no service trade restrictiveness index has so far been developed for computer services. This paper thus presents the first of its kind for this sector. The STRI indices are presented in aggregate form as well as decomposed into several classifications: by policy area, by mode of supply, a discriminatory and non-discriminatory taxonomy, and an entry and on-going operations rubric.

Offshoring of computer services has provided new opportunities for entering foreign markets for a number of developed as well as developing countries. Trade in computer services take place largely through cross-border trade, but usually in combination with commercial presence and movement of natural persons. Exports of computer services from India, for instance, largely takes place through offshoring by multinational companies, and in many cases Indian computer software engineers work on sites in developed countries (Dossani and Kenney, 2007; Khomiakova, 2007).

Offshoring of computer-services is a two-way process where the client needs to be in frequent contact with the vendor in order to monitor performance and ensure a common understanding of the tasks at hand. By the same token the vendor sometimes needs to complement on-line services with visits to the client in order to solve technical and relational problems. Therefore, cross-border trade may be sensitive to restrictions on the temporary

1. Some countries have different degrees of liberalisation towards different trading partners, as a result of regional integration or of international agreements. In these cases, the STRI records the level of openness towards third countries and does not take into account preferential agreements. For instance, the database for European Union members records legal provisions applying to suppliers from outside the European Economic Area.

movement of people both from the country of the vendor to the client and from the client to the vendor. Furthermore, trade in computer services is highly sensitive to time constraints. In order to be able to respond to customer needs swiftly, a number of computer services firms have chosen to establish commercial presence in major markets to support or in some cases substitute for cross-border trade. For example Infosys, the leading Indian computer services exporter has affiliates in 31 countries in the Americas, Europe, Middle East and Africa.[2] Complementarities between modes of supply and the contractual relationship between vendors and clients result in a relatively complex trading pattern where regulations in a number of areas are relevant.[3]

The rest of the paper is organised as follows: Section 2 defines the sector and discusses how computer and related services are traded. Section 3 identifies which measures to include in the STRI.[4] Section 4 gives a brief summary of the methodology for constructing the STRI while Section 5 reveals and analyses the results. Finally, Section 6 includes sensitivity analysis, while Section 7 concludes.

2. What are computer and related services and how are they traded?

This section defines the sector to which the STRI applies and briefly discusses how computer services are traded. Table 1 presents definitions of the computer and related services sector according to the World Trade Organization (WTO) Services Sectoral Classification List (W/120) used by most countries for GATS scheduling purposes, the Central Product Classification (CPC), Extended Balance of Payments Statistics (EBOPS), which is the most commonly used classification system for reporting trade in services, and International Standard Industrial Classification (ISIC) Rev 4 which is used for reporting foreign direct investment, foreign affiliate sales and production.

Table 1. Definition of the computer and related services sector

W/120	Name	CPC	EBOPS	ISIC Rev 4
1.B.a.	Consultancy services related to the installation of computer hardware	841	263	62
1.B.b.	Software implementation services	842	263	62
1.B.c.	Data processing services	843	263	62+63
1.B.d.	Data base services	844	263	62
1.B.e.	Other	845+849	263	62

Source: WTO, OECD, UN.

The W/120 and corresponding ISIC categories are chosen as the basis for defining the computer services sector in this study. This is clearly not the only possible definition, but since the purpose of the STRI is to identify and quantify barriers to trade in services in a way that is useful for trade negotiators and policy analysis, it seems to be the best option.

2. See www.infosys.com/about/Pages/locations.aspx

3. See the sector studies presented at the June 2008 OECD Services Experts Meeting (Nordås, 2008 and Kirkegaard, 2008) and Nordås and Kox (2008).

4. A "measure" within the context of this paper is not a term of art nor intended to have any legal significance.

Computer and related services account for a relatively small but rising share of services trade. For instance, computer services accounted for 6.8% of services exports in 2010 as recorded in the UN services trade data base, up from 4.9% in 2005. The five largest exporters of computer services in 2012 were India, Ireland, Germany, the United States and the United Kingdom. However, while computer services accounted for as much as 34 and 39% of India and Ireland's total services exports respectively in 2012, computer services exports account for only 7.5, 4.2 and 1.7% of total services exports for Germany, the United Kingdom and the United States respectively.

The five largest importers of computer services in 2012 were the United States, Germany, France, the United Kingdom and the Netherlands. In all these countries computer services account for 6% or less of total services imports. Furthermore, in no country in the UN database did computer services account for more than 10% of total services imports.[5] Production of computer services for exports is thus concentrated in a few countries, while imports are much more evenly dispersed. Such a trade pattern indicates that the natural barriers to trade in computer service are quite low.[6]

All four modes of supply are relevant for computer services. Trade and investment patterns were studied in detail in Kirkegaard (2008) and Nordås (2008). These studies show that the growth rate of cross-border trade in computer services has been among the highest of all services sectors, and that the relative importance of commercial presence as measured by foreign affiliate sales has increased over time in most countries for which comparable data are available.

The shift towards commercial presence reflects the maturing of the sector. Contracts between suppliers and customers become more complex as they contain more value added services that require frequent interactions. Local presence, either through establishing an affiliate or frequent visits by consultants from the computer services suppliers, has become essential for the computer services segments at the higher end of the value added ladder (Rubalcaba and Kox, 2007). Therefore, openness as far as cross-border supply is concerned is no longer enough to ensure open markets in computer services.

3. Which measures should be included in the STRI?

Computer and related services is a competitive sector, and there are no particular market imperfections that require regulation. Therefore, as opposed to for instance telecommunications, computer services are rarely subject to sector-specific measures.[7] As with the other sectors, the index should include information that is sufficiently specific and detailed that it can inform trade negotiations and regulatory reform. But the index should not be so detailed that the primary barriers are overshadowed by lesser restrictions that add little to the essence of trade restrictiveness.

5. The highest share, 7.8%, was observed in Finland.

6. Geographical concentration of production combined with geographical dispersion of consumption has been suggested as an indicator of how tradable a service is (Jensen and Kletzer, 2006; Gervais and Jensen, 2013).

7. Nevertheless, sector-specific regulation is captured in the index and the database. For instance foreign equity limits are a measure included in all sectors, but the limit may differ across sectors. Likewise discrimination in public procurement is included in all sectors, but there may be specific restriction on computer services offshoring from the public sector which would be recorded in the database and captured in the index for computer services.

Annex B presents the list of measures included in the computer services STRI. The selection of measures is based on the following criteria:

- Barriers and regulations that are mentioned explicitly in the GATS;
- Barriers and regulations that are mentioned explicitly in regional trade agreements; and
- Barriers and regulations that experts (during the June 2008 OECD Expert Meeting on Business Services) identified as relevant.

In practice, most of the barriers and regulations proposed satisfy more than one of these criteria. Classifying barriers and regulations under different typologies can increase the usefulness of the STRI by highlighting different dimensions of the data specifically for negotiators, regulators and industry analysts. A detailed list of the measures included in the STRI by policy area is found in Annex B. The annex table also entails information on which category according to GATS classification the measure belongs to; to which mode of supply the restriction applies; whether the measure applies to the establishment of a services supplier or to ongoing operations; and finally whether or not the measure is discriminatory.

The GATS terminology is appealing insofar as it increases the relevance of the STRI for World Trade Organization (WTO) and regional trade agreement (RTA) negotiators. However, as with any classification, it is not always possible to clearly identify to which category certain restrictions belong and there are overlaps in the classification of some barriers. Therefore, *market access* and *national treatment* measures are classified together. This grouping also allows a distinction to be made between restrictions subject to scheduling under the GATS and domestic regulatory measures that usually do not need to be scheduled. Restrictions not captured by either market access or national treatment are classified under *domestic regulation, and other.* The classification is without prejudice to WTO Members' commitments and obligations under the GATS.

Indices according to the GATS modes of supply can provide useful information for negotiators. These Modes include: Mode 1: Cross-border supply; Mode 2: Consumption abroad; Mode 3: Commercial presence; and Mode 4: Temporary movement of natural persons. It has proved difficult to distinguish between regulation that applies to Mode 1 and 2, or to find any policy measures that specifically apply to these. Regulations that do not explicitly affect Mode 3 or Mode 4 are mainly behind the border and potentially affect all modes of supply. They are therefore lumped together under the category *All modes*.

The STRI further classifies measures according to regulations that apply to the establishment of firms versus those affecting their on-going operations; and measures that are discriminatory versus non-discriminatory. Establishment restrictions can generally be regarded as impediments to the movement of factors of production, while those applying to firms' operations constrain service provision after establishment. Non-discriminatory measures may raise the cost for all services providers, resulting in higher prices and lower demand for services, whereas discriminatory ones shift demand towards local suppliers. These classifications could prove useful in helping regulators and industry analysts identify priority areas for reform given defined economic policy objectives.

Restrictions on foreign entry

The list of measures under this policy area corresponds closely to the measures included in the OECD foreign direct investment (FDI) restrictiveness index.[8] Prominent examples of these measures include restrictions on foreign direct equity stakes, requirements for foreign investment only through joint ventures, limitations on mergers and acquisitions for foreign

8. The OECD FDI restrictiveness index does, however, not cover computer services.

firms and controlling the number of firms that may operate by economic needs tests or quotas. The imposition of residency requirements for board members represents another important regulation that restricts market entry for foreign firms, and thus impedes trade. The measures under this policy area correspond closely to the restrictions that need to be scheduled in the GATS if the sector is committed.

Restrictions on the movement of people

Limitations on the temporary movement of people can act as a significant barrier to trade in computer and related services. For instance, restricting the number of foreign software engineers permitted to practice by labour market needs tests or quotas exert a dampening effect on trade. Moreover, curbs on the duration of stay of intra-corporate transferees can negatively affect trade in computer and related services. These measures are addressed in several recent RTAs. The measures under this policy area correspond closely to the measures that need to be scheduled in the GATS under Mode 4 if the sector is committed.

Other discriminatory measures

Discriminatory taxes and other forms of subsidies further apply as important measures to include in the STRI. In addition, discrimination in government procurement is included because, while currently excluded from the primary GATS disciplines, WTO members have a mandate to negotiate disciplines in this area and many of the countries included in the STR database are parties to the WTO Government Procurement Agreement (GPA). Note, however, that the STRI does not take into account preferential provisions for any measure, including government procurement. Finally lack of implementation of international standards, where such standards exist, create additional costs for services suppliers and are included in this policy area.

Barriers to competition[9]

Measures that allow publicly-controlled firms some type of exemption from the general competition law reduce competition in the sector. Further, the policy area captures to what extent foreign firms have access to dispute settlement mechanism and to subsequent appeal procedures. All of these measures have been included in some recent RTAs. Public ownership on the other hand is not frequently subject to international agreements, but may constitute a barrier to competition, particularly if government controlled companies have privileges for instance related to taxes, subsidies or government procurement.

Regulatory transparency

Regulatory transparency is important for a stable and predictable business environment while administrative procedures may impose significant costs on firms. Objective and comparable information on administrative procedures is not available in primary sources, so for these measures a secondary source, the World Bank's Doing Business Database, is used. Finally, the extent to which lengthy visa processing apply is incorporated in the index.

4. Methodology for developing the STRI

The STRI is derived by aggregating regulations that are potentially trade restricting into a composite measure of restrictiveness. The construction of the index involves decisions concerning three main issues: scoring, weighting and aggregation. Scoring relates to how

9. The policy area includes public ownership, which may have the effect of market access restriction.

regulatory measures are transformed from qualitative to quantitative information. Weighting captures the relative importance of impediments in terms of trade restrictiveness (the higher the weight the more restrictive a category of measure is considered relative to other categories). The aggregation method determines how weights are applied to scores for calculating the index number. OECD (2014) explains the methodology in detail, while a technical paper explaining the alternative methodologies, their advantages and disadvantages and the robustness of the chosen methodology is available for interested readers (OECD, 2014). Here a brief non-technical summary is presented.

The approach taken to scoring in the STRI is to transform qualitative information on regulation into binary variables.[10] A majority of the questions included in the regulatory database are Yes/No questions. Regulatory information of a more complex nature (e.g. foreign equity limits) can easily be transformed to binary variables by introducing multiple thresholds. Therefore, for each type of impediment in a given country a score is assigned either 0 or 1, with the former representing the absence and 1 the presence of the restriction. This method ensures that all variables are measured on the same scale such that comparison across different countries and over time is possible.

It is important that the STRI captures as much of the variance in the underlying data as possible. The scoring of foreign equity limits, for instance, should reflect that an equity limit of, say 49% is more restrictive than a limit of 66%. This is obtained by introducing multiple thresholds. For foreign equity the thresholds are less than 33%, less than 50%, and less than 100%. A country with a limit of 49% will receive a score of one on the less than 50% threshold as well as less than 100% (i.e. two scores of one), while the country with a limit of 66% will receive one score of one (on the less than 100% threshold). The same approach is used for other variables for which more detailed information is available (e.g. duration of stay of inter-corporate transferees).

Aggregating individual restrictions into the STRI consists of two steps. The first step involves assigning weights to the policy measures. The second step involves aggregation into the overall STRI. A number of weighting schemes have been explored to develop the STRI. These are equal weights, expert judgement and random weights. Equal weights are the most common weighting scheme applied for constructing composite indicators. It is a transparent way of creating an index in the absence of any clear alternative. Lack of clear alternatives could be due to insufficient knowledge of causal relationships, absence of an empirical basis for deciding which is more important, or lack of clarity of what the index is supposed to measure. Equal weights are, however, not as free of judgement as is often claimed. With equal weights, the relative importance of each measure depends on how many measures are included and how individual restrictions are organised into sub-indicators, leaving rather a lot to subjective judgement or arbitrariness.

As noted, equal weights are used when there is a lack of clear alternatives. For trade restrictiveness indices, however, it is clear that the measures should be weighted according to their contribution to trade costs, which in turn consist of entry costs and operational costs.[11] Services trade data are, however, not sufficiently detailed for estimating the trade cost equivalent of trade barriers and behind the border regulation that affects services trade. Nevertheless, there is a growing literature on measuring trade costs on the basis of observed

10. When compiling a composite indicator, it is not advisable to include both binary and continuous variables in the same dataset as the resulting indicator would not have a clear interpretation (see OECD, 2008).

11. For trade in goods estimating the contribution of tariffs and non-tariff barriers is straight forward. The International Monetary Fund's Overall Trade Restrictiveness Index (OTRI), for instances makes such estimates by the tariff line (IMF, 2005).

trade patterns in services, but usually at a higher level of aggregation than what is required for the STRI (Miroudot *et al*., 2012). Furthermore, the different approaches to measuring trade costs on the basis of observed trade flows have strengths and weaknesses (Nordås, 2011) and as of yet a widely accepted methodology is not available.

Being constrained by lack of data, alternative ways of weighting the measures in a way that reflects contribution to trade costs have to be sought. Asking those directly and indirectly involved in services trade is one option. Such expert judgement has the advantage that relative importance can be captured in a realistic and meaningful way. One objection to using expert judgement is subjectivity. As argued above this objection also applies to other methodologies and the problem can be reduced, for instance, by asking a large group of experts.

A third methodology for weighting measures is principal component analysis (PCA). This is a statistical methodology that assigns the highest weight to the variables that contribute the most to the variation in the dataset. The disadvantage of PCA is that the assigned weights do not reflect the relative trade restrictiveness of a measure, and the weights are based on the sample of countries for which they are estimated. Thus, when the index is extended to new countries, the scores of countries already included may change. We have therefore chosen not to use PCA.

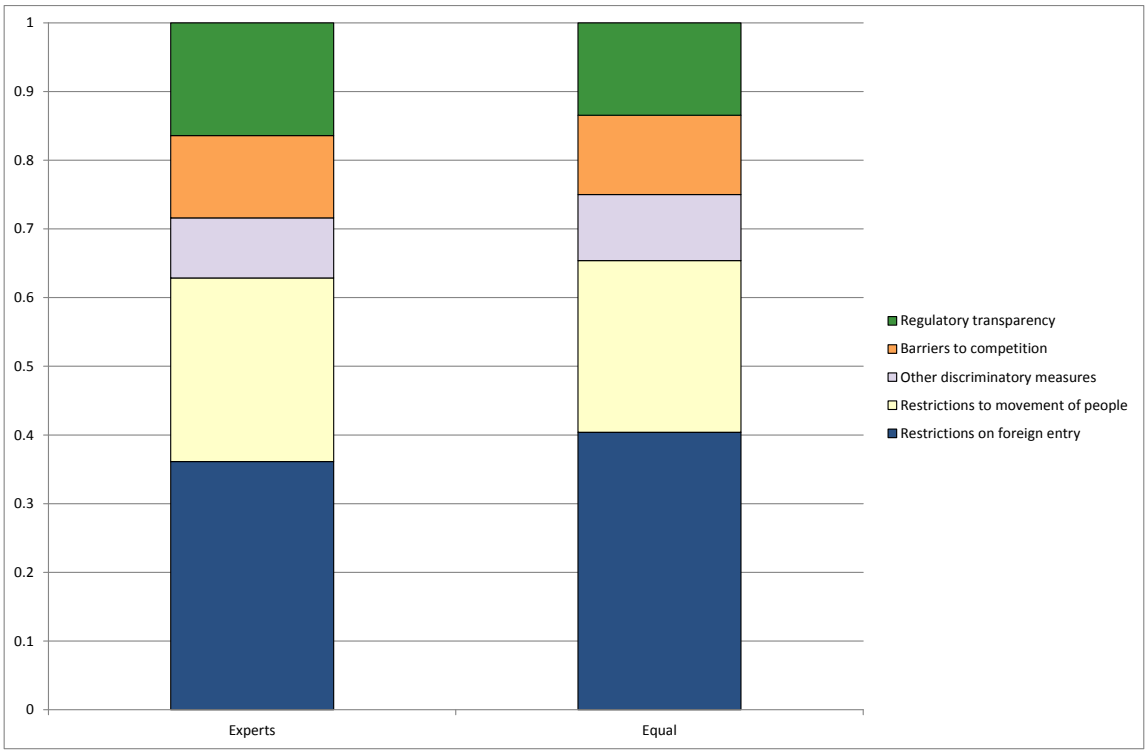
The weighting scheme used for the calculation of the STRI relies on expert judgment. A large number of experts were asked to allocate 100 points among the five policy areas presented above. These are translated into weights by assigning the weight experts allocated to the policy area to each measure that falls under it and correct for differences in the number of measures under the policy areas.[12] The sensitivity of the indices to the weighting scheme has been tested by experimenting with alternatives and by picking 3000 weighting schemes at random (i.e. Monte Carlo simulations).

Figure 1 illustrates how expert judgment weights differ from equal weights in the computer services STRI.[13] It depicts the index for a hypothetical country in which all of the measures in the STRI take the most restrictive value. Experts judge *Restrictions on Movement of people* and *Regulatory transparency* as more important than the equal weight scenario, while *Restrictions on foreign entry* are considered less important. The weights reflect that computer services are a skilled labour-intensive sector where temporary movement of people is important, either in combination with other modes or as a stand-alone mode of supply. The fact that weighting schemes yield a different regulatory profile should not be confused with the impact of the weighting scheme on the overall restrictiveness index. Indeed the overall index value is one regardless of the weighting scheme in a closed economy and zero regardless of weighting scheme in a totally open economy. The sensitivity of the value of the index to the weighting scheme depends on the extent to which countries have a similar level of regulation in all categories or an uneven regulatory profile. The weighting scheme matters much more for the overall index in the latter case.

12. The formula for measure *j* under category *i* is the following: $w_{ji} = score_j w_i / \sum_i n_i w_i$ where n_i is the number of measures under category i and w_i is the share of the total number of points allocated to policy area *i* by the experts.

13. Equal weights are defined as $w_i = 0.20$ for all *i* in the formula above.

Figure 1. The composition of the STRI in a totally restrictive country



The method for aggregating the categories into one single index chosen is linear, taking the weighted average (using the expert judgement weights) of the scores. An advantage of assigning a unique weight to each measure is that measures can be aggregated in different ways into different classifications in a consistent manner as shown in the charts below. The disadvantage is a high degree of compensation such that a high score in one category can be compensated by a low score on another category, with the result that there is less variation among countries in the aggregate index than in the sub-indicators. It may, however, well be the case that restrictions are complementary rather than additive. This problem has been dealt with through the scoring system creating hierarchies and bundles of complementary measures when they are logically linked as explained in the methodology paper.

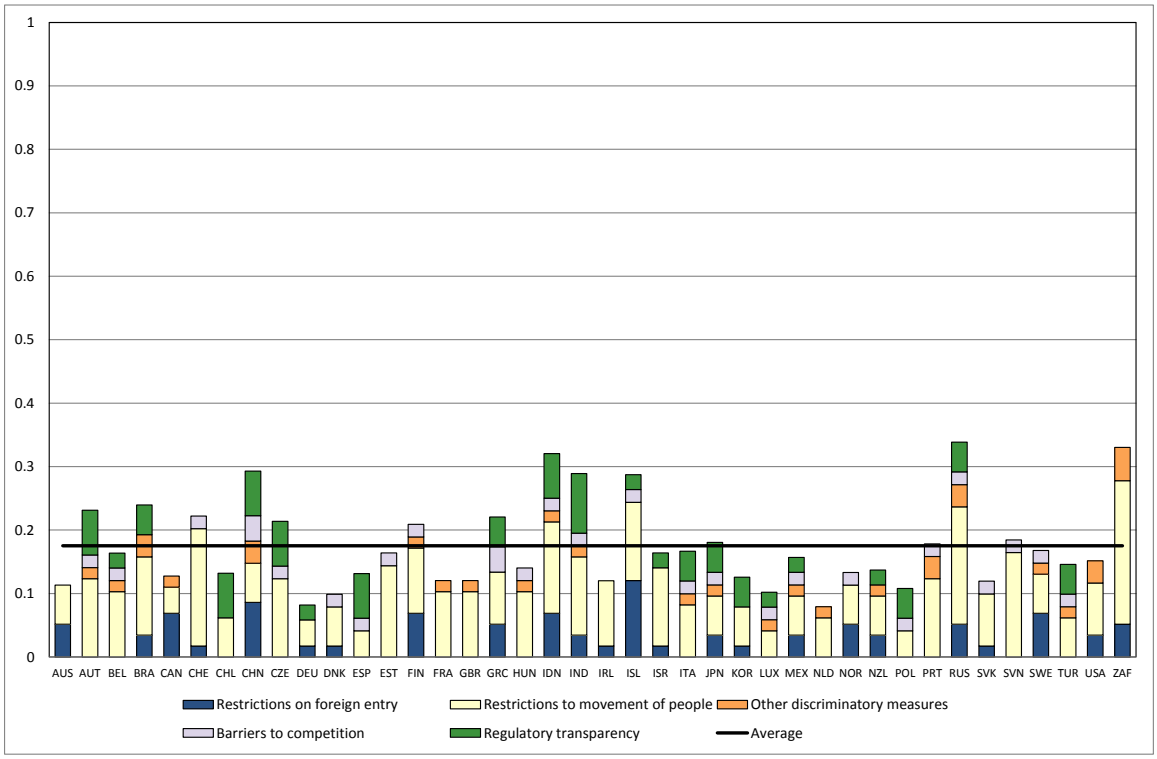
5. Results[14]

This section presents and analyses the results of the STRI calculations. Figure 2 presents STRI for computer and related services by policy area, together with a line indicating the sample average. It is observed that the overall level of restrictiveness is quite low, ranking from 0.08 to 0.34, (where one represents the maximum score) with an average of 0.18 and standard deviation 0.074, suggesting that the STRI captures variation in trade restrictiveness quite well. It is also noted that the distribution according to restrictiveness is slightly skewed towards the low end, as there are fewer countries above than below the average.

14. The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Two policy areas dominate in this sector: *Restrictions on movement of people* and *Regulatory transparency*. It is important to notice that this is not because there are particularly high barriers in these areas for computer services, but rather because there are few other barriers. The last category includes visa processing time. As noted, movement of people is an important mode of supply of computer services, often in combination with cross-border trade or commercial presence. Therefore, experts have assigned a higher weight to barriers to movement of people in this sector than most of the other STRI sectors.

Figure 2. Aggregate computer and related services STRI by category



It is evident that the regulatory profile differs considerably across countries. Note that 16 countries do not have any restrictions on foreign entry. Looking at the details, no country included has foreign equity restrictions in this sector, but some countries, (Estonia, Iceland, Norway and Sweden) require that at least half the board of directors must be residents. This regulation applies to all firms incorporated in the country in question, whether locally owned or foreign. It also applies to all sectors. A number of countries may screen foreign investment in this sector, but only Canada, China and Greece require that investors must show net benefits. It should be noted that the screening regulation is rarely used in some of the countries where such laws are in force. Nevertheless, as long as there is a legal basis for screening, it is recorded in the STRI. China, India and Russia have limitations on cross-border mergers and acquisitions, while all six Key Partners have controls on foreign capital flows in place.

All countries included in the STRI database have some limitations on movement of natural persons as defined in the GATS mode 4. Economic needs tests are applied to stays that last longer than 3-6 months in all countries in which the contribution to the STRI from *restrictions on movement of people* accounts for more than 10 basis points of the index. Quotas on one or more category of natural persons (intra-corporate transferees, contractual services suppliers or independent services suppliers) are in force in Estonia, Greece, Hungary,

Italy, Russia, Slovenia, Switzerland, South Africa and the United States. Russia's high score in this category is also explained by the fact that entry of foreign contractual services suppliers is not permitted. India has labour market tests for the mode 4 categories included in the STRI database, but business visitors may obtain a multiple entry visa of five years' duration allowing for stays for up to six months at a time. These are not subject to labour market tests or quotas.

Other discriminatory measures contain measures related to taxes and subsides, public procurement and the extent to which international standards are considered when setting new domestic standards. Only South Africa reports any form of discrimination related to taxes or subsidies, while a number of countries limit access to public procurement to RTA partners and GPA members. Brazil and China have limitations on government offshoring of computer services. Finally, in a number of countries there is no requirement to consider international standards when setting new national standards. Barriers to competition, which includes public ownership, do not appear wide-spread or particularly pernicious in computer services. The measure that is most frequently recorded is minimum capital requirements, found in 23 countries and the government controls a major firm in the sector in two countries (China and Japan).

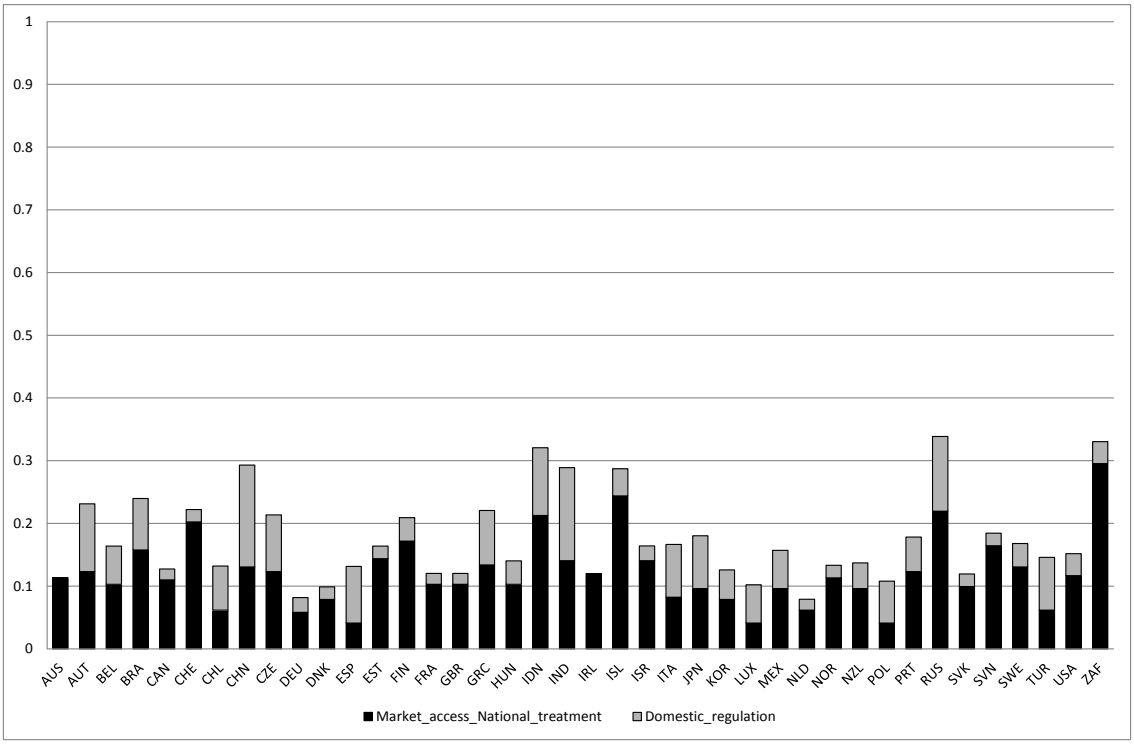
Regulatory transparency builds on information from the administrative laws and regulations countries' embassies and the World Bank Doing Business Survey. The latter records time, cost and number of procedures required for establishing a company. These measures are benchmarked against a global threshold which is set at the 25th percentile of all countries included in the World Bank survey. Forty countries were below that threshold in 2013 (see the methodology paper for details). Perhaps surprisingly, as many as 17 countries in the sample are not among those for one or more of the measures sourced from the Doing Business Survey. There are no legal requirements to publish regulations prior to entry into force or provisions for public comments in 10 countries.

The individual regulatory measures are classified in several ways to highlight different aspects of trade restrictiveness. Figure 3 depicts the composition of the index according to the GATS classification. Panel A represents a decomposition of the STRI by market access and national treatment on the one hand and domestic regulation and other on the other. With the exceptions of Chile, China, India, Italy, Japan, Luxembourg, Poland, Spain and Turkey, measures classified as market access and national treatment make up for more than half of the index value, while the STRI for Australia and Ireland only includes this category.

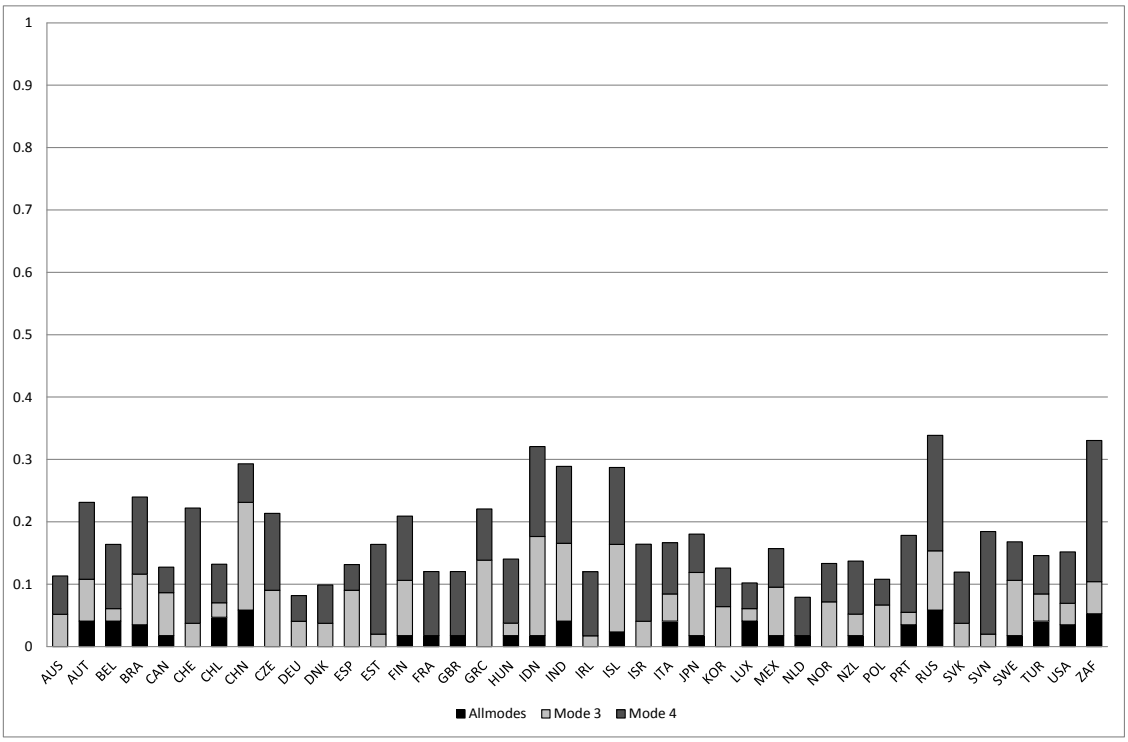
Panel B decomposes the STRI by GATS mode of supply. Across countries, restrictions on the temporary movement of people (Mode 4) represent the most significant component of the STRI. Indeed, all countries contain some barriers or administrative burdens related to this mode of supply. Commercial presence (Mode 3) is restricted mainly through requirements that board members or directors be residents as noted above. In addition administrative procedures related to registration of firms (from the World Bank doing business database) contribute to the Mode 3 part of the index.

Figure 3. STRI by GATS classification

Panel A: Market access/national treatment and domestic regulation/other



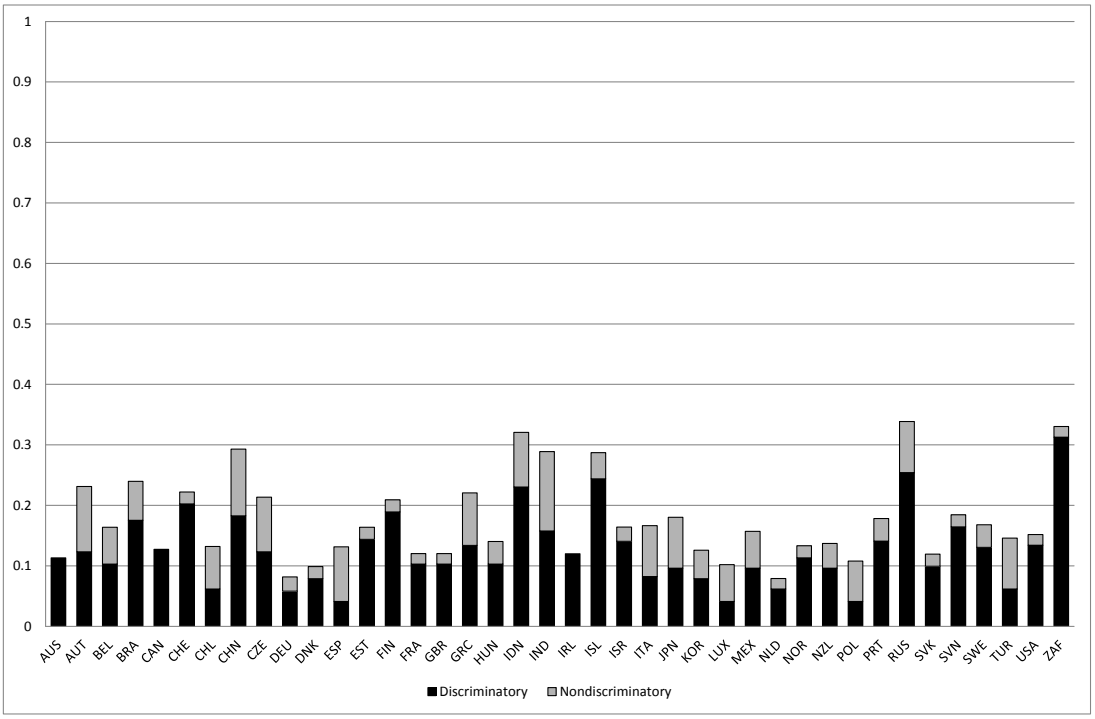
Panel B: Mode of supply



Other classification schemes also shed light on which types of barriers most affect trade in computer and related services (Figure 4).

Figure 4. STRI by other classifications

Panel A: Discriminatory versus non-discriminatory measures



Panel B: On-going operations versus establishment

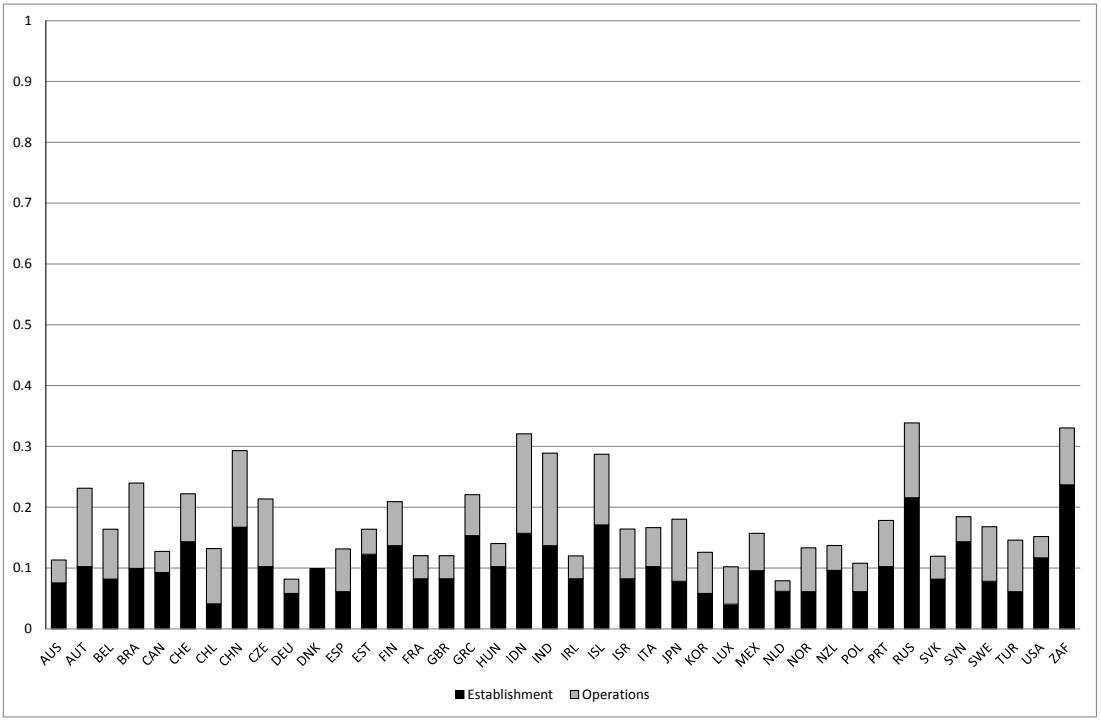


Figure 4 (Panel A) presents the STRI decomposed into discriminatory and non-discriminatory measures. One striking insight from this figure is the large extent to which discriminatory measures contribute to the STRI in this sector. Non-discriminatory measures, such as transparency measures, competition issues and administrative procedures, feature much less prominently in the index.

In the on-going operations and establishment classification (Figure 4, Panel B), barriers to establishment are much more prominent contributors to trade restrictiveness in the sector. This is largely driven by barriers to temporary movement of people, which – from the point of view of the Mode 4 services supplier – is a restriction on entry.[15]

To summarise, those measures classified as discriminatory or as national treatment and market access measures contribute the most to countries' STRI scores. Mode 4 barriers are the most prevalent among the modes of supply, and also the restrictions on Mode 3 are related to movement of people since the most prevalent of these are residency requirements for board members and managers. None of the countries analysed restrict foreign ownership via equity limitations.

6. Sensitivity analysis

This section tests the sensitivity of results to the weighting scheme that has been chosen. Figure 5 shows how much the chosen weighting scheme drives the STRI results. Panel A depicts the overall index for computer and related services when equal weights are used, Panel B presents the range of possible index values when calculated on the basis of 3 000 weighting schemes chosen at random (Monte Carlo simulations).The mean for all simulations and the lowest and the highest simulation result are shown and compared to the STRIs calculated on the basis of expert judgement weights.

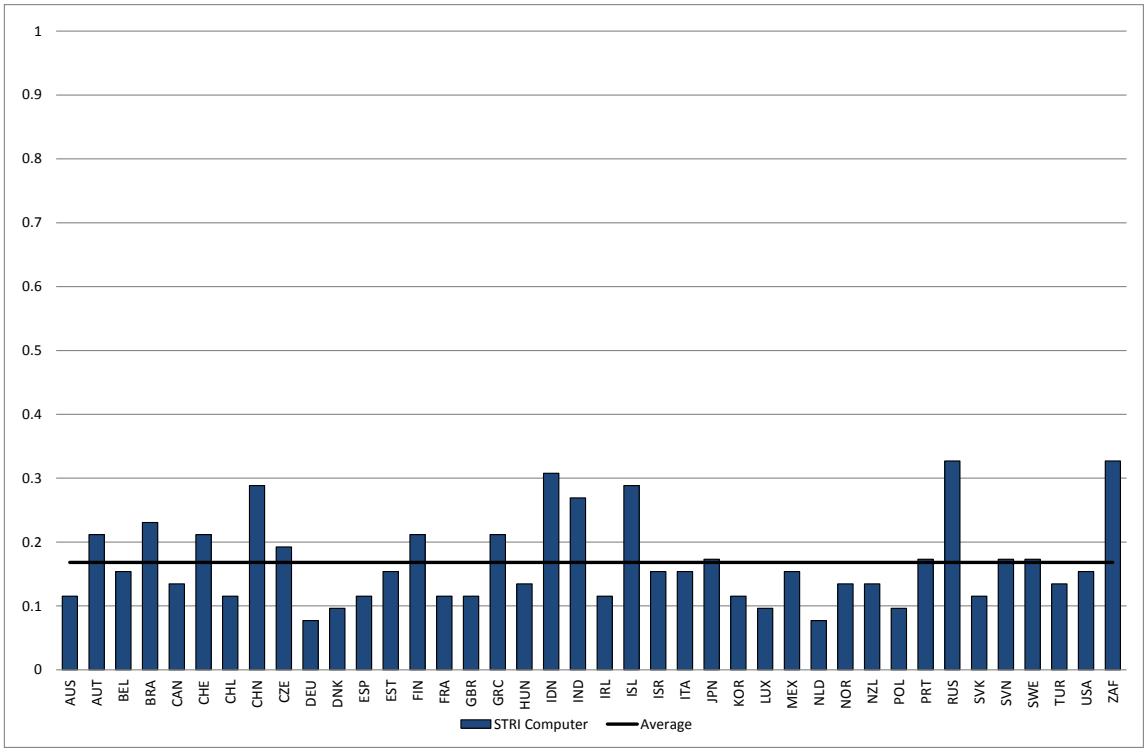
Comparing the equal weights-based indices to the STRIs (Figure 2) it is noticed, first, that the average is slightly lower in the equal weights case. Second, some countries have exactly the same index value in Figure 5A. For instance Australia, Chile, France, Ireland, Korea, the Slovak Republic, Spain and the UK have the same score. There are several other groups of countries that also score the same. This is not observed to the same extent in the indices calculated on the basis of expert judgment weights presented in Figure 2. Expert judgment weights thus capture variation in restrictiveness across countries better than equal weights. Finally, the weighting makes a relatively large difference for the index value of countries that have an uneven regulatory profile with restrictions concentrated in one of two policy areas, as should be expected. Chile is a case in point where restrictions are found only in the two policy areas which experts deemed most important. The Spearman rank correlation between the STRI calculated with expert judgement and equal weights is 0.988.

As explained in Section 4, an index value is more affected by the weighting scheme the less even the regulatory profile. For computer services, the restrictions are concentrated under two or three categories for most countries. This being the case, it is obvious that the overall index value depends on the weights that are assigned to categories under which the restrictions are found, as is clearly illustrated in Panel B, which depicts all possible values of the STRI drawn from 3 000 random sets of weights (Monte Carlo simulations). The distance between the lowest and highest possible value is quite large, but the average for the random weights simulations are quite close to the STRIs calculated using expert judgment.

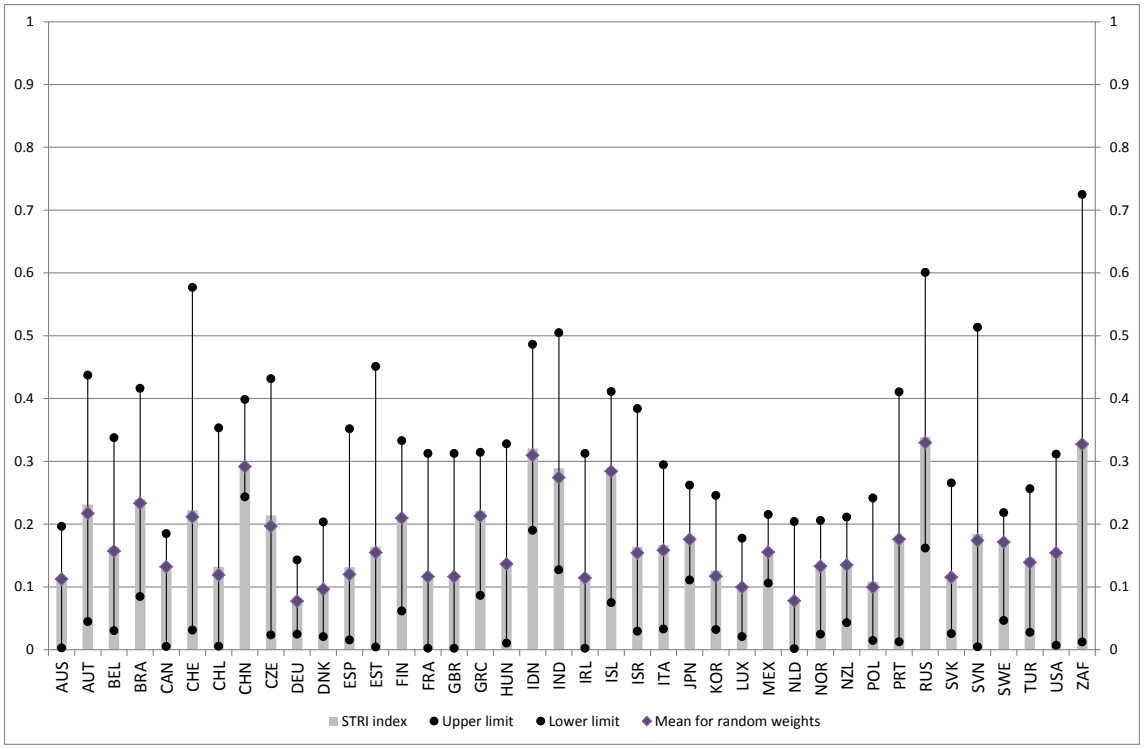
15 . Restrictions on intra-corporate transferees are, however, considered a restriction on operations (see the Annex table).

Figure 5. The computer and related services STRI using different weighting schemes

Panel A: Equal weights



Panel B: Random weights



7. Summary and conclusions

This paper has presented the STRI for computer services, which is one of the most dynamic sectors in international services trade. Computer services can easily be traded across borders through electronic networks. Therefore it has been considered a freely traded service in the popular debate. Although one should be cautious about direct comparisons between sectors, it appears that the barriers to trade in computer services are on average not very different from those in the other sectors included in the STRI project. This is mainly because computer services are sensitive to general trade restrictive regulations related to movement of people and administrative procedures that may be time consuming.

The importance of barriers to the movement of natural persons is unsurprising. This is a skilled labour-intensive sector, and although computer services can in principle be traded cross-border, recent research has found that modes of supply appear to be complementary. For instance, previous research under the STRI project found that restrictions related to the movement of natural persons are negatively associated with both trade and investment in the sector, and this was also the only sector analysed in which this was the case (Nordås and Kox, 2008).

Computer services are sensitive to timely delivery. Most economic activities depend on computer systems, and problems with their smooth running can create large economic losses. Regulatory barriers that impede the timely delivery of computer services can therefore be quite trade restrictive.

The way the STRI is constructed provides policy makers with a tool for identifying in which policy areas reforms are most needed. It is well suited for cross-country comparison and also, in the future, developments over time. For trade negotiators it provides a tool for identifying in which areas the binding trade restrictions can be found, which informs the process of setting priorities for a negotiating agenda.

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Annex A. The STRI Index values by policy area

Country	Restrictions on Foreign Entry	Restrictions to movement of people	Other discriminatory measures	Barriers to competition	Regulatory transparency	Overall indicator
AUS	0.05	0.06	0.00	0.00	0.00	0.11
AUT	0.00	0.12	0.02	0.02	0.07	0.23
BEL	0.00	0.10	0.02	0.02	0.02	0.16
BRA	0.03	0.12	0.03	0.00	0.05	0.24
CAN	0.07	0.04	0.02	0.00	0.00	0.13
CHE	0.02	0.19	0.00	0.02	0.00	0.22
CHL	0.00	0.06	0.00	0.00	0.07	0.13
CHN	0.09	0.06	0.03	0.04	0.07	0.29
CZE	0.00	0.12	0.00	0.02	0.07	0.21
DEU	0.02	0.04	0.00	0.00	0.02	0.08
DNK	0.02	0.06	0.00	0.02	0.00	0.10
ESP	0.00	0.04	0.00	0.02	0.07	0.13
EST	0.00	0.14	0.00	0.02	0.00	0.16
FIN	0.07	0.10	0.02	0.02	0.00	0.21
FRA	0.00	0.10	0.02	0.00	0.00	0.12
GBR	0.00	0.10	0.02	0.00	0.00	0.12
GRC	0.05	0.08	0.00	0.04	0.05	0.22
HUN	0.00	0.10	0.02	0.02	0.00	0.14
IDN	0.07	0.14	0.02	0.02	0.07	0.32
IND	0.03	0.12	0.02	0.02	0.09	0.29
IRL	0.02	0.10	0.00	0.00	0.00	0.12
ISL	0.12	0.12	0.00	0.02	0.02	0.29
ISR	0.02	0.12	0.00	0.00	0.02	0.16
ITA	0.00	0.08	0.02	0.02	0.05	0.17
JPN	0.03	0.06	0.02	0.02	0.05	0.18
KOR	0.02	0.06	0.00	0.00	0.05	0.13
LUX	0.00	0.04	0.02	0.02	0.02	0.10
MEX	0.03	0.06	0.02	0.02	0.02	0.16
NLD	0.00	0.06	0.02	0.00	0.00	0.08
NOR	0.05	0.06	0.00	0.02	0.00	0.13
NZL	0.03	0.06	0.02	0.00	0.02	0.14
POL	0.00	0.04	0.00	0.02	0.05	0.11
PRT	0.00	0.12	0.03	0.02	0.00	0.18
RUS	0.05	0.19	0.03	0.02	0.05	0.34
SVK	0.02	0.08	0.00	0.02	0.00	0.12
SVN	0.00	0.16	0.00	0.02	0.00	0.18
SWE	0.07	0.06	0.02	0.02	0.00	0.17
TUR	0.00	0.06	0.02	0.02	0.05	0.15
USA	0.03	0.08	0.03	0.00	0.00	0.15
ZAF	0.05	0.23	0.05	0.00	0.00	0.33

Annex B. List of measures by category

Measure	MA&NT/ Domestic reg./other	Mode	Establishment/ Operations	Discr./ Non-discr.
Restrictions on foreign entry				
Foreign equity restrictions: maximum foreign equity share allowed (%)	MA&NT	3	E	D
Non-residents are allowed to invest in local computer services firm through minority shares in local investment companies. Maximum foreign ownership in local investment companies (%)	MA&NT	3	E	D
There are statutory or other legal limits to the number or proportion of shares that can be acquired by foreign investors in firms that are controlled by national state or provincial governments	MA&NT	3	E	D
Legal form: only joint ventures are allowed	MA&NT	3	E	D
The number of firms permitted to practice is restricted by quotas	MA&NT	3	E	D
Board of directors: majority must be nationals	MA&NT	3	O	D
Board of directors: majority must be residents	MA&NT	3	O	D
Board of directors: at least one must be national	MA&NT	3	O	D
Board of directors: at least one must be resident	MA&NT	3	O	D
Manager must be national	MA&NT	3	O	D
Manager must be resident	MA&NT	3	O	D
Screening: foreign investors must show net economic benefits	MA&NT	3	O	D
Screening: approval unless contrary to national interest	MA&NT	3	E	D
Screening: notification	MA&NT	3	E	D
Restrictions on the type of shares or bonds held by foreign investors	MA&NT	3	E	D
Conditions on subsequent transfer of capital and investments	MA&NT	3	E	D
Restrictions on cross-border mergers and acquisitions	MA&NT	3	E	D
Other restrictions				
Restrictions on the movement of people				
Quotas: intra-corporate transferees	MA&NT	4	O	D
Quotas: contractual services suppliers	MA&NT	4	E	D
Quotas: independent services suppliers	MA&NT	4	E	D
Labour market tests: intra-corporate transferees	MA&NT	4	O	D
Labour market tests: contractual services suppliers	MA&NT	4	E	D
Labour market tests: independent services suppliers	MA&NT	4	E	D
Limitation on duration of stay for intra-corporate transferees (months):	MA&NT	4	O	D
Limitation on duration of stay for contractual services suppliers is limited to (months):	MA&NT	4	E	D
Limitation on duration of stay for independent services suppliers is limited to (months):	MA&NT	4	E	D

Measure	MA&NT/ Domestic reg./other	Mode	Establishment/ Operations	Discr./ Non-discr.
Other discriminatory measures				
Foreign suppliers are treated less favourably regarding taxes and eligibility to subsidies	MA&NT	All	O	D
Foreign participation in public procurement: discrimination in the application of financial or technical criteria for project tender	Other	All	O	D
Foreign participation in public procurement: restrictions on government offshoring of computer services	Other	All	O	D
There is a formal requirement that regulators consider comparable international standards and rules before setting new domestic standards	DR	All	O	ND
Barriers to competition				
When appeal procedures are available in domestic regulatory systems, they are open to affected or interested foreign parties as well.	MA&NT	3	O	D
Foreign firms have redress when business practices are perceived to restrict competition in a given market	MA&NT	3	O	D
National, state or provincial government control at least one major firm in the sector	Other	3	E	ND
Publicly-controlled firms or undertakings are subject to an exclusion or exemption, either complete or partial, from the application of the general competition law	Other	3	E	ND
Minimum capital requirement	Other	3	E	ND
Regulatory transparency				
Regulations are published or otherwise communicated to the public prior to entry into force	Other	All	O	ND
There is a public comment procedure open to interested persons, and/or the regulator has a formal mechanism for consultation with stakeholders, including foreign suppliers	Other	All	O	ND
Range of visa processing time (days)	Other	4	O	ND
Time to complete all official procedures required to register a company (in calendar days)	Other	3	O	ND
Total cost to complete all official procedures required to register a company (in USD)	Other	3	O	ND
Number of official procedures required to register a company	Other	3	O	ND

Note: MA&NT refer to market access and national treatment.