Quantification of Services Trade Restrictions
- *Some New Results*

Manoj Pant[1] and Sugandha Huria[2]

Abstract

Recent research and availability of value-added statistics have made the design and implementation of services trade policies a high-profile issue for many countries. However, in contrast to the extensive literature available on the assessment of goods trade and trade-barriers, limited attention has been paid to quantify the regulatory restrictiveness of services trade across the globe.This paper attempts to contribute to this literature by building on the well-known World Bank and OECD'sservices trade restrictiveness indices. We propose an alternative weightingand a new scoring technique, the application of which to OECD data,alters various properties of the indexand makes it more appropriate to be used for policy purposes.A number of robustness and relevance checks verify that the index performs in line with the theory. We also show that (like OECD STRI), our resulting indicatorstrongly correlates with bilateral services trade flows at the sectoral level. However, the relative ranking of policies (in terms of restrictiveness) significantly differ when the two STRIs are assessed at the level of policy-groupings.

Key Words: Services Trade, Regulations, WTO trade negotiations, OECD's Services Trade Restrictiveness Index, World Bank's Services Trade Restrictiveness Index

JEL Classification: F13, F15, O24

1. BACKGROUND

When trade negotiations led to the establishment of the World Trade Organisation in 1995, one element of the structure established was the General Agreement on Trade in Services (GATS). However, at that particular point, there were limited interests by countries on establishing an architecture for regulating services trade. This lack of interest manifested itself in the use of the'positive list' approach as compared to the 'negative list' approach used for goods trade.Even the majority of the trade pacts at the bilateral or plurilateral levels, in the past,were centred around goods trade only. Services, on the contrary, were perceived to be of interest to the rich industrialised nations and usually side-lined as other trade matters (Roy 2019).

Recent research and availability of value-added statistics (OECD, World Bank, and other databases), however, have completely rendered these perceptions baseless. Estimates show that not only the services sector is important in its own right, but also serves as a backbone to ensure physical as well as digital connectivity throughout the world. In fact, data reveal that services underpin virtually all the

[1] Indian Institute of Foreign Trade, New Delhi-India. Email: <mpant101@gmail.com>, <diroffice@iift.ac.in>; Contact No. +919811227753.

[2] Jawaharlal Nehru University, New Delhi-India. Email: <sugandhahuria@hotmail.com>; Contact No. +919811056512.

Acknowledgements

The authors would like to thank Ministry of Commerce and Industry (MOCI, Government of India) for funding this research. They would also like to thank Prof. K. L. Krishna, Prof. BishwanathGoldar, Prof. Aparna Sawhney and Dr.Pralok Gupta for their invaluable suggestions in critically analysing the methodologies of the existing indicators. Thanks, is due to Dr.HidegunnNordas and Dr. Sebastian Benz for their continuous help in understanding the OECD technique, and to Dr.Aaditya Mattoo for explaining the details of the World Bank methodology. The authors would also like to thank Prof. James Nedumpara and his team at the Center for Trade and Investment Law for their help in organizing the workshop with legal experts and to the participants of the workshop for sharing their expert views on policies affecting sector-specific services. The authors are highly grateful to Piyali Majumder, StutiBawa, Srinka Bose, SukritiMahana, Mahika Sharma and Yamini Nair Chandran for their help in data work. The paper immensely benefitted from suggestions received during the World Bank-MOCI workshop on 'Trade Facilitation in Services–Concepts and Empirical Analysis' in December' 2019. The discussions with the trade policy division's officials at the MOCI have been very helpful in conducting this research.

economic activities needed in the production of other goods and services.[3]Along with the growing literature on servicification of manufacturing firms and rising global value chains (that is indicative of this latter phenomenon), the expanding body of research on trade in services, with a specific focus on its impact on economic development and trade integrations, has made services trade policy a high-profile issue for many countries.Consequently, services have started gaining attention on the global policy front as well. For instance, there is this plurilateral arrangement (Trade In Services Agreement) where 50 countries (28 belonging to the European Union) are attempting to negotiate principles governing services trade.A services trade chapter is already being negotiated in many regional trade agreements like EU-Japan, India-ASEAN and in other mega-blocs like TTIP, CPTPP along with the related issue of foreign direct investment. The multiple rounds of RCEP negotiations held in the past, also made it quite evident (though the details are not publicly known) that a key feature of the deal is its extension to incorporate services trade-related commitments.

While it seems that the old perceptions are gradually changing, it is essential to note that serious forward movement on regulating services trade (specifically at the global front) is still in infancy for a number of reasons. There (still) exists a dearth of studies on assessment of services trade restrictivenessin comparison to the extensive literature available on regulations affecting goods trade.For one,it is easy to identify the barriers affecting goods trade on the basis of broader restrictions like tariff and non-tariff measures. Various big organisations such as the WTO, UN, OECD or UNCTAD, regularly update their toolkitswith information onboth goods trade (at a fairly disaggregated (internationally harmonised) level) and trade restrictiveness to help countries identify regulatory divergence and guide policymakers during negotiations.

However, the nature of services trade is such that restrictiveness is based on internal regulatory policies that are not easy to orchestrate at a global level. Not only are these restrictions qualitative, but they also differ according to various modes of supply of services (as defined in GATS).[4] In addition, countries loathe to come up with an internal legislative commitment when this involves sub-national authorities, especially in large open economies.Even when the nature of services is harmonised at a multilateral level and databases of the OECD,WTO (among others) are now available where detailed classifications of services can be found with some degree of international standardisation, the question remains how to quantify the restrictiveness of services trade. This is essential to ensure informed decision making, backed by sound theoretical as well as empirical research.

Work on this quantification actually began with Hoekman's (1995a) seminal study on 'Assessing the General Agreement on Trade In Services'. In the absence of (disaggregated) services trade statistics and regulatory databases during that time, the author definedthree proxy measures for services trade restrictiveness by scaling the sectoral commitments of GATS' members. The three indicators were – (a) Number of sector-modes of supply commitments relative to maximum possible commitments, (b). a weighted average of sector-modes listed as a share of the maximum possible, weighted by openness/binding factors. The weights so utilised were – '1' for none/no-restrictions, '0' for unbound, and '0.5' for bound restrictions. The third measure or (c) equals the share of 'no-restrictions'

[3]Miroudot et al. (2012), Lanz and Maurer (2015), Lodefalk (2017), Miroudot and Cadestin (2017).

[4]Unlike tariffs, even non-tariff measures (NTMs) are not easy to quantify/model. Various approaches, such as the inventory approach (e.g., frequency/transaction index) or the modelling approach, computation of tariff/subsidy equivalents or price wedge, etc. have been utilised to quantify the impact of NTMs (Bora et al. 2002). In fact, several databases such as the World Bank's WITS database, UNCTAD-TRAINS, and WTO I-TIP (Integrated Trade Intelligence Portal) 'Goods' now entail detailed information on NTMs applied by the WTO members in merchandise trade. The data is provided by country, type of measure, affected product (at the most disaggregated level) and partner country, and several other variables, including the source of information, dates, textual descriptions, etc.

commitments in (i) a member's total commitments and, (ii) relative to the possible sectors of the GATS' list. Such measures could be construed asdrawing a parallel between goods trade (that is also restricted by NTMs, the extent of which are quantified using frequency measures) and services trade, which is often guided by non-border regulations that are 'non-price-based' in nature. Similar attempts were also made by Mattoo (1999) and Khatun et al. (2019) with a specific focus on financial services and by Brown and Feinberg (2004), where the primary objective was to quantify impacts of negotiated commitments affecting voice telephone services. Mattoo et al. (2006) also constructed an index for telecommunication and financial services using a lexicographic method focussing on three variables – domestic market structure, foreign equity participation and nature of regulation in telecommunication/ease of cross border trade in financial sector by using policy information from negotiated commitments as stated in GATS. Undoubtedly, the method proposed by Hoekman (1995a) instigated research in this unexplored area, but the issue with the usage of such indices is that they do not reflect the actual/existing level of restrictiveness – which (at present) seems to be less than what is reflected by GATS' commitments (though (of course) the difference between the two varies across countries). In addition, GATS commitments are limited to market access and national treatment (with MFN treatment being a general obligation in GATS), while STRIs go into the area of domestic regulation, thus covering a broader set of trade restrictive measures.

Against this backdrop, the first detailed quantification was attempted by the Australian Productivity Commission, in association with Australian National University during the late 90s and early 2000s. As a summary measure, the project reported an objective 'restrictiveness index' based on regulatory regimes, for a total of 9 sectors and 34 economies spanning regions of Europe, Asia, North and South America. The index captures the extent to which regulatory policies restrict services trade. The results of the study were also utilised to produce tax equivalents of the price/cost effects of restrictions in selected services.[5] As argued by Dee (2003), their estimates were reasonably comprehensive in terms of their coverage. They provided the first set of assessments of the extent and impact of services trade restrictiveness in the selected countries.However, all this information is available for only a year and has not been extended to cover moresectors or countries, thus warranting additional work in this area.

While variousother systems came into being around the same time, the next (and a relatively more comprehensive) attempt was made by the World Bank in establishing a Services Trade Restrictiveness Index (STRI) from around 2008.Using a database of internal and external regulatory measures requiring liberalisation of services, an index was developed for a large cross-section ofdeveloping and developed countries.[6]Simultaneously, the OECD also initiated this exercise in a somewhat similar system, spanning a broader range of policies and services sectors. Even though the OECD yields estimates only for a handful of developing economies (apart from the 36 OECD countries), it regularly updates its database to come up with a continuous time series(on a yearly basis), starting from 2014 onwards (unlike the Bank's data that is limited to only one year[7]).

Both the World Bank and OECD methodologies rely on calculations of a theoretical index applied to perception-based surveys, which provided quantification byscoring of regulatory policies.The two indices indicate policy areas where restrictiveness could be graded from high to low and where countries could get some handle on where to start with liberalisation of services in trade.[8] These policy areas are very exhaustive and range from restrictions on the entry of foreign services providers to domestic discretionary regulatory measures. In fact, the review of the existing literature suggests that

[5]For details, see Findlay and Warren (2000), Kalirajan (2000), Nguyen-Hong (2000), among others.
[6]Borchert et al. (2012).
[7]2008/2011 – depending upon when the country (under consideration) was surveyed.
[8]A more elaborate description of the methodology is given in section 2.

the two indices are now increasingly utilised by policymakers in analysing their potential areas for reforms or designing negotiating frameworks (at various fora);the release of their databases also initiated an altogether new line of research on assessing the impact of regulatory (services) policies on trade, investment and other facets of economic performance.[9] In a recent study, Hoekman and Shepherd (2019) have utilised an innovative method using Machine Learning tools to extend the OECD STRI coverage to cover more number of developing economiesusing the recently released World Bank-WTO data on applied services trade policies for the year 2016.[10]A series of robustness checks reveal that their indicator values correlate well with the OECD STRI. Since it is known that a serious challenge in generating indicators based on policy information (if at all it is available, otherwise, collection of such data is a strenuous activity in itself and fairly costly as well) is to appropriately weigh and aggregate the information into a single numerical measure, the technique devised by the authors provides a sound alternative to generate a quantitative indicator of services trade restrictions.While this represents a laudable effort, their study doesn't estimate policy-area specific STRIs, which assume an imperative role in guiding the policy decisions.

In this light, the present paper aims to contribute to this literature by building on the well-known and widely used World Bank and OECD STRIs. Critically analysing their methodologies, we propose the usage of an alternative weighting technique and an improved scoring criterion, which, when applied to the existing indices, alter some of their properties and also correct for certain inherent issues,thus making them more appropriate for policy purposes.

To empirically demonstrate the working of the alternative index, we utilise information from OECD's (STRI) Regulatory database[11] for the year 2018 and recompute the value of their indicator using our proposed methodology. The resulting estimates generate a few interesting observations, the first being – at the sectoral level, our STRI correlates closely with that of the OECD measure. This goes well with the theory as introducing changes in weighting and scoring technique (while retaining the OECD expert weights as well as scores of restrictiveness) should not lead to a major difference in indicator values. Thus, like in the case of OECD, we find that our alternative indicator fits well with the analytical literature on services policies, and strongly correlates with bilateral trade in services in the context of a standard gravity model. The second and perhaps the most important finding is that the policy-area specific STRIs significantly differ between the two. In other words, we find that for many country-sector pairs, the prioritisation of policies for liberalisation tends to change – something that is very crucial in provoking dialogues and carrying forward international trade negotiations at various fora. Limited pilot work on an alternative method of generating data on weights indicates that even the choice of the type of survey technique alters rankings considerably. While we recognise the fact that no indicator is 'perfect', our results suggest that the application of the proposed criteria to OECD data might be useful in improving the existing estimates.

Subsequent sections of this paper are organised as follows. Section 2 briefly discusses the OECD's and the World Bank's STRI methodologies, focussing on their theoretical construction and empirical estimation. The next section entails information about the alternative index that we propose and how that compares

[9]The World Bank's STRI data is available at <https://www.worldbank.org/en/research/brief/services-trade-restrictions-database> and the OECD's Regulatory data is available at <https://stats.oecd.org/>. Studies by van der Marel and Shepherd (2013), Beveralli et al. (2017), Hoekman and Shepherd (2017), among others, have utilised the World Bank' estimates, while those by Nordas and Rouzet (2015, 2017), Chanda (2017), Ciuriak et al. (2019), etc. have employed the OECD estimates in their empirical research.

[10]This database is available at <http://i-tip.wto.org/services>.

[11]This data is available at <https://qdd.oecd.org/subject.aspx?Subject=063bee63-475f-427c-8b50-c19bffa7392d> and <https://sim.oecd.org/>.

with the existing indices. In section 4, we apply our alternative technique to OECD regulatory data and present the resulting policy indicators. This section also validates the alternative STRI by running a few robustness and relevance checks. Finally, the lastsection concludes the study by suggesting potential steps forward.

2. CONSTRUCTION OF AN STRI - *A brief about World Bank's and OECD's Methodology*

From the review of existing literature, it is clear thatsix-seven steps in the construction of an STRI can commonly be distinguished, namely:

a. Identification of regulatory policies in services,
b. Categorisation of regulations into different groups/sub-groups,
c. Identifying the weights to be assigned to group/sub-groups determined in step (b),
d. Distribution of weights assigned to the groups/sub-groups to regulations that belong to them,
e. Determination of restrictiveness scores of all the measures for countries/sectors under consideration,
f. Calculating the group/sub-group specific STRI, and finally
g. Computing the sectoral/country-level STRI

In the case of the World Bank's STRI,[12] regulations were categorised in terms of modes, while the OECD categorises them under five heads, which they refer to as the policy areas.[13] These are - Restrictions on Foreign Entry, Restrictions to Movement of People, Other Discriminatory Measures, Barriers to Competition, and Regulatory Transparency. While some of the regulations may be common to all/more than one mode, the five policy areas are distinctly defined.

The weighting technique so applied, however, seems to be more or less similar in the two cases. Both the World Bank and the OECD consulted experts to know their opinions regarding the importance of groups (modes/policy areas) in sectors under consideration. The OECD, in particular, adopted the Budget Allocation Process, whereby the experts were asked to allocate a total of 100 points among the five policy areas in terms of their level of importance.

The next important step (which plays a crucial role in defining the theoretical construct of the indices) relates to the distribution of weights among the regulations (or what OECD terms as 'measures') belonging to groups. Considering the fact that not all the policy areas are equally loaded with measures, the OECD normalises the expert weights to correct for these differences and compute what we refer to as Computed Weights, which of course, differ from expert assignments.[14] Thereafter, they divide the computed weights equally among the measures belonging to a policy area.

Algebraically, these weights can be represented as:

$$cw_i^{OECD} = \underbrace{\frac{n_i}{\sum_i n_i w_i^{OECD}}}_{\text{normalisation}} * w_i^{OECD} \quad \ldots. (1)$$

And, $cw_i^{j,OECD} = \frac{cw_i^{OECD}}{n_i}$

[12]Here, we focus only on the 'old' World Bank Index that was released in the year 2012 since complete information about the new World Bank-WTO index is not available.
[13]Grosso et al. (2015).
[14]Only when all the policy areas contain an equal number of measures, can computed weights be the same as the expert weights.

Here, i and j represent the policy area and measure belonging to that policy area, respectively, with n_i referring to the number of such measures. Similarly, w_i^{OECD} and cw_i^{OECD} represent the expert weight and computed weight of policy area i, respectively, while $cw_i^{j,OECD}$ refers to the computed weight of any measure j belonging to area i.[15]

What is different in the case of the World Bank? – Rather than assigning weights to all the measures pertaining to a mode, the WB determines the most restrictive/binding measure in the group and assigns thetotal weight to that particular measure. For instance, if foreign suppliers are not allowed to enter in the first place, then that restriction is binding, and other restrictions on operations and regulatory environment do not matter. According to Borchert et al. (2012), this methodof assigning a score of restrictiveness to a bundle of measures allows one to consider the existence of binding restrictions that potentially render other measures redundant. As a result, it also helps in avoiding the issue of double-counting or adding individual measures with fixed weights. While the technique ensures that the STRI is independent of the number of individual measures and hence, any measure could be easily substituted, added or removed in the building of the index, it also involves a lot of subjectivity as far as the determination of the most binding indicator is concerned and may not (always) appropriately capture the existing policy restrictiveness in a country. More details about this issue are discussed in the section (3).

The next step, (e) again differs between the two. The World Bank uses a'Quasi-continuous scoring' technique. Essentially, the policy regimes were graded based on 5 broad categories, and accordingly, a restrictiveness score from 0 to 100 with intervals of 25 was assigned to each of them. The five regimes are – Completely open, virtually open, existence of major/non-trivial restrictions, very limited opportunities to enter and operate, and no entry allowed at all.On the contrary, the OECD's scoring methodology utilises 0/1 or Binary scores. While these scores are applied directly to all the binary measures (yes/no) covered in the OECD database, measures with numerical answers (for example, Foreign Equity Participation allowed) are broken down into thresholds (at times, multiple thresholds) to which binary scores are applied.For example, consider a measure in policy area 1 such as "Foreign Equity Limits". To assign a binary score to this measure, four threshold levels have been determined– less than 100 percent, less than 50 percent, less than 33 percent and 0. So, if the maximum foreign equity share equals 75 percent, then there will be one score of 1 and three scores of 0 (giving a total score of 1) and, if no foreign investment is allowed, then, there will be four scores of one each and thus, a total score of 4 will be assigned to this measure. Further, the OECD also takes into consideration the information about the measures that constitute hierarchies and accordingly assignsa score of 0 or 1.

Finally, both the indices at the level of the policy groups (modes in the case of WB, and policy areas in the case of the OECD) are calculated using the following formula:[16]

[15]To understand the working of this formula, consider a case with three policy areas – 1, 2 and 3 and assume that these areas contain five, ten and fifteen measures, respectively. If experts assign a weightage of 20% to policy area 1, 50% to policy area 2, and 30% to policy area 3, then as per equation (1), computed weight of the three policy areas will be given by: $\left(\frac{5}{5*20+10*50+15*30} * 20\right), \left(\frac{10}{5*20+10*50+15*30} * 50\right)$, and $\left(\frac{15}{5*20+10*50+15*30} * 30\right)$, i.e., $(9.52\%, 47.62\%, 42.86\%)$. Therefore, the computed weights for measures belonging to each of these areas will be given by: $\left(\frac{0.0952}{5}, \frac{0.4762}{10}, \frac{0.4286}{15}\right) = (0.0190, 0.0476, 0.0286)$.

[16]Consider that the OECD's expert weights are similar to the World Bank's expert weights. In that case, if there are three restrictive measures in policy area 1, then $STRI_1^{OECD} = 0.0190 * 3 = 0.057$. However, if out of the three measures, the most restrictive measure gets a restrictiveness score of 50, then, $STRI_1^{WB} = 0.0952 * 50 = 4.76$. It is worth mentioning here that the OECD STRI always lies between [0, 1], while the WB's STRI belongs to the range [0, 100]. But, to ensure consistency throughout the paper, we have used the OECD's notations as well as terminology, wherever possible.

$$STRI_i^q = Weight_i^q * RestrictivenessScore_i^q \; q \in \{WB, OECD\} \quad ....(2)$$

where$Weight_i^q$ = Expert-weight assigned to mode i, if $q = WB$

= Computed Weight assigned to measures belonging to policy area i, if $q = OECD$

And,

$RestrictivenessScore_i^q$ = Restrictiveness score of the binding measure in mode i, if $q = WB$

= Number of restrictive measures in policy area i, if $q = OECD$

These group-specific STRIs are then linearly aggregated to compute sectoral STRIs. The WB moves one step ahead and also calculates country-level STRIs by considering a weighted average of sectoral STRIs. Here, weights are equivalent to the average share of a given services sector in services value added for an average industrialised country (based on Hoekman 1995b).

Thus, this is how the two STRIs have been computed. From the discussion, it is evident that there are two parts to any index – the theoretical definition of the indicator itself and its empirical counterpart, which is constructed/estimated using data from different sources. The former depends on how the group-specific weights are distributed among the regulations and how the group-specific STRIs are ultimately aggregated to find out (say) sectoral STRI. Undeniably, the selection of weights might have a significant effect on the conclusions derived from an index. This is because, as stated inOECD (2008) report, the meaning of weights is actually twofold as far as a composite index is concerned – one, it represents the 'explicit importance' attributed to a criterion (groups, in our case). This is because it is a kind of a coefficient that is attached to a criterion to signify its importance.Secondly, it also refers to the 'implicit importance' since weight of a criterion is determined relative to the other criteria. In other words, these weights also represent the trade-off between different pairs of criteria that shows up in the final process of aggregation.The empirical counterpart, however, relates to how these weights are collected, scores are determined, and finally applied to compute the value of a composite index. This implies that the robustness of an STRI and soundness of the policy messages that it conveys depend not only on the theoretical approach used in its construction but also on the data and the quality of the framework so applied. This forms the basis of our selection of an alternative method to derive an objective indicator of services trade restrictions, the details of which are provided in the next section.

3. AN ALTERNATIVE STRI – *theoretical and empirical issues*

Based on the review of the literature on composite indicators as well as existing STRIs, we divide this section into two sub-sections. First and foremost, it is important to note that since the entire OECD regulatory data (on expert/computed weights, scores, policy-specific and sector-specific STRI) is available online on OECD's STRI Policy Simulator database, most of our discussion revolves around how one can build on the OECD's method and develop an alternative indicator. However, this does not imply that we do not take into consideration the construction of the World Bank STRI – in fact, at each step, we compare the properties of our alternative method vis-à-vis both OECD and the WB methods. Subsection 3.1 discusses the implications of applying an alternative weighting techniqueand how that affects the sensitivity of the index with respect to different parameters, its final values as well as policy conclusions so derived using the existing method. The focus of the next subsection, however, is to discuss empirical issues associated with the construction of an STRI with a greater emphasis on the usage of a new technique for the collection of weights as well as scoring of measures that have not been used in any of the existing STRIs.

3.1 THEORETICAL ISSUES

Policy measures and areas/modes are two important pillars in the construction of the OECD and the WB STRI. As regards the OECD technique, from section 2, it is clear that while assessing the contribution of each policy area, expert weights are normalised to correct for differences in the number of measures across the five policy areas and the calculated/computed weights are then utilised to derive sectoral STRIs. This normalisation is statistically correct and also ensures that the value of the index remains within its limit of [0, 1]. However, it implicitly raises a question – how good a technique can this really be, particularly when the experts were provided with details on all the measures covered in each of the five areas in the questionnaire that they were supposed to fill?Rather, had it been the case that the expert weights reflect the contribution of only an individual measure in one policy area relative to an individualmeasure in all other policy areas, then normalisation would have been necessary to compute the contribution of all measures in one relative to all measures in other policy areas. Algebraically, this means that

$$cw_i^{OECD} = w_i^{j,OECD} \frac{n_i}{\sum_i n_i w_i^{j,OECD}}$$

where$w_i^{j,OECD}$now represents the expert (and not computed) weight assigned to any one measure j belonging to area i and cw_i^{OECD} refers to the weight assigned to all measures in area i relative to all measures in other policy areas, i.e. it represents the (total)computed weight of area i.However, as detailed in the methodology note by Grosso et al. (2015) (and also from OECD's e-questionnaire), the experts were asked to assign a score of importance to the five policy areas only.

An alternative weighting technique could be to retain the expert weights assigned to policy areas by directly distributing them among the respective set of measures.[17] In fact, some of the widely-used composite indices such as the Human Development Index (HDI) or the National Council of Applied Economic Research (NCAER's) State Investment Potential Index (SIPI), among others, also rely on this method. In such a case, the final formula for computation of a policy area-specific STRI will be given by:

$$STRI_i^{New} = w_i^{j,New} * RestrictivenessScore_i = (w_i^{OECD}/n_i)\, RestrictivenessScore_i \quad \ldots(3)$$

where $w_i^{j,New}$ =Weight assigned to any measure belonging to policy area$i$,

n_i = number of measures belonging to policy area i,

w_i^{OECD} = Expert-weight assigned to policy area i,

And,

$RestrictivenessScore_i$ =Number of restrictive measures in policy area i (same as OECD STRI)

However, before applying this technique to data, it is essential to analyse its statistical properties. Appendix A.1shows that the indicator constructed using the alternative techniquealso lies within the

[17] It is well known that participatory methods (often) suffer from the issue of subjectivity bias (though the extent of subjectivity can somewhat be mitigated by extensive consultations with a fairly large group of respondents). However, it is important to note two points here – 1. The point being raised in the main text is not (per se) about the method by which weights are collected, but about the technique via which policy area-specific weights are distributed amongst measures or finally utilised in computing the STRIs; 2. In the absence of sufficient service-wise data on regulations and other service trade barriers, the next best choice is to rely on 'expert weights' to determine the relative importance of the five policy areas in the case of OECD or mode-specific STRIs in the case of the WB. Nevertheless, we cannot neglect the role of the participatory method applied to obtain expert responses.

range of [0, 1]. On comparing the properties of this technique vis-à-vis those applied by the OECD or the WB, we find:

1. Unlike the OECD method, the usage of the alternative weighting technique does not create any divergence between expert weights and the weights that are ultimately used for calculating the index (computed weights in the case of OECD STRI). In fact, in the case of the latter, in some sectors, this divergence is as large as 20-50 percentage points. Table A.2in Appendix A.2 illustrates this difference between expert opinionsand computed weights for all the 22 services covered in the OECD regulatory database.Consider, for example, the case of accounting services, in which the difference between the two columns for policy area 1 or foreign entry restrictions, is given by 28.12 percentage points, or Air Transport, Architectureservices, in which case, the difference is more than 45 percentage points.Consequently, the contribution of policy measures to sectoral STRIs also changes with the usage of computed weights. The alternative weighting technique, while correcting for this issue, also deals with other concerns that crop up due to the OECD's correction/normalisation factor. These are:

a. More than values, the important concern is that the alternative technique does not lead to any change in preference ordering of policy areas (in terms of their importance as impediments to global trade in services), when expert weights are distributed amongst the measures. However, such is not the case with OECD STRI. To investigate the association between the ranking of policy areas for different sectors using the two sets of weights (expert/computed), we calculate Spearman's Rank correlation coefficient. On average, we observe a correlation of about 0.682 (significant at 1 percent level), thus indicating the absence of a one-to-one link between the two rankings. Further, a closer look at the datareveals that this correlation varies across sectors – while it is negative in the case of sound recording and computers, it equals 1 in the case of accounting, distribution, maritime transport, and motion pictures.
With reference to insurance services, for instance, as per Table A.2, the experts view otherdiscriminatory measures as more important than barriers to competition, while the reverse ranking holds once the expert weights get transformed into the OECD's computed weights. That may not be ideal and could (probably) be fixed by ensuring the same number of measures under each policy area. However, the STRIs correspond to the classifications used in international trade agreements/GATS, where measures are only classified under market access and national treatment. As a consequence, the related policy areas(such as restrictions to foreign entry) are implicitly loaded witha higher number of policies than behind the border regulations such as barriers to competition or transparency in administrative procedures in the existing OECD database. This means that we cannot equalise the number of measures in each policy area; rather, thealternative weighting technique can be applied to(completely) correct for this problem. The literature also does not seem to portray any well-defined/widely used composite indicator, which utilises the technique of transforming expert opinions.

b. The second (direct) implication is that the normalisation exercise corrects for this difference by inflating the weights of policy areas with a comparatively higher number of measures while reducing the weightage for others. For instance, let the number of measures belonging to policy area 1 increases, then,

$$\frac{\partial cw_1^{OECD}}{\partial n_1} = \frac{w_1^{OECD}(\sum_{i=1}^{5} n_i w_i^{OECD} - n_1 w_1^{OECD})}{(\sum_{i=1}^{5} n_i w_i^{OECD})^2} > 0$$

And,

$$\frac{\partial cw_k^{OECD}}{\partial n_1} = -\frac{w_k^{OECD}(w_1^{OECD})}{(\sum_{i=1}^{5} n_i w_i^{OECD})^2} < 0$$

where k $\in \{2,3,4,5\} \subset i \in \{1,2,3,4,5\}$. This, in turn, implies that the final index value is dependent on how these policy areas are defined, and a small change in their definition/composition (even while retaining the same set of measures) might lead to dramatic changes in the area-specific STRIs. However, the bigger issue is that the technique creates interdependence between these STRIs due to which any addition (or subtraction) in the number of regulations belonging to any policy area does not only affect the weight and hence, STRI of that area but also necessarily reduces (raises) the STRI of the other policy areas without any change in the restrictiveness of their measures.As a consequence, piecemeal liberalization of policy areas and regulatory measures could not be attempted as it is not possible to theoretically insulate liberalisation in one policy area from other policy areas. This is a worry in that developing countries, in particular, must have some flexibility in prioritising areas for reform.

However, if we apply the alternative weighting technique to compute STRI, then, in that case, the weights and hence, the STRI of policy areas remain independent of the weight of the other policyarea in which changes are introduced (even though the weight of the measure of the latter policy area changes).

Nevertheless, it is equally important to discuss a related issue here. In the scenario described above, regardless of whether or not the total number of restrictive measures change (i.e., whether $\sum D_i^j$ changes or not), OECD STRI of the policy area (to which another measure is added) definitely changes. The magnitude of this change, however, will be less in comparison to when there had been no normalisation (i.e., when we use the alternative weighting technique).[18,19] This is because, by associating the weight of a policy area to the number of measures that it contains, the OECD technique, in a way, attempts to stabilise the fluctuations in the weight assigned to the (older) measures, which might happen if some measures are added to/removed from the respective area under consideration. But this happens only at the cost of weight attached to other areas as their relative importance (and, hence, contribution to overall STRI) also changes. Even the alternative criteria suffer from this issue of adjustment of weights.

2. The afore-mentioned issuesdo not arise in the case of the WB STRI because, by its very construction, the index takes into account the score of only that measure, which is most restrictive within a particular policy area. As a consequence, the number of measures also do not influence the weight of individual modes in the calculation of the index, which is an advantage over both OECD's and the alternative weighting technique. However, this also means that the index does not incorporate information about all the regulations affecting a sector's trade in a particular country.For instance, it seems reasonable to assume that if foreign equity participation is prohibited, then other related measures such as nationality/residency requirements for the board of directors, screening requirements, etc. do not matter. On the contrary, if 100% foreign equity participation is allowed and nationality requirements exist in one country while only screening requirements exist in the other, then it is not clear how the two countries compare in terms of their restrictiveness.
   In contrast to WB STRI, the alternative technique considers restrictiveness scores of all the measures on an average. Algebraically, from (3), we can re-write the formula for$STRI_i^{New}$ as

$$STRI_i^{New} = w_i^{OECD} * (Restrictiveness\ Score_i / n_i) \quad \ldots(4)$$

[18] This is shown in Appendix A.3. The index formulated using an alternative weighting technique is referred to as the $STRI^{New}$ index.

[19]Considering the temporal dimension of STRI, this implication implies that any change in restrictiveness score of a measure will lead to a higher change in sectoral STRI (in comparison to when expert weights are retained) if this measure belongs to the area with a higher number of measures vis-à-vis others, and vice-a-versa. This has been shown mathematically in Appendix A.4 to the main text.

This implies that the alternative method also retains the expert assigned weights and (without distributing them among respective measures), consider their product with average restrictiveness score for the group to compute group-specific STRIs. More so, as argued by Grosso et al. (2015), assigning unique weights to measures gives the flexibility to break the STRIs down in various ways. For instance, it is of equal interest to club the measures into those that relate to Market Access, National Treatment, and those that come under the category of Domestic Regulations and find out whether a country is more restrictive in terms of the one or the other.

Thus, it seems plausible to conclude that the alternative weighting techniqueoffers certain advantages over the existing methods of determining the importance of measures belonging to policy areas/modes. It could possibly serve as a better guide to where services trade restrictiveness should be reduced/reforms should be introduced in a particular country, while we cannot discount the fact that even this is not a perfect technique. One limitation of the alternative criteria is that it considers all the measures (belonging to a policy area) as equally important, which may not necessarily be the case. In fact, the same persists for OECD STRI though they recognise this limitation while determining the scores of restrictiveness. We suggest a method that can (possibly)be used to deal with such an issue and construct a better indicator of services trade restrictions in the concluding section.

3.2 EMPIRICAL ISSUES

Empirical issues in the construction of an STRI primarily relate to the scoring of measures and determination of weights of policy areas. As regards the former, from section 2, it is known that for assigning the binary scores of restrictiveness to non-binary regulations covered in the OECD regulatory database, certain thresholds have been determined. While for some measures, only one threshold has been determined, there are others, which have been scored on the basis of multiple thresholds (4 thresholds maximum). Althoughthis offers a simple, transparent (and an easy-to-implement) technique, however, the issue with the binary scoring method is that it is too restrictive in the sense that a country can either be scored as completely closed with respect to a measure or completely open and there does not exist any intermediate category in between (specifically in the case of binary measures). As a consequence, this indicator does not reflect the gradual movement of a country towards trade liberalisation.

The World Bank's quasi-continuous scoring seems to correct for this issue to some extent. This is because, instead of assigning only the extreme score (0-1/0-100), their indicatorgrades the policy regimes on the basis of 5 broad categories and accordingly assignsa restrictiveness score from 0 to 100 with intervals of 25. This technique should also be utilised for binary measures in the OECD Regulatory database wherever there exists a considerable amount of a grey area. For instance, in the existing STR database, whether or not a country applies a labour market test has been captured as a 'yes-no' question. However, a measure regarding how burdensome is the process in a country, does not find any place in the OECD's list of policy measures. More so, in some countries, these tests exist only on papers, while they do not apply them in practice. Another example concerns information on licencing requirements. As of now, whether or not 'a temporary licensing system is in place' is covered as a 0-1 question. Butdetails on how cumbersome are the requirements to obtain a licence & a registration, whether a single-window exists for fulfilling the requirements, etc. are not incorporated. Such 'grey areas' need to be identified and included to make the index an exhaustive indicator of a country's services trade restrictiveness. However, for those measures which are non-binary, this technique is similar to the determination of multiple thresholds (rather than just one or two). In this case, a better indicator, as

identified from the literature on composite indices (OECD 2008, Nguefack-Tsague et al. 2011), is to use a Dimension Indicator (DI).

By its very definition, a DI takes into account information about the least- and the most-restrictive countries and then calculates the score for a particular measure by rescaling the non-binary answer for that measure using the following linear transformation:

$$\text{DI} = 1 - \frac{\text{Actual} - \text{Minimum}}{\text{Maximum} - \text{Minimum}}, \text{where, answer} \propto (1/\text{restrictiveness})$$

$$= \frac{\text{Actual} - \text{Minimum}}{\text{Maximum} - \text{Minimum}} \quad , \text{where, answer} \propto \text{restrictiveness}$$

Here, 'minimum' and 'maximum' (respectively) represent the minimum and maximum of all the countries' answers to the selected non-binary regulation (after dropping the outliers, if any), and 'actual' represents the answer for the country under consideration. Further, in order to ensure the comparability of STRIs over time, a specific timeperiod should be chosen to fix these across the years. So, in case of 'number of documents needed to obtain a business visa', if actual days required are 5, while minimum and the maximum number of days (considering all the countries in the database) equal 2 and 16, respectively, then DI=0.2143.[20] On the other hand, for specific measures such as 'foreign equity limits' or 'limitations on duration of stay of intra-corporate transferees', answers are inversely related to restrictiveness. In that case, DI can be calculated using the first formula so that a higher DI represents a higher score of restrictiveness. Indices such as the WB's Doing Business Indicator or NCAER's SIPI also utilise the concept of dimension indices to score the performance of different categories.[21]

When applied in the case of OECD or WB STRI, a dimension index is likely to offer the following benefits:

a. The first advantage is that there is no definitional issue regarding the determination of thresholds, which, in turn, requires a detailed perception-based classification of services restrictions.Hence, in this way, a DI eliminates the possibility of any kind of subjectivity or biasedness that may (unknowingly) affect the neutrality of an STRI. For instance, in the case of OECD STRI, the majority of the measures in policy area 5 or 'Regulatory Transparency' are scored by determining the cut-off value as equivalent to the value of the 25th percentile in the list of 182 countries covered in WB Doing Business database (considering the average for years 2004-11 to ensure that the threshold is independent of the sample/constant over time).While in some of these cases, the chosen range seems to contain more information on the rich and industrialised economies, in some others, developing countries also fare well vis-à-vis their developed counterparts.
Another issue in the case of OECD STRI is that for most of these measures, the thresholds are defined as a proportion of per capita income (of the host economies), which may bias the score to 1 (restrictive) for

[20] In the present paper, while calculating the DI for various non-binary regulations, (for illustration purpose), we have utilised information only for those countries which are covered in the OECD Regulatory database. However, a better alternative is to find out the worst and best performers from an exhaustive list of countries so as to make scoring independent of the countries covered in the database.

[21]As per its construction, the use of DI only normalises the non-binary indicators to have an identical range [0,1] and is not dependent on any standardisation technique (based on distribution). Thus, it can be used along with a binary technique of scoring. More so, even a binary indicator can be shown to have a similar score by using a binary (0-1) technique or a DI. For example, with reference to a free trade benchmark, we know that a country should not have any screening requirement (coded as 0), and, if a country is restrictive, it takes a score equal to 1, which is the code indicating the presence of such restrictions. Therefore, if Indian laws impose such requirements, then its actual value equals 1. Numerator for DI (Actual - Minimum) = (1-0) = 1 and denominator (Maximum - Minimum) = (1-0) = 1. This implies that for India, DI for such a measure equals 1 (a same score that we get when we use a Binary technique) - thereby indicating that there should not be any (standardisation) issue while using DI along with Binary scores.

the developing countries where the per capita income is rather low (so the costs represent a relatively higher share of the low base).

b. Next, both the OECD and the WB databases contain information on regulations for which multiple thresholds are determined. One such measure relates to Foreign Equity restrictions. In the case of OECD STRI, this measure has been assigned a weight equivalent to four measures by determining three different thresholds, i.e., this measure is counted four times while scoring its restrictiveness. However, if instead of three, two cut-offs were used (say, 24% and 49%), the weight assigned to these measures and hence to policy area 1 would have been lower because of a fall in the number of measures belonging to this category.[22]The usage of DI, in such a case, offers twin advantages – a). it helps in eliminating the (likely) arbitrariness that may arise while deciding on the number of cut-offs to use for the permissible foreign equity variable and hence, the resultant hike in the weights and b). it completely eliminates the issue regarding multiple counting of different measures, unless (otherwise) required. For instance, considering the fact that the developing countries have long contended for greater openness in Mode 4 while developed countries have been negotiating for greater market access under Mode 3 of the supply of services, a larger number of cut-offs in case of foreign equity limitsmay magnify the STRI score against developing countries. However, this issue does not arise in the case of the World Bank STRI as their thresholds are determined within the range of 0 and 100 only, and the index does not count this measure more than once to incorporate its restrictiveness for a sector-mode pair under consideration.

c. Further, in OECD database, in case of certain services,information about multiple sub-sectors have been considered. This, in turn, further inflates the number of regulations within a policy area or two. This happens when the same set of measures applies differently to each of the sub-sectors considered for analysis. For instance, in the case of air transport services, four subsectors are considered viz. domestic traffic (passenger and cargo) and international traffic (passenger and cargo), while in case of maritime transport, no such subsector is considered. As a consequence, a measure such as foreign equity limit is assigned a weight equivalent to 16 (= 4 X 4) measures in case of the former, while it is considered only four times in case of the latter. This, in turn, further inflates the weight assigned to policy area 1 in case of air freight services and also raises concerns regarding the comparability of OECD STRI across different services within a particular economy. A dimension index, utilised in such a case, may at least correct (if not eliminate) the issue of multiple counting (for instance, in the example discussed above, instead of 16 times, the measures related to foreign equity will be considered only fourtimes).

d. One of the most crucial issues in using binary scoring in case of non-binary measures is that, sometimes, a change in a policy does not modify the index value because of no change in its restrictiveness (from 0 to 1 or vice-a-versa). This is becausethe change in restrictiveness, in turn, depends on the threshold value. So, if for a particular measure, threshold limit (for a regulation to be restrictive) is say, more than 32 units and a country experiences a rise in the value of this measure from 10 to 28, then also, it will be shown as non-restrictive in nature. The usage of the dimension index is more flexible in such cases and also represents the true policy restrictiveness in any country.

Therefore, while (at present) both the OECD and the WB STRI do not capture allmarginal measures of liberalisation, the use of a dimension index may improve the properties of an objective STRI altogether.

[22]This has been explained in the previous sub-section 3.1.

The next empirical issue relates to the generation of weights of policy areas/modes. The ideal approach should be to determine the weights in accordance with the contribution of different groups to services trade costs. However, in the absence of a sufficiently detailed trade data set, both the OECD and the WB employed participatory methods so that the relative significance of different regulations could be captured in a more realistic and meaningful manner. In the case of OECD, for instance,surveys were conducted with sector-specific experts from within the OECD economies.While it could be a possibility that they are well aware of services trade restrictions in OECD as well as in emerging markets, considering a broader group of sector-specific experts (including traders from the industry), nodal regulatory bodies from all over the world along with the legal practitioners (who represent a coalition of views as they deal with a diversified set of domestic and foreign clients) from different representative regions of the world might help in reducing the extent of subjectivity bias, if any. For example, a comparison of weights across 22 services in Table A.2 (Appendix A.2) shows that the expert weights given to restrictions on the movement of people are generally lower than the weight given to the restrictions on foreign entry, which is more important for services firms in leading OECD countries. In the case of World Bank STRI, on the other hand, the weights were assigned based on some informal interactions with industry-specific professionals.

Further, for the survey, the OECD used what in technical terms is referred to as the Budget Allocation Process, in which the experts were asked to assign numerical scores to their perceptions regarding the relative importance of five impediments in restricting sector-specific services trade. A plausible disadvantage of this method is that it might lead to circular thinking and at times, a respondent may not be able to clearly make out whether a policy area which is more important than others, should be assigned a weightage equivalent to (say) 39 percent or 42 or 45 percent. In other words, despite being a simple andeasy-to-implement technique, it becomes difficult for the respondent to attach numbers to their policy choices. A better and more reliable approach in which circular thinking is both moderated and verifiable, could be to employ the Analytic HierarchyProcess or AHP (Greco et al. 2017).

AHP was introduced by Saatyin his 1977study and has wide applicability in the field of supplier selection, formulating accounting and auditing decisions, education, engineering, and management, etc. (Arrington et al. 1984, Ghodsypour and O 'Brien 1998, Razi and Karatas 2016, among others). We suggest a novel use of AHP in the field of services trade assessment.In this survey method, pairwise comparisons among groups are carried out by the experts on an ordinal scale with nine levels, ranging from 'equally important' to 'much more important'. The scale represents how many times more important, one groupis, with respect to the other. Thus, in this sense, the weights elicited with the AHP process are less prone to errors of judgement in comparison to that of the BAP process. Moreover, apart from setting the weights relatively, a consistency measure is also introduced in the AHP (namely the 'inconsistency ratio'), that assesses the cognitive intuition of respondents in the pairwise comparison setting (OECD 2008).[23]

[23]To verify the appropriateness of this method, a few pilot surveys were conducted in New Delhi with regulators and sectoral/legal experts from India for a total of six services - 37 experts from legal services, 14 from architecture, 11 from Accounting, and about 10 each from Computer, Telecom, and Engineering Services. While our sample is very small, our limited analysis generates two important observations – a). we observe a diversion in responses obtained from the Indian experts and those that were collected by the OECD STRI team. For instance, in the case of Legal services, for OECD experts, regulatory transparency is more important than measures that affect competition. In contrast, as per the Indian experts, it is the other way around. Perhaps this reflects the type of barriers that the respective sets face in their destination economies. This type of bias could possibly arise while asking experts from the business community. b). the policy choices/responses change for the same set of respondents when they are asked to follow the BAP than when they are asked to make pairwise comparisons to grade the five policy areas – something that has also been observed in a study by Saisana et al. (2005), who

Other than the weighting and the scoring techniques, there are some miscellaneous issues (inherent) in the construction of the existing indices, which, when accounted for, may serve a better guide for negotiating trade in services. First, the indicators are heavily dependent upon regulations affecting mode3 of the supply of services and contain a fewer number of measures in mode 4, which are more important for an underdeveloped economy. This could be because the dominant focus of the two indices is on producer services, i.e., the services which are used by producers. Some elements of consumer services are also present (e.g., passenger transport by airlines, mobile phone services used by individuals). Still, consumer services form a relatively smaller component of the overall index,whilethose such as education, health are not considered for analysis.More so, Research and Development, product design, clinical trials for pharmaceutical products, etc. in which Indian markets, for example, are mostly open, are also missing from the database. If such services were included in the STRI, some of the leading EME's index of restrictiveness would have been lower than it is at present.

Another point that should be highlighted in the case of the OECD STRI relates to adoption of a general rule based on a few exceptions. To elaborate, non-mode-specific measures can have a differing restrictive score across the various modes. For instance, a measure such as restrictions on advertising in the case of the legal sector can have a score of zero when the foreign providers wish to enter through mode 3 but can be totally restrictive when they want to enter as independent lawyers. This difference in restrictions should be accounted for by incorporating separate measures depending on the mode of entry. Also, attempts should be made to maintain unanimity while designing measures. For instance, a measure such as the requirement of local/commercial presence in order to provide cross-border services explicitly caters to mode 1 of supply of services, but such is not the case for all measures that vary in restrictiveness across modes. For instance, performance requirements could apply to any mode of supply of service but have been considered only once, and it is unclear how its restrictiveness score has been assigned.

To conclude, in this section, we have attempted to make some methodological contributions by proposing and comparing alternative ways of quantifying impediments to trade in services. Acknowledging the fact that there is no perfect indicator of services trade restrictions, we argue that a careful selection of experts, choice of survey method, weighting technique, and scoring criterion may improve the properties of existing indicators and, therefore, provide an appropriate tool for guiding policy decisions.

4. SERVICES TRADE RESTRICTIONS – *Some New Evidence*

In this section, we utilise the OECD's Regulatory database to provide a few illustrations of how an indicator value changes when one switches from OECD's to an alternative technique of computing STRI.[24] From our discussion in section 3, there are two (broad) suggestions that can be directly applied to OECD data – one, regarding the alternative weighting technique where policy area-specific expert weights are directly distributed among the measures belonging to each area, and two, the application of

shows how human judgement alters according to the way in which the same question is formulated. Hence, it is critical to carefully choose the most suitable technique as per the questionnaire.

[24]It is important to mention that in the detailed OECD data, in case of certain measures, the answers and the corresponding restrictiveness scores are not perfectly correlated because of some related regulations which make a measure(s) restrictive or non-restrictive regardless of what the answers are. One good example is the case of Turkish Accounting policies, according to which accountants and auditors are required to obtain a license to operate, and only Turkish nationals may obtain that permission. In this case, even though, as per the OECD database, 100% foreign equity is permitted in the country's accounting sector, yet the measure is assigned a score of 4 (meaning thereby that the sector is completely closed). However, henceforth, whatever data analyses have been done, we have (for now) directly applied the OECD technique to answers and scores detailed in its simulator database.

dimension index for scoring restrictiveness of non-binary measures. The latter also allows to correct for the number of measures in policy areas that contain non-binary measures with multiple thresholds while recomputing the STRI values (henceforth referred to as Modified STRI or MSTRI values, while OSTRI refers to the OECD index only). Table 4.1 presents summary statistics for both OSTRI and MSTRI at the sectoral levels considering information about all the 45 economies covered by the OECD data for the year 2018.[25] Figure 4.1, on the other hand, represents the correlation between the two indicators.

(Table 4.1 here)

(Figure 4.1 here)

Two points are particularly noteworthy from the summary statistics presented in Table 4.1. It shows that while the maximum value of MSTRI falls short of OECD's STRI, that equals 1 (thus, signifying the role of using a DI for scoring (existing) non-binary measures), on an average, MSTRI exceeds the STRI. This could be because sectoral experts/traders, in general, tend to assign higher weightage to those areas where they experience maximum restrictiveness while trading in the international market. This implies that areas with a higher restrictiveness score, are likely to be assigned higher weights, thus leading toMSTRI values, over and above the OSTRI.

Nevertheless, Figure 4.1 shows the close link between the two indicators at the sectoral level, even though the correlation is not perfect as would be (theoretically) expected with any modification of the original data (Hoekman and Shepherd 2019).Primarily, in our case, the strong correlation is observed because of two reasons – a). the summation of weights cannot be less/more than 100, and our weighting approach is equivalent to a re-distribution of OECD'scomputed weights among the five policy areas and the measures therewith, b). only 10-15 percent of the total measures have been incorporated as non-binary indicators in the OECD database, to which a DI has been applied forscoring of restrictiveness in order to compute MSTRI.Further, computing average STRIs at the country level, we find that the correlation coefficient (between OSTRI and MSTRI) is slightly higher than 0.90 (significant at 1% level), while in the case of sectoral analysis, the coefficient roughly equals 0.79.

With the robustness of OSTRI as an indicator already established in the existing literature on services trade and trade-related policies, it seems unlikely for country-level MSTRI to lead to major differences in analytical findings. We validate this assertion by running a few relevance checks. Figure 4.2 shows how the two STRIs correlate with four different performance indicatorsviz. level of development (as proxied by Log of GDP per capita in PPP terms), Services value added (as a percentage of GDP), Average Labour Productivity in Services Sector and Regulatory quality index[26](extracted from the World Governance Indicators' database).Each panel presents a scatter plot with STRI values on the horizontal axes (OSTRI in left-panel, and MSTRI in the right) and the chosen performance indicator on the y-axis. The dashed or the fitted-values lines represent the directional association between the two variables of interest.Table 4.2 encapsulates information on the slopes of the fitted values lines (plotted in Figure 4.2). These slopes could be interpreted as correlations between the performance indicators and the two STRIs. From the table as well as from Figure 4.1, it is clear that all the slopes are negative; in fact, they reflect that MSTRI closely mirrors the performance of OECD's STRI.

(Figure 4.2 here)

(Table 4.2 here)

[25]The choice of the year is guided by the availability of detailed data in OECD's Policy Simulator.

[26] Regulatory Quality (as explained in the World Governance Indicators' database), captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.

We alsoexamine the validity of our modified STRI by utilising a Gravity Model framework and regressing bilateral services exports against the two STRI indicators (OSTRI and MSTRI) in two different specifications (along with other gravity controls).Our primary objective is to assess whether the performance of MSTRI closely correlates with the performance of OSTRI or not. For each sector 's', the baseline regression equation is given by:

$$X_{ij} = \alpha_0 + \alpha_1 Importer\ STRI + \alpha_2\ Exporter\ STRI + FTA_{ij} + Gravity\_Controls_{ij} + \gamma_i + \gamma_j + \varepsilon_{ij}$$

where,i, j represent the exporter and importer countries, respectively and $\boldsymbol{X_{ij}}$ represents the exports of service 's' from country i to country j.γ_i, γ_j, and ε_{ij}(respectively) represent exporter fixed effects, importer fixed effects and the error term.Table A.5 (AppendixA.5) entails a description of all the variables as well as their respective data sources.Our model closely follows the framework adopted in the studies byNordoz and Rouzet (2017), Hoekman and Shepherd (2019),among others.

However, in contrast to the existing literature, trade data has been extracted from the OECD's Trade In Value Added database.[27] The advantage of using this dataset is that it also incorporates information about intra-national trade (i.e., trade from country i to country i). We use data for 2015 – the latest available year, corresponding most closely to the year of our STRI data (2018). Further, TiVA's sectoral classification is not exactly similar to the one adopted by OECD STRI. Therefore, we concord the two datasets and estimate the regression equation for five sectors viz. Computer, Telecommunication, Financial Services, Transportation and storage, and Distribution services. While STRI scores for Computer, Telecom, and Distribution are directly available from the regulatory database, for Financial services, we consider a simple average of STRI scores of Commercial Banking and Insurance services. For transportation and storage, a simple average across the four modes of transport (Air, Road freight, Rail freight, and Maritime transport) and the four Logistics services (cargo handling, customs brokerage, freight forwarding, and storage-warehousing) has been considered.

Table A.6 (Appendix A.6) reports estimation results for all the sectors. Once again, in line with the existing literature, all the policy variables (exporter as well as importer STRIs) have a negative coefficient, statistically significant at 1 percent level. Interestingly, in the case of both OSTRI and MSTRI, we observe that the coefficients on exporter STRI are of larger magnitude vis-à-vis importing country's STRI in case of telecommunication services and transportation, storage related services. A similar result was also observed in Nordas and Rouzet (2017) for some services,thus highlighting the significance of domestic policies in such cases. Thus, this exerciseestablishes that even after controlling for other explanatory variables, our alternative STRI (or MSTRI)strongly correlates with bilateral services trade flows in the sectors under consideration.

Althoughthe results (as mentioned above) are (mostly) indicative and do not necessarily imply a causal association between STRI and other variables of interest, the crucial point to note is that our estimates indicate a remarkable degree of similarity between OSTRI and MSTRI. This implies that any of the two could be utilised to produce similar results, at least at the sectoral or country level.Even though the analytical findings (as such) rely on aggregated STRIs at thesetwo broad levels, however, for policy decisions as well as trade negotiations, what matters more are the policyarea-specific restrictions. This is because once the restrictive sectors are identified, area-specific STRIs serve as a guide to governments and negotiators in classifying which area (within those sectors) to look into on a high priority basis to provide efficient piecemeal reforms. Equally important is their role in analysing regulatory homogeneity

[27]This data is available at <https://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm>.

between different trading partners, which serve as an aid in identifying a common ground to conclude mutual recognition agreements.

Having shown that our alternative weighting and scoring techniques produce an acceptable (modified) version of OECD's STRI, we next present some descriptive evidence on services policies considering MSTRI data on the two groups of countries covered in the OECD databank – the OECD and 9 Non-OECD economies (referred to as the non-OECD group in the analysis that follows). Simultaneously, we also show how the policy conclusions (ranking of policies, to be more specific)derived using MSTRI compare and contrast with those derived using OSTRI. The four panels in Figure 4.3 show average values of both the STRIs for the two broad groupings for all the 22 sectors. The first-panel plots policy area-specific OSTRIs for OECD economies (considering an average across the 36 countries covered in the OECD database), followed by the second plot with information on MSTRI for the same group of countries. The third- and the fourth-panel represent average OSTRI and MSTRI, respectively, for the non-OECD economies. Table 4.3, on the other hand, presents results from a t-test on the inequality of means between the two indicators.

(Figure 4.3 here)

(Table 4.3 here)

As shown in Figure 4.3, regardless of the methodology used, the non-OECD economies, on average, are more restrictive vis-à-vis their OECD counterparts in almost all the sectors. However, these results should be interpreted with some caution as they only reflect an aggregate picture and do not represent the actuallevel of restrictiveness in individual countries. Moreover, only nine non-OECD economies are covered in the OECD data. Nonetheless, some important policy conclusions emerge from the data.

a. For each sector, indicator values (as represented by the height of the stacked bars in Figure 4.3) differ between the two STRIs. Once again, we observe that OSTRI falls short of MSTRI – which is also reflected by the t-statistics in Table 4.3. However, considering policy area-specific STRIs, we find that while STRI for policy area 1 drastically reduces (for all the country-sector pairs) if we switch from OECD to our modified STRI, the STRI of policy area 3 or 'other discriminatory measures' necessarily rises. In fact, as shown in Table 4.3, employment of the alternative methodology raises the (average)STRIs of the other three policy areas (2, 4, and 5)as well. Primarily, this happens because Policy area 1 entails information on the maximum number of measures (in comparison to any other area), due to which its computed weight is always more than the expert assignments(Table A.2, Appendix A.2). As a result, when we correct for the divergence between expert and computed weights, the relevance of other policy areas also shows up in the data.This implies that the weighting scheme can have a significant impact on the final outcome of an index.

b. As expected, the change in STRI values (when we switch from OSTRI to MSTRI) also affects the relative ranking of different policy areas in terms of their restrictiveness. In other words, the prioritisation of policies for liberalisation tends to change. For instance, while the OECD STRI for the Computer sector (considering the first two panels in Figure 4.3) shows that policy area 3 is less restrictive than policy area 1 and 5, it is the other way around when we consider the restrictiveness as portrayed by MSTRI values. Similarly, for the non-OECD countries, from the bottom two panels of the figure, it is clear that in case of computer services, policy area 3 is more restrictive than areas 1, 2 and 5 as per OSTRI, while it becomes the most restrictive area in terms of MSTRI.
To validate this assertion, we also compute Spearman rank correlation coefficient between OSTRI and MSTRI for all the country-sector pairs. Table 4.4 summarises this information for all the 22 sectors.

(Table 4.4 here)

On an average, the correlation coefficient roughly equals 0.50 (significant at 1 percent), meaning thereby that about 50 percent of the times, the relative rankings change when we make a switch between the two STRIs. In fact, as observed from the table, the correlation coefficients are less than 0.60 for the majority of the sectors covered in the OECD database. Thus, even though the two STRIs perform quite similarly at the aggregate level, their usage by policymakers as well as traders (in identifying priority markets), might lead to different conclusions – depending upon which approach is followed.

c. Even the relative rankings of some of the sectors in terms of their restrictiveness also change. This is highlighted by the order in which sectors appear in the four panels of Figure 4.3. For instance, considering the case of OECD countries, we find the ranking of rail freight sector, insurance, construction worsens once we switch from OSTRI to MSTRI, while that of Telecom, Maritime transport, logistics cargo-handling, storage and warehouse, etc. improves.

d. Conclusions (a) and (b) hold for all the OECD and non-OECD economies.

It is particularly important to note that while point (c) clearly matters for carrying forward services trade negotiations at the WTO or even at the bilateral/plurilateral levels, the importance of (b) while determining the priority areas for reforms within a country, cannot be undermined.

In a nutshell, to the casual eye, the alternative technique may seem facile as expert weights are retained, thus avoiding complex calculations to normalise the weights, but it is imperative to dig deeper into the analysis as shown in the present section. It shows how the employment of this weighting technique, along with the correction of scores for the non-binary measures using DI, changes some of the policy conclusions derived using the OECD indicator. This also complements our discussion in section 3 that shows how the alternative weighting/scoring techniques alter various properties of the index and correct for certain inherent issues.

5. CONCLUDING REMARKS

With services trade likely to gain crucial importance in almost all the future trade negotiations at the multilateral as well as at the sub-multilateral level, the issue of how to measure its restrictiveness needs to be assessed more thoroughly. In this study, we make an attempt to propose a method to quantify such restrictions by building on the World Bank's and OECD's STRI methodology – the two well-known and widely applied indicators recognised in the literature. Outlining the theory underlying the calculation of these indices, we show how the employment of a new weighting technique and an improved scoring criterion (retaining other features) alter various properties of the existing indicators and correct for certain inherent issues so that they can be appropriately utilised by policymakers while scheduling the reforms in different services sectors of their countries. We also apply the two criteria to the publicly accessible OECD Regulatory data for the year 2018 to compute the values of the alternative indicator (or MSTRI) for all the country-sector pairs and empirically demonstrate how the restrictiveness as well as (potential) policy prescriptions change when one makes a switch from the OECD to an alternative technique of computing sector-specific services trade barriers.

Apart from this, we also propose that a careful selection of experts and the choice of an appropriate survey method are equally essential to mitigate the risks of subjectivity bias and derive robust policy implications.

While deriving such conclusions may appear simple in theory, their application, as well as implementation, are fairly difficult in practice. On the one hand, there are trade theorists who advocate free trade as the best policy, others with development orientation call for (some) positive level of protection to safeguard the interest of the domestic players, more specifically in the countries that lie at the lower end of the ladder of development. Since no policy action comes up with an entirely 'win-win' situation unless compensatory reforms are introduced, it seems that the policymakers are constantly held in a battlefield to come up with the right policies (and introduce the right set of reforms) at the right time. And, of course, this holds true for all set of policy actions, including those related to services trade as well. Against this background, the purpose of calculating an appropriate STRI is to shed light on the actual level of protection resulting from a complex set of regulatory policies that act as barriers to services trade. Since the empirical analysis of services trade policies is still in its infancy, these indices assume much wider importance. Thus, it is imperative to ensure that they are appropriately designed so that they could at least encourage more informed debate on services trade policy reforms. At the same time, their construction should be such that they allow the policymakers to introduce piecemeal legislation to reform policy areas within their own economies.

As far as we are aware, this study is one of its kind, and no earlier researcher has reviewed the two indices critically to come up with alternative weighting and scoring technique – the two building blocks in the construction of a composite index. However, we should also acknowledge some limitations of our exercise. First of all, like in the case of OECD STRI, our proposed indicator considers all the measures (belonging to a particular policy area) as equally important, which may not necessarily be the case. The extent of this limitation, however, can be mitigated by following a multi-stage assessment of policy areas in the first step, where the experts are asked not only to make a pairwise comparison of the five policy areas, but also to rank different groups of measures (belonging to a policy area) in terms of their importance. For instance, considering the OECD's list of measures under Policy area 1, one can group them into (say) four different categories viz. restrictions on foreign ownership, restrictions on operation, nationality/residency requirements, and data localisation requirements. Following such a method will also help to identify which set of measures (under any policy area) requires more attention at a particular point in time. Since the present study entirely relies on the OECD database on weights and scores, for now, we have left this exercise for future work.

Secondly, some of the existing binary indicators can very well be converted into non-binary measures. This will make the index more comprehensive in terms of its construction while increasing its utility as well as usage for both policymakers and researchers. The absence of detailed (publicly available) information/data on country-specific restrictiveness scores and answers precluded us from doing this exercise though our improved scoring criterion allows for gradation of at least the existing non-binary measures on a continuous scale.

The final limitation relates to the application of dimension indices to identify restrictiveness scores of non-binary measures. In the present study (for illustration purposes), we have utilised the information only for those countries which are covered in the OECD Regulatory database. However, a better alternative is to find out the worst and best performers from an exhaustive list of countries to make scoring independent of the countries covered in the database.

Since 'weights' assume a critical role in identifying how restrictive an economy's services trade is, and also to assess the elements of restrictiveness, future work in this area should be concentrated in working out an alternative to participatory methods. This will help to cater to the issue of subjectivity or country-biasedness that is presently involved in the construction of any STRI. The WTO's recently released TISMOS data set could be utilised to estimate what we can refer to as 'data-driven' weights. In line with the ExtendedBalance of Payments Classification (2010) as identified and explained in the Manual on Statistics on International Trade In Services 2010 edition, this database entails information on country-wise trade in services by modes of supply for the years 2005-2017. Thus, it could be utilised to measure trade costs based on observed trade patterns in services by adopting techniques such as those utilised by Miroudot et al. (2012).

Further, in the future, efforts should be concentrated to accumulate information on and quantify 'bilateral' trade costs in services in contrast to the existing indicators that capture only the 'MFN' scenario. Not only will these be useful to design MRAs or carry forward negotiations at the bilateral level, it will also help to undertake robust policy research and improve the available estimates of the welfare effects of services liberalisation.

References

Arrington, C. Edward, William Hillison, and Robert E. Jensen. "An application of analytical hierarchy process to model expert judgments on analytical review procedures." *Journal of Accounting Research* (1984): 298-312.

Beverelli, Cosimo, Matteo Fiorini, and Bernard Hoekman. "Services trade restrictiveness and manufacturing productivity: the role of institutions." *Robert Schuman Centre for Advanced Studies Research Paper No. RSCAS* 63 (2015).

Bora, Bijit, Aki Kuwahara, Sam Laird, and United Nations Conference on Trade and Development. Division for International Trade in Goods and Services, and Commodities. Trade Analysis Branch (Geneva). "Quantification of non-tariff measures." *UN*(2002).

Borchert, Ingo, BatshurGootiiz, and Aaditya Mattoo. *Guide to the services trade restrictions database*. The World Bank, 2012.

Brown, Richard W., and Robert M. Feinberg. "The measurement and effects of barriers to trade in basic telecommunication services: the role of negotiations." *World Trade Review* 3, no. 2 (2004): 225-237.

Chanda, R., "Services for Manufacturing", In *India Development Report,* edited by S. Mahendra Dev, 209-223. Oxford University Press, New Delhi, 2017.

Ciuriak, Dan, Ali Dadkhah, and Dmitry Lysenko. "The Effect of Binding Commitments on Services Trade." *World Trade Review* (2019): 1-14.

Dee, Philippa. "Modelling the policy issues in services trade." *Économieinternationale* 2 (2003): 283-300.

Findlay, Christopher, and Tony Warren. *Impediments to trade in services*. London and New York: Routledge, 2000.

Ghodsypour, Seyed Hassan, and Christopher O'Brien. "A decision support system for supplier selection using an integrated analytic hierarchy process and linear programming." *International journal of production economics* 56 (1998): 199-212.

Greco, Salvatore, Alessio Ishizaka, MenelaosTasiou, and GianpieroTorrisi. "On the methodological framework of composite indices: A review of the issues of weighting, aggregation, and robustness." *Social Indicators Research* 141, no. 1 (2019): 61-94.

Grosso, Massimo Geloso, Frédéric Gonzales, Sébastien Miroudot, HildegunnKyvikNordås, DorothéeRouzet, and Asako Ueno. "Services Trade Restrictiveness Index (STRI): scoring and weighting methodology." *OECD Trade Policy Papers*, No. 177, OECD Publishing, Paris (2015).

Hoekman, Bernard, and Ben Shepherd. "Services productivity, trade policy and manufacturing exports." *The World Economy* 40, no. 3 (2017): 499-516.

Hoekman, Bernard, and Ben Shepherd. "Services trade policies and economic integration: new evidence for developing countries." Working Paper DTC-2019-1, Developing Trade Consultants, 2019. https://developing-trade.com/wp-content/uploads/2019/12/Working-Paper-DTC-2019-1.pdf (accessed on January 26, 2020).

Hoekman, Bernard. "Assessing the general agreement on trade in services." *World Bank Discussion Papers* (1995a): 327-364.

Hoekman, Bernard. "Tentative First Steps: An Assessment of the Uruguay Round Agreement on Services." World Bank Policy Research Working Paper No. 1455, 1995b.http://documents.worldbank.org/curated/en/160421468739499350/pdf/multi-page.pdf (accessed on October 28, 2018).

Joint Research Centre-European Commission. *Handbook on constructing composite indicators: methodology and user guide*. OECD publishing, 2008.

Kalirajan, Kaleeswaran. "Restrictions on trade in distribution services." *Productivity Commission Staff Research Paper* 1638 (2000). <https://dx.doi.org/10.2139/ssrn.270871>

Khatun, Rabia, Arindam Banik, and Pradip K. Bhaumik. "Measuring the Barriers to Trade in Financial Services in BRICS Economies: Commitments and Current Practices Under the General Agreement on Trade in Services (GATS)." *Global Business Review* (2019): 0972150919830796.

Lanz, Rainer, and Andreas Maurer. "Services and global value chains: Servicification of manufacturing and services networks." *Journal of International Commerce, Economics and Policy* 6, no. 03 (2015): 1550014.

Lodefalk, Magnus. "Servicification of firms and trade policy implications." *World Trade Review* 16, no. 1 (2017): 59-83.

Mattoo, Aaditya. *Financial services and the World Trade Organization: Liberalization commitments of the developing and transition economies*. The World Bank, 1999.

Miroudot, Sébastien, and Charles Cadestin. "Services In Global Value Chains: From Inputs to Value-Creating Activities." *OECD Trade Policy Papers*, No. 197, OECD Publishing, Paris (2017).

Miroudot, Sébastien, JehanSauvage, and Ben Shepherd. "Trade costs and productivity in services sectors." *Economics Letters* 114, no. 1 (2012): 36-38.

Nguefack-Tsague, Georges, Stephan Klasen, and Walter Zucchini. "On weighting the components of the human development index: a statistical justification." *Journal of Human development and Capabilities* 12, no. 2 (2011): 183-202.

Nguyen-Hong, Duc. "Restrictions on trade in professional services." (2000). *Productivity Commission Staff Research Paper* 1638 (2000). Available at SSRN: http://dx.doi.org/10.2139/ssrn.270787

Nordås, Hildegunn K., and DorothéeRouzet. "The impact of services trade restrictiveness on trade flows." *The World Economy* 40, no. 6 (2017): 1155-1183.

Nordås, HildegunnKyvik, and DorothéeRouzet. "The impact of services trade restrictiveness on trade flows: First Estimates." *OECD Trade Policy Papers*, No. 178, OECD Publishing, Paris (2015).

Razi, Nasuh, and Mumtaz Karatas. "A multi-objective model for locating search and rescue boats." *European Journal of Operational Research* 254, no. 1 (2016): 279-293.

Roy, Martin. "Elevating services: Services trade policy, WTO commitments, and their role in economic development and trade integration." *Journal of World Trade* 53, no. 6 (2019): 923-950.

Saaty, Thomas L. "A scaling method for priorities in hierarchical structures." *Journal of mathematical psychology* 15, no. 3 (1977): 234-281.

Saisana, Michaela, Andrea Saltelli, and Stefano Tarantola. "Uncertainty and sensitivity analysis techniques as tools for the quality assessment of composite indicators." *Journal of the Royal Statistical Society: Series A (Statistics in Society)* 168, no. 2 (2005): 307-323.

Van der Marel, Erik, and Ben Shepherd. "Services trade, regulation and regional integration: evidence from sectoral data." *The World Economy* 36, no. 11 (2013): 1393-1405.

Tables

Table 4.1: Summary Statistics, Indicator OSTRI and MSTRI (2018)

Variables	No. of Observations	Mean	Standard Deviation	Minimum	Maximum
OSTRI	983	0.261	0.140	0.096	1.000
MSTRI	983	0.283	0.118	0.097	0.942

Source: OECD Regulatory Database; Authors' estimates

Table 4.2: Correlation Coefficients (Figure 4.2)

	OSTRI	MSTRI
Level of Development	-3.902***	-3.401***
Services VA (% of GDP)	-0.790***	-0.661**
Labour Productivity (Services)	-2.967***	-2.539***
Regulatory Quality	-6.105***	-6.097***

Source: OECD Regulatory Database; Authors' estimates. *Note: *** indicates significance at 1% level.*

Table 4.3: t-estimates, OSTRI V/s MSTRI (2018)

Policy Area	Classification/Policy Area	Mean		
		OSTRI	MSTRI	Difference
Indicator STRI		0.261	0.283	-0.022***
1	Restrictions on Foreign Entry	0.098	0.057	0.041***
2	Restrictions on Movement of People	0.059	0.077	-0.018***
3	Other Discriminatory Measures	0.024	0.058	-0.034***
4	Barriers to Competition	0.033	0.040	-0.006***
5	Regulatory Transparency	0.047	0.052	-0.005***

Source: OECD Regulatory Database; Authors' Estimates. *Note: *** indicates significance at 1%, ** at 5%, * at 10% level*

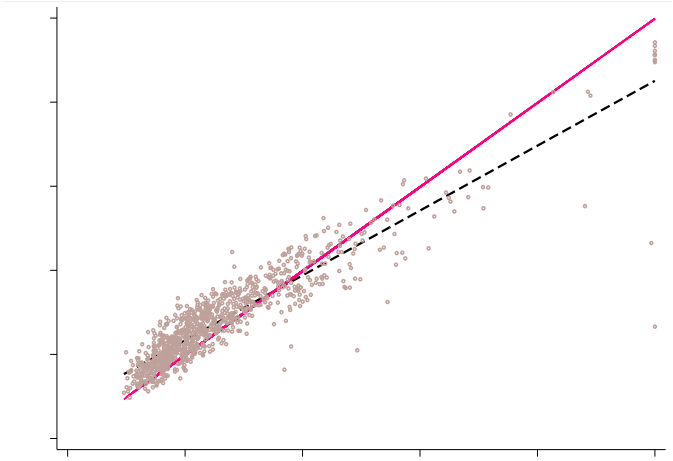
Table 4.4: Correlation Coefficients between policy area-specific OSTRI and MSTRI, by sectors (2018)

Sector	Correlation Coefficient
Telecom	0.113*
Courier	0.249***
Rail freight transport	0.286***
Logistics cargo-handling	0.296***
Distribution	0.342***
Computer	0.404***
Logistics customs brokerage	0.429***
Logistics storage and warehouse	0.442***
Architecture	0.456***
Engineering	0.500***
Broadcasting	0.529***
Air transport	0.544***
Legal	0.547***
Construction	0.564***
Commercial banking	0.602***
Accounting	0.624***
Maritime transport	0.626***
Road freight transport	0.636***
Motion pictures	0.649***
Logistics freight forwarding	0.651***
Sound recording	0.707***
Insurance	0.824***

Source: OECD Regulatory Database; Authors' calculations. *Note: *** indicates significance at 1% level.*

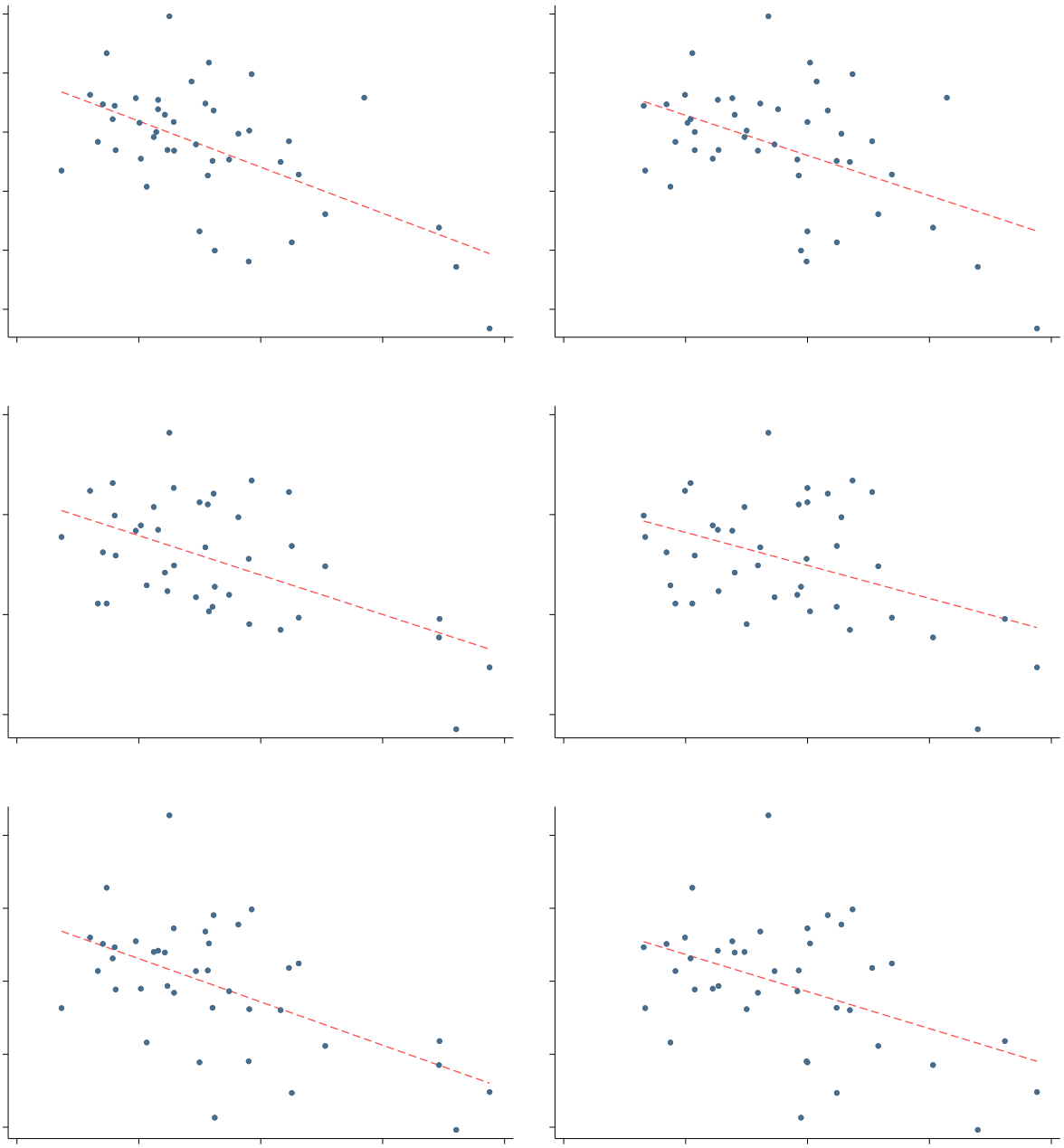
Figures

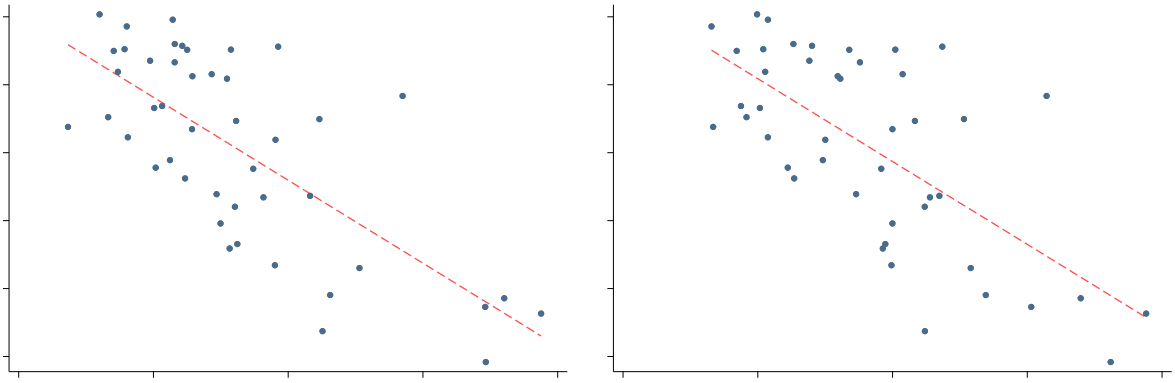
Figure 4.1: Correlation between OSTRI and MSTRI, 2018



Source: OECD Regulatory Database; Authors' estimates

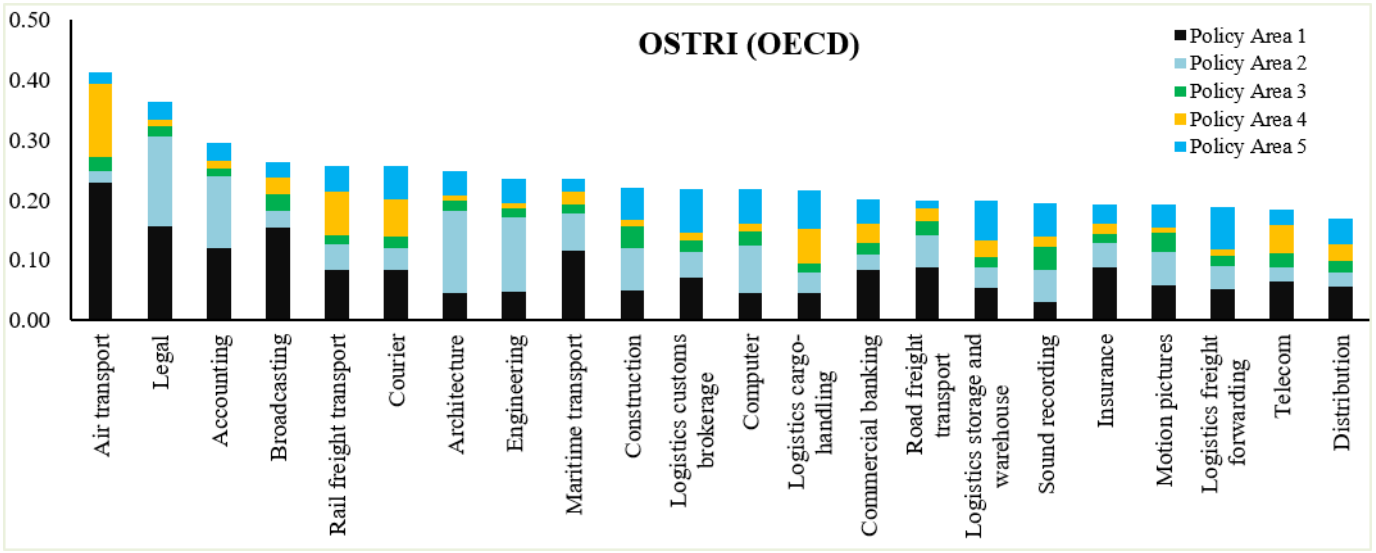
Figure 4.2: Correlation Plots, OSTRI and MSTRI (2018)

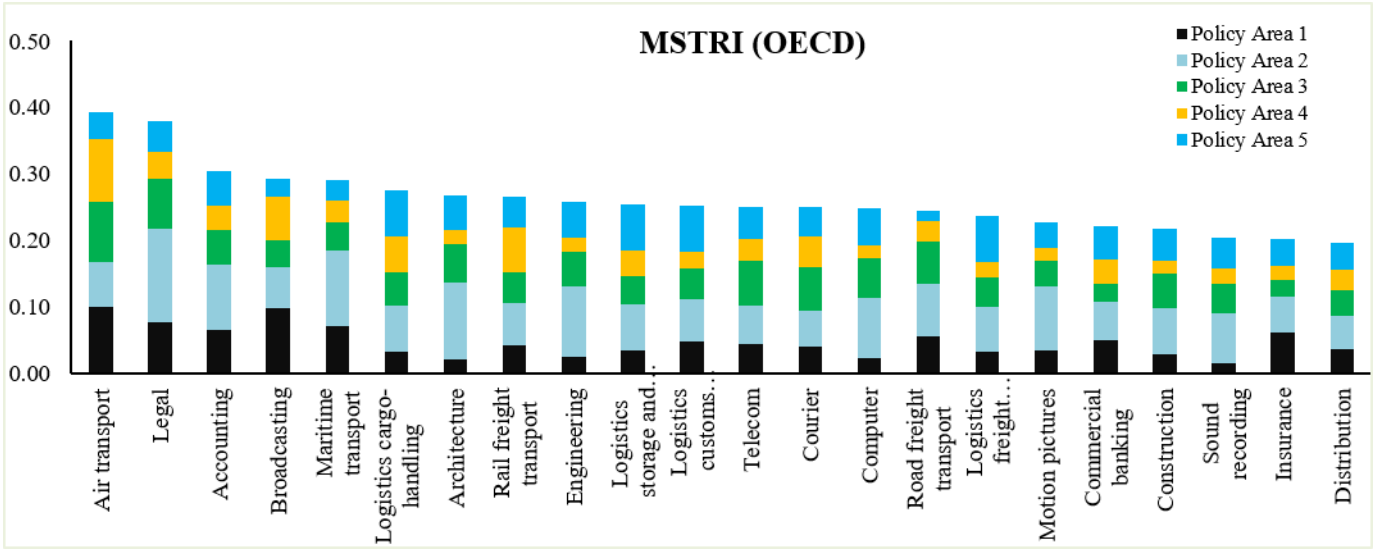


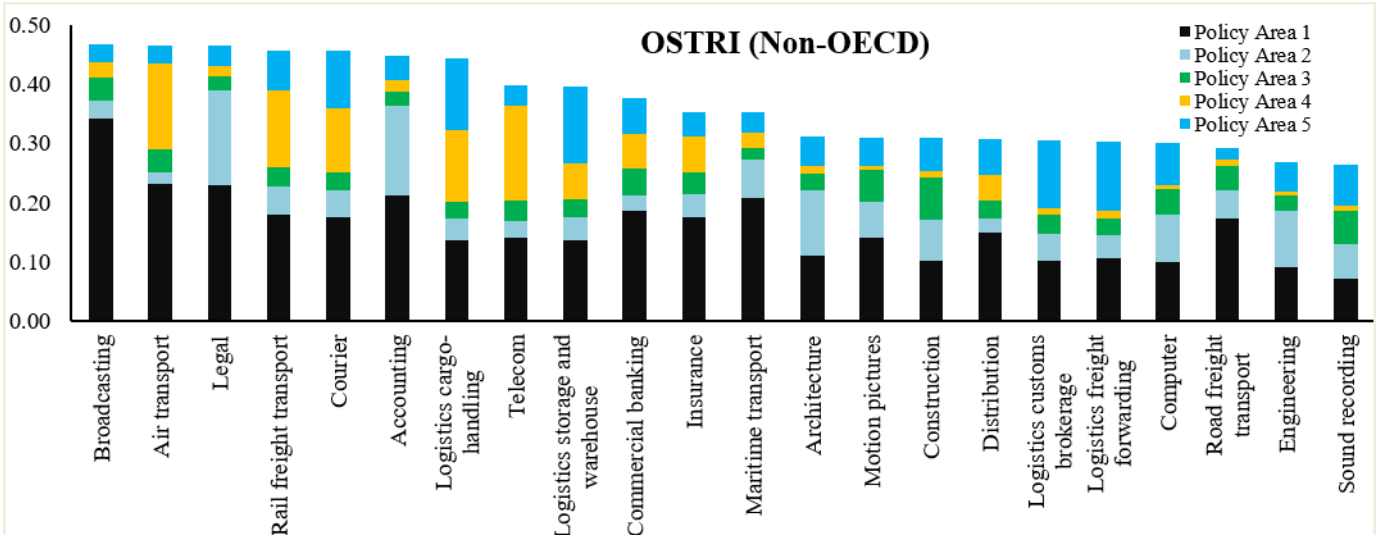


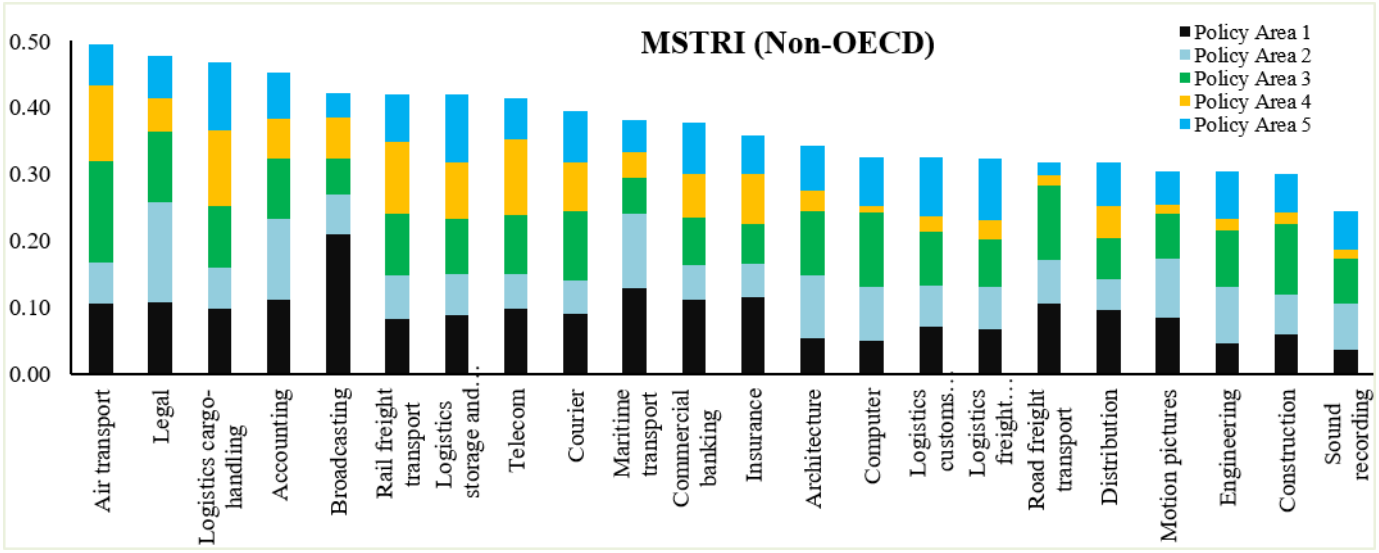
Source: OECD STRI Regulatory Database, World Bank's World Development Indicators; Authors' calculations.

Figure 4.3: OSTRI and MSTRI by sectors and country groups, 2018









Source: OECD Regulatory Database; Authors' calculations. *Note: The five policy areas (in order) are: Restrictions on Foreign Entry, Restrictions on Movement of People, Other discriminatory measures, Barriers to competition, and Regulatory Transparency.*

Appendix

A.1Derivation of STRI using 'non-normalised' expert weights i.e., $STRI^{New}$

Let D_i^j represents the restrictiveness score of a measure $j \in i$ such that$D_i^j = \mathbf{0}$(if the measure is not restrictive) **or 1** (if it is restrictive). Thus, from equation (3) in the main text, we can write:

$$STRI_i^{New} = \sum_j D_i^j \frac{w_i^{OECD}}{n_i} = \frac{w_i^{OECD}}{n_i} \sum_j D_i^j \quad \ldots.(i)$$

And, for the sector as a whole,

$$Indicator\_STRI^{New} = \sum_i STRI_i^{New} \quad \ldots.(ii)$$

To show that the $Indicator\_STRI^{New}$ always lies between [0, 1], let's assume two cases viz.

(a). $D_i^j = 0 \; \forall \; j \in i$ - - - - (All measures are non-restrictive)

(b). $D_i^j = 1 \; \forall \; j \in i$ - - - - (All measures are restrictive)

In case (a), using information from (i), (ii), we find,

$$Indicator\_STRI^{New} = \frac{w_1^{OECD}}{n_1} \sum_j D_1^j + \frac{w_2^{OECD}}{n_2} \sum_j D_2^j + \ldots + \frac{w_5^{OECD}}{n_5} \sum_j D_5^j \quad \ldots.(iii)$$

$$\Rightarrow Indicator\_STRI^{New} = 0,$$

which represents the lower bound for $STRI^{New}$. Similarly, for case (b), it is clear that

$$Indicator\_STRI^{New} = \frac{w_1^{OECD}}{n_1} n_1 + \frac{w_2^{OECD}}{n_2} n_2 + \ldots + \frac{w_5^{OECD}}{n_5} n_5 \quad \ldots.(iv)$$

Since $\sum_{i=1}^{5} w_i^{OECD} = 1$, the upper bound of the alternative index or $STRI^{New}$ is given by:

$$Indicator\_STRI^{New} = 1$$

It is important to note here that for this derivation, we have only changed the weighting technique in deriving the OECD indicator (ceteris paribus), which we refer to as $STRI^{New}$. Similar properties will hold if we also introduce the new scoring technique, the details about which are discussed in sub-section 3.2. In that case, D_i^j will become a non-binary variable lying between [0, 1] for some of the measures for which non-binary answers are available in the OECD Regulatory Database.

A.2 Sector-wise Expert Weights and Computed Weights, OECD STRI

(Table A.2 here)

A.3Comparison (I) of OECD STRI and STRI^{New} derived using 'non-normalised' expert weights (with respect to n_i)

Let n_i^0 and n_i^r(respectively) represent the number of non-restrictive and restrictive measures, belonging to area 'i' such that

$$n_i^0 + n_i^r = n_i$$

From equation (1) in the main text, it is clear that,

$$Indicator\_STRI^{OECD} = \frac{n_1^r w_1^{OECD} + n_2^r w_2^{OECD} + n_3^r w_3^{OECD} + n_4^r w_4^{OECD} + n_5^r w_5^{OECD}}{n_1 w_1 + n_2 w_2 + n_3 w_3 + n_4 w_4 + n_5 w_5} = \frac{\sum_{i=1}^5 n_i^r w_i^{OECD}}{\sum_{i=1}^5 n_i w_i^{OECD}} \quad ....(v)$$

Let's assume that number of measures belonging to policy area 1 (or n_1) changes. Differentiating (v) w.r.t. n_1, we find[28]

$$\Rightarrow \quad \frac{\partial Indicator\_STRI^{OECD}}{\partial n_1} = \frac{\sum_{i=1}^5 n_i w_i^{OECD} [w_1^{OECD} (\partial n_1^r / \partial n_1)] - (\sum_{i=1}^5 n_i^r w_i^{OECD}) w_1^{OECD}}{(\sum_{i=1}^5 n_i w_i^{OECD})^2}$$

or,

$$\frac{\partial Indicator\_STRI^{OECD}}{\partial n_1} = \frac{-w_1^{OECD} \sum_{i=1}^5 n_i^r w_i^{OECD}}{(\sum_{i=1}^5 n_i w_i^{OECD})^2} [1 - \frac{\sum_{i=1}^5 n_i w_i^{OECD}}{\sum_{i=1}^5 n_i^r w_i^{OECD}} (\partial n_1^r / \partial n_1)] \quad ....(vi)$$

Similarly, using (i) and (ii), we find

$$\frac{\partial Indicator\_STRI^{New}}{\partial n_1} = \frac{-n_1^r w_1^{OECD}}{(n_1)^2} [1 - \frac{n_1}{n_1^r} (\partial n_1^r / \partial n_1)] \quad ....(vii)$$

Now, there can be two (extreme) cases:

a. $\Delta n_i = \Delta n_i^0$, which means that the new measure(s) is (are) non-restrictive, and
b. $\Delta n_i = \Delta n_i^r$, which implies that the new measure(s) is (are) restrictive and therefore, adds to the restrictiveness score of the first policy area.

In case (a), it can be shown that $STRI^{New}$will be less sensitive to a change in number of measures belonging to any policy area (policy area 1, in the present case) vis-à-vis that of $STRI^{OECD}$, iff

$$\frac{w_1^{OECD} \sum_{i=1}^5 n_i^r w_i^{OECD}}{(\sum_{i=1}^5 n_i w_i^{OECD})^2} > \frac{n_1^r w_1^{OECD}}{(n_1)^2}$$

On the contrary, in case (b), for $STRI^{New}$ to be less sensitive vis-à-vis that of the $STRI^{OECD}$, the following condition should hold:

$$\frac{-w_1^{OECD} \sum_{i=1}^5 n_i^r w_i^{OECD}}{(\sum_{i=1}^5 n_i w_i^{OECD})^2} \left[1 - \frac{\sum_{i=1}^5 n_i w_i^{OECD}}{\sum_{i=1}^5 n_i^r w_i^{OECD}}\right] > \frac{n_1^r w_1^{OECD}}{(n_1)^2} \left[1 - \frac{n_1}{n_1^r}\right]$$

This implies that, in general, one cannot conclude whether the OECD or the Alternative formulation is less sensitive to any change in the number of measures belonging to an area.

[28]For ease of understanding, we are considering n_i to be a continuous (and not a discrete) parameter.

A.4. Comparison (II) of OECD STRI and STRI derived using 'non-normalised' expert weights (with respect to n_1^r)

Let us now assume that a non-restrictive measure in policy area 1 becomes restrictive so that from (v),

$$\Rightarrow \qquad \frac{\partial Indicator\_STRI^{OECD}}{\partial n_1^r} = \frac{w_1^{OECD}}{\sum_{i=1}^{5} n_i w_i^{OECD}} \ldots (viii)$$

And, using (i) and (ii), we find

$$\Rightarrow \qquad \frac{\partial Indicator\_STRI^{New}}{\partial n_1^r} = \frac{w_1^{OECD}}{n_1} \ldots (ix)$$

Now, OECD STRI will be more sensitive to any change in the number of restrictive measures belonging to area 1 in comparison to the Alternative Formulation (or $STRI^{New}$) when $(viii)$ > (ix), or

$$\frac{w_1^{OECD}}{\sum_{i=1}^{5} n_i w_i^{OECD}} > \frac{w_1^{OECD}}{n_1}$$

$$\Rightarrow \qquad n_1(1 - w_1^{OECD}) > n_2 w_2^{OECD} + n_3 w_3^{OECD} + n_4 w_4^{OECD} + n_5 w_5^{OECD}$$

$$\Rightarrow \ (n_1 - n_2)(w_2^{OECD}) \ + \ (n_1 - n_3)(w_3^{OECD}) \ + \ (n_1 - n_4)(w_4^{OECD}) \ + \ (n_1 - n_5)(w_5^{OECD}) > 0 \ \ldots\ldots (x)$$

One of the sufficient conditions under which (x) will hold true is when $n_1 =$ Maximum $(n_i, i \neq 1)$.

A.5. Variables, Definitions and Sources

(Table A.5 here)

A.6.Regression Results

(Table A.6 here)

Tables

Table A.2: Expert weights and Computed weights by policy area and sector (OECD)

Policy Area → / Sector ↓	Restrictions on Foreign Entry		Restrictions to Movement of People		Other Discriminatory Measures		Barriers to Competition		Regulatory Transparency	
	Expert Weights	Computed Weights	Expert Weights	Computed Weights	Expert Weights	Computed Weights	Expert Weights	Computed Weights	Expert Weights	Computed Weights
Broadcasting	39.67	63.27	12.00	7.11	17.33	12.64	17.67	7.24	13.33	9.72
Motion	27.24	47.61	21.84	16.19	19.24	15.28	13.44	6.40	18.24	14.49
Sound	12.00	24.45	17.00	15.64	23.00	19.65	27.00	19.52	21.00	20.71
Construction	21.97	41.81	16.87	20.33	22.07	15.40	18.57	9.42	20.53	13.02
Courier	27.20	43.62	12.20	9.13	19.20	5.13	21.00	23.57	20.40	18.54
Computer	17.44	38.51	20.84	23.00	17.73	6.98	20.23	12.76	23.76	18.73
Distribution	30.11	51.48	10.28	5.85	17.67	8.51	21.94	20.18	20.00	14.01
Commercial Banking	26.27	46.74	12.13	7.19	18.67	11.92	20.83	19.01	22.10	15.12
Insurance	31.00	50.24	13.80	12.09	16.00	9.72	19.13	15.89	20.07	12.04
Accounting	24.97	53.09	22.26	28.59	15.72	4.18	17.11	5.30	19.93	8.83
Architecture	18.61	66.93	25.62	16.40	17.11	2.91	16.49	6.16	22.17	7.60
Engineering	19.47	43.19	26.58	32.58	15.58	4.54	15.55	6.35	22.82	13.32
Legal	22.28	50.29	29.76	33.59	15.90	3.59	14.41	4.55	17.66	7.97
Telecom	24.89	41.12	13.07	6.89	15.44	5.23	26.31	37.57	20.29	9.16
Air Transport	24.50	55.62	14.00	5.23	23.75	6.14	20.00	25.86	17.75	7.14
Maritime Transport	35.00	60.79	25.00	16.43	12.50	4.69	14.50	9.53	13.00	8.54
Rail Freight	24.89	45.78	13.07	10.20	15.44	5.16	26.31	26.40	20.29	12.44
Road Freight	35.00	59.39	15.00	12.72	25.00	9.09	20.00	14.54	5.00	4.24
Logistics*	25.40	37.28	14.30	9.10	17.30	5.08	20.50	22.12	22.50	26.39

Source: Grosso *et al*. (2015); **Note:Information on Logistics sector was obtained from the OECD STRI Team. The weights do not vary across the four different segments of logistics sector viz. Cargo-handling, Storage-Warehouse, Customs-Brokerage and Freight Forwarding*

Table A.5: Variables, Definitions and Sources

Variables	Definition	Source
X_{ij}	Sector-specific exports from i to j.	OECD TiVA
Importer/Exporter OSTRI	OECD STRI	OECD
Importer/Exporter MSTRI	Modified STRI	Alternative weighting and scoring technique applied to OECD's STRI data
Contiguity	Dummy variable equal to 1 if i and j share a common border.	CEPII
Common Language	Dummy variable equal to 1 if i and j have a language in common.	CEPII
Common Coloniser	Dummy variable equal to 1 if i and j were colonised by the same power.	CEPII
Colony	Dummy variable equal to 1 if one of the two was in a colonial relationship with the other.	CEPII
Log Distance	Log of distance between i and j	CEPII
FTA	Dummy Variable equal to 1 if i and j are members of the same agreement.	CEPII

Table A.6: Regression Results

	Distribution		Computer		Telecom		Financial Services		Transport & Storage	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Importer OSTRI	-10.889***		-25.016***		-5.566***		-14.654***		-2.110	
	(2.532)		(2.502)		(1.198)		(2.262)		(1.976)	
Exporter OSTRI	-8.715***		-10.205***		-6.686***		-9.607***		-8.237***	
	(2.997)		(2.660)		(1.304)		(2.471)		(2.024)	
Importer MSTRI		-7.368***		-15.610***		-5.928***		-13.497***		-1.655
		(1.713)		(1.562)		(1.276)		(2.083)		(1.550)
Exporter MSTRI		-5.897***		-6.368***		-7.121***		-8.848***		-6.460***
		(2.028)		(1.660)		(1.389)		(2.276)		(1.587)
Contiguity	1.472***	1.472***	1.191***	1.191***	1.130***	1.130***	1.403***	1.403***	1.488***	1.488***
	(0.170)	(0.170)	(0.133)	(0.133)	(0.117)	(0.117)	(0.147)	(0.147)	(0.166)	(0.166)
Common Language	0.802***	0.802***	0.721***	0.721***	0.550***	0.550***	0.657***	0.657***	0.579***	0.579***
	(0.126)	(0.126)	(0.104)	(0.104)	(0.084)	(0.084)	(0.111)	(0.111)	(0.118)	(0.118)
Common Coloniser	1.685***	1.685***	1.752***	1.752***	1.171***	1.171***	1.640***	1.640***	1.863***	1.863***
	(0.535)	(0.535)	(0.350)	(0.350)	(0.267)	(0.267)	(0.395)	(0.395)	(0.349)	(0.349)
Colony	0.237*	0.237*	0.281**	0.281**	0.403***	0.403***	0.401***	0.401***	0.673***	0.673***
	(0.127)	(0.127)	(0.113)	(0.113)	(0.112)	(0.112)	(0.123)	(0.123)	(0.122)	(0.122)
Log Distance	-0.054	-0.054	-0.083	-0.083	-0.185***	-0.185***	-0.026	-0.026	-0.051	-0.051
	(0.096)	(0.096)	(0.072)	(0.072)	(0.057)	(0.057)	(0.075)	(0.075)	(0.090)	(0.090)
FTA	0.446***	0.446***	0.227**	0.227**	0.265***	0.265***	0.228**	0.228**	0.345**	0.345**
	(0.150)	(0.150)	(0.109)	(0.109)	(0.091)	(0.091)	(0.110)	(0.110)	(0.138)	(0.138)
Constant	7.483***	6.291***	8.805***	6.254***	5.858***	6.455***	7.840***	7.609***	6.614***	6.121***
	(1.459)	(1.267)	(1.211)	(0.994)	(0.853)	(0.926)	(1.299)	(1.270)	(1.390)	(1.277)
Observations	2,025	2,025	2,025	2,025	2,025	2,025	2,025	2,025	2,025	2,025
R-squared	0.753	0.753	0.788	0.788	0.768	0.768	0.799	0.799	0.724	0.724
Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Note: All models are estimated using Importer and Exporter Fixed Effects with log of exports as the dependent variable. Robust Standard Errors are adjusted for clustering by country pair. Statistical significance: *(10%). **(5%), and ***(1%).*