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SERVICES TRADE RESTRICTIVENESS INDEX (STRI): TELECOMMUNICATION SERVICES

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ABSTRACT

This paper presents the services trade restrictiveness indices (STRIs) for telecommunications. The STRIs are composite indices taking values between zero and one, zero representing an open market and one a market completely closed to foreign services providers. The indices are calculated for 40 countries, the 34 OECD members and Brazil, China, India, Indonesia, Russia and South Africa. The STRIs capture de jure restrictions. This report presents the first vintage of indicators for telecommunications and captures regulations in force in 2013. The scores range between 0.06 and 0.61, with a sample average of 0.22. Barriers to competition, reflecting inadequate regulation of incumbents with significant market power, and state ownership in some countries make the largest contribution to the index value, followed by restrictions on foreign entry. The paper presents the list of measures included in the indices, the scoring and weighting system for calculating the indices and an analysis of the results.

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

JEL: F13, F14, K33, L96

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

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EXECUTIVE SUMMARY

This paper presents the Services Trade Restrictiveness Indices (STRIs) for the OECD countries and Key Partners (Brazil, the People's Republic of China, India, Indonesia, the Russian Federation and South Africa) for telecommunications services. Telecommunications are defined as comprising fixed line, mobile and internet services. Telecommunications are subject to a number of market imperfections – the most important being network externalities, access to essential facilities and switching costs. These all favour incumbent firms and constitute an important entry barrier for new providers.

Regulation may be required for competitive markets to prevail. The STRI for telecommunications therefore includes pro-competitive regulation in addition to explicit barriers to trade and investment. However, the extent and nature of regulation needed to keep markets open and competitive depend on the maturity of the market. Lack of pro-competitive regulation on dominant suppliers contributes to the STRI index, while in a competitive market lack of such regulation is not scored as a restriction.

The STRIs take values between zero and one, one representing a totally closed and zero a fully open sector. It records restrictions that apply on a most favoured nation (MFN) basis and does not consider preferential trade agreements. The STRI ranges between 0.06 and 0.61 in this sector. The results are driven by two policy areas: *Restrictions on foreign entry* and *Barriers to competition.* Bearing in mind that telecommunications is a capital-intensive sector subject to market imperfections, the indices capture the special characteristics of this sector well. The countries that have index values above average either impose limits on foreign equity or the government holds a controlling stake in the incumbent provider, with the exceptions of Chile. In contrast, the four countries with the lowest index value (Austria, France, the United Kingdom and Portugal) have no restrictions under the first policy area and telecommunications companies are majority owned by the private sector.

The STRI also categorises indices according to mode of supply. The bulk of restrictions mainly affect mode 3. Furthermore, measures that fall under market access or national treatment as defined in the GATS are distinguished from restrictions that do not have to be scheduled in the General Agreement on Trade in Services (GATS). Market access and national treatment account for about 37% of total STRI values. The STRIs are thus helpful at identifying areas for further liberalisation under the GATS or regional trade agreements (RTAs).

It is nevertheless noteworthy that as much as 63% of the index values stem from measures that are not subject to scheduling, most notably barriers to competition and government control. Pro-competitive regulation is included in a number of recent RTAs. Since such regulation is largely non-discriminatory, unilateral reforms as well as inclusion in RTAs help lower entry barriers for all telecoms providers.

1. Introduction

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

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

2. The STRI database contains information on market access, national treatment, relevant domestic regulation and administrative procedures in all the OECD Member countries and the Key Partners (Brazil, People's Republic of China, India, Indonesia, the Russian Federation and South Africa). The sources of information for the database are laws and regulations in each Member country and do not consider preferential treatment entailed in preferential trade agreements (PTAs).[1] Each entry is documented by reference to the source. Members have verified their data and subsequently the database has been subject to peer review to assess its factual accuracy.

3. The STRIs translate the qualitative information contained in the database to numerical values that can be used for quantitative policy analysis, including impact assessment of policy reforms. The methodology for calculating the indices is described in OECD (2014a). This paper presents the indices for telecommunications services, which is the first services sector for which an agreement under the auspices of the World Trade Organization (WTO) and the General Agreement on Trade in Services (GATS) was finalised.

4. Work on services trade restrictiveness indices was pioneered by the Australian Productivity Commission (APC), which developed indices for a range of services, including telecommunications, in the late 1990s (Warren, 2000). A number of institutions, including the OECD (Dihel and Shepherd, 2007) and the World Bank (Borchert et al., 2012) have developed services trade restrictiveness indices since then. However, so far such indices have been published only for one year and for a limited number of countries and sectors. Within the OECD economy-wide indices of product market regulation (PMR) have been developed as well as indices for particular sectors, including telecommunications (Boylaud and Nicoletti, 2000; Conway and Nicoletti, 2006). Finally, the OECD foreign direct investment (FDI) restrictiveness index partly overlaps with the STRI for telecommunications (Kalinova et al., 2010).

5. The STRIs are presented in aggregate form as well as decomposed into several classifications: by policy area, GATS classification, a discriminatory and non-discriminatory taxonomy, and an entry and on-going operations rubric. These different classifications will facilitate the use of the indicators in policy analysis for multiple purposes and as a tool for trade negotiators.

6. Telecommunications are still characterised by a number of market imperfections, although liberalisation and technological progress have improved the competitiveness of the market substantially. Many OECD countries have rolled back state ownership and lifted explicit barriers to trade and investment in the sector, but in almost half government still has a stake in the incumbent, while all the Key Partners

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

have a fully or partly state-owned telecoms company. The absence of explicit barriers is, however, not enough to facilitate market access for foreign services suppliers. In addition, regulation that ensures interconnection with or access to major suppliers or dominant firms' essential facilities is necessary. Hence, in telecommunications regulation can be trade enhancing, while a lack thereof may well be trade restricting. The STRI therefore covers regulatory issues beyond explicit barriers to trade and investment.

7. It is well established in the literature and in regulatory practices that essential facilities in the telecommunication infrastructure need to be shared to create competitive markets. There are several ways that governments can mandate or encourage infrastructure sharing. Among the least intrusive ways is mandating interconnection on reasonable terms, followed by different forms of local loop unbundling (bitstream, full unbundled access). Among the most intrusive ways is mandating functional or structural separation of vertically integrated companies. Regulating interconnection in a way that facilitates foreign market entry is firmly entrenched in the WTO Telecommunications Reference Paper on Basic Telecommunications as well as in a number of free trade agreements.

8. Telecommunications are subject to rapid technological progress. Developing a trade restrictiveness index for the sector that captures current trade restricting and trade promoting regulation and in addition provides forward-looking policy recommendations is challenging. In several market segments the appropriate regulation that fosters open and competitive markets depends on the maturity of the market and the technology. Furthermore, technology is converging towards a common internet-based platform, which may open new avenues for competition, but may also change the ability of new entrants to gain access to the infrastructure of incumbents. Many governments have therefore introduced regulatory reforms with the objective of developing pro-competitive, technology-neutral regulations.

9. The rest of the paper is structured as follows: Sections 2 and 3 define telecommunications and trade in telecommunications respectively. Section 4 discusses market imperfections and how they can be addressed through trade-enhancing regulation. Section 5 discusses the choice of regulatory variables to include in the STRI, Section 6 presents the methodology while Section 7 reveals and analyses the results. Sensitivity analysis is presented in Section 8 and Section 9 concludes.

2. Definition of the sector

10. Table 1 presents definitions of the telecommunications sector according to the WTO Services Sectoral Classification List (W/120) used by most countries for GATS scheduling purposes, the Central Product Classification (CPC), Extended Balance of Payments Statistics (EBOPS) which is the most commonly used classification system for reporting trade in services and International Standard Industrial Classification (ISIC) Rev 4 which is used for reporting foreign direct investment, foreign affiliate sales and production.

Table 1. Definition of the telecommunications sector

Name	W/120	CPC	EBOPS	ISIC 4
Voice telephone services	2.C.a.	7521	247	611+612+619
Packet-switched data transmission services	2.C.b.	7523**	247	611+612
Circuit-switched data transmission services	2.C.c.	7523**	247	611
Telex services	2.C.d.	7523**	247	611
Telegraph services	2.C.e.	7522	247	611
Facsimile services	2.C.f.	7521**+7529**	247	611
Private leased circuit services	2.C.g.	7522**+7523**	247	611
Electronic mail	2.C.h.	7523**	247	611+612
Voice mail	2.C.i.	7523**	247	611+612
On-line information and data base retrieval	2.C.j.	7523**	247	611+612
Electronic data interchange (EDI)	2.C.k.	7523**	247	611+612
Enhanced/value-added facsimile services, incl. store and forward, store and retrieve	2.C.l.	7523**	247	611
Code and protocol conversion	2.C.m.	n.a	n.a	n.a
On-line information and/or data processing (incl. transaction processing)	2.C.n.	843**	247	611+612

Source: WTO, OECD, UN. (**) indicates that the service specified constitutes only a part of the total range of activities covered by the UN's Central Product Classification (CPC) concordance (e.g. voice mail is only a component of CPC item 7523). ISIC classification is according to type of infrastructure (wired, wireless and satellite).

11. The lack of details in the EBOPS classification is reflected in a lack of detail in the trade data. A number of countries provide trade data for total telecommunications only and for some countries trade data are available at an even more aggregate level (i.e. including postal services). As a result, it is difficult to isolate trade patterns – as well as study the impact of the STRI – in telecommunication services at a more disaggregated level than EBOPS will allow.

12. The W/120 and corresponding ISIC categories are chosen as the basis for defining the telecommunications sector in this study. Although the classification may seem antiquated, existing commitments in the GATS as well as requests and offers during the Doha round are largely made according to this classification. It should also be noted that the STRI does not include any specific regulations on services such as telex and facsimile. It aims, however at covering all services currently being provided and will be revisited in future as needed when new services and technologies are introduced.

13. Data on regulation and trade restrictions usually distinguish between fixed line, mobile and internet services. This corresponds to the ISIC classification of telecommunications, which allows an analysis of regulation and its relationship with sector performance. However, the activities that naturally fall under the telecommunications services from a business point of view change with technology. For instance, television is often offered to households as part of a bundle of electronic communications services charged at a flat monthly rate.[2] Yet television is found under different chapters both in trade agreements and in the classification of services in the balance of payments. For this reason and the fact that broadcasting is subject to different regulatory concerns, there is a separate STRI index for television and broadcasting..

3. How are telecommunications services traded?

14. Telecommunication services involve the transmission or treatment of a signal between different locations, which can involve an alteration of its properties or storage. Any transaction between two parties

2. 43% of European households buy a communications bundle and about half of these include television in 2011, suggesting that more than 20% of European households buy television as part of a communication bundle (Commission of the European Communities, 2012) .

in different countries for the purposes of the transmission or treatment of a signal can be considered international trade. Table 2 outlines the relevance of different modes of supply for telecommunication services sub-sectors (that is, fixed line, mobile services and internet).

Table 2. Examples of different modes of trade for telecommunications sub-sectors

	Fixed line	Mobile	Internet
Mode 1: Cross border trade	Revenue from international calls or transmitted through the country		Revenues from interconnection with foreign networks or from services of signal treatment
Mode 2: Consumption abroad	Revenue from tourists and business travellers using the local network	Revenue from international roaming charges	Revenue from tourists and business travellers using local internet services
Mode 3: Commercial presence	Revenues from foreign branches, affiliates and joint ventures		
Move 4 Movement of people	Earnings by telecommunications professionals providing services abroad on a temporary basis		

15. Measuring telecommunications services trade has become increasingly difficult. A large amount of international traffic takes place under peering agreements between providers, that is, without a record of currency transactions across borders. Furthermore, although most countries report gross trade flows, a few still report net flows.

16. In what follows, we draw attention to a number of distinctive characteristics of trade in each sub-sector. It is worth noting that the separation among different activities in the sector may become less relevant as voice and data increasingly share common internet platforms.

3.1 Fixed line telecommunication services

17. Cross-border trade in telecommunications is mainly related to making international telephone calls. In the past, the accounting rate system undertaken within a framework agreed to at the International Telecommunication Union (ITU) governed the payments for international calls. It typically involved net payments at bilaterally negotiated wholesale prices among state-owned monopolies. Payments were made only if the number of minutes terminated was unbalanced. Furthermore, the accounting rates tended to entail considerable transfers from developed to developing countries. With the liberalisation of the sector, the accounting rate system has largely been replaced by a reference termination rate which is non-discriminatory.

18. Like under the accounting rate system, payments between carriers of international traffic are usually made on a net basis, and sometimes "bill and keep" is used, involving no financial transactions even when traffic is not balanced. Assessing trade in telecommunications from balance of payments data may therefore shed little light on developments in international markets in telecommunications. As explained by Molnar (2008), fixed line minutes of international calls have declined in recent years and the price per minute has declined even more. Falling demand in spite of sharply lower prices reflects the substitution away from fixed line telephony to e-mail, mobile and voice over internet protocol (VoIP).

19. VoIP is provided over internet broadband networks where, technically speaking, voice is like any other piece of information. However, in order to call fixed line and mobile telephones, interconnection is required. VoIP can be particularly attractive for international calls as voice can be transported on the internet across the border and terminated as a local call. International calls in the traditional sense could therefore cease to exist in the not-too-distant future.

20. Commercial presence is established through foreign direct investment, where minority shareholding and mergers and acquisitions (M&A) have been the most common ways of entering the market. Globally, the share of telecoms in total services M&A increased from 12% in the period 1987-92 to 36.6% in 1999-2004 with the highest share (56.4%) in the latter period in Denmark, Sweden and the United Kingdom (Coerdacier et al., 2009).

21. Explicit barriers to cross-border trade are few and the technological possibilities to enforce remaining restrictions are probably limited in the fixed line and VoIP telephone segment. In contrast, restrictions on commercial presence are relatively numerous. First, direct restrictions on foreign ownership remain in place in four OECD countries and are more common in non-OECD countries. Second, uncompetitive markets affect both foreign and local entrants. Therefore, the STRI for telecoms includes a number of non-discriminatory regulatory measures that affect the entry of foreign firms through commercial presence.

3.2 Mobile telecommunications services

22. Mobile services have become increasingly important. Indeed, mobile services made up 47.8% of all OECD-area telecommunication revenues in 2011 (OECD, 2013). Similar data are not readily available for the Key Partners, but while the share of mobile subscriptions in total telephone subscriptions was on average 71% in OECD Members in 2011, the shares ranked between about 80% in China to almost 97% in India among the Key Partners (Source: WDI database). Mobile telecommunication is unique in that it uses radio waves (spectrum), instead of wires, to connect users. Spectrum is a scarce resource that is non-homogeneous (that is, the characteristics of each area of the spectrum are different, so that only a portion of the entire spectrum is suited to mobile telephony). Because of spectrum's scarcity, both domestic and international regulation and standards play an essential role in the mobile services market.

23. When a stand-alone service, mobile tariffs are usually a combination of a fixed fee and per minute rates. However, the fixed fee includes a certain number of minutes, and if that number is not exceeded by the customer, mobile services are in practice subject to a flat rate, similar to fixed and internet services.

24. Trade in mobile telecommunication services can be characterised by the four modes of supply outlined in the GATS (see Table 2). Cross-border supply and commercial presence represent the two most important channels for mobile services trade. In the past, the impetus for establishing a foreign affiliate was heightened by the desire to avoid high roaming fees from other networks. One way to reduce high roaming fees is to ensure that foreign mobile operators receive mobile virtual network operator (MVNO) status in the host country rather than being limited to using the services of only a single mobile operator in the host country. Trade via Mode 2, or consumption abroad, is a relatively minor share of mobile services trade and is limited primarily to fees derived from roaming.

25. In the past several years, technological advances have facilitated a convergence between fixed and mobile telephony (phones that act as a mobile phone outside the home but connect to Wi-Fi or Bluetooth when inside the home). However, it is not clear that these so-called "converged services" substitute to a large degree for one another. Yet there appears to be significant scope for substitutability in the future, particularly as there is a shift of SMS to internet-based routing and VoIP over mobile networks (Sutherland, 2007).

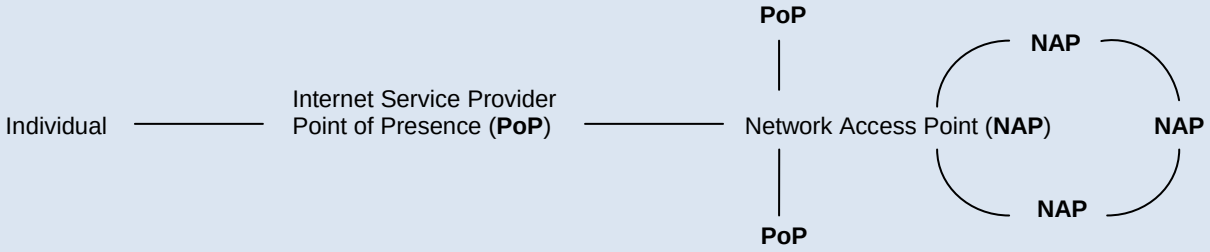
3.3 Internet services

26. Both fixed and mobile services are associated with the transmission of voice, while the internet involves the transmission of any signal that can be electronically stored in a computer. The internet

operates in a distinct manner from the other telecommunication sub-sectors in that trade occurs almost exclusively between firms rather than between individual customers and firms. The case of foreign affiliates operating in a country is a notable exception to this rule, as well as many activities in the sector involving the treatment of signals. The operation of the internet and how trade takes place in the sector is summarised in Box 1.

Box 1. Trade and the internet

Internet service providers need a link to the universal network in order to provide customers with access to all available internet content. A new service provider needs to establish a link to just one other internet provider to access the universal network. Every provider has physical Points of Presence (PoP) in a number of regions. Firms maintain connections between PoPs at the so-called Network Access Points (NAPs). Schematically we could represent the system as follows:



Trade occurs at the NAPs, where firms of different nationalities interconnect. While the addition of new members involves a flow of data across borders, international trade will not take place if the new entrant establishes a link with a firm of the same nationality in order to access the universal network. Payments between firms for these interconnections can take the form of exchanges in kind (peer transactions). Trade can also occur from the operation of foreign affiliates in a country, or else consist of payments for the treatment or storage of data.

Source : Economides (2005).

27. Contrary to fixed and mobile telephony, trade in internet services is completely disassociated from the origin and destination of signals. Trade occurs when a firm chooses to establish a link with the universal network by connecting to a provider of a different nationality. The establishment of such a link involves agreements that do not depend on the volume and directional flows of signals. The infrastructure used for the transmission of signals on the internet is the same as for fixed line and to an increasing extent, mobile services.

28. To summarise, this section has discussed trade in telecommunications by type of technology. While still useful, technical convergence has to some extent blurred the distinction between the three sub-sectors. For instance, VoIP is gaining market share at the expense of fixed line telecommunications services, and may in the near future dominate the market. It is also increasingly common to purchase a bundle of services, including fixed line telephony and/or VoIP, internet services, television and sometimes mobile services. Furthermore, the price of the bundle is typically a flat fee.

4. Regulation and trade in telecommunications

29. The telecommunication sector has developed from a largely state-owned monopoly sector towards competitive markets over the past two decades or so. The policy elements in this development have been privatisation and liberalisation. A considerable body of literature on the sequence of reforms and complementarities between policies has emerged, which suggests that competitive markets emerge only if opening up to entrants is accompanied by liberalisation. For instance, privatisation of the incumbent does

not by itself create competition, but could well transform a publicly owned monopoly into a privately owned monopoly. By the same token, liberalisation may trigger new entry and create competitive markets even if the state retains a significant ownership share in the incumbent.

30. As opposed to many other services sectors, lack of regulation can be a trade restriction in telecommunications. This is an issue well established in international trade agreements, which often include articles on regulation. Principles for regulation are also the main topic of the WTO Telecommunications Reference Paper on Basic Telecommunications under the GATS. Pro-competitive regulation should therefore be included in the STRI.

31. As a background to the presentation of the specific measures included in the STRI for telecoms, this section reviews recent literature on regulation and identifies the market imperfections that are most relevant for trade. The most important market imperfections identified in the literature are network externalities (bandwagon effects), control over essential facilities in the network, and switching costs. For each market failure a policy intervention may be necessary to ensure that markets function properly, including facilitating the entry of foreign services providers.

32. It is important to note up front that the telecommunication sector is subject to rapid technological changes and in many cases a best practice has yet to be established. Furthermore, the appropriate regulation depends on the maturity of the market and the technology in question. Finally, regulation is costly and subject to imperfections and a cost-benefit analysis may not always come out in favour of regulation even when market failures can be identified.

4.1 Network externalities or bandwagon access

33. Network effects arise because a network has a higher value to the individual the more people are linked to the network. Such effects are found both in relation to subscription and use. A new subscriber gains the opportunity to communicate with all existing subscribers, while existing subscribers gain from one more member in the network. The new subscriber will, however, only consider her own benefit when deciding whether to subscribe. The internet is also subject to indirect network effects between final consumers and content providers in which case the internet can be seen as a two-sided platform (Rysman, 2009).

34. Network effects can be internalised by the market, in which case they should not be a cause of concern for regulators. Where this is not the case, network effects are considered network externalities that can lead to start-up problems and underinvestment in the absence of regulation. The regulatory remedy is typically price regulation or subsidies to compensate the supplier until a critical mass of subscribers is reached and demand is sustained.

35. Alternatively, universal service obligations (USO) may be imposed. In practice, it is often the incumbent dominant firm that faces universal services obligations, while entrants are often required to share the cost. Whether universal service obligations are a burden for the incumbent or an advantage in the long-run depends on the way in which contracts for USOs are tendered and the particularities of each market. Contributions to universal services that are transferred to the incumbent can be considered a tax on entrants if, in fact, the incumbent gains from fulfilling the obligation. This is more likely to take place if USO contracts are not competitively awarded (e.g. grandfathering).

36. In market segments in which access to networks is already universal, the start-up problem has obviously been solved and continued government intervention to stimulate demand may be superfluous. However, with the emergence of new technologies that require substantial investments in infrastructure, the issue may resurface. Investment in broadband appears to be the sub-sector in which network

externalities may justify government intervention in order to stimulate investment or demand in some countries (ITU, 2009). In general the optimal access regulation may depend on the market structure and level of development (Lestage and Flacher, 2014).

37. Network externalities in the use of telecommunications networks can more easily be internalised. When a telephone conversation is made both parties usually gain, but only one – most often the caller – pays. Markets have internalised this by introducing toll-free numbers, which have been institutionalised in the Universal International Freephone Number (UIFN) administered by the International Telecommunication Union (ITU). In the consumer market, collect (or reverse) calls are possible.

38. In addition to the investment issue, network externalities can also be a competition issue. If newcomers are denied access to the incumbent's customers or are only allowed access at unfavourable conditions, the newcomer may be unattractive to potential consumers because of the limited number of people that customers can reach at competitive rates. Therefore, mandated access to the network on reasonable terms is the standard policy measure to deal with network externalities, a policy that is applied in most countries that have established a telecoms regulatory regime.

39. Governments also recognise the need to regulate interconnection and the terms of interconnection, but the scope of regulation differs. Dominant fixed line telecommunication firms are usually required to interconnect entrants at regulated prices, while newcomers do not face the same requirement. Mobile services providers are also required to interconnect in many countries, while interconnection in the internet backbone market is typically not regulated. Yet, the largest firms have chosen to interconnect through peering agreements in which traffic, but no money, is exchanged and information flows seamlessly across borders (Faulhaber, 2005).

40. Another regulatory issue related to network externalities is standards. They have an important impact on market conditions and the diffusion of technology. Common standards reduce entry barriers in new markets. It has, for instance, been argued that a common standard has facilitated the high mobile penetration rate in Europe.

41. Traditionally, standards were mainly set by regulatory bodies, which co-ordinated at an international level (e.g. through the ITU).[3] Thus, international standards in fixed line telephony are adopted in all countries. However, market-driven *de facto* standards for technical compatibility have also emerged and some observers argue that the standards problem can be solved by the market and is not automatically a reason for government intervention. For instance, in the mobile market standards differ among countries, rendering international roaming difficult or impossible in the past. More recently, however, handsets often come with technology that ensures interoperability even when standards differ.

42. A technical standard may lock in a technology and its future development path. Therefore, setting standards too early may lead to the adoption of an inferior technology, while setting standards too late may result in a slower diffusion of the technology than would otherwise be the case. Moreover, setting standards can under some circumstances result in higher prices and a less competitive market. For instance, when standards are proprietary and used strategically by incumbent firms, they may lead to higher prices and less competition than if different technologies competed *for* the market. In any case, inter-operability among different services providers and technological compatibility are considered important for competitive markets and trade.

3. The International Telecommunications Union (ITU) was established in 1865. It produces recommendations for the adoption of standards in telecommunications, from traditional telephony to emerging technologies such as the Next Generation Network (NGN).

43. There is no consensus on the extent to which and in which areas international standards are necessary to ensure open markets. It is beyond the scope of the STRI project to pass judgement on the extent to which international standards are needed. The approach should instead be to accept the rationale for existing standards under international standard setting bodies, and include in the STRI index adoption of international standards when such standards exist. Or put differently, not adopting international standards when such standards exist is considered trade restricting.

4.2 Access to essential facilities

44. An essential facility is defined as a physical facility that is truly non-duplicable, owned by a monopoly and potential competitors cannot circumvent it (Faulhaber, 2005). When essential facilities exist, the regulatory response is to mandate the facility to be shared among rivals on reasonable conditions. The telephone local loop is typically such an essential facility, and local loop unbundling (LLU) is mandated in almost all the countries included in the STRI project.

45. However, with new technology there may be substitutes to the services that hitherto could only be delivered through the local loop. Examples are cable TV networks offering voice and internet services. In addition, mobile telephone services could be a sufficiently close substitute to constitute competitive pressure on the incumbent controlling the local loop, at least for voice services. These are examples of facilities-based competition and it has been argued that local loop unbundling is no longer necessary when facilities-based competition is feasible. Nevertheless, regulators such as Ofcom and the European Commission argue that "enduring economic bottlenecks" remain and necessitate access regulation, and most if not all OECD countries and Key Partners have such regulation in place.

46. The regulatory issues at present appear to be more related to the conditions under which unbundled loops are rented (i.e. price regulation of local loops). In addition, LLU of fibre networks have arisen as a new regulatory issue. While there is some debate on whether mandating unbundling of this type would discourage investment, the ITU's view is that the unbundling options that apply to copper should also apply to fibre (ITU, 2009). OECD research, however, points out that there may be technical difficulties related to unbundling of next generation access networks and that other regulation that ensures non-discrimination in access to the network may be more appropriate (OECD, 2008b; 2010).

4.3 Switching costs

47. Switching costs in the context of telecommunications are defined as the real or perceived costs that are incurred when changing supplier but which are not incurred when remaining with the current supplier (Xavier and Ypsilanti, 2008). Switching costs arise from lengthy and cumbersome switching procedures, non-transparent pricing, technical incompatibility of equipment and long-term contracts with customers.

48. From a regulatory point of view, number portability is a key issue related to switching costs. If consumers and businesses have to change telephone numbers to switch telecoms provider, they may hesitate from making the switch even if other services providers offer lower prices or a preferred services package. This may constitute an entry barrier to new services providers, including foreign ones, since switching costs are likely to deter potential customers. In addition, switching costs contribute to less competition among existing services providers.

49. Mandating number portability both for mobile and fixed lines has become a common regulatory response to uncompetitive behaviour related to switching costs. However, even when number portability is mandated, a lengthy porting process can still constitute a significant switching cost. Therefore, a maximum porting time is often imposed in addition to the number portability requirement. The UK regulator, for

instance has set a maximum porting lead time for mobile numbers to two hours from 1 September 2009 (Ofcom, 2009).

50. Other potential regulatory issues related to switching costs are bundling of services. Such bundling can benefit consumers substantially, providing complementary services at lower prices than purchasing the services one by one. Furthermore, bundling may save consumers considerable search costs. However, the practice may negatively impact the level of competition in the market when consumers find it difficult to compare prices and quality among telecoms services providers, and when it is difficult to switch services provider for one of the services included in the bundle. In the latter case in particular, it is difficult for new specialised services providers to enter the market, including foreign firms. Finally, long-term contracts may lock consumers in and raise switching costs.

51. This section has provided a brief discussion of the most important market imperfections in the telecommunications sector. It has argued that when markets are inherently uncompetitive, pro-competitive regulation is necessary to create open markets. On the basis of this discussion, Table 3 sets out the pro-competitive regulatory measures that can be considered trade enhancing.

Table 3. Market imperfections and trade enhancing regulatory responses

Market imperfection	Regulatory response
Network externalities	Mandating interconnection Regulating the terms and condition of interconnection Universal services requirements
Essential facilities	Local loop unbundling (LLU) Regulating pricing and conditions of LLU Rights of way
Switching costs	Number portability Number portability processes

52. All of these regulations are candidates for being included in the STRI for telecoms. For universal service requirements, it is the way the USO contracts are awarded and the way USO is financed rather than USO requirements per see that can potentially distort trade. Grandfathering is considered the least transparent and least competitive way of awarding USO contracts, and is selected for inclusion in the index, as further discussed in Section 5.

53. The use of scarce resources such as bandwidth is not a market imperfection per see, but the way that such resources are allocated may raise competition and trade issues. Licensing of mobile operators is a case in point. Both the decision on how many licenses to award and the way they are awarded (e.g. auctions versus beauty contests) can raise trade issues, particularly related to commercial presence. Likewise the allocation of bandwidth and the extent to which secondary trading is allowed has a bearing on the competitiveness of the market and access for foreign services providers.

54. Assessing the competitiveness of the market is not always straight forward. Temporary market power can be a result of superior technology and better value for money. Furthermore, a mark-up over costs for firms in this position can be considered a return on the innovation that gained them the

prominence in the first place. Mark-ups can also provide an incentive for others to invest in innovation and infrastructure.[4] If so, competition *for* the market can create a dynamic and efficient market.

55. This discussion leads us to the difficult question of when regulation is necessary to create a competitive market. And consequently under which circumstances should a lack of regulation be considered a trade barrier? As the discussion reveals there is not always consensus on this. Furthermore, the need for regulation may vary from one market to the next depending on its size and maturity. A solution to this dilemma is to deem lack of pro-competitive regulation trade restricting when the market is considered uncompetitive (i.e. when there is a dominant firm). This is the solution adopted for the STRI as further explained in Section 6.

5. Which regulations should be included in the STRI?

56. The construction of a telecommunications trade restrictiveness index is a complex exercise in part because the rapid pace of technological change continuously alters the structure of the industry. The index should include information that is sufficiently specific and detailed that it can inform trade negotiations and regulatory reform. But the index should not be so detailed that the primary barriers are overshadowed by lesser restrictions that add little to the essence of trade restrictiveness.

57. After careful analysis of different regulatory regimes and input from a wide range of industry experts, a list of measures that should be included in a telecommunications STRI was approved by OECD Members. The selection of measures is based on the following criteria:

- Barriers and regulations that are mentioned explicitly in the GATS;
- Barriers and regulations that are mentioned explicitly in regional trade agreements; and
- Barriers and regulations that experts (during the December 2008 OECD Expert Meeting on Telecommunications as well as in bilateral consultations) identified as relevant for entering a foreign market.

58. In practice, most of the barriers and regulations satisfy more than one of these criteria. Classifying barriers and regulations in telecommunications under different typologies can increase the usefulness of the regulatory profile and STRI by highlighting different dimensions of the data specifically for negotiators, regulators and industry analysts. The measures included in the STRI are presented by policy area in Annex B. The annex also includes information according to the GATS classification; mode of supply; whether the measure applies to the establishment of a services supplier or to ongoing operations; and finally whether or not the measure is discriminatory.

59. Applying the GATS terminology increases the relevance of the STRI for WTO negotiators. However, as with any classification, it is not always possible to clearly identify to which category certain restrictions belong and there are overlaps in the classification of some barriers. Market Access and National Treatment measures are classified together because they are often difficult to distinguish in practice. This grouping also allows a distinction to be made between restrictions subject to scheduling under the GATS – and consequently to negotiations for their removal – and domestic regulatory measures that usually do not need to be scheduled. The classification is without prejudice to WTO Members' commitments and obligations under the GATS.

4. See Molnar and Bottini (2008) who find that mark-ups in telecommunications are in the middle range compared to other sectors.

60. Restrictions not captured by either market access or national treatment are classified under *Domestic regulation and other*. This category aims at capturing relevant measures, including those that are part of supplementary documents such as The WTO Annex on Telecommunications and the WTO Reference Paper on Basic Telecommunications. Domestic regulatory measures are subject to both existing disciplines and further negotiations with a view to reinforcing them.

61. Indices according to the GATS modes of supply can provide useful information for negotiators. These modes include: mode 1: Cross-border supply; mode 2: Consumption abroad; mode 3: Commercial presence; and mode 4: Temporary movement of natural persons. It has proved difficult to distinguish regulations or any policy measures that apply to only mode 1 or 2. There are, however, measures that apply to all modes of supply, for instance many of the domestic regulation measures. By highlighting which modes are most restrictive, negotiators can better tailor their requests and offers in the context of services trade talks.

62. This study further classifies measures according to regulations that apply to the establishment of firms versus those affecting their on-going operations; and measures that are discriminatory versus non-discriminatory. Establishment restrictions can generally be regarded as impediments to the movement of factors of production, while those applying to firms' operations constrain service provision after establishment. Non-discriminatory measures may raise costs for all services providers, resulting in higher prices and lower demand for services whereas discriminatory ones shift demand towards local suppliers. These classifications could prove useful in helping regulators and industry analysts identify priority areas for reform given defined economic policy objectives. In the following the classification according to policy area is presented in some more detail as this classification forms the basis for the weighting scheme.

Restrictions on foreign market entry

63. Explicit barriers to foreign ownership and the operation of foreign-owned firms are obvious measures that should be included in the STRI. Prominent examples of these measures include restrictions on foreign direct equity stakes, requirements for foreign investment only through joint ventures, limitations on mergers and acquisitions for foreign firms and controlling the number of firms that may operate by economic needs tests or quotas and finally the imposition of nationality or residence requirements for board members.

Restrictions on the movement of people

64. Although telecommunications are a capital-intensive sector, limitations on the temporary movement of people can deter trade. For instance, restricting the number of foreign professionals permitted to practice by labour market needs tests or quotas may delay establishment of commercial presence, impose costs on foreign services providers and discourage local services providers from using e.g. foreign consultants.

Other discriminatory measures

65. Discriminatory taxes and other forms of subsidies further apply as important measures to include in the STRI.[5] In addition, discrimination in government procurement is included because, while currently excluded from the primary GATS disciplines, WTO members have a mandate to negotiate disciplines in this area and many of the countries that are included in the STRI database are parties to the WTO Government Procurement Agreement (GPA). Note, however, that the STRI does not take into account

5. The importance of a regulatory measure refers to how trade restrictive it is if introduced, not how frequently it is introduced.

preferential provisions for any measure, including government procurement. Standards play an important role in telecommunications services. National standards that deviate from international standards, where relevant, may constitute a significant entry barrier in this sector.

Barriers to competition[6]

66. The most numerous barriers included in the STRI fall under the barriers to competition category, reflecting the fact that as a sector formerly dominated by monopoly providers, ensuring competitive markets is of utmost importance. Measures that allow publicly-controlled firms some type of exemption from the general competition law or the government to overrule the decisions of the regulator all reduce competition in the sector. Other measures involving dispute resolution, such as whether appropriate dispute resolution mechanisms are in place for foreign suppliers as well as if firms are permitted to launch appeals of regulatory decisions, are incorporated. Then telecommunication-specific measures are added, such as regulation of access and interconnection; whether resale of voice services, number portability, local loop unbundling and infrastructure sharing are required; and whether secondary spectrum trading is allowed. Further, measures concerning the competitiveness of the process through which universal service obligation contracts are assigned, and whether vertical separation (usually accounting separation) among network owners and service suppliers is mandated are incorporated in the STRI. Many of these measures have been included in some recent RTAs.

67. The regulation of prices – both at the retail and wholesale level – is an important regulatory tool that can increase competition in the market for telecommunication services. The STRI includes measures on price regulation in each of the three sub-sectors: fixed line, mobile and internet. Price regulation is typically imposed in combination with access regulation to prevent incumbents with significant market power from exploiting their market power. Some RTAs explicitly mention various types of price regulation that may be necessary to bring about a sufficient degree of competition in the market. For instance, the regulation of prices for access to leased lines is a common feature, and indeed acts as almost a pre-requisite for new entrants in the fixed and internet markets. Regulation of international roaming rates are not yet found in RTAs, but experts identified roaming regulation as the most important price regulation in the context of trade in mobile services.

68. The size and scope of public enterprises are particularly important in the telecommunications industry because most countries had government monopoly service providers until relatively recently. And while government involvement in the sector has been rolled back significantly in the last 10-15 years, vestiges of these monopoly providers still remain in some countries, in some cases acting as barriers to foreign providers. For example, if the public sector still holds an equity stake in the largest company in the sector or has special voting rights (e.g. golden shares), foreign entrants may find themselves at a disadvantage.

Regulatory transparency

69. Measures concerning regulatory transparency and licensing are also included in the STRI. These regulations involve the publication and communication of the regulatory and licensing regimes as well as interconnection agreements and spectrum information. Objective and comparable information on administrative procedures is not available in primary sources, so for these measures a secondary source, the World Bank's Doing Business Database, is used. Finally, the extent to which lengthy visa processing apply is incorporated in the index.

6. Public ownership may have the effect of market access restriction.

6. Methodology for developing the STRI

70. The STRI is derived by aggregating regulations that are potentially trade restricting into a composite measure of restrictiveness. The construction of the index involves decisions concerning three main issues: scoring, weighting and aggregation. Scoring relates to how regulatory measures are transformed from qualitative to quantitative information. Weighting captures the relative importance of impediments in terms of trade restrictiveness (the higher the weight the more restrictive a category of measure is considered relative to other categories). The aggregation method determines how weights are applied to scores for calculating the index number. The methodology paper (OECD, 2014a) explains the scoring and weighting in detail, while a technical paper explaining the alternative methodologies, their advantages and disadvantages and the robustness of the chosen methodology is available for interested readers (OECD, 2014b). Here a brief non-technical summary is presented.

71. The approach taken to scoring in the STRI is to transform qualitative information on regulation into binary variables.[7] A majority of the questions included in the regulatory database are Yes/No questions. Regulatory information of a more complex nature (e.g. foreign equity limits) can easily be transformed to binary variables by introducing multiple thresholds. Therefore, for each type of impediment in a given country a score is assigned either 0 or 1, with the former representing the absence and 1 the presence of the restriction. This method ensures that all variables are measured on the same scale such that comparison across different countries and over time is possible.

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

73. Some measures in the STRI are considered restrictive only under certain conditions. As alluded to in Section 4, regulation is necessary to facilitate the entry of suppliers if markets are uncompetitive. This is captured in the index by making the absence of regulation under the *Barriers to competition* heading conditional on there being a dominant firm in the market. Finally, access regulation is considered effective only when access conditions are regulated as well. In addition the regulator needs information on costs to assess whether a dominate supplier offers entrants access at reasonable terms. Therefore measures related to access regulation are complementary and the scoring depends on the presence of regulation on access, access conditions and transparency.

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

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

individual restrictions are organised into sub-indicators, leaving rather a lot to subjective judgement or arbitrariness.

75. As noted, equal weights are used when there is a lack of clear alternatives. For trade restrictiveness indices, however, it is clear that the measures should be weighted according to their contribution to trade costs, which in turn consist of entry costs and operational costs.[8] Services trade data are, however, not sufficiently detailed for estimating the trade cost equivalent of trade barriers and behind the border regulation that affect services trade. Nevertheless, there is a growing literature on measuring trade costs on the basis of observed trade patterns in services, but usually at a higher level of aggregation than what is required for the STRI (Miroudot et al., 2012). Furthermore, the different approaches to measuring trade costs on the basis of observed trade flows have strengths and weaknesses (Nordås, 2011) and as of yet a widely accepted methodology is unavailable.

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

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

78. The weighting scheme used for the calculation of the STRI relies on expert judgment. A large number of experts were asked to allocate 100 points among the five policy areas presented above. These are translated into weights by assigning the weight of the policy area to each measure that falls under it and correct for differences in the number of measures under the policy areas.[9] The sensitivity of the indices to the weighting scheme has been tested by experimenting with the alternatives and by running Monte Carlo simulations using random weights.

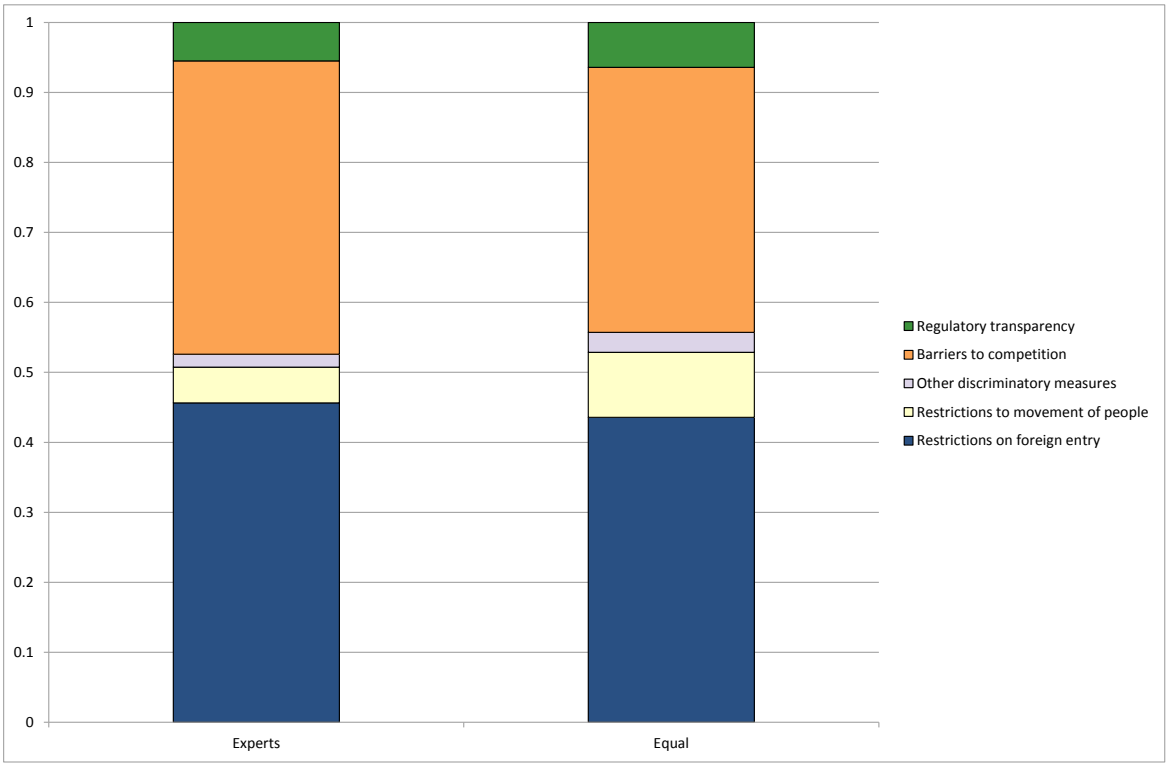
79. Figure 1 illustrates how expert judgment weights differ from equal weights in the telecoms STRI.[10] It depicts the index for a hypothetical country in which all of the measures in the STRI take the most restrictive value. We note that in this sector two policy areas dominate: *Restrictions on foreign market entry* and *Barriers to competition*, reflecting that telecommunications is a capital-intensive sector subject to market imperfections.

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

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

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

Figure 1. The composition of the STRI if all measures take the value of one



7. Results[11]

80. The STRI for telecommunications is presented in Figure 2. It depicts the index by policy area for each country as compared to the sample average, which is 0.22 with a standard deviation of 0.135. The STRI thus captures variation in restrictiveness across countries quite well. The level of restrictions is moderate to high ranging from 0.06 to 0.61 and somewhat skewed towards the low end with 14 countries above and 26 countries below the sample average.

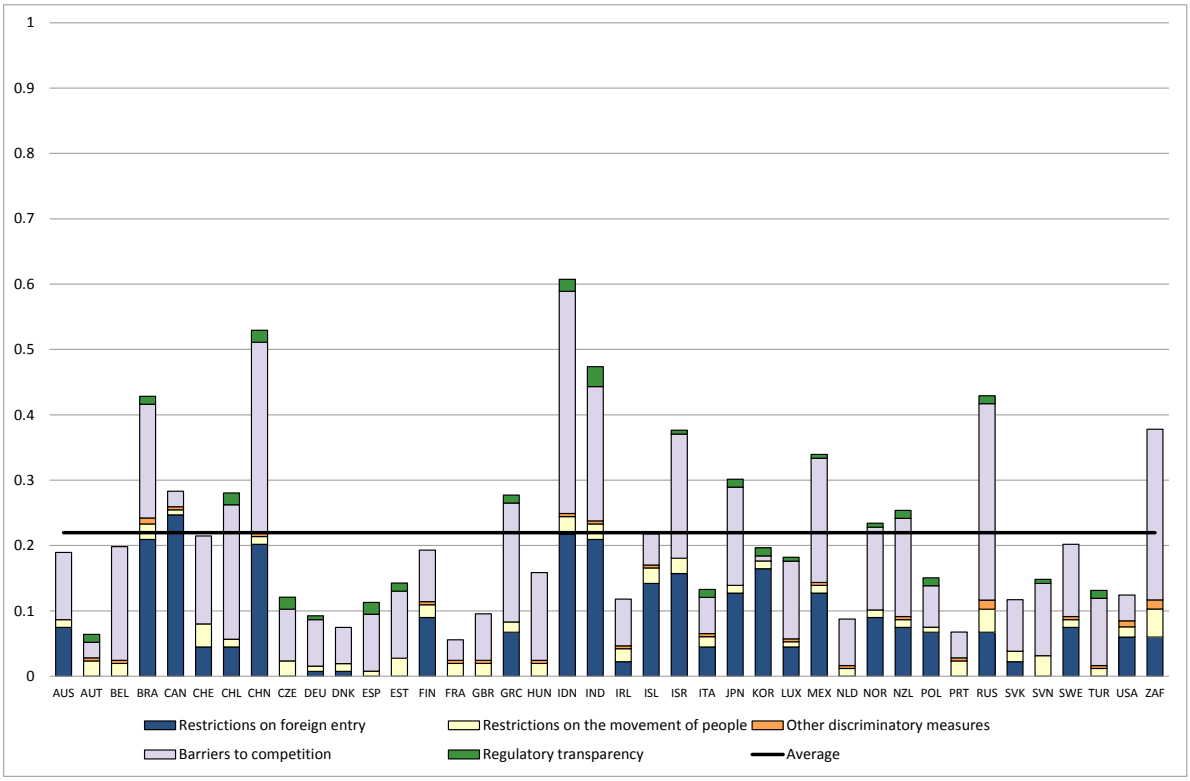
81. Figure 2 depicts the contribution of each policy area to the total index. *Restrictions on foreign market entry* together with *Barriers to competition* feature prominently in the index. Twelve countries have no restrictions in the first policy area, while eight countries have foreign equity limits in the sector (Brazil, Canada, China, India, Indonesia, Israel, Korea and Mexico). Other countries where the first policy area contributes significantly to the STRI are Finland, Norway and Sweden where residency requirements for board members and the manager are the most important.

82. *Barriers to competition* contribute substantially to the indices of all the countries scoring above OECD average except Korea, where the sector consists of privately owned enterprises and there are virtually no barriers to competition. Lack of regulation that mandates the incumbent dominant supplier to allow new entrants to access its network at reasonable terms is the main driver of this result where Chile, China, India, Indonesia, Israel, Russia and South Africa have high scores. Chile, Israel and Mexico have

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

initiated regulatory reform in this sector, however, which will result in a significantly lower index once new regulation enters into force. The government controls at least one major supplier in 14 countries (Belgium, China, Estonia, India, Indonesia, Japan, Luxembourg, Norway, New Zealand, Poland, Russia, Slovenia, South Africa and Switzerland).

Figure 2. STRI in telecommunications by policy area

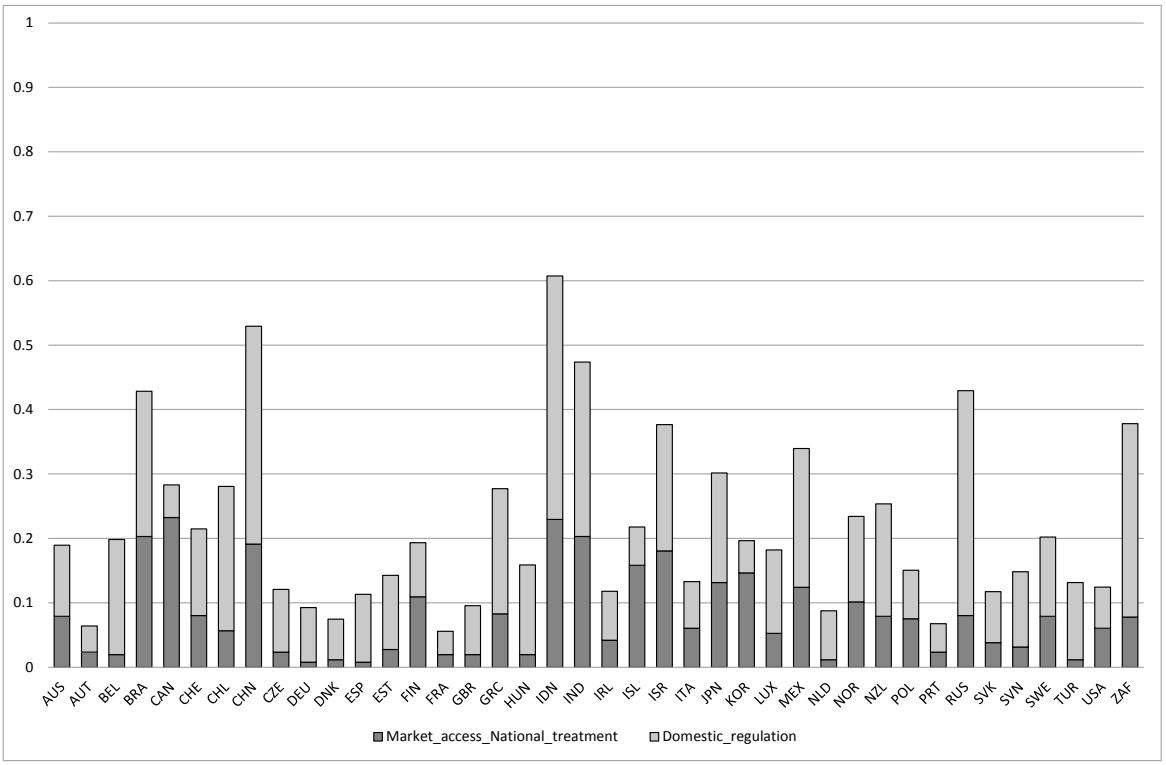


83. The individual regulatory measures are classified in several ways in order to highlight different aspects of trade restrictiveness. Figure 3 depicts the composition of the index according to GATS classification where Panel A presents the measures according to market access and national treatment on the one hand and domestic regulation and other measures not elsewhere classified on the other hand. Panel B shows restrictions by mode of supply.

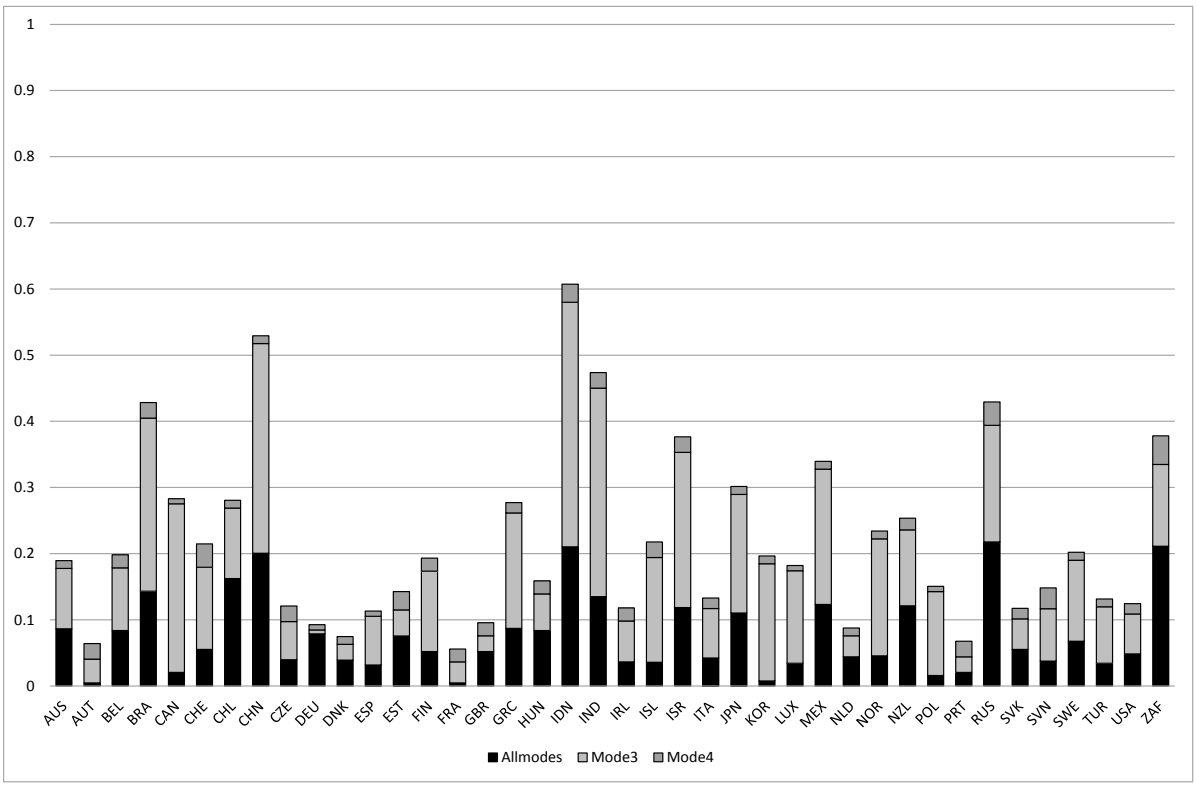
84. It is clear from Panel A that *Domestic regulation and other* constitute the bulk of restrictions in most countries, except Canada, Finland, Iceland, Korea and Norway. In Canada and Korea foreign equity limits explain the large contribution from *Market access and national treatment*, while in Norway and Iceland residency requirements for board members, which is a horizontal requirement for all corporations, account for the restrictions under the first heading. Iceland also has a law in force mandating screening of foreign investments.

Figure 3. STRI by GATS classification

Panel A: Market access/national treatment and other



Panel B: By mode of supply



85. The restrictions recorded under *Market access and National Treatment* in Panel A largely corresponds to restrictions that apply to Mode 3 in Panel B, with a smaller contribution of restriction on the movement of people. When comparing to other sectors, it is important to notice that the policies related to movement of people in the telecommunications sector are generally not more liberal than in other sectors, for instance computer services where such restrictions account for the bulk of the index. The difference to other sectors are explained by the weights where Mode 4 account for a much smaller share of total trade in telecoms than in the other sectors and therefore is assigned a lower weight. Germany has very few restrictions in mode 3. In Canada and Korea in contrast, most of the restrictions in place affect Mode 3.

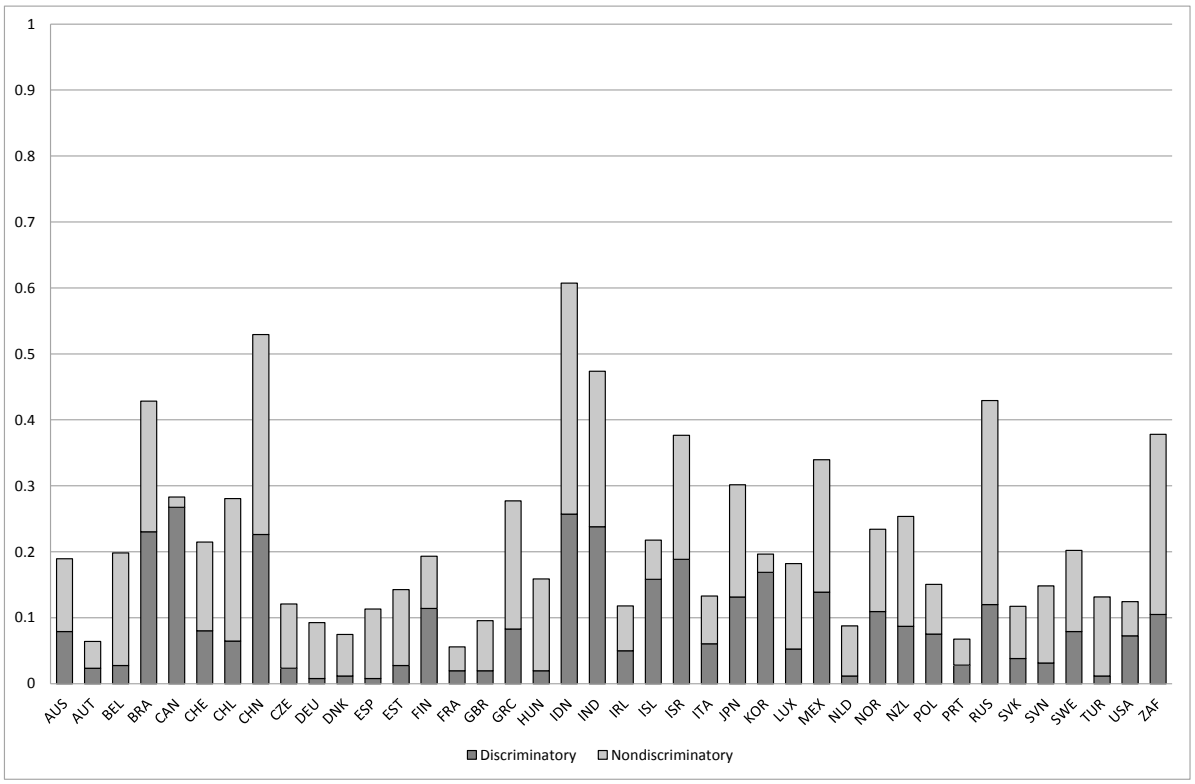
86. Most restrictions under the policy area *Barriers to competition* are classified under the rubric *All modes*, with the exception of those related to access to ducts, poles and other physical network elements, which are classified under Mode 3. This explains the large contribution of *All modes* in the graph.

87. Figure 4 reports results for other classifications where Panel A introduces the discriminatory/ non-discriminatory dimension and Panel B distinguishes between restrictions on establishing a commercial presence and on ongoing operations.

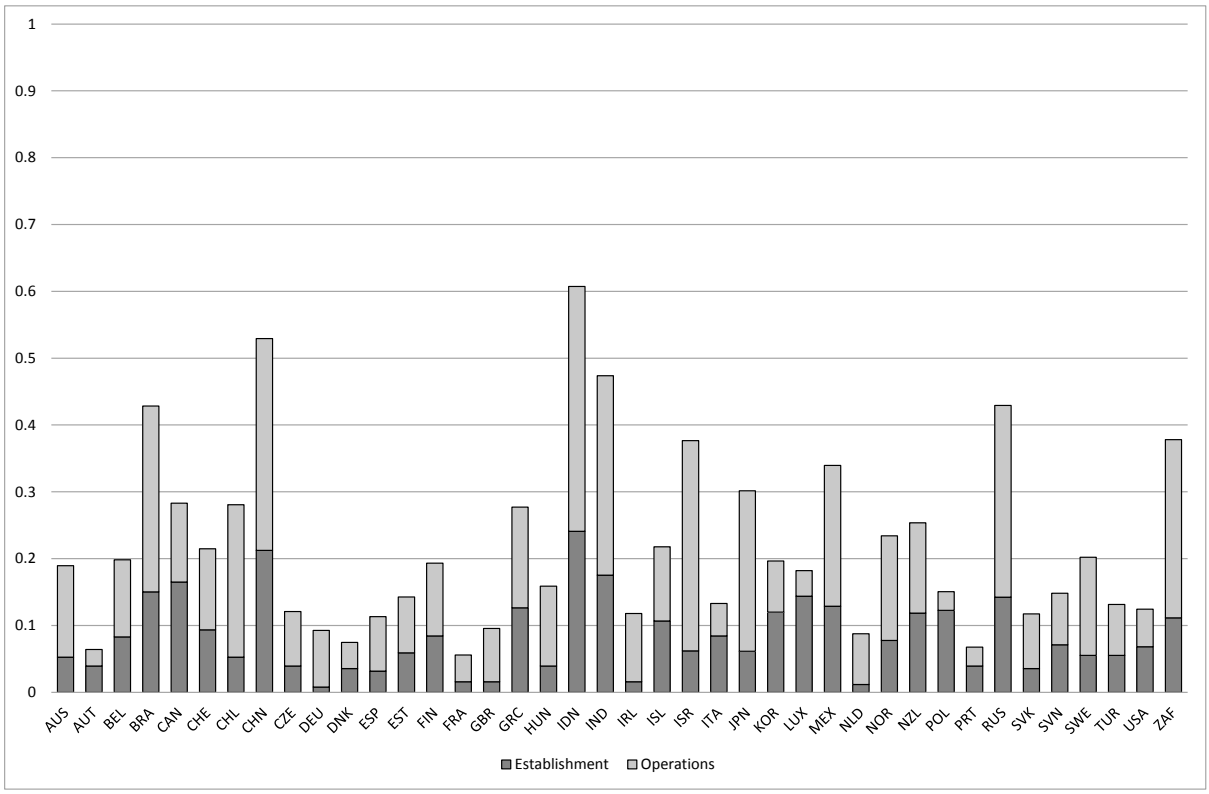
88. The distinction between discriminatory and non-discriminatory measures complements the market access/national treatment typology by providing some clarity regarding the discriminatory nature of the measures (market access and national treatment were combined in the previous classification because of difficulties in distinguishing them). The relative importance of restrictions on ongoing operations and establishment appears not to be strongly related to the overall score of a country, although the most liberal countries tend to have fewer restrictions on establishment, with the notable exception of Austria, which has the lowest overall index, but remaining restrictions are mainly on establishment related to Mode 4.

Figure 4. STRI by other classifications

Panel A: Discriminatory versus non-discriminatory



Panel B: On-going operations versus establishment

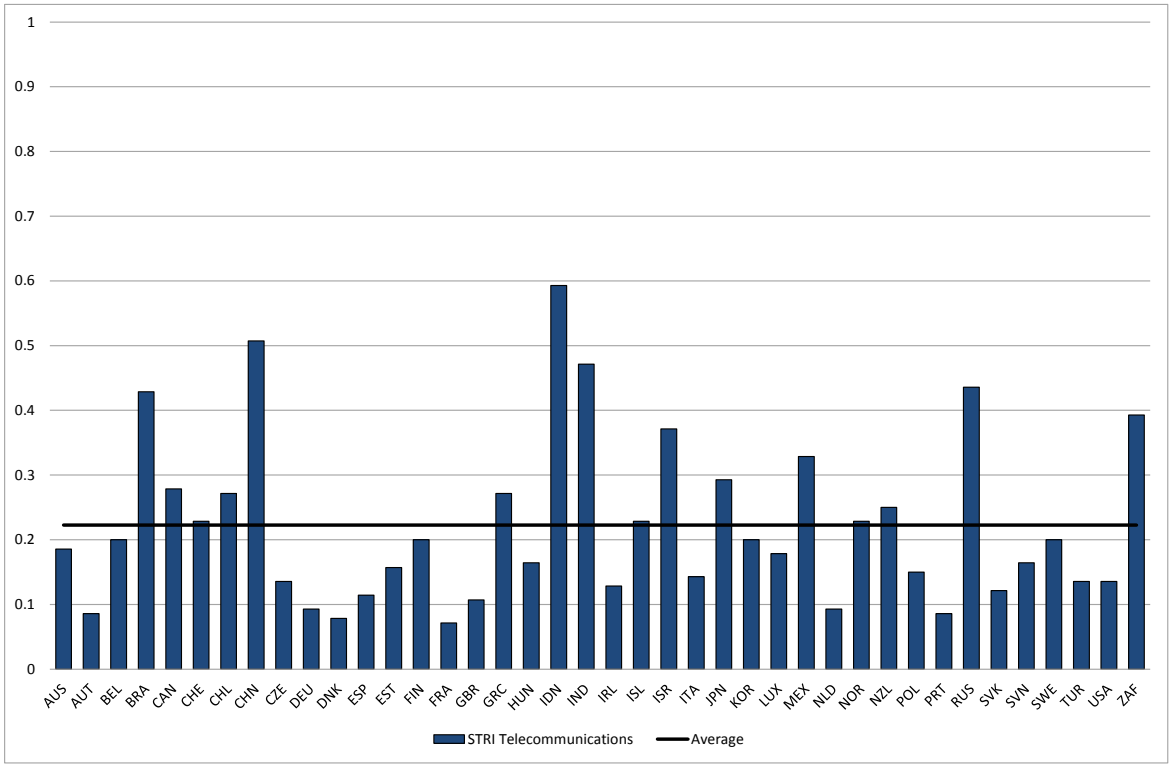


8. Sensitivity analysis

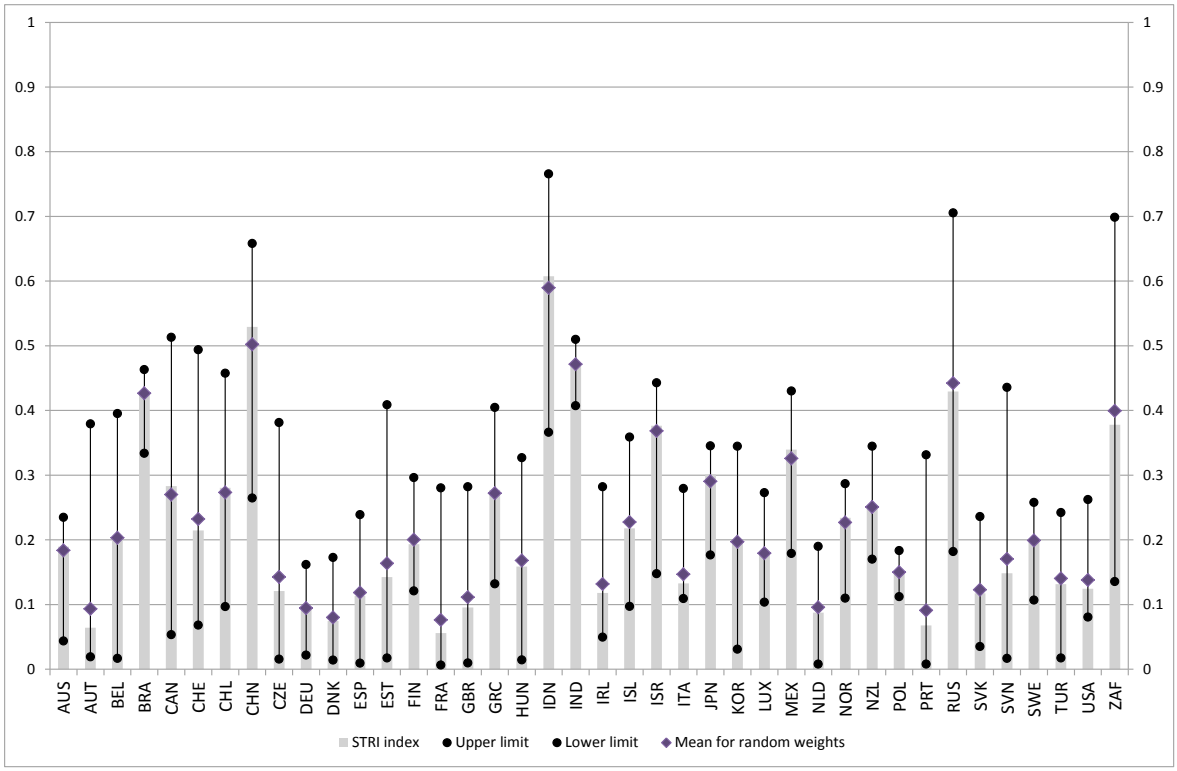
89. This section tests the sensitivity of results to the weighting scheme that has been chosen. Section 6 discussed the strengths and weaknesses of the most commonly used weighing schemes for estimating composite indicators and concluded that expert judgement is the preferred scheme. It was also emphasised that sensible people may disagree on what is the most appropriate weighting scheme. Therefore, it is useful to test how sensitive the overall indices are to the weighting scheme. The results are reported in Figure 5. Panel A shows the overall index for telecoms when equal weights are used, Panel B presents the results with random weights.

Figure 5. Telecommunications STRI according to different weighting schemes

Panel A: Equal weights



Panel B. Random weights



90. The average and standard deviation of the STRI scores are about the same when calculating on the basis of equal weights. However, there are several groups of countries with exactly the same index value when using equal weights. Equal weights thus do not capture variation in regulation as well as expert judgement weights. The Spearman rank correlation between expert judgment weights and equal weights is 0.99, suggesting that the indices and the ranking of countries are not very sensitive to which of the two weighting systems are used. Twenty-four countries stay the same in the ranking while the maximum change in ranking is two places.

91. Panel B presents the result of 3 000 simulations in which the computer program picked weights at random (Monte Carlo simulations). It shows the STRI indices together with the lowest, the mean and the highest value of the index that emerged from the simulations. Three interesting observations are made from this exercise. First, the mean value of the STRI using random weights is pretty close to the STRI indices (using expert judgment as the preferred methodology). Second, to the extent the mean value from random weights differ from the STRI index, it tends to be higher. Third, countries with a relatively even regulatory profile with restrictions in all policy areas have a smaller spread between the lowest and the highest value. This spread shows to what extent the country's index value is sensitive to the weighting system. Poland's score is the country least affected by the weighting scheme. The scores most sensitive to the weighting system are for the countries with the lowest scores, e.g. Austria, France and Portugal.

9. Summary and conclusions

92. Telecommunications represent an infrastructure sector that provides essential services for the economy and the information society. Due to its critical importance and a number of market imperfections the sector was dominated by government monopolies in the past. During the last two decades, however, technological progress, reforms and liberalisation have transformed telecoms towards a dynamic sector in which some market segments have become competitive.

93. The most important remaining market imperfections in the sector are network externalities, essential facilities and switching costs. These all favour incumbent firms and may constitute a severe entry barrier for new providers in general and foreign providers in particular. Therefore, the STRI for telecommunications includes lack of pro-competitive regulation in markets that are uncompetitive. An innovation in the STRI methodology is to introduce conditional restrictions. Lack of pro-competitive regulation is deemed restrictive only if the market is uncompetitive. This approach can be further developed and refined, and should help maintain an index that is relevant to policy makers in a rapidly changing sector.

94. The STRI for telecommunications shows a ranking of countries according to trade restrictiveness along several dimensions that should make it suitable for policy analysis as well as for trade negotiators. The countries that have STRI values above the average have either foreign equity limits in place, or there is an incumbent that is controlled by the government, with the notable exceptions of Brazil and Chile.

95. Nevertheless, a large share of the trade restrictions comes from barriers to competition. Many RTAs have chapters covering access to networks and interconnection issues, including terms and conditions for interconnection and access. A challenge for future negotiations is to design agreements that are sufficiently flexible to secure competitive markets under different market structures and technologies and to avoid unnecessary administrative and regulatory burdens on telecommunications providers. Better regulation would ease access for new entrants, be they local or foreign to the benefit of consumers as well as businesses that depend on effective, low-cost state of the art telecommunications services.

REFERENCES

Borchert, I. B. Gootiz and A. Mattoo (2012), "Guide to the Services Trade Restrictions Database", World Bank Policy Research Working Paper WPS 6108.

Boylaud, O. and G. Nicoletti (2000), "Regulation, Market Structure and Performance in Telecommunications", Economics Department Working Paper no. 237, OECD, Paris.

Coerdacier, N., De Santis, R.A., Aviat, A. (2009), Cross-border Mergers and Acquisitions and European Integration », *Economic Policy*, January, 55-106.

Commission of the European Communities (2012), "European Commission Special Eurobarometer 381 E-communications Household Survey", http://ec.europa.eu/public_opinion/archives/ebs/ebs_381_sum_en.pdf

Conway, P. and G. Nicoletti (2006), "Product Market Regulation in the Non-Manufacturing Sectors of OECD Economies: Measurement and Highlights", Economics Department Working Paper no. 530, OECD, Paris.

Dihel, N. and B. Shepherd (2007), "Modal Estimates of Services Barriers", OECD Trade Policy Working Paper No. 51, OECD, Paris.

Economides, N. (2005), "The Economics of the Internet Backbone", *NET Institute Working Paper No 04-23.*

Faulhaber, G.R. (2005), "Bottlenecks and Bandwagons: Access Policy in the New Telecommunications", in *Handbook of Telecommunications Economics, Volume 2,* Elsevier B.V.

Internationl Monetary Fund (IMF) (2005), "Review of the IMF's trade restrictiveness index", Note February 14, 2005, www.imf.org/external/np/pp/eng/2005/021405r.pdf

International Telecommunication Union (ITU) (2009), "The Accounting Rate System", ICT regulation toolkit, www.ictregulationtoolkit.org/en/Section.2145.html

Kalinova, B., A. Palem and S. Thomsen (2010), "OECD's FDI restrictiveness index: 2010 update". OECD Working Papers on International Investment 2010/3.

Lestage, R. and D. Flacher (2014), "Infrastructure investment and optimal access regulation in the different stages of telecommunication market liberalization", *Telecommunications Policy*, 38, 569-579.

Miroudot, S., J. Sauvage and B. Shepherd (2012). "Trade costs and productivity in services sectors", *Economic Letters,* 114, 36-38.

Molnar, M. (2008), "Different Regulation, Different Impacts: What Determines Trade Restrictiveness in Telecommunications?", paper presented at the OECD Services Expert Meeting, 10 December.

Molnar, M and Bottini, N. (2008), "How large are competitive pressures in services markets? Estimation of mark-ups for selected OECD countries", Paper presented to the technical workshop on the STRI 12 December 2008.

Nordås, H.K. (2011), "Measuring barriers to trade and investment in services", Chapter 6 in Sauvé, P., G. Pasadilla and M. Mikic (eds), *Services Sector Reforms, Asia-Pacific Perspectives.* Tokyo: ADBInstitute.

OECD (2007a), "Towards a Services Trade Restrictiveness Index (STRI). A Proposal for a Road Map for Future Trade Committee work on Services", TAD/TC(2007)4.

OECD (2008a), *Handbook on Constructing Composite Indicators: Methodology and User Guide*, OECD, Paris.

OECD (2008b), "OECD Policy Guidance on Convergence and Next Generation Networks", paper for the OECD Ministerial Meeting in Seoul, Korea, 17-18 June.

OECD (2010), "Next generation access networks and infrastructure", DSTI/ICCP/CISP(2010)5/FINAL.

OECD (2013), *OECD Communications Outlook 2013*, OECD, Paris.

OECD (2014a), "The STRI: Scoring and weighting methodology", TAD/TC/WP(2011)30/FINAL

OECD (2014b), "Methodology for Deriving the STRI", Forthcoming.

Rysman, M. (2009), "The economics of two-sided markets", *The Journal of Economic Perspectives*, 23, 125-143.

Sutherland, E. (2007), "Fixed-Mobile Convergence", in *Trends in Telecommunication Reform 2007*, ITU, Geneva, pp. 87-100.

Warren, T. (2000), "The Identification of Impediments to Trade and Investment in Telecommunications Services", in Findlay, C. and Warren, T. (eds) *Impediments to Trade in Services: Measurement and Policy Implications*, Routledge, London and New York.

Xavier, P. and Ypsilanti, D. (2008), "Switching Costs and Consumer Behaviour: Implications for Telecommunications Regulation", *Emarald*, 10, 13-29.

ANNEX A. INDEX VALUES BY POLICY AREA

Country	Restrictions on Foreign Entry	Restrictions to movement of people	Other discriminatory measures	Barriers to competition	Regulatory transparency	Overall indicator
AUS	0.07	0.01	0.00	0.10	0.00	0.19
AUT	0.00	0.02	0.00	0.02	0.01	0.06
BEL	0.00	0.02	0.00	0.17	0.00	0.20
BRA	0.21	0.02	0.01	0.17	0.01	0.43
CAN	0.25	0.01	0.00	0.02	0.00	0.28
CHE	0.04	0.04	0.00	0.13	0.00	0.21
CHL	0.04	0.01	0.00	0.21	0.02	0.28
CHN	0.20	0.01	0.00	0.29	0.02	0.53
CZE	0.00	0.02	0.00	0.08	0.02	0.12
DEU	0.01	0.01	0.00	0.07	0.01	0.09
DNK	0.01	0.01	0.00	0.06	0.00	0.07
ESP	0.00	0.01	0.00	0.09	0.02	0.11
EST	0.00	0.03	0.00	0.10	0.01	0.14
FIN	0.09	0.02	0.00	0.08	0.00	0.19
FRA	0.00	0.02	0.00	0.03	0.00	0.06
GBR	0.00	0.02	0.00	0.07	0.00	0.10
GRC	0.07	0.02	0.00	0.18	0.01	0.28
HUN	0.00	0.02	0.00	0.13	0.00	0.16
IDN	0.22	0.03	0.00	0.34	0.02	0.61
IND	0.21	0.02	0.00	0.21	0.03	0.47
IRL	0.02	0.02	0.00	0.07	0.00	0.12
ISL	0.14	0.02	0.00	0.05	0.00	0.22
ISR	0.16	0.02	0.00	0.19	0.01	0.38
ITA	0.04	0.02	0.00	0.06	0.01	0.13
JPN	0.13	0.01	0.00	0.15	0.01	0.30
KOR	0.16	0.01	0.00	0.01	0.01	0.20
LUX	0.04	0.01	0.00	0.12	0.01	0.18
MEX	0.13	0.01	0.00	0.19	0.01	0.34
NLD	0.00	0.01	0.00	0.07	0.00	0.09
NOR	0.09	0.01	0.00	0.13	0.01	0.23
NZL	0.07	0.01	0.00	0.15	0.01	0.25
POL	0.07	0.01	0.00	0.06	0.01	0.15
PRT	0.00	0.02	0.00	0.04	0.00	0.07
RUS	0.07	0.04	0.01	0.30	0.01	0.43
SVK	0.02	0.02	0.00	0.08	0.00	0.12
SVN	0.00	0.03	0.00	0.11	0.01	0.15
SWE	0.07	0.01	0.00	0.11	0.00	0.20
TUR	0.00	0.01	0.00	0.10	0.01	0.13
USA	0.06	0.02	0.01	0.04	0.00	0.12
ZAF	0.06	0.04	0.01	0.26	0.00	0.38

ANNEX B. LIST AND CLASSIFICATION OF MEASURES

Measure	MA&NT/domestic regulation, other	Mode	Establish/Operations	Discrim/No
Restrictions on foreign ownership and other market entry conditions				
Foreign equity restrictions: maximum foreign equity share allowed (%) (fixed, mobile, internet)	MA&NT	3	E	D
Non-residents are allowed to invest in local telecommunication services firm through minority shares in local investment companies: Maximum foreign equity limit in such investment companies (%). (fixed, mobile, internet)	MA&NT	3	E	D
There are statutory or other legal limits to the number or proportion of shares that can be acquired by foreign investors in firms that are controlled by national state or provincial governments (fixed, mobile, internet)	MA&NT	3	E	D
Legal form: only joint ventures are allowed (fixed, mobile, internet)	MA&NT	3	E	D
The number of firms permitted to practice is restricted by quotas (fixed, mobile, internet)	MA&NT	3	E	D
Board of directors: majority must be nationals (fixed, mobile, internet)	MA&NT	3	O	D
Board of directors: majority must be residents (fixed, mobile, internet)	MA&NT	3	O	D
Board of directors: at least one must be national (fixed, mobile, internet)	MA&NT	3	O	D
Board of directors: at least one must be resident (fixed, mobile, internet)	MA&NT	3	O	D
Manager must be national (fixed, mobile, internet)	MA&NT	3	O	D
Manager must be resident (fixed, mobile, internet)	MA&NT	3	O	D
Screening: foreign investors must show net economic benefits (fixed, mobile, internet)	MA&NT	3	E	D
Screening: approval unless contrary to national interest (fixed, mobile, internet)	MA&NT	3	E	D
Screening: notification (fixed, mobile, internet)	other	3	E	D
Restrictions on type of shares or bonds held by foreign investors (fixed, mobile, internet)	MA&NT	3	E	D
Conditions on subsequent transfer of capital and investments (fixed, mobile, internet)	MA&NT	3	E	D
Restrictions on cross-border mergers and acquisitions (fixed, mobile, internet)	MA&NT	3	E	D
Other restrictions				
Restrictions on the movement of people				
Quotas: intra-corporate transferees	MA&NT	4	O	D

Measure	MA&NT/domestic regulation, other	Mode	Establish/Operations	Discrim/No
Quotas: contractual services suppliers	MA&NT	4	E	D
Quotas: independent services suppliers	MA&NT	4	E	D
Labour market tests: intra-corporate transferees	MA&NT	4	O	D
Labour market tests: contractual services suppliers	MA&NT	4	E	D
Labour market tests: independent services suppliers	MA&NT	4	E	D
Limitation on duration of stay for intra-corporate transferees (months)	MA&NT	4	O	D
Limitation on duration of stay for contractual services suppliers is limited to (months)	MA&NT	4	E	D
Limitation on duration of stay for independent services suppliers is limited to (months)	MA&NT	4	E	D
Other discriminatory measures and international standards				
Foreign suppliers are treated less favourably regarding taxes and eligibility to subsidies.	MA&NT	3	O	D
Foreign participation in public procurement: discrimination in the application of financial or technical criteria for project tender.	other	All	O	D
There is a formal requirement that regulators consider comparable international standards and rules before setting new domestic standards.	DR	All	O	ND
Other restrictions				
Barriers to competition and public ownership				
The decision of the regulator can be appealed	other	3	O	ND
Foreign firms have redress when business practices are perceived to restrict competition in a given market	MA&NT	3	O	D
National, state or provincial government control at least one major firm in the sector (fixed, mobile, internet)	other	3	E	ND
Publicly-controlled firms or undertakings are subject to an exclusion or exemption, either complete or partial, from the application of the general competition law (fixed, mobile, internet)	other	3	E	ND
National state or provincial government have special voting rights (e.g. golden shares) in any firms in the sector (fixed, mobile, internet)	other	3	E	ND
The government can overrule the decisions of the telecommunications regulator	other	3	O	D
Access to and use of public telecommunications service is mandated (fixed, mobile, internet)	other	All	O	ND
Wholesale access prices are regulated (fixed, mobile, internet)	other	All	O	ND
Interconnection is mandated (fixed, mobile)	other	all	O	ND
Interconnection prices and conditions are regulated (fixed, mobile)	other	all	O	ND
Interconnection and/or access agreements are made public	other	all	O	ND

Measure	MA&NT/domestic regulation, other	Mode	Establish/Operations	Discrim/No
Unbundling of the local loop is required	other	3	O	ND
Local loop unbundling prices are regulated	other	3	O	ND
Collocation or site sharing is mandated	other	3	O	ND
Resale of public telecommunications services to other suppliers of telecommunications services, including foreign suppliers are mandated (fixed, mobile)	other	all	O	ND
Rates and conditions for resale by dominant firms of public telecommunications services to other suppliers of telecommunications services are regulated (fixed, mobile)	other	all	O	ND
Secondary spectrum trading is allowed	other	all	O	ND
Mobile termination rates are regulated	other	all	O	ND
Wholesale roaming rates are regulated	other	all	O	ND
Retail roaming rates are regulated	other	all	O	ND
Number portability is required (fixed, mobile, VOIP)	other	all	O	ND
Time and conditions for porting are regulated (fixed, mobile, VOIP)	other	all	O	ND
Dialing parity is required (fixed, mobile, VOIP)	other	all	O	ND
Vertical separation is required (fixed, mobile, internet)	other	3	O	ND
Contracts for universal services obligations are assigned through grandfathering (fixed, mobile, internet)	other	all	O	ND
Minimum capital requirement (fixed, mobile, internet)	other	3	E	ND
Regulatory transparency and administrative requirements				
Licensing agreements are publicly available	other	all	O	ND
Information on spectrum (regulations, spectrum management table, spectrum fees etc.) are publicly available	other	all	O	ND
Regulations are published or otherwise communicated to the public prior to entry into force	other	all	O	ND
There is a public comment procedure open to interested persons, and/or the regulator has a formal mechanism for consultation with stakeholders, including foreign suppliers	other	all	O	ND
Range of visa processing time (days)	other	4	O	ND
Time to complete all official procedures required to register a company (in calendar days)	other	3	O	ND
Total cost to complete all official procedures required to register a company (in USD)	other	3	O	ND
Number of official procedures required to register a company	other	3	O	ND