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**BARRIERS TO TRADE IN
ENVIRONMENTAL GOODS AND
ENVIRONMENTAL SERVICES: HOW
IMPORTANT ARE THEY? HOW MUCH
PROGRESS AT REDUCING THEM?**

Jaime de Melo and Mariana Vijil

***INTERNATIONAL TRADE AND
REGIONAL ECONOMICS***



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ABSTRACT

Barriers to Trade in Environmental Goods and Environmental Services: How Important Are They? How Much Progress at Reducing Them?*

Barriers to trade in Environmental Goods (EGs) and Environmental Services (ESs) are documented for a large sample of countries and compared with barriers to trade in other goods and other services. Some progress at reduction in barriers has occurred at the national, regional and sectoral levels but not at the multilateral level where countries have been unable to agree on an approach to reduce barriers to trade. For EGs, tariffs and NTBs are highest for low-income countries and low for high-income countries. First-order estimates of the import response to a 50% reduction in tariffs for low-income countries suggest an increase in imports of around 4%. For ESs, estimates draw on the comparison of an Environment Services Liberalization index calculated across modes and services sub-sectors. The limitations of this ordinal index coupled with the inadequacy of the UN CPC list where services are defined in an exclusionary manner so that they cannot appear on two lists, casts greater uncertainty as to the informational content of the commitment measures presented here which, at best, indicate bindings on market access and national treatment rather than actual policies. It would appear nonetheless that at least as great, and probably greater commitments took place in the environmental sectors (as defined by the CPC) both multilaterally and regionally than for 'other' services with the same pattern across income groups: greater commitments observed for HIC than for MICs and LICs although it is widely recognized that GATS commitments by HICs largely amounted to consolidated members' unilateral services policies. North-South Regional Trade Agreements resulted mostly in commitments by the Southern partners indicating greater prospects for reducing barriers to trade in a regional than in a multilateral context.

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1. The Problem and Challenges

Many environmentalists view the consequences of international trade (accelerated depletion of natural resources, accelerated loss of biodiversity, relocation of production towards countries with lax environmental policies, foreign direct investment attracted towards pollution 'havens', transport-related pollution) as a brake in the elaboration of a green-growth strategy. For other observers, however, trade could play an important role in moving towards a green development strategy, by accelerating the greening of the economy (e.g. making factories and buildings use energy more efficiently, providing sanitation and clean drinking water or simply facilitating virtual trade in water). The stated importance of trade for the environment was clear at the launch of the Doha Round, dubbed the Round for the "Developing Countries and for the protection of the environment", during which barriers to trade in Environmental Goods (EGs) and in Environmental Services (ESs) were to be reduced.¹ Accelerating the reduction of barriers to trade in EGs and ESs was expected to result in a triple-win situation for trade, for development, and for the environment. A more open trading system for both goods and for services would decrease the cost of environmental technologies, stimulate innovation and technological transfer. For developing countries, importers would get greater access to EGs and ESs while developing-country exporters would get access to OECD markets. As to the environment, benefits would occur at the national and global levels.

Since all human activities have an impact on the environment (we live in the 'anthropocene'), it is very difficult to measure progress (or lack of it) relative to other activities that have a lesser impact on the environment. For EGs, once defined, a reduction or elimination of tariffs and non-tariff barriers should help diffuse products and technologies necessary to reduce environmental damage (e.g. pollution at source or at end-of-pipe). But very often these products and technologies form part of environmental projects that include ESs (e.g. wastewater management services, water collection and purification, recycling). Thus environmental projects have a great degree of 'jointness' or complementarity between the services provided by EGs and those provided by ESs. Moreover, as summarized in several case studies, ESs included in environmental projects include an increasingly large array of services that extend beyond those that are classified as ESs (e.g. business and engineering services, telecommunications).² Complementarities between trade in EGs and trade in ESs are especially strong in developing countries where trade in environmental goods and services often involves the sale of entire plants. Cognizant of these difficulties, this paper tries to document the extent of trade barriers and any progress at removing them using the largest possible sample of countries. Information is analysed at the country level, but the

¹ The Doha ministerial decision of November 2001, paragraph 31(iii) stated that "...With a view to enhancing the mutual supportiveness of trade and the environment, we agree to negotiations, without prejudging their outcome, on: (...) (iii) the reduction or, as appropriate, elimination of tariff barriers to environmental goods and services". Negotiations take place in the Special Session of the Committee on Trade and the Environment (CTE in Special Session or CTESS). The other two mandates under paragraph 31 are on coordination and dispute settlement and on information exchange with Multilateral Environmental Agreements (MEAs).

² See e.g. Kennett and Steenblik (2005) and Steenblik and Geloso Grosso (2011).

narrative is at the level of country groupings (World Bank categories by income group), these corresponding approximately to the positions and measures taken by countries at all levels: multilateral, regional and unilateral. Most of the time, these averages at the income-classification level are comparisons between average estimates of barriers to trade for EGs (and for ESs) with the corresponding average estimates for 'other' goods (and for 'other' services). Some information is lost by this aggregation but the quality of the data suggests that a useful first step is to start with broad comparisons at the aggregate level.

The paper makes three contributions. First, it gives an up-to-date estimate on the extent of protection in EGs. These estimates show that tariff protection for EGs is slightly less than for other goods for all country groups. But the time line of tariffs for both set of goods has remained fairly constant for all country groups over the period 2002-11. Including the ad-valorem equivalents (AVEs) of NTMs does change the picture for low-income countries, which appear with higher trade-policy barriers for EGs than for other goods. Second, the paper gives rough first-order estimates of the import response to a reduction in barriers to trade in EGs; these estimates cast doubts on the fear that an across-the-board liberalization would lead to a flooding of EGs imports from high-income countries. Third, using qualitative indexes, it compares commitments to market access and national treatment for ESs with those for other Services, both at the multilateral and regional levels. While probably the best that can be done for a relatively large sample of countries, for reasons discussed in the text, these estimates are even less reliable than those for EGs. They confirm that the commitments by developing countries were only in the context of Regional Trade Agreements (RTAs) and that they were about the same for ESs as they were for other services.

Mercantilistic behaviour has been evident during the Doha negotiations among the countries that submitted lists for tariff reductions as they systematically excluded from their submission lists EGs with tariff peaks, behaviour that might resurface when the recent APEC announcement of a reduction of tariffs on a list of 54 EGs is implemented. This can be interpreted that the environment has not been 'taken on board' by the international community. But there are other inherent 'technical' difficulties in identifying EGs and ES. These are discussed in section 2. Section 3 reviews progress on EGs at the multilateral level. Because progress on ESs occurred mostly in the context of RTAs, commitments for ESs are reviewed in section 4 where the focus is on progress at the regional level. Section 5 concludes.

2. Classification Obstacles: Some Practical considerations

A decade into the negotiations, no progress was registered as countries could not agree on an approach to reduce protection in EGs nor on a better definition of ESs because of differing interests, possibly for strategic reasons as the environment could have served as a bargaining chip in the multi-dimensional agenda. In addition, there are the technical difficulties in classification for EGs and, probably even more so for ESs. These are

summarized here to serve as a warning of caution in interpreting the estimates of reduction in protection presented later on.

2.1. Classifying Environmental Goods.

A decade into the negotiations, WTO members failed to agree on one of the three proposed approaches to reduce barriers to trade in EGs: (i) the “List approach” preferred by the developed countries, but opposed by many developing countries who expected that a reduction in tariffs would result in a flooding of imports from developed countries; (ii) the “Request-and-Offer approach” preferred by some developing countries; and, (iii) the “Integrated-Project approach” where projects would be selected by national authorities (e.g. under the Clean Development Mechanism of the Kyoto protocol) that finds support in the nature of environmental projects that are typically bundled in a combination of imports of goods and services. Main difficulties are summarized here.³

Inadequacy of HS descriptors. The first difficulty facing negotiators is that EGs are not an internationally defined category. The Harmonized System (HS) used to draw EGs lists was set up for trade and customs purposes and was not designed according to end-use. The first to draw lists, the APEC and the OECD, agreed that EGs would include those that “measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems related to the waste, noise and eco-systems...[including] cleaner technologies, products and services that reduce environmental risk and minimize pollution and resource use” (Steenblik, 2005b.; p.75)). One solution is to use “ex” headings for identification at the 8 or 10-digit level of national customs classifications. Later in the negotiations “hybrid” approaches were also proposed.

Multiple end-use. Although it would be costly to implement for developing countries, extending the HS system could be used to distinguish energy-efficient refrigerators from others, it still does not solve the problem of multiple end-use which besets many Goods for Environmental Management (GEM).⁴ An alternative would be to use the project or define-by-doing approach. The drawback is that such an approach would be transient and liable to capture by interest groups.

Environmentally preferable products (EPPs) and ‘like products’ at the WTO. For some, an agreement on EGs should take into account how environmentally friendly a product is in its production, consumption or disposal. This calls for a life-cycle analysis which might entail distinguishing goods by their Processes and Production Methods (PPMs). While differentiation for statistical purposes should be possible, unless “ex” headings were created at the 8 or 10 digit level of national customs classification, this would run into an

³ Steenblik (2005b) and Balineau and de Melo (2011) elaborate.

⁴ Differentiation according to end-use is a possibility. It was applied to a list of products in the 1973 Agreement on Civil Aircraft where only articles with a civil aircraft manufacturer could qualify. Artificial distinguishing features were also applied to control trade in pharmaceuticals in the Doha Declaration on TRIPS suggesting that a label “environmental” or “non-environmental” could be used on a product (Steenblik, 2005b.; p.79)).

interpretation of 'like products' since WTO agreements require that imported products receive no less favorable treatment than 'like products' of national origin, for instance an energy-efficient washing machine or the use of low-emission technology in aluminium production (e.g. Pre-bake rather than Soderberg technology).⁵

Relativism and attribute disclosure. Criteria are lacking to judge what is "environmental friendly". Apart from the divergence in preferences (conceptions of the "environment"), this is also due to the hurdles facing the completion of a life-cycle assessment as a same good may be used and disposed of in different ways. As examples, Steenblik (2007) and Hufbauer *et al.* (2009), stress that the use of bio-fuels to save on energy and reduce CO2 emissions is, at best, doubtful. Moreover, today's cleanest available technology will change as technological progress occurs, calling for regular updates of the list of goods that would benefit from tariff exemptions. Also, the identification of EPPs requires an efficient disclosure mechanism which can be very costly when attributes are not observable in the final product (e.g. efficient third-party certification for "credence goods" calling for an international standard and certification process).⁶

Lessons from the list approach. Several negotiated lists were proposed ranging from 26 to 411 products. By 2010, several rounds of proposals resulted in a combined list, the so-called 'WTO list' of 411 products that included many of the products in the earlier OECD and APEC lists and most among the 154 products on the "Friends of the Environment list". In 2011, Australia, Colombia, Hong Kong, Norway and Singapore agreed on a supposedly non-controversial 'core list' of 26 products. Balineau and de Melo (2013) studied the political-economy of product selection in these country submissions comparing indices of revealed comparative advantage and the height of applied tariffs in the goods submitted on country lists versus all those on the WTO list of EGs. They found that countries mostly submitted goods in which they had a revealed comparative advantage and that they systematically excluded from their submission lists goods with tariff peaks, confirming mercantilistic behaviour.

2.2. Classifying Environmental Services.⁷

Production is increasingly taking the form of trade in tasks (i.e. services) as opposed to trade in products, services now accounting for more than 50% of world trade when trade is measured in terms of the value that is added by processing imported components rather

⁵ The jurisprudence at the GATT/WTO on PPMs is still in flux. Moreover, several members, including developing countries, are against designating PPM-based EGs. Developing countries actually fear that this would open the door to discrimination against their products based on other than environmental concerns ("social concerns" for example, based on the absence of legislation on domestic workers' rights).

⁶ Goods whose attributes cannot be observed before their purchase ("search goods", e.g. the price of tuna) or their consumption ("experience goods", e.g. the taste of tuna). For example, consumers cannot know if tuna have been fished in dolphin-safe conditions before, during, or even after consumption. Disclosure of credence characteristics requires other mechanisms than repeated purchases and reputation.

⁷ This discussion draws on Geloso Grosso (2005), Kirkpatrick (2006) and Francois and Hoekman (2010)

than measuring trade flows on the basis of the gross value of goods crossing the border. Services play an input function through space (transport, telecommunications) and time (financial services) as well as direct inputs into economic activity as they generate knowledge and human capital. Differentials in total factors productivity growth across industries have been largely attributed to differences in services productivity but the linkage between intermediate services, regulation, and policies is still largely unexplored, if only because of the lack of data both on services and regulations (services do not meet customs for registration, and regulations are, at best, imperfectly captured).

Aspects of the Proximity burden. A proximity burden is imposed on certain forms of services because, unlike goods, they cannot be stored. However, technological change has led to the geographical splintering of the production chain for both tangible inputs and for services. Yet, trade in services may require a heavier dose of local presence of suppliers in the mix of cross-border and locally-produced services than in the case with goods. In addition, services provision will often have “jointness in production” as complementary inputs—including other services—are needed to allow effective exchange (trade) to occur. This is recognized in the GATS four-way classification of services:

- Mode 1: No movement of either supplier or buyer (direct cross-border trade);
- Mode 2: Customer moves to the country of the provider (e.g. tourism);
- Mode 3: Commercial presence through sales of an affiliate (e.g. an MNE or a legal person);
- Mode 4: Temporary movement of natural persons to provide services.

For modes 2 and 4, indicators of reducing restrictions on the movement of natural persons and providing market access on non-discriminatory terms (and guarantees for repatriation of funds as provided for in the large number of Bilateral Investment Treaties) for foreign firms can provide a rough approximation of trade liberalization. For modes 1 and 3, much like the choice between vertical and horizontal FDI, the mix of trade and coordination costs (inclusive of policy-imposed trade barriers) will determine firms’ choices. Changes in trade policies that affect the balance of these costs (contract costs vs. management costs) will then determine the choice of mode, if choice there is, since modes of supply may be complements or substitutes. If the unconstrained mode is the most efficient mode, and modes are substitutes, changes in constrained modes will have no effect while if modes are complement, a liberal policy in one mode would have no effect on provision of the service.

Lack of data. Unlike goods trade, flows for which data exist because they are taxed, except for labor and FDI flows, the services are not directly observed crossing borders, and since disembodied trade is becoming more important as the burden of proximity has loosened, the tracking of flows is poor and it is hard to get an estimate of the relative importance of trade flows by mode.

Characterization of the services sector. Establishing indicators of trade restrictiveness measures for services is further complicated by the characterization of services industries: as pointed out by Francois and Hoekman (2010), barriers to entry (policy and natural), network externalities (telecommunications, finance), heavy regulation (communications, finance, professional services), all conjure to giving these industries market power especially since they are “margin sectors” - i.e., they facilitate transactions between agents. Indicators of policy stance for ESs would then need to capture regulation and competition while recognizing that not all policies affecting foreign services transactions are discriminatory.

The WTO Services Sectoral Classification List (W/120). This list is largely based on the Provisional United Nations Central Product Classification (Provisional CPC). The complete list of services sectors negotiated at the GATS during the Uruguay Round has 155 sub-sectors among which 4 sub-sectors are categorized as environmental services. These are:

- (a) sewage services (CPC Prov. 9401);
- (b) refuse-disposal services (CPC Prov. 9402);
- (c) sanitation and similar sectors; and
- (d) other services (CPC Prov. 9404; CPC Prov. 9405; CPC Prov. 9406; CPC Prov. 9409). These include cleaning services for exhaust gases, noise abatement services, nature and landscape protection services, and other environmental services not elsewhere classified.

The sub-sectors in this list are exclusive so a service sub-sector such as engineering services cannot appear twice as an Environmental Service Sector and as a ‘standard’ service sector. Since there are complementarities in the provision of services across sub-sectors, any measures of barriers to trade in services based on the CPC classification are necessarily inadequate approximations of the state of restrictions in the ES sector.

Dating from the GATS commitments negotiated during the Uruguay Round nearly 20 years old, this classification is outdated. This narrow GATS classification defines ESs as end-of-pipe public infrastructure services, largely focused on waste management and pollution control. It also fails to reflect the current market and policy characteristics of the ES sector as the proximity burden has fallen, opening the road to linkages across modes and across services sub-sectors. It fails to take account of the growing public sensitivity towards the environment which would call for more services sectors being classified as ESs, as well as the shift from pollution control towards pollution prevention through the adoption of cleaner technologies for production and products (OECD, 2005).

Furthermore, as sectors in the CPC classification system are mutually exclusive, the CPC classification cannot take into account environmental services that fall within the scope of other sectors, such as business, construction and engineering, and education and tourism. Finally, as illustrated in case studies (e.g. Steenblik and Geloso Grosso, 2011), this classification fails to take into account that many operators, especially in developing

countries, integrate the supply of ES with the importation of EGs. As noted by Kirpatrick (2006), the liberalization of the ES is negotiated under the GATS while liberalization of goods is negotiated under NAMA (Non-Agricultural Market Access).

3. How Much Reduction in Trade Barriers for Trade in Environmental Goods

We review evidence on the reduction of barriers to trade in EGs, even if it is still difficult to measure barriers to trade in EGs because of NTBs. Analysis is either with the 'core list' of 26 products or the 'WTO list' of 411 products. The more difficult case of ESs is covered in section 4. Section 3.1 covers tariffs and section 3.2 NTBs measured by their ad-valorem tariff equivalents (AVEs). Section 3.3 gives illustrative estimates of import response to a reduction in barriers.

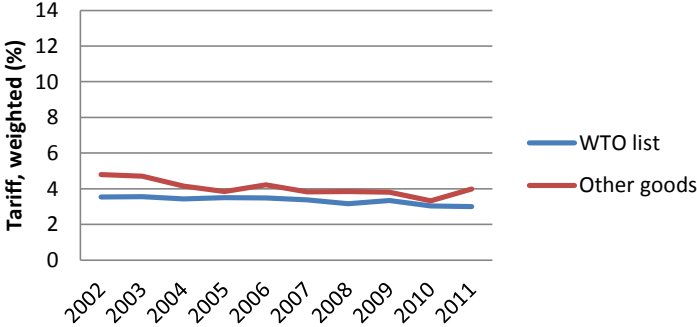
3.1. Tariff barriers to Trade in environmental goods compared with other goods

Figure 1 traces the time profile of average (trade-weighted) applied MFN tariffs for EGs (WTO list of 411 products) vs. all other (non-EGs) products for 120 countries at the HS-6 level (TRAINS and BACI data) by country income group. The profiles are for the WTO list of 411 products (see Figure B.1. for the Core list which results in the same trends). The data show several patterns. First is a steady, but small, decline in average tariffs across all income groups, except the high-income group where tariffs were already very low at the start. However, there is no acceleration in the reduction of tariffs on EGs (or for other goods) as the Doha negotiations proceeded. Second, the trends are essentially the same for EGs and for other products and average protection is the same for EGs and non-EGs. Third, it should be noted that these trends are for applied MFN tariffs while much trade takes place on a preferential basis. While there is no evidence that preferential margins are different for EG and non-EG goods, intra-PTA trade is around 50% of world trade (WTO (2011, figure B6)), so applied tariffs could be around half the rates shown in figure 1.

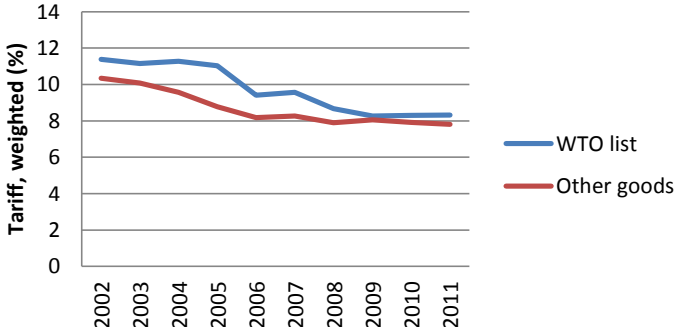
Finally, there are some differences across income groups. Protection of EGs remains highest in the low-income group. With average tariffs around 8 percent, this is barely high enough for a bilateral barter among developing countries by a request-and-offer approach to be rewarding as it had been in the early days of the GATT (Baldwin, 2010). As to developed countries, average tariffs were around 3 percent, so their expected gains from participation in the negotiations would be from reduction in tariffs by developing countries (which explains why many developing countries were generally opposed to a list approach which would have resulted in larger tariff reductions for them). Furthermore, applied tariffs are even lower for countries participating in preferential trade agreements that are mostly Free Trade Areas. Also in some countries, governments have at time waived import duties on equipment used for an environmental purpose.

Figure 1: Profile of Average Protection Environmental Goods vs. other goods 2002-11

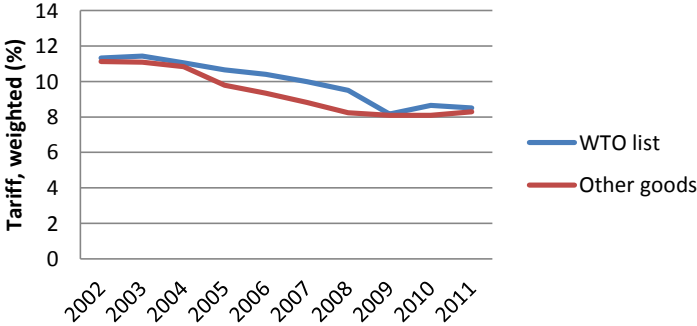
HIC: MFN applied (WTO list vs other products)



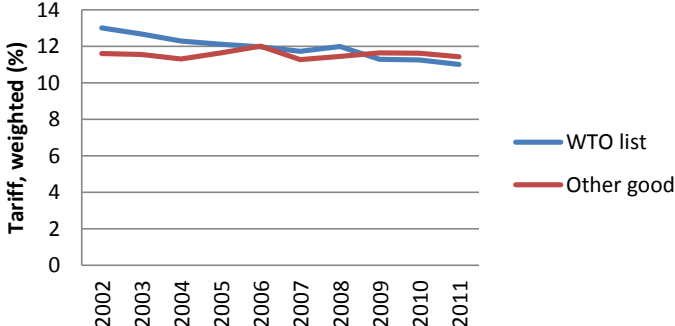
UMIC: MFN applied (WTO list vs other products)



LMIC: MFN applied (WTO list vs other products)



LIC: MFN applied (WTO list vs other products)



The difference between consolidated tariffs and applied MFN tariffs or “binding overhang”, a margin of flexibility (“policy space”) for governments, is greatest for middle-income countries, and practically non-existent for HICs (Figure B.2.). If this room to manoeuvre is viewed as desirable by many governments, when important, it is also a source of uncertainty for traders and investors. Thus, trade liberalisation not only entails lowering applied MFN tariffs but also binding them at a lower level. In a standstill compromise, whereby tariffs would be bound at applied rather than bound rates, the UMIC and LMIC groups would lose the most leeway as the gap of 15 and 14 percentage points would have to be closed. For the LIC group, the gap is 7 percentage points, so average applied tariffs would have to be reduced from their current level of 14% to 7% (HICs would only have to reduce their average tariffs by 1 percentage point, to 2%). On the other hand, in the case of no agreement, the two middle-income groups could triple their applied tariffs unilaterally, while the LIC group could only double theirs. Similar patterns appear when the comparisons are carried out for the WTO list except that averages are higher (Figure B.3.)

Using a slightly different data set over the period 1996-2010, Balineau and de Melo (2013) examined cases of ‘substantial tariff reductions’ in EGs defined as tariff reductions of 5 percentage points or more. They found that two thirds of the countries (86) had at least one substantial tariff reduction or ‘event’ during 1996-2010 defined as a tariff reduction of at least 5 percentage points. Three patterns emerged: (i) Events are fairly evenly distributed across products (HS 6-digit codes) with each product in the core list accounting for about 4%-5% of the number of events; (ii) events were concentrated in the middle-income group; and (iii) the upper-middle income and low income groups had the highest average absolute reduction per event.

3.2 Including Non-tariff barriers: Overall protection for EGs vs. other goods

Table 1 draws on the estimates of the Ad-Valorem Equivalents (AVEs) of NTBs estimated by Kee et al. (2009) for 70 countries at the HS-6 commodity level, the same level used for the tariff reported above. Adding these Ad-Valorem Equivalent (AVE) estimates to the tariff estimates reported above gives an estimate of combined measures of protection. Their AVE estimates draw on earlier import-demand elasticities of Kee et al. (2008) that control for applied tariffs and comparative advantage (Figures B.4. and B.5. show tariff and ad-valorem equivalent non-tariff barriers). Their NTB estimates cover the following measures: price control measures, quantity restrictions, monopolistic measures, technical regulations and agricultural domestic support that are only available for a smaller group of countries and AVEs are calculated as long as one of the NTBs is reported. Since we are focussing on a core list of EGs, domestic support for agriculture was not included among the NTBs. Even though these estimates are only available for one year, between 2002 and 2004, we use applied MFN tariff estimates for 2011 as they are close to actual tariffs. Finally, since not all NTBs are accounted for in the Kee et al. (2009) estimates some of which may arguably be

important for environmental policies (e.g. government procurement, burdensome custom procedures, local content requirements, etc.), the average estimates by country grouping in Table 1 could represent lower-bound estimates of the actual level of protection. On the other hand, unlike tariffs, not all NTBs are welfare-reducing since some provide regulations to correct market failures.

Table 1: Overall protection by income group

	Tariffs only (applied MFN) (120 countries)						Overall protection (Tariffs+AVEs of NTBs) (70 countries)						
	EGs			Other goods			EGs			Other goods			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
Income group (number of countries)	Tariff (import weighted)	TRI	OTRI	Tariff (import weighted)	TRI	OTRI	Income group (number of countries)	Tariff + NTBs (import weighted)	TRI	OTRI	Tariff + NTBs (import weighted)	TRI	OTRI
HIC (18)	3.1	3.7	3.0	3.7	15.6	4.1	HIC (14)	6.2	22.0	7.4	6.9	30.1	8.8
UMIC (29)	6.7	9.0	6.8	7.9	12.8	8.2	UMIC (23)	10.8	20.6	10.2	16.9	42.5	18.2
LMIC (27)	6.1	7.9	6.0	7.7	14.5	7.9	LMIC (23)	26.6	41.0	28.9	19.6	44.6	20.8
LIC (21)	7.3	9.2	7.3	13.3	19.1	13.6	LIC (10)	45.3	65.4	48.5	10.7	25.6	10.4

Source: Authors' calculations from TRAINS (2013), BACI (2013), Kee et al. (2008, 2009) and WDI (2013) data. EGs are drawn from the core list. Average values for each income group. Applied MFN tariffs (including AVE) and imports are mean values for 2010-11.

Notes: The groups are (abbreviation and 2011 GNI per capita, y_p , cut-offs in \$ in parenthesis): high-income (HIC, $y_p > 12,476$), upper-middle Income (UMIC, $y_p > 4,036$ and $< 12,475$), lower-middle income (LMIC, $y_p > 1,026$ and $< 4,035$), and low-income countries (LIC, $y_p < 1,025$).

To reduce the weight of extreme elasticity estimates, for each income group estimates outside the 1st and 9th deciles were fixed at the respective decile cut-offs. The TRI and OTRI formulas for country c are the following:

$$TRI_c = \left(\frac{\sum_n m_{n,c} \varepsilon_{n,c} T_{n,c}^2}{\sum_n m_{n,c} \varepsilon_{n,c}} \right)^{\frac{1}{2}}; \quad OTRI_c = \frac{\sum_n m_{n,c} \varepsilon_{n,c} T_{n,c}}{\sum_n m_{n,c} \varepsilon_{n,c}}; \quad T_{n,c} = (mfn_{n,c}; mfn_{n,c} + NTB_{n,c});$$

$mfn_{n,c}$ = applied MFN tariffs and $NTB_{n,c}$ = ad-valorem equivalent of NTBs from Kee et al. (2009), for product n at the HS 6-digit level in country c ;

$m_{n,c}$ = import value (thousand USD) and $\varepsilon_{n,c}$ = import demand elasticities for product n in country c taken from Kee et al. (2008).

Tariffs are reported in cols. 1 and 4 and overall protection (i.e. tariffs + NTB equivalents) are reported in cols. 7 and 10. The LIC group has the highest average tariffs (col 1) and highest overall protection (col 7 on the smaller sample of 70 countries), but with only 10 countries

in the group, the overall protection estimates may not be representative for low-income countries. Average tariffs are lower for EGs than non-EGs for this core list of 26 products and the variance in tariffs is also higher for non-EG products (see below).

Several columns report the Trade Restrictiveness Index (TRI) and Overall Trade Restrictiveness Index (OTRI). The TRI is the uniform tariff that, if applied to imports instead of the current structure of protection, would leave welfare at its current level while the OTRI is the uniform tariff that, if applied on home imports instead of the current structure of protection, would leave aggregate imports at their current level. The difference across columns is due to the fact that the welfare costs of tariffs rise more than proportionately with the tariff. Thus, the percentage difference between cols. 8 and 7 is greater than the corresponding difference between cols. 2 and 1. The cost of protection is also positively related to the variance in tariffs. This explains why the gap between the TRI and the tariff is higher for other goods than for EGs where the sample is much smaller. Finally, overall protection for EGs is higher than for other goods for the LMIC and LIC groups. Since few NTBs are reported for low-income countries, this pattern may not stand up to further scrutiny.

3.3 Estimates of import response to a lowering of trade barriers

A first sign of the expected triple-win from a reduction in trade barriers on imports of EGs and ESs should be an increase in imports if trade barriers were reduced. Here we report on two sets of estimates for EGs. The first is the ex-post estimates of Balineau and de Melo (2011) who studied the import response to significant unilateral reductions in tariffs. The second are ex-ante predicted import responses to a reduction in the trade barriers estimates reported in section 3.2.

Balineau and de Melo (2011) checked import response for all occurrences of 'substantial' (5 percentage points) tariff reductions. These 'estimates' do not control for other factors and show that for about 65% of the events, the average value of imports was higher after the event than before and on average, imports were between 50% and 100% higher after the reduction in tariffs. Since under normal circumstances, imports would be growing in real terms, they also reported the same estimates for the control group (i.e. the HS-6 tariff lines that did not have an event during the period). Import growth was less in the control group, but not significantly so (see Balineau and de Melo, 2011; Table 3)). The lack of significant import response to tariff reductions could reflect several factors. Environmental regulations could have affected the demand for EGs much more than tariffs. Low import price elasticities (according to figure 2, they are lower for the LIC group where most events took place), water in the tariff, or strong complementarities with ESs are other possible contributing factors as well as lax environmental policies.

The second set draws on the tariff estimates presented here and on the price elasticities of Kee et al. discussed earlier. Estimates at the country and product level are added up to the income level classification. Because of the lack of consensus on defining EGs, estimates are reported for both the core list (26 products) and the WTO list (411 products), and because not all NTBs are barriers to trade, tariff equivalents of NTBs are not included in the estimates. The price elasticity estimates are applied to average import data for 2010-11 at the HS 6-digit level and the reduction in protection is carried out using the following formula:

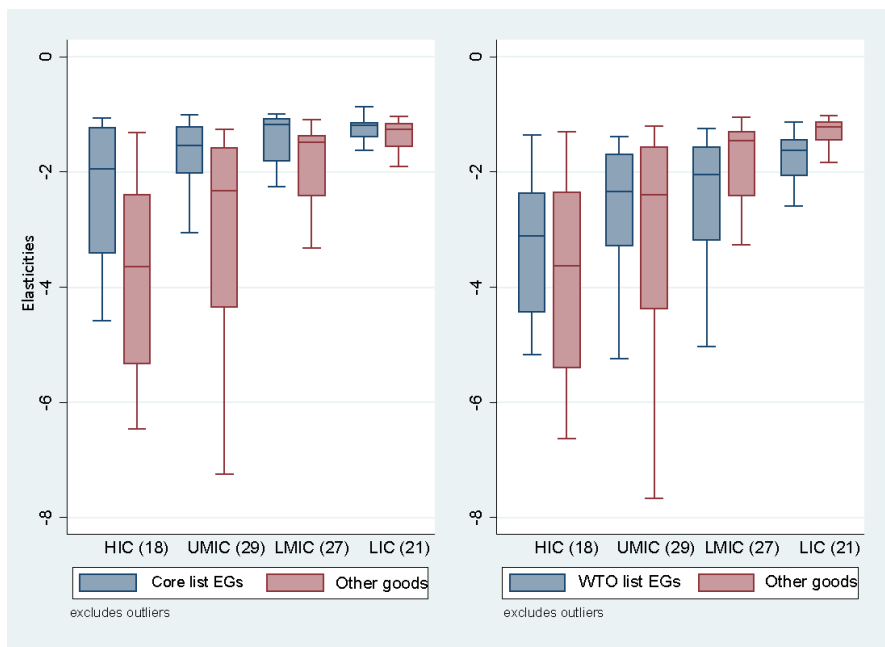
$$\begin{aligned}
 A_k &= M_k^0 / \left((1 + t_k^0)^{-\varepsilon_k} \right) \Rightarrow M_k \equiv (M_k^1 - M_k^0) / M_k^0 ; k = 1, \dots, 4900 \\
 M_k^0 &= A_k \overline{PW}_k (1 + t_k^0)^{-\varepsilon_k} ; M_k^1 = A_k \overline{PW}_k (1 + t_k^1)^{-\varepsilon_k} ; t_k^1 = \lambda t_k^0 ; 0 < \lambda < 1 ; \overline{PW}_k \equiv 1
 \end{aligned}
 \tag{0.1}$$

In equation (0.1), M_k^0 (M_k^1) are imports of EGs at the HS-6 product level before (after) the reduction in the applied MFN tariff t_k^0 (t_k^1); A_k is a product-specific calibrating factor and ε_k are the elasticity estimates of Kee et al. (2008).

Figure 2 shows the distribution of average elasticities by income group for EGs for both core and WTO lists and other goods (table B.1. reports average elasticities and standard deviation by income group). The median estimates range from -2.5 for the HIC group to -1.5 for the LIC group. Median elasticities are generally higher on the WTO list. The less elastic response for low-income countries confirms a general lack of substitutes for imports for all categories of imports. Interestingly, though greater than 2 in absolute value, price elasticities for the HIC and MIC groups are systematically lower for EGs than for other products, perhaps indicating more specialization in these products across countries.⁸ Because of the number of extreme estimates, to reduce their weight, for each income group, elasticities outside the 9th and 10th decile were set at the corresponding decile cut-offs. The resulting averages for elasticities and for applied tariffs are reported in the first three columns of table 2 by income group for both lists. Results should be viewed as ball-park estimates.

⁸ We thank Marcelo Olarreaga for pointing out that the much lower values for the LIC group also reflects the way the import elasticities are computed (see Kee et al., 2008; eq.11, which weighs the elasticity by the inverse of the import share in GDP, that share being typically much larger for countries in the LIC group). It could also reflect larger errors in the measurement of trade flows for the LIC group as Kee et al. did not use mirror data.

Figure 2: Import Demand Elasticities by Income Group (2011)



Source: Authors' calculations. Kee et al. (2008) and WDI (2013) data.

Notes: Median values indicated by a bar. All values outside 1.5*interquartile range are considered outliers.

Results for three tariff scenarios are reported in table 2, all from mean applied tariffs in 2010-11: 10% and 50% reduction and total removal. The greater import response, in the 5%-20% range, on the WTO list reflects the higher average price elasticities for the WTO list than for the core list. The LIC group has highest average tariff, but also the lowest average price elasticities. Table 2 estimates suggest that the higher average tariff effect would be the dominating effect in the import response as it is the group with the largest estimated import response to a reduction in tariff. Because it is over a large number of countries and products and over two lists, it is likely that an across-the-board tariff reduction of the kind negotiated multilaterally would have the largest impact on low-income countries. In terms of order of magnitude, high-income countries with the largest shares would account for the bulk of the increase in imports if tariffs are cut in half, ranging, on average, from \$81 million for the core list to \$1.3 billion for the WTO list. Estimated increases for low-income countries would be very low, \$2 million to \$57 million, hardly estimates to justify fears of a flooding of imports if they were to cut tariff levels in half, even if long-run effects would be larger when supply

response would be factored in.⁹ Only if NTBs were first tariffied (i.e. replaced by equivalent tariffs), then if tariffs were reduced in half from their average estimated level of 40% (see Table 1), would imports increase noticeably, from 22% (\$33 million) for the core list to 10% (\$180 million) for the WTO list. As new products would probably be imported if NTBs were removed, these are lower-bound estimates.

Table 2: Simulated Import Responses to a reduction in Trade Barriers (Tariffs)

Environmental Goods				Applied MFN tariff reduction						
Income group	Elasticities	Applied MFN tariff	Initial imports*	10%		50%		100%		
				Add. Imports*	Var.	Add. Imports*	Var.	Add. Imports*	Var.	
Core list	HIC (18)	-3.5	3.1	6 966	16	0.4%	81	1.9%	167	3.9%
	UMIC (29)	-1.9	7.1	2 184	10	0.8%	51	4.1%	112	9.1%
	LMIC (27)	-1.5	6.5	355	2	0.7%	12	3.4%	26	7.4%
	LIC (21)	-1.3	8.3	43	0.3	0.7%	2	3.9%	4	8.5%
WTO list	HIC (18)	-4.1	2.9	74 223	256	0.5%	1 335	2.4%	2 822	5.2%
	UMIC (29)	-2.9	6.9	19 333	258	1.4%	1 476	7.8%	3 886	20.9%
	LMIC (27)	-2.6	6.8	5 036	61	1.1%	342	5.8%	864	13.3%
	LIC (21)	-1.8	8.9	688	10	1.5%	57	7.9%	130	17.9%

Source: Authors' calculations. BACI (2013), TRAINS (2013), Kee et al. (2008), WDI (2013) data.

Notes:* Million US \$ corresponding to means over countries within each income group. Applied MFN tariffs and initial imports (in million \$) are mean values for 2010-11. To reduce the weight of extreme elasticity estimates, for each income group estimates outside the 1st and 9th deciles were fixed at the respective decile cut-offs.

4 Progress at the Regional and Sectoral levels

Recently, by far, the most popular form of reciprocal trade liberalization has been the formation of regional trade agreements. These are signed for a wide range of political motives ranging from getting the necessary support to reduce protection (Grossman and Helpman, 1995; and Krishna, 1998) to reducing the probability of political conflicts by increasing the opportunity cost of war (Martin et al., 2012). In the case of climate change, the environmental problem for which it is most difficult to get collective action, Ostrom (2009) argues that, without denying the global nature of the problem, much progress on climate change can be achieved by actions at multiple scales (the household, the region, the country). The successive COP meetings have vindicated her observation as progress is currently taking place at the local, national and sectoral levels rather than at the multilateral level. For example, firms in the steel sector in 7 Asia and Pacific countries (the APP) applied a voluntary sector approach to diffuse more energy-efficient technologies in steel making.

⁹ Since these are group averages, to get the increase in imports for each group, these estimates have to be multiplied by the number of countries so for the LIC group, a 50% tariff cut would increase imports by \$61.0 billion.

Steenblik and Geloso Grosso (2011) report that this voluntary approach has been successful in diffusing energy-efficient techniques that reduce CO2 emissions. Progress is also expected when the APEC tariff-reduction initiative will be implemented as well as through commitments on services in the RTAs that cover services.

4.1 The APEC Initiative to reduce tariffs on environmental goods¹⁰

In the context of climate-change discussions, in September 2012 APEC announced:

“...In that light, we are pleased to endorse the below APEC List of 54 [according to 2012 HS-6 classification] Environmental Goods that directly and positively contribute to green growth and sustainable development objectives on which we will reduce applied tariff rates to 5 per cent or less by the end of 2015 taking into account economies’ economic circumstances and without prejudice to their positions in the World Trade Organization (WTO), as we committed in 2011.... We believe that reducing our tariffs on environmental goods demonstrates our commitment to pursuing green growth objectives, addressing climate change and securing sustainable economic development, and are committed to continuing APEC’s leadership role in this regard»

APEC countries represented almost 70% of world trade in 2011 in the 54 sub-headings of the APEC list. Thus, the APEC declaration appears to represent politically significant progress in terms of EGs trade liberalisation. However, how much reduction in tariffs is likely to take place, and by whom, from this announcement? Table 3 describes APEC members’ tariff structure of APEC for these 54 HS-6-level goods along with the number of tariff lines in each member’s national tariff schedule.¹¹ Only 21% of tariff lines are above the 5 percent ceiling. China, a large importer, has 36% of its tariff lines (43 lines) above the 5% threshold with maximum rates as high as 35%. In the same wave, Mexico has 28% of its APEC tariff lines with an applied MFN tariff above 5%; with tariffs that can reach 20%. At the other end, Australia, Hong-Kong, Japan and Singapore have no tariff lines above 5%.

¹⁰ The paper was written prior to the Davos announcement of January 24 whereby 14 countries (many from the APEC group) agreed to launch negotiations on reductions to trade barriers in EGs taking the APEC list of 54 products as a starting list for the negotiations.

¹¹ To identify EGs, each APEC member must identify EGs within its national tariff lines at the 8-digit, 10-digit or higher using guidelines in Annex C of the APEC declaration, as only these tariff lines are required to benefit from tariff reductions. As shown in table 3, at least 1080 (=54*20) TL would qualify if no “ex-outs” were selected, with an upper limit of 2636 TL if all were selected. So trade based on 6-digit level information will over-estimate trade in EGs that would qualify for APEC tariff reductions.

Table 3: APEC Tariff Structure for the list of 54 EGs

Country (20)	EGs imports in billion USD (share of world imports)	Average Bound tariff ^a	Average Applied MFN tariff ^a	Tariff max	Nbr of TL	Nbr TL under 5%	% TL above 5%
Australia	7 (2 %)	6.89	2.61	5.0	70	70	0%
Canada	12 (3 %)	3.75	0.83	9.5	108	100	7%
Chile	1 (0 %)	25.00	6.00	6.0	80	0	100%
China	97 (21 %)	5.07	4.99	35.0	121	78	36%
Hong Kong, China	26 (5 %)	0.00	0.00	0.0	88	88	0%
Indonesia	4 (1 %)	25.08	2.87	15.0	161	143	11%
Japan	19 (4 %)	0.04	0.04	2.0	72	72	0%
Korea, Rep.	27 (6 %)	7.56	5.41	8.0	246	83	66%
Mexico	14 (3 %)	35.04	5.16	20.0	250	180	28%
Malaysia	9 (2 %)	6.51	1.94	30.0	84	74	12%
New Zealand	0.7 (0 %)	11.89	3.30	5.0	80	76	5%
Peru	0.9 (0 %)	30.00	0.25	9.0	100	97	3%
Philippines	2 (0 %)	12.89	1.83	10.0	174	168	3%
Papa New Guinea	0.2 (0 %)	n.a. ^b	0.46	25.0	54	53	2%
Russia	9 (2 %)	n.a. ^b	8.55	20.0	157	63	60%
Singapour	13 (3 %)	4.54	0.00	0.0	159	159	0%
Thailand	7 (2 %)	15.40	3.26	20.0	175	140	20%
Taipei, Chinese	n.a.	2.30	2.15	10.0	128	117	9%
United States	67 (14 %)	1.30	1.46	16.0	168	157	7%
Vietnam	4 (1 %)	1.59	0.59	14.0	161	155	4%
Total	320 (69 %)	11.33	2.59	35.0	2636	2073	21%

Source: BACI (2013) import values are in \$billion for 2011; Consolidated Tariff Schedule (CTS) database, most recent available year. n.a.= not available

Notes: ^a = Simple average. ^b The latest available year on bound tariffs data for Russia is 2001. Brunei Darussalam excluded because its population is below 1 million habitants. Trade data for Chinese Taipei is missing from BACI.

TL= number of national tariff lines (at 8 digit or 10 digit code) within the corresponding HS 2002 6-digit code. PNG has no 8-10 digit codes. The average number of lines per country is 138.

Unlike WTO negotiations that reduce bound rates and are binding, the APEC outcome will only affect MFN tariff lines in a non-binding way. The binding overhang for the APEC list of EGs is relatively high for some countries, as import-weighted bound tariffs were on average at 10% in 2011, with average bound rates reaching 25%-35% in developing country members (Chile, Mexico, Indonesia and Peru—see figure B.6.). Thus, a binding commitment that tariff rates will not exceed the 5% threshold appears crucial to reduce the uncertainty for traders and investors even if it seems unlikely that members would raise applied tariffs once these have been lowered.

Of the 54 products in the APEC list, only 8 (15%) are common to the 26 product core list while 51 belong to the 411 WTO list. Most APEC products belong to the following HS chapters: 84 (machinery and mechanical appliances) and are used in air pollution control, renewable energy plants and solid waste management; 85 (electrical machinery and equipment) and are used in renewable energy plants; 90 (environmental monitoring, analysis and assessment equipment). In spite of limited overlap, there is rather broad agreement as to what constitutes an EG. Also, regardless of the chosen list, APEC members have relatively low tariffs.¹²

Comparing average tariffs and AVEs of NTBs for APEC countries and for the rest of the world indicates that the APEC list reflects EGs in which these countries have a comparative advantage. Assuming that the entire 54-product APEC list can be considered as an EG, taking data for 2004 (because of the NTB estimates), Table 4 shows that APEC members have lower trade restrictions across the board, including for non-EGs, than the rest of the world. Altogether, APEC countries have a more open trade policy regime than the rest of the world as regards to the APEC list of 54 environmental goods, but agreeing on tackling down NTBs appears more promising than a reduction in applied tariffs.

Table 4: APEC list: Applied MFN Tariff and NTBs for APEC and Rest-of-the world

	APEC (17 countries)	Rest of the World (53 countries)
APEC list of EGs		
Applied MFN tariff	3.8	5.9
NTBs (AVE)	25.8	38.0
Non-EGs		
Applied MFN tariff	7.3	12.5
NTBs (AVE)	38.4	44.2

Source: Authors' calculations. TRAINS (2013) and Kee et al. (2009). Simple average tariff and non-tariff barriers. Values correspond to means over countries within each group. Because NTBs are for 2000 to 2004, applied MFN tariffs are for 2004.

In conclusion even if the APEC initiative has limited ambitions, it involves 20 members including developed and developing members and is the first attempt to have agreed on a list of EGs and gone on to commit to reducing tariffs. This attempt could have repercussions. One is that it is a positive signal to the WTO as well as to other bilateral and regional trade agreements as it shows that a relatively large and heterogeneous group can agree and move forward. Even though WTO talks did not make progress, following the September 2012 APEC

¹² In parenthesis for each list, simple averages for 2004, in the order (bound MFN tariffs, applied MFN tariffs, AVEs of NTBs): WTO list (15.3%; 6.1%; 30.7%); Core list(14.9%; 5.6%; 40.5%); APEC list (11.9%; 3.4%; 25.8%).

announcement, Bolivia, India and South-Africa expressed their fear that the APEC agreement might influence talks at the WTO, or that the proponents of the list approach may seek to “multilateralise” it (Committee on Trade and Environment, 2012). Another is that it could have complementarity effects, as did the Anglo-French Treaty of 1860 that led to a host of other agreements (Irwin, 1993) or more recently the “domino” effect of the EC on EFTA partners that decided to join the EC (Baldwin, 1995) and the evidence that preferences in FTAs induce faster declines in external tariffs in FTAs (Estevadeordal et al., 2008).

4.2 Environmental services: do RTAs reduce trade barriers in Environmental Services?

RTA in services have grown rapidly though recent estimates of trade costs in services suggest that these costs are higher than for trade in goods. Solving a gravity model from trade to obtain trade costs suggested by Novy (2012), Miroudot and Shepherd (2013) report estimates of trade costs over the period 1999-2009 for 55 countries involved in 66 RTAs. Data limitations allowed them to examine mainly trade costs for cross-border trade (modes 1 and 2). Their estimates show trade costs for these services at between 120 and 125 percent, whereas for goods trade they are between 50 percent (for RTA members) and 75 percent (for non-RTA members). Controlling for other factors specific to bilateral RTAs, they find that RTAs reduce bilateral trade costs, but that these reductions in trade costs largely benefit non-members as well. The extra reduction in trade costs for RTA members are minimal, around 6 percent, leading them to conclude that in practice it is difficult to give preferences for trade in services, both because regulatory reform occurs de facto on an MFN basis and rules of origin are quite lax.¹³ So in effect, any liberalization in the services sector (for modes 1 and 2) through an RTA is tantamount to a multilateral liberalization. However, they acknowledge that lack of data on mode 4 where the scope for discrimination is greater, results in an incomplete picture. In conclusion, these estimates of small reduction in trade costs for services confirm the often-made remark that commitments at the GATS—for those countries that made commitments (since countries were not obliged to table any offers)—just consolidated members’ existing services policies.

With this caveat in mind, we use indexes to draw comparisons on the extent of GATS commitments for ESs vs other services by income group, then look at differences in commitments between the GATS (multilateral) and regional levels. The indexes are built using the weighing scheme described in annex 2. Like bound tariffs, the values of these indexes are an inaccurate indicator of applied Services policies. As in the case of goods, we confirm that GATS commitments have been greatest for the HICs. Next we examine commitments at the bilateral level through commitments made during RTAs by taking inspiration from the recent literature on services liberalization through RTAs (Roy et al.,

¹³ Laws in Services are designed for domestic purposes and do not give legal instruments for trade negotiators to give preferences to specific countries. Rules of origin (RoO) apply more often to the service providers than to the “service” itself (see discussion by Miroudot et al., (2010)).

2006; Miroudot et al., 2010). We use the database compiled at the OECD by Miroudot et al. (2010)¹⁴ that covers 37 countries and 57 RTAs where an OECD country, China or India is a party¹⁵.

To measure GATS commitments, we use an Environmental Service Liberalization (ESL) index adapted from Miroudot et al. (2013) to reflect better the importance of different services and modes of delivery for environmental services. The ESL index gives scores and weighs scores by mode at the sub-sector level (155 sub-sectors). The resulting ESL index is described in annex 2 (see equation (0.6)) and its values ranges from 20 (no commitment) to 100 (full commitment). The informational value of the index is limited because actions to improve the use of services to protect the environment go beyond those categorized as ES in the CPC, which are the only services considered as belonging in the ES category.

The relationship between commitments and the level of economic development observed earlier is confirmed. Indeed, according to this scheme, the HIC group has the highest score, suggesting that they have liberalized further their environmental sector compared with the two developing country groupings. Also, the HIC group has made deeper commitments at the GATS for the ES sector (as defined here) than in other sectors, while it is the opposite for developing countries, though the difference between ES and Other Services is small. This difference probably reflects a combination of factors: first the environment is a normal good so that the demand—and hence the supply—of measures to protect the environment is greater in HIC; second, in developing countries environmental services (particularly infrastructure related ES) are provided by the public sector, hence they make fewer commitments at the GATS. Commitments by mode of supply show that developed countries have committed more at the GATS than developing and low-income countries across all modes. The scores also confirm that Mode 4 is relatively less open than Mode 3. However, there is no specificity in commitments by ES sub-sector.¹⁶

¹⁴ We thank Ben Shepherd for sharing the data.

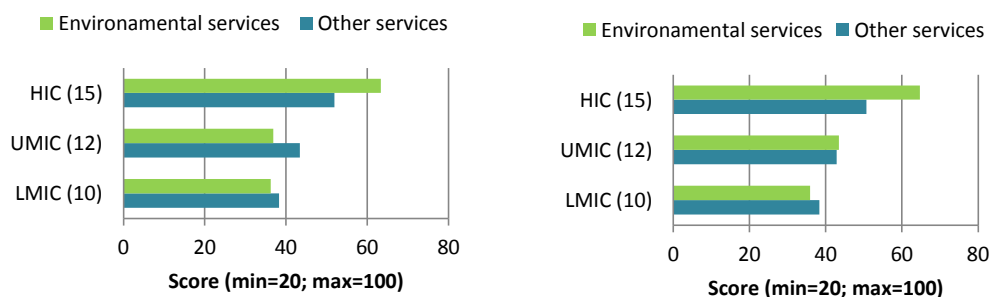
¹⁵ According to the WDI (2012) income groups, in the sample of 37 countries, 15 are HIC (counting EU15 as one), 12 are UMIC and 10 are LMIC.

¹⁶ See figures B.7. and B.8.

Figure 3: GATS score commitments for environmental services and other services

3.a. ES: narrow definition

3.b. ES: wide definition

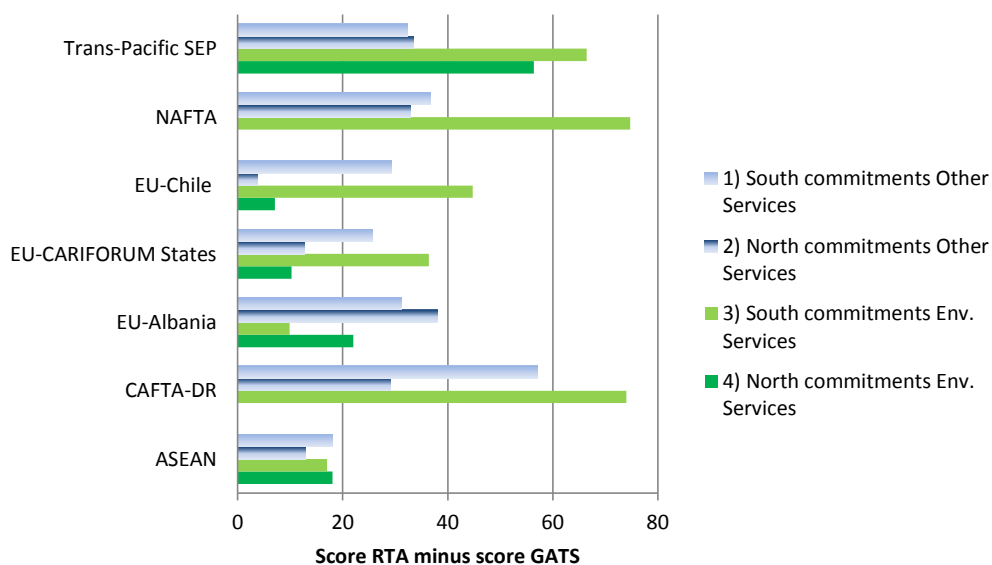


Source: Authors’ calculations; income categories from WDI (2012). There are no available data for LIC in the service commitments database. The narrow definition only considers ES as defined by the W/120 list; the wide definition adds to these ES the following W/120 sectors: professional services, research and development services, other business services, and construction and related engineering services.

Turning to liberalization measures via RTAs (again keeping in mind that commitments are only a rough indicator of applied policies and that it is difficult to effectively grant preferential access in Services RTAs—in effect the indexes do not indicate if preferential treatment is actually offered as we do not know the de facto trade regime), a priori, one might expect “liberalization” in ESs to go further through North-South RTAs than multilaterally as most of the world market, particularly for infrastructure ES, is in the hands of firms from HIC that have strong interests in prying open developing countries’ domestic markets (Kirkpatrick, 2006). To examine this, we use a database that covers 57 bilateral and regional RTAs where an OECD country, India, or China is a party. The extent of liberalization of ESs through RTAs is again assessed using the same ESL indexes by comparing commitment scores under the GATS with scores obtained in each RTA (Annex D). Figure 4 for Regional North-South and (B.9. for Bilateral North-South) for South-South (B.10) commitments confirm this expectation. Substantial commitments are carried out in bilateral and regional North-South RTAs where developing countries committed to almost open fully their ES sector which they had kept unbound in the GATS. RTAs promoted by the United-States, such as the CAFTA-DR and the NAFTA, show differences in scores close to 80, suggesting that the ES sector became almost fully open after the RTA. On the contrary, European Union lead RTAs show less opening from moderate (EU-Chile RTA) to inexistent (EU-Mexico), the difference is likely to due to the difference in negotiating templates: the US using a negative list (all sectors included except on the list) while the EU adopts a positive list (commitments

only for those on the list).¹⁷ Environmental services commitments in South-South RTAs also tend to go further than GATS commitments, particularly in the case of Mexico (Figure B.10); and trade liberalization in ES is higher than for other services.¹⁸

Figure 4: Multilateral vs. North-South RTA Commitments: ESs versus Other Services



Source: Authors' calculations from formulas described in annex A2.

Notes: Score reported is the difference RTA score minus multilateral score. All RTAs have greater commitments (positive scores ; higher score means greater commitment). Since no multilateral commitment corresponds to a score of 20 and a maximum commitment (full market access and full national treatment) to a score of 100, the maximum difference is 80. Each bar always follows the same order. A score of zero indicates no difference between the multilateral and regional commitment.

Disentangling North-South environmental services commitments by mode of supply shows similar commitment patterns for developing countries across all modes of supply, except for less opening for mode 4 (Figure B.11.). Overall, in spite of heterogeneity across RTAs, as

¹⁷ Adlung and Mamdouh (2013) contest this widely-held view, arguing that the difference comes from the amount of impetus that governments are ready to generate in the negotiations.

¹⁸ In the case of bilateral free trade agreements, the United-States – Peru, the Korea-Chile, the Japan-Mexico and the Japan-Chile FTAs are the most ambitious North-South FTAs as regards to environmental services (Figure B.9). They also opened further their ES sector compared with other services sector.

noted by Miroudot et al. (2010), similarities in commitments across modes might be sufficiently high that these liberalization steps could be multilateralized.

5 Conclusions

This paper has reviewed progress at liberalization of barriers to trade in Environmental Goods (EGs) and in Environmental Services (ESs). Both face difficulties in classification that have contributed to the lack of progress in the multilateral negotiations. When compared with 'other' Goods and 'other' Services over a large sample of countries, barriers to trade in EGs and ESs have usually been lower on average. There was no acceleration in the pace of reduction in tariffs during the ten-year period of negotiations. Tariffs and NTBs are highest for the low-income countries and they are very low for high-income countries whose interests in a multilateral reduction in EGs would largely come from a reduction in trade barriers in low-income countries. However, the small import response to sizable tariff reductions in the past and first-order estimates of the likely import response to a 50% reduction in tariffs would only result in a 4% increase in EGs imports.

As discussed in section 2, measuring flows and assessing policies in the services sectors is very difficult. These difficulties are compounded when extending the discussion to ESs because of the packaging and embodiment of these services with EGs in environmental projects, particularly for low-income countries. Moreover the inadequacy of the UN CPC list, where services are defined in an exclusionary manner so that they cannot appear on two lists, casts greater uncertainty as to the informational content of the commitment measures presented here. It would appear nonetheless that at least as great, and probably greater commitments took place in the environmental sectors (as defined by the CPC) both multilaterally and regionally than for 'other' services with the same pattern across income groups: greater commitments observed for HIC than for MICs and LICs although it is widely recognized that GATS commitments by HICs largely amounted to consolidated members' unilateral services policies. North-South RTAs resulted mostly in commitments by the Southern partners, indicating greater prospects for reducing barriers to trade in a regional than in a multilateral context.

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Annex A. 1: Classifying GATS commitments by Mode of Supply

This annex reviews GATS commitments by mode of supply that are most important for the delivery of services to improve the environment. Trade in environmental services takes place under all modes. Vikhlyaev (2003) and Geloso Grosso (2005) suggest that commercial presence (Mode 3) could be the most important, particularly for infrastructure environmental services such as water distribution and wastewater and solid-waste management. However, the supply of services by Mode 3 is often accompanied by the temporary movement of natural persons (Mode 4) through intra-corporate services trade (Kirkpatrick, 2006). Considering that trade in services is a potential channel for technology transfer, Geloso Grosso (2005) remarks that these two Modes of supply are particularly important for the diffusion of active knowledge spillovers through learning and adaptation of the embedded technology.

Cross-border trade (Mode 1) and consumption abroad (Mode 2) are also becoming increasingly important, particularly for environmental support services as technological change has lessened the proximity burden that distinguished services trade from goods trade. The scope for cross-border supply is likely to be particularly relevant for the transmission of architectural, engineering and design plans for environmental projects, or of reports from consultants on environmental issues. Geloso Grosso (2005) gives the example of air-pollution control where air monitors are often set up by the service provider, but samples are collected by the client and sent to the service provider's laboratory for analysis.

GATS commitments under Mode 3. Table A.1.1. summarizes the main types of market access and national treatment restrictions by mode of supply along with some examples. Trade through commercial presence (Mode 3) is particularly important for infrastructure environmental services. Trade in such services was limited in the past as they were principally provided by municipalities (Kirkpatrick, 2006). However, trade has increased in recent years following changes in their delivery and innovative regulatory frameworks that encourage private participation in the supply and management (Kirkpatrick, 2006; Geloso Grosso, 2007). In the case of market access, limitations can take many forms, such as restrictions on foreign ownership or on the type of legal entity; national treatment limitations can take the form of licensing requirements motivated by consumer protection or public health and safety regulations that may become barriers to trade if they discriminate between local and foreign companies.

Table A1 1: Typology of limitations in partial market access and national treatment commitments

Category	Name	Mode of supply	Examples
a Market access			
1	Market access unbound	All	
2	Restrictions on foreign ownership or on the type of legal entity	Mode 3	Foreign equity limits Only joint ventures are allowed Restrictions on mergers and acquisitions for foreign firms
3	Quantitative restrictions on the service or service suppliers (not including Mode 4)	Mode 1, 2 & 3	Limitations on the number of service suppliers (e.g., quota or economic needs test) Limitations on the total value of transaction or assets Limitations on the quantity of services output
4	Scope of sub-sector limited (as compared to W/120 classification)	All	Commitment limited to a list of activities. Commitment in sub-sector x but not including y.
5	Market access restrictions to the mover	Mode 4	Limitations on the number of natural persons Nationality requirements for suppliers of services
6	Market access full	All	
n National treatment			
7	National treatment unbound	All	
8	Nationality and residency requirements for boards of directors and managers, discriminatory	Mode 1 & 3	Nationality and residency requirements for boards of directors and managers Discriminatory licensing requirements
9	National treatment restrictions on the movement of people	Mode 4	Discriminatory qualification or licensing requirements
10	Discriminatory measures with regard to subsidies or taxes	Mode 1, 2 & 3	Eligibility to subsidies reserved for nationals A tax is imposed on non-residents
11	Restrictions on ownership of property or land	Mode 1, 2 & 3	Foreigners may not acquire direct ownership of land Non-residents are excluded from the acquisition of real estate
12	Other discriminatory measures	Mode 1, 2 & 3	Discriminatory measures with respect to competition Prohibition on the hire of local professionals Local content requirements Technology transfer/training requirements
13	National treatment full	All	

Source: Inspired from Miroudot et al. (2010).

In view of their lack of domestic capacity and financing, when governments in developing countries decide to open infrastructure environmental services to private participation, they often opt in favor of foreign participation (Kirkpatrick, 2006). The market structure of infrastructure relate environmental services is then mainly concentrated in the hands of a few multinationals from HIC that provide integrated activities. However, participation from companies in developing countries is increasing in the water and sewage sub-sectors, as well as environmental support services, not only in terms of regional trade but also in terms of exports to HIC (Kirkpatrick, 2006). Thus, both HIC and some UMIC have an offensive interest in ESs negotiations for Mode 3.

It can be seen from Figure B.12. that more than half of HIC have fully committed their environmental sector under Mode 3 for at least one sub-sector, while UMIC and LMIC have made few partial or full commitments. Once we disaggregate by ES sub-sector and by type of

partial commitment (Annex C), we can see that most of the differences between income groups come from limitations on market access. HIC usually commit on a limited scope of sub-sectors and register quantitative restrictions on the service or service suppliers. UMIC usually commit on restrictions on foreign ownership or on the type of legal entity, while most of LMIC do not make any commitment. The fact that commitments tend to increase with the level of economic development reflects the reluctance of the poorest developing countries to liberalize what is seen as a public sector, as experience has shown that the benefits of private-sector participation in terms of efficiency and service access will depend on the design of the reform and the strength of the regulatory system (Kirkpatrick, 2006; Geloso Grosso, 2007).

Finally, the “Other services” sub-sector (which principally includes non-infrastructure ES) shows a different pattern from the rest as market-access limitations appear more frequently in all groups of countries (particularly restrictions related to a “scope of sub-sector limited”) (Annex C, Figure C.7.). Non-infrastructure related ES are expected to become increasingly important for developing countries as their utilization increases with the level of economic development. Indeed, these services involve new approaches to resource use and generally reflect high environmental awareness and standards (Geloso Grosso, 2005). The few full commitments in this sub-sector seems to reflect the fact that the W/120 classification list tends to define environmental services as an end-of-pipe public infrastructure service and thus does not take accurately into account the variety of non-infrastructure ESs which are becoming increasingly important. It may also reflect the idea that unlike infrastructure related ES, understanding of the role played by non-infrastructure related ES is low (Kirkpatrick, 2006) and thus negotiators prefer not to fully commit on this sub-sector.

GATS commitments under Mode 4. Greater freedom for the temporary movement of individual service providers is negotiated under Mode 4 of the GATS. Market access limitations for this mode usually take the form of limitations on the number of natural persons or nationality requirements for suppliers of services. National treatment limitations can take the form of a lack of recognition of qualifications, educational degrees, training and experience; and licensing requirements (see Table A.1.1.). While limitations in Mode 4 are usually horizontal and arise from a variety of reasons (some non-economic), it is commonly agreed that Members’ schedules by sector tend to be biased in favor of intra-corporate transferees, so that the value of these commitments is dependent on limitations under Mode 3 (Kirkpatrick, 2006). Figure B.7. shows that for the environmental services sector, Mode 4 appears relatively less liberalized than Mode 3. Also, it seems that even if countries fully opened their sector for Mode 3, they usually keep the freedom to impose limitations such as nationality requirements for suppliers of services, discriminatory qualifications or licensing requirements in Mode 4.

This strategy may be beneficial for developing-country importers as it favors knowledge transmission to local professionals. In fact, it has been pointed out that the increasing

number of companies from developing countries participating in environmental service trade (Steenblik et al. 2005) tend to be from Asian or Latin American countries that have themselves acquired technological and services capacities through their experience in joint ventures in their own countries (Kirkpatrick, 2006). At the same time, these developing-country ES exporters have an offensive interest in Mode 4, in particular because they are exporting not only to other developing countries but also to HICs which remain relatively closed under this Mode.

Finally, limitations on the movement of natural persons are particularly important for environmental non-infrastructure and support services, which are typically provided by Small and Medium Enterprises (SMEs) that need to bring in highly specialized professionals (Geloso Grosso, 2005). These services, mainly classified in the “Other services” sub-sector, include activities such as monitoring air pollution emissions or consultancy on the protection of biodiversity. Members tend to make commitments more frequently in terms of market access for specific services under this sub-sector, particularly LMIC and UMIC (Annex C, Figure C.7.).

Annex A. 2: An Index of Commitments under GATS and RTAs

This annex presents the ordinal weighting scheme used in the text to convert the qualitative information in the GATS schedules to an index of commitments. It takes inspiration from Hoekman (1996) and Miroudot et al. (2013). As discussed in the text, commitments are by sectors, sub-sectors and mode of supply. They are either “full” (no limitation), “partial” (some limitations) or “unbound” (no commitment). Partial commitments can be further differentiated and classified into various limitations related to market access and national treatment. The resulting typology is shown in Table A.1. 1.

All commitments in terms on market access and national treatment notified to the WTO under GATS and under RTAs are reported for all 155 sub-sectors of the W/120 Service Sectoral Classification List and for the four GATS modes of supply. For the RTAs, cross-country and cross-sector consistency is ensured by reporting all horizontal commitments in each sub-sector and by converting commitments from a NAFTA-style negative list agreement to a GATS-style positive list agreement.

The weighing schemes are computed according to the following observation rule applied to the $(k = 1, \dots, 155)$ sub-sectors. Market-access commitments for country i are over four modes $(m = 1, \dots, 4)$ and over the types of access described in table A1.1 $(a = 1, \dots, 6)$ where $(a = 6)$ corresponds to a full commitment in which case no penalty is entered in score, penalty scores being the same for all countries for a given form and mode, i.e. $(\alpha_{k,i}^{m,a}, \forall i)$. The penalty—when applicable—takes the value of zero when market access is given and, otherwise the penalty value is indicated in the corresponding cell in table A1.2. The penalty

scores chosen are from Miroudot and Shepherd (2013). As noted by them, there is inherent subjectivity in ranking and weighting the importance of trade restrictive measures.

Table A1 2: Scores to calculate the commitment indexes

Commitments		Market access (a)					National treatment (n)							
		$\alpha_{k,i}^m$					$\beta_{k,i}^m$							
		Unbound	Partial				Full	Unbound	Partial				Full	
		1	2	3	4	5	6	7	8	9	10	11	12	13
\in	Mode 1	50	0	20	15	0	0	30	15	0	2.5	2.5	2.5	0
	Mode 2	50	0	0*	20	0	0	30	0	0	5	5	5	0
	Mode 3	50	20	5	15	0	0	30	15	0	2.5	2.5	2.5	0
	Mode 4	50	0	0	15	20	0	30	0	15	0	0	0	0

Source: Miroudot and Shepherd (2013). Columns correspond to those defined in table A.1.1.

So the market-access commitment penalty for sub-sector k in country i in mode m is given by:

$$\begin{aligned}
 &= 0 && \text{full commitment} \\
 MA_{k,i}^m &= UB_{k,i}^m ; UBM_{k,i}^m = 50 \forall k, i \text{ no commitment} && (0.2) \\
 &= \sum_{a=1}^4 \alpha_{k,i}^{m,a} && \text{partial commitment}
 \end{aligned}$$

A similar observation rule applies to commitment on national treatment where the types of restriction to national treatment are also described in table 1 ($n = 7, \dots, 13$). When they apply, penalty scores are again the same for all countries for a given form and mode, i.e. ($\beta_{k,i}^{m,n}, \forall i$) where the penalty—when applicable—for sub-sector k in country i in mode m is analogously given by:

$$\begin{aligned}
 &= 0 && \text{full commitment} \\
 NT_{k,i}^m &= UB_{k,i}^m ; UBN_{k,i}^m = 30 \forall k, i \text{ no commitment} && (0.3) \\
 &= \sum_{n=1}^5 \beta_{k,i}^{m,n} && \text{partial commitment}
 \end{aligned}$$

As in Miroudot and Shepherd (2013), the higher penalty for no-commitment for market access than for national treatment reflects the assumption that market access matters relatively more than national treatment. Assume that the penalty scores for national treatment and market access can be added. This gives an overall index of openness (higher values corresponding to more openness) for each country by sub-sector and mode.

$$ESL_{k,i}^m = 100 - MA_{k,i}^m - NT_{k,i}^m \quad (0.4)$$

So a country with full market access and national treatment commitment on mode m obtains a score of 100 since no penalties are deducted. A country with “no-commitment” schedule on market access nor on national treatment gets a score of 20, while “partial commitment” schedules corresponding to partial access (or partial restrictions as indicated in table A.1. 1) gives a score below 100, but above 20.

The formulas for computing these indices reveal their usefulness and limitations. Accepting that restrictions to trade in services can be given a score, the formulas show that the construction of the indices treat all countries and all sub-sectors, whether they relate to environmental services or not, equally. Because restrictions to trade in services are mode-specific (foreign equity limits only apply to cross-border trade (mode 1) and nationality requirements only apply to the movement of natural persons (mode 4)), restrictions have to be applied by mode. Subject to these assumptions, a higher index value for a sub-sector and a mode for country i than for country j indicates that i has a higher binding for this subsector and mode. Since applied restrictions will be typically different from GATS commitments, on the basis of these scores one still cannot conclude that i has more liberalized services policies for that sub-sector and mode than country j even though it is tempting to assume that a ranking by commitment would hold when it comes to actual applied policies.

Taking a weighted sum over the 4 modes of supply gives an overall index by sub-sector:

$$ESL_{k,i} = \sum_m \frac{1}{w^m} (100 - MA_{k,i}^m - NT_{k,i}^m) \quad (0.5)$$

By assigning a higher weight for Mode 3 (50%) and 4 (30%) than for the two other modes (10% each), this index deviates from Miroudot and Shepherd (2013) who put 70% of the weight in Mode 1 and 10% to the rest. This is because our reading of the literature suggests that trade in environmental services mainly takes place via commercial presence and the movement of natural persons.

Finally, averaging across sub-sectors gives a sectoral index of liberalization by country:

$$ESL_{s,i} = \frac{\sum_k \left[\sum_m \frac{1}{w_k^m} (100 - MA_{k,i}^m - NT_{k,i}^m) \right]}{k} \text{ with } k \in s \quad (0.6)$$

An overall country-index can be further computed averaging across sectors. Figure 3 in the text compares average values of the ESL index in (0.6) for the 4 environment sectors with the corresponding one for the other non-environmental services.

Annex A. 3: Linking Environmental Goods with associated Services

Environmental products and services are usually provided on an integrated basis, whether horizontally by firms that bring together all the services and material necessary to undertake an entire project for a particular environmental activity, or vertically by firms that use particular goods to provide consulting, construction and engineering in a range of environmental services. Case studies have emphasized the important complementarities arising between EGs and ESs at the firm level, illustrating the extent to which liberalization of these two must go hand by hand (Steenblik et al., 2005). Table A1.3 summarizes the tariff protection estimates for each EG in the core list along with GATS and RTA commitments for the associated environmental services.

Table A1 3: Complementarities between EGs and ESs

N°	HS CODE DESCRIPTION	Applied MFN tariffs (NTBs, AVE)				Complementary ES	ES commitments GATS*				ES commitments RTAs*			
		HIC	UMIC	LMIC	LIC		HIC	UMIC	LMIC	LIC	HIC	UMIC	LMIC	LIC
1	460120: Mats, matting and screens of vegetable materials	3.8 (0.0)	15.3 (27.7)	18.3 (30.1)	22.1 (59.1)	A/D/	65.5/60.5	34.4/40.2	39.4/36.8	n.a.	81.3/83.3	59.7/75.0	59.7/60.8	n.a.
2	730820: Towers & lattice masts	2.2 (5.7)	9.0 (44.7)	10.4 (47.4)	5.5 (80.9)									
3	732111: Cooking appliances and plate warmers: For gas fuel or for both gas and other fuels.	4.7 (0.0)	17.1 (5.0)	15.7 (5.8)	16.0 (0.0)									
4	732490: Other sanitary ware and parts thereof, of iron or steel	2.6 (0.0)	15.9 (0.0)	16.2 (41.1)	23.0 (0.0)	A (waste-water management, water treatment)	65.5	34.4	39.4	n.a.	81.3	59.7	59.7	n.a.
5	840290: Steam or other vapour generating boilers (other than central heating hot water boilers capable also of producing low pressure steam); super-heated water boilers: Parts	2.9 (28.2)	5.5 (89.0)	3.4 (78.3)	2.3 (144.2)	B/ (management of solid or hazardous waste); D/ (air pollution control, remediation and clean-up of soil, surface water and groundwater).	65.1/60.5	33.8/40.2	37.5/36.8	n.a.	82.9/83.3	63.7/75.0	52.5/60.8	n.a.
6	840410: Auxiliary plant for use with boilers of heading 84.02 or 84.03 (for example, economisers, super-heaters, soot removers, gas recoverers); condensers for steam or other vapour power units	2.8 (0.0)	4.4 (0.0)	3.6 (10.9)	3.8 (14.4)	B/ (management of solid or hazardous waste); D/ (air pollution control, remediation and clean-up of soil, surface water and groundwater).	65.1/60.5	33.8/40.2	37.5/36.8	n.a.	82.9/83.3	63.7/75.0	52.5/60.8	n.a.
7	840510: Producer gas or water gas generators, with or without their	2.3 (0.0)	4.0 (5.7)	3.0 (0.0)	3.6 (0.0)	B/ (management of solid or hazardous	65.1/60.5	33.8/40.2	37.5/36.8	n.a.	82.9/83.3	63.7/75.0	52.5/60.8	n.a.

N°	HS CODE DESCRIPTION	Applied MFN tariffs (NTBs, AVE)				Complementary ES	ES commitments GATS*				ES commitments RTAs*			
		HIC	UMIC	LMIC	LIC		HIC	UMIC	LMIC	LIC	HIC	UMIC	LMIC	LIC
	purifiers; acetylene gas generators and similar water process gas generators, with or without their purifiers					waste); D/ (air pollution control)								
8	840681: Steam turbines and other vapour turbines for marine propulsion: Of an output exceeding 40 MW	1.8 (20.4)	4.6 (109.6)	3.9 (110.5)	2.2 (156.6)									
9	840999: Parts suitable for use solely or principally with the engines of heading 84.07 or 84.08 other	2.5 (4.1)	8.3 (17.9)	5.6 (8.3)	9.5 (0.9)	D (air pollution control, noise and vibration abatement)	60.5	40.2	36.8	n.a.	83.3	75.0	60.8	n.a.
10	841011: Hydraulic turbines and water wheels of a power not exceeding 1,000 kW	2.4 (169.4)	5.3 (80.5)	2.7 (122.0)	1.6 (n.a.)	A/ D (air pollution control)	65.5/ 60.5	34.4/ 40.2	39.4/ 36.8	n.a.	81.3/ 83.3	59.7/ 75.0	59.7/ 60.8	n.a.
11	841012: Hydraulic Turbines and Water Wheels, Power 1, 000-10, 000kw	2.3 (134.3)	5.0 (56.5)	2.3 (78.7)	0.0 (134.1)	A/ D (air pollution control)	65.5/ 60.5	34.4/ 40.2	39.4/ 36.8	n.a.	81.3/ 83.3	59.7/ 75.0	59.7/ 60.8	n.a.
12	841090: Hydraulic turbines, water wheels, and regulators ; parts, including regulators	2.3 (0.0)	4.5 (0.0)	3.1 (0.0)	2.8 (0.0)	A/ D (air pollution control)	65.5/ 60.5	34.4/ 40.2	39.4/ 36.8	n.a.	81.3/ 83.3	59.7/ 75.0	59.7/ 60.8	n.a.
13	841181: Other gas turbines of a power not exceeding 5,000 kW	1.4 (0.0)	3.1 (0.0)	3.2 (0.0)	1.4 (0.0)									
14	841182: Other gas turbines of a power exceeding 5,000 kW	1.6 (42.5)	2.9 (43.5)	3.4 (85.3)	2.2 (120.7)									
15	841861: Other refrigerating or freezing equipment; heat pumps: Compression-type units whose condensers are heat exchangers	3.9 (2.8)	12.4 (5.9)	5.2 (6.9)	7.7 (0.0)									
16	841919: Instantaneous or storage water heaters, non-electric: Other	4.4 (172.8)	13.2 (166.1)	9.1 (160.4)	5.7 (n.a.)	D (air pollution control)	60.5	40.2	36.8	n.a.	83.3	75.0	60.8	n.a.
17	841950: Heat exchange units	2.2 (50.3)	4.2 (54.4)	2.8 (59.5)	2.3 (63.5)	A/ (waste-water management, water treatment); B/ (management of solid or hazardous waste); D/ (air pollution control)	65.5/ 65.1/ 60.5	34.4/ 33.8/ 40.2	39.4/ 37.5/ 36.8	n.a.	81.3/ 82.9/ 83.3	59.7/ 63.7/ 75.0	59.7/ 52.5/ 60.8	n.a.

N°	HS CODE DESCRIPTION	Applied MFN tariffs (NTBs, AVE)				Complementary ES	ES commitments GATS*				ES commitments RTAs*			
		HIC	UMIC	LMIC	LIC		HIC	UMIC	LMIC	LIC	HIC	UMIC	LMIC	LIC
18	847989: Other machines and mechanical appliances: Other	4.0 (35.8)	7.3 (42.6)	5.3 (41.3)	5.8 (68.3)	B/ C/ (management of solid or hazardous waste)	65.1/ 62.3/	33.8/ 39.0/	37.5/ 31.3/	n.a.	82.9/ 83.1/	63.7/ 61.0/	52.5/ 48.4/	n.a.
19	850231: Other generating sets: Wind-powered	1.8 (16.6)	4.5 (17.6)	3.2 (15.7)	1.8 (51.6)	D (air pollution control)	60.5	40.2	36.8	n.a.	83.3	75.0	60.8	n.a.
20	850410: Ballasts for discharge lamps or tubes	2.2 (0.0)	9.0 (28.9)	7.1 (12.3)	6.5 (0.0)									
21	853710: Boards, panels, consoles, desks, cabinets and other bases, equipped with two or more apparatus of heading 85.35 or 85.36, for electric control or the distribution of electricity, including those incorporating instruments or apparatus of Chapter 90, and numerical control apparatus, other than switching apparatus of heading 85.17For a voltage not exceeding 1,000V	3.0 (23.3)	8.6 (30.7)	8.8 (55.9)	6.8 (82.1)									
22	854140: Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes.	0.0 (0.0)	3.0 (20.2)	1.1 (11.5)	3.0 (0.0)	D (air pollution control, nature and landscape protection, remediation and clean-up of soils, surface water and ground water)	60.5	40.2	36.8	n.a.	83.3	75.0	60.8	n.a.
23	900190: Optical fibres and optical fibre bundles; optical fibre cables other than those of heading 85.44; sheets and plates of polarising material; lenses (including contact lenses), prisms, mirrors and other optical elements, of any material, unmounted, other than such elements of glass not optically worked: other	2.7 (47.1)	10.5 (35.8)	7.7 (26.1)	9.4 (0.0)									
24	900290: Lenses, prisms, mirrors and other optical	2.1 (137.8)	9.3 (57.8)	8.0 (114.7)	15.7 (231.3)	D (monitoring, analysis)	60.5	40.2	36.8	n.a.	83.3	75.0	60.8	n.a.

N°	HS CODE DESCRIPTION	Applied MFN tariffs (NTBs, AVE)				Complementary ES	ES commitments GATS*				ES commitments RTAs*			
		HIC	UMIC	LMIC	LIC		HIC	UMIC	LMIC	LIC	HIC	UMIC	LMIC	LIC
	elements, of any material, mounted, being parts of or fittings for instruments or apparatus, other than such elements of glass not optically worked: other													
25	902730: Spectrometers, spectrophotometers and spectrographs using optical radiations (UV, visible, IR)	0.0 (0.0)	2.0 (3.5)	1.8 (25.0)	2.3 (0.3)	A/ (waste-water management, water treatment)/ B/ (management of solid or hazardous waste) D (monitoring, analysis, air pollution control)	65.5/ 65.1/ 60.5	34.4/ 33.8/ 40.2	39.4/ 37.5/ 36.8	n.a.	81.3/ 82.9/ 83.3	59.7/ 63.7/ 75.0	59.7/ 52.5/ 60.8	n.a.
26	903210: Thermostats	1.7 (0.0)	5.8 (1.2)	3.8 (52.7)	5.8 (105.3)	A/ (waste-water management, water treatment)/ B/ (management of solid or hazardous waste) D (monitoring, analysis, nature and landscape protection, remediation and clean-up of soil, surface water and groundwater)	65.5/ 65.1/ 60.5	34.4/ 33.8/ 40.2	39.4/ 37.5/ 36.8	n.a.	81.3/ 82.9/ 83.3	59.7/ 63.7/ 75.0	59.7/ 52.5/ 60.8	n.a.

Source: authors' calculations, Trains (2013), Kee et al. (2009), Miroudot et al. (2010), OECD (2005) and Balineau and de Melo (2013). Mean values within income group of countries. Applied MFN tariffs (including AVE) are for 2011.

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Environmental services are classified following the W/120 SSCL: A) Sewage services (CPC Prov. 9401); B) Refuse-disposal services (CPC Prov. 9402) ; C) Sanitation and similar services (CPC Prov. 9403); and D) Other (CPC Prov. 9404; CPC Prov. 9405; CPC Prov. 9406; CPC Prov. 9409). *ES commitments can go from 20 to 100, the higher the index the more committed the sector in GATS or RTAs.

References Annex A (not mentioned in the main text)

Hoekman, B. (1996) "Tentative First Steps: An Assessment of the Uruguay Round Agreement on Services" PRSWP #1455, World Bank

Vikhlyaev, A. (2003) "Environmental Goods and Services: Defining Negotiations or Negotiating Definition", *UNCTAD Trade and Environment Review*, pp. 33-60

Annex B: Extra Figures and Tables

Figure B.1.: Profile of Average Protection Core list (26 products) Environmental Goods vs. other goods 2002-11

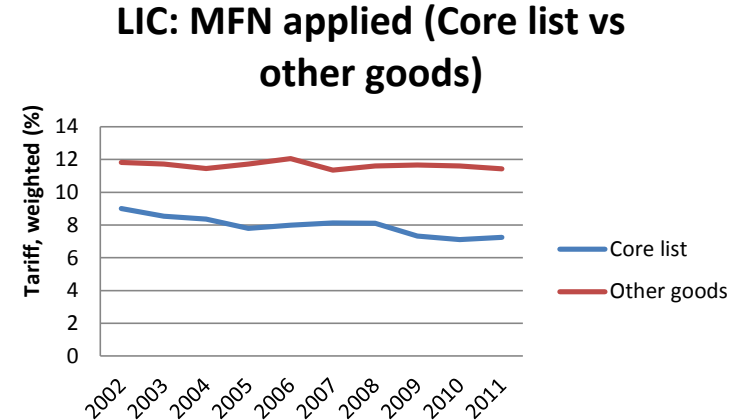
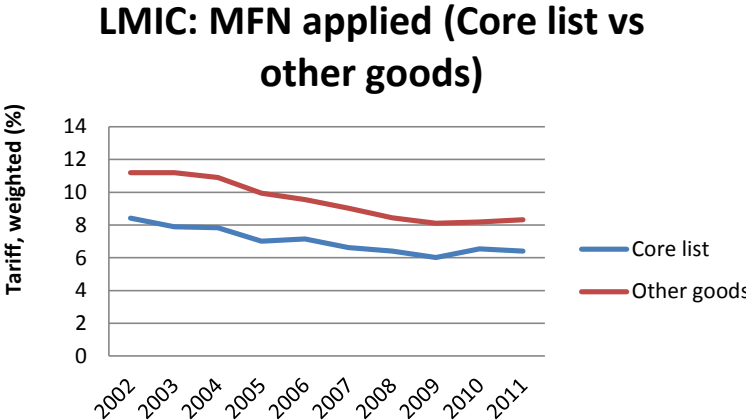
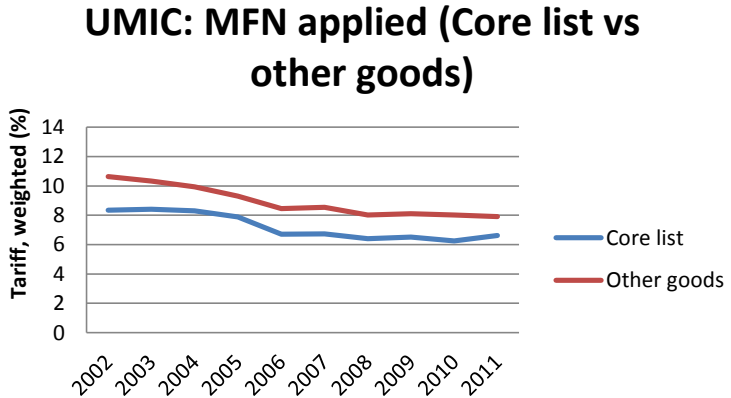
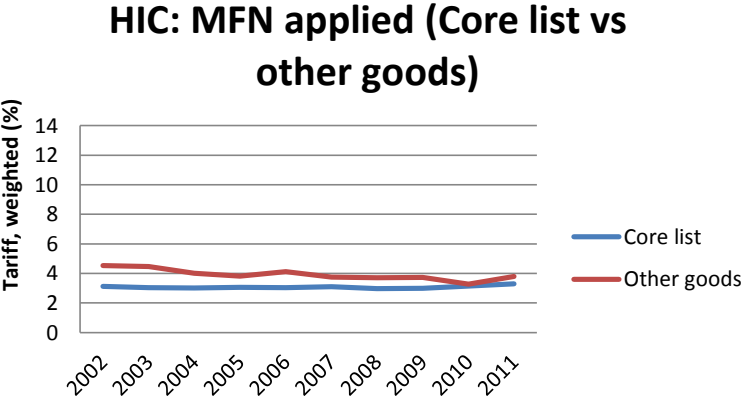
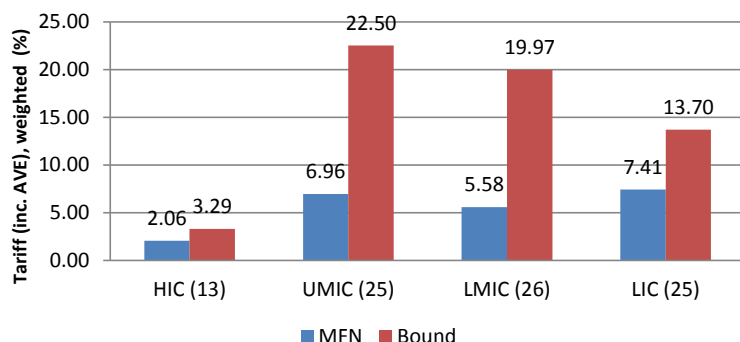
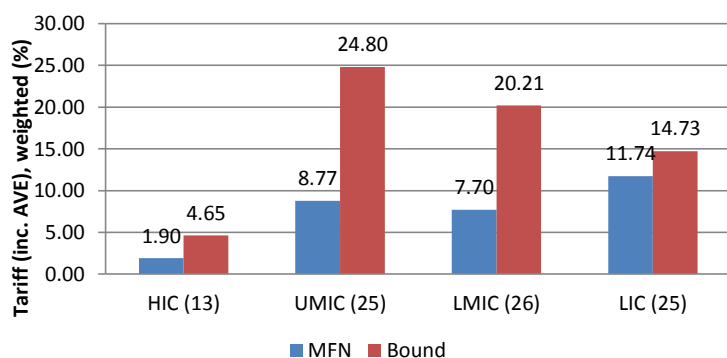


Figure B.2. Applied MFN vs Bound tariffs in 2011 (core list)



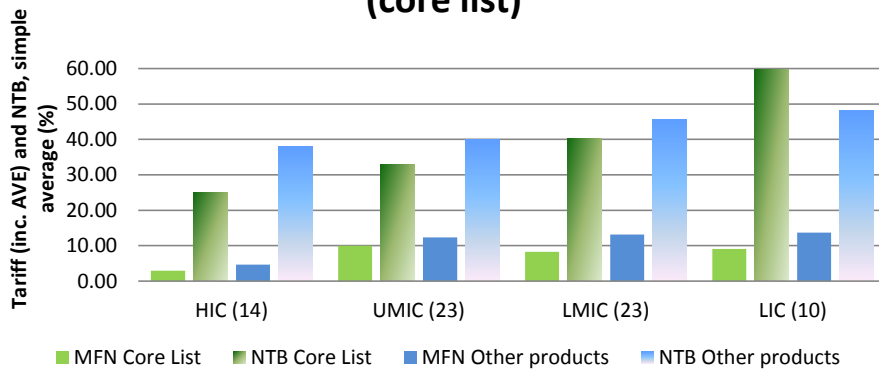
Source: Authors' calculations from BACI (2013), TRAINS (2013), Consolidated Tariff Schedules (2013) and WDI (2013) data. Core list= 26 products. Applied MFN rates (including ad-valorem equivalents) and bound rates are those for 2011 or for the latest available year and are weighted by imports. European Union of 15 = 1 country. 7 oil exporting countries have been excluded.

Figure B.3. Applied MFN vs Bound tariffs in 2011 (WTO list)



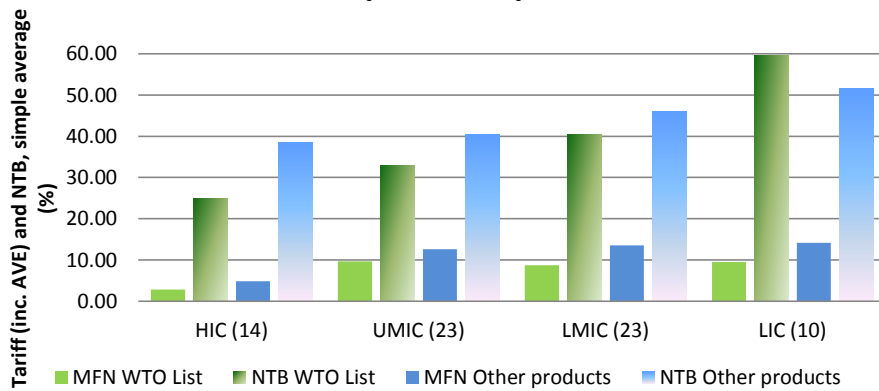
Source: Authors' calculations from BACI (2013), TRAINS (2013), Consolidated Tariff Schedules (2013) and WDI (2013) data. WTO list= 411 products. Applied MFN rates (including ad-valorem equivalents) and bound rates are those for 2011 or for the latest available year and are weighted by imports. European Union of 15 = 1 country. 7 oil exporting countries have been excluded.

**Figure B.4. Applied MFN Tariff vs NTB
(core list)**



Source: Authors' calculations from TRAINS (2013), Kee et al. (2009) and WDI (2013) data. EGs are drawn from the core list. Average values for each income group. Since the AVEs computed by Kee et al. (2009) used data between 2000 and 2004, applied MFN tariffs for 2004 are used.

**Figure B.5. Applied MFN Tariff vs NTB
(WTO list)**



Source: Authors' calculations. TRAINS (2013), Kee et al. (2009) and WDI (2013) data. Values correspond to means over countries within each income group. Since the AVEs computed by Kee et al. (2009) used data between 2000 and 2004, applied MFN tariffs for 2004 are used.

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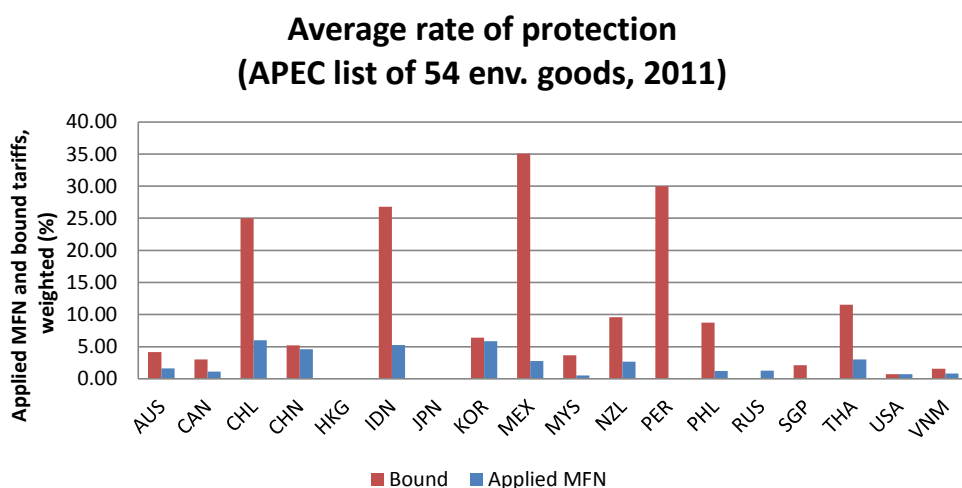
Table B.1.: Average Import Price Elasticities of Demand

Income group	Simple average	Import-weighted
HIC (18)	-3.50 (4.76)	-1.26 (0.32)
UMIC (29)	-1.86 (0.98)	-1.15 (0.17)
LMIC (27)	-1.54 (0.85)	-1.27 (0.67)
LIC (21)	-1.27 (0.24)	-1.18 (0.23)

Source: Authors' calculations. BACI (2013), Kee et al. (2008) and WDI (2013) data.

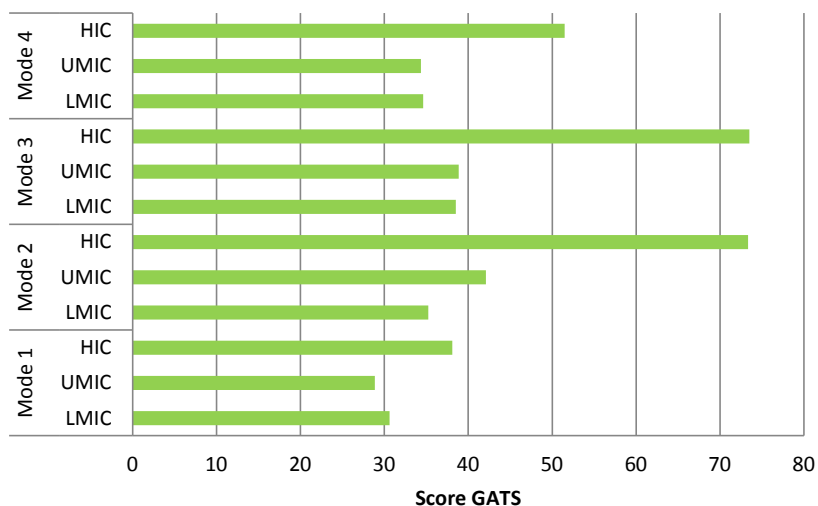
Notes: Core list. Standard deviation in parenthesis. Elasticities are weighted by the value of imports in 2011. From the sample of estimates, 68% of core list elasticities are significantly different from zero at a 10% confidence level (while in the entire sample, 75% of elasticities are significantly different from zero at that confidence level).

Figure B.6.: Applied MFN versus Bound tariffs for APEC countries, APEC list (54 products)



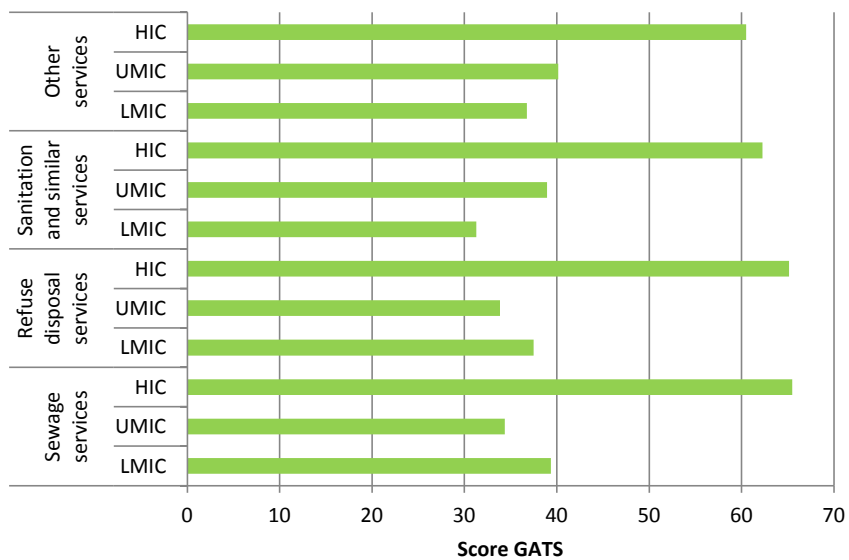
Source: Authors' calculations. BACI (2013), TRAINS (2013), Consolidated Tariff Schedules (2013) and WDI (2013) data. Applied MFN rates (including ad-valorem equivalents) and bound rates are those for 2011 or for the latest available year. Tariffs are weighted by the value of imports.

Figure B.7.: GATS score commitments for environmental services, by Mode of supply



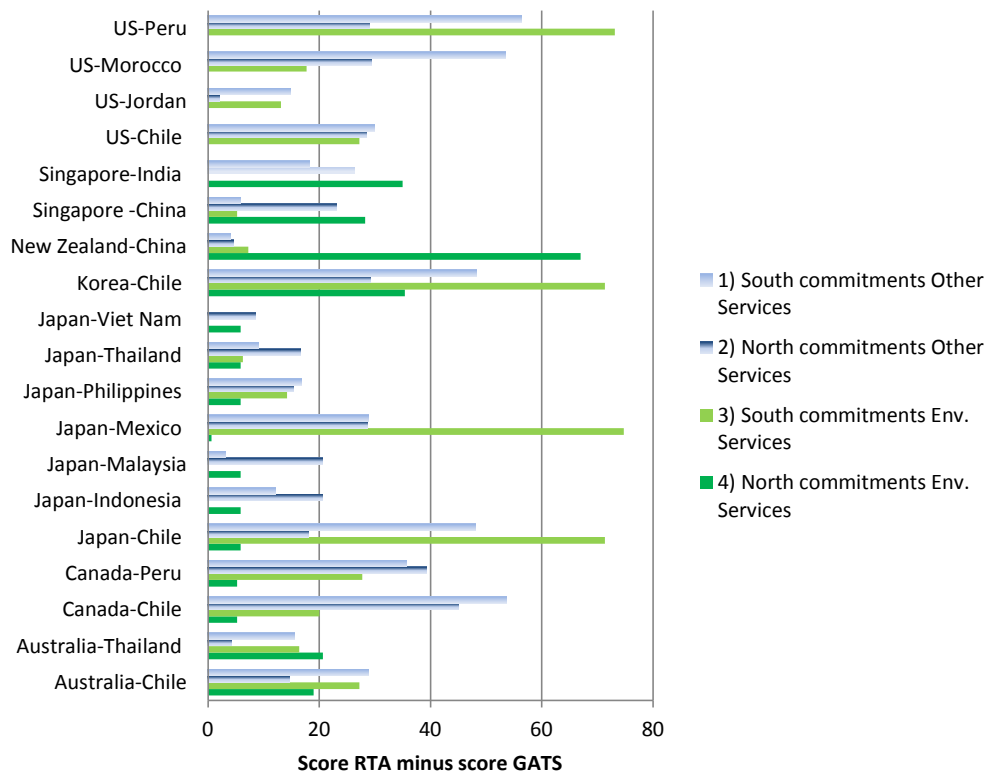
Source: Authors' calculations; Income categories from WDI (2012); HIC (15 countries), UMIC (12 countries), LMIC (10 countries).

Figure B.8.: GATS score commitments for environmental services, by ES sub-sector



Source: Authors' calculations; Income categories from WDI (2012); HIC (15 countries), UMIC (12 countries), LMIC (10 countries).

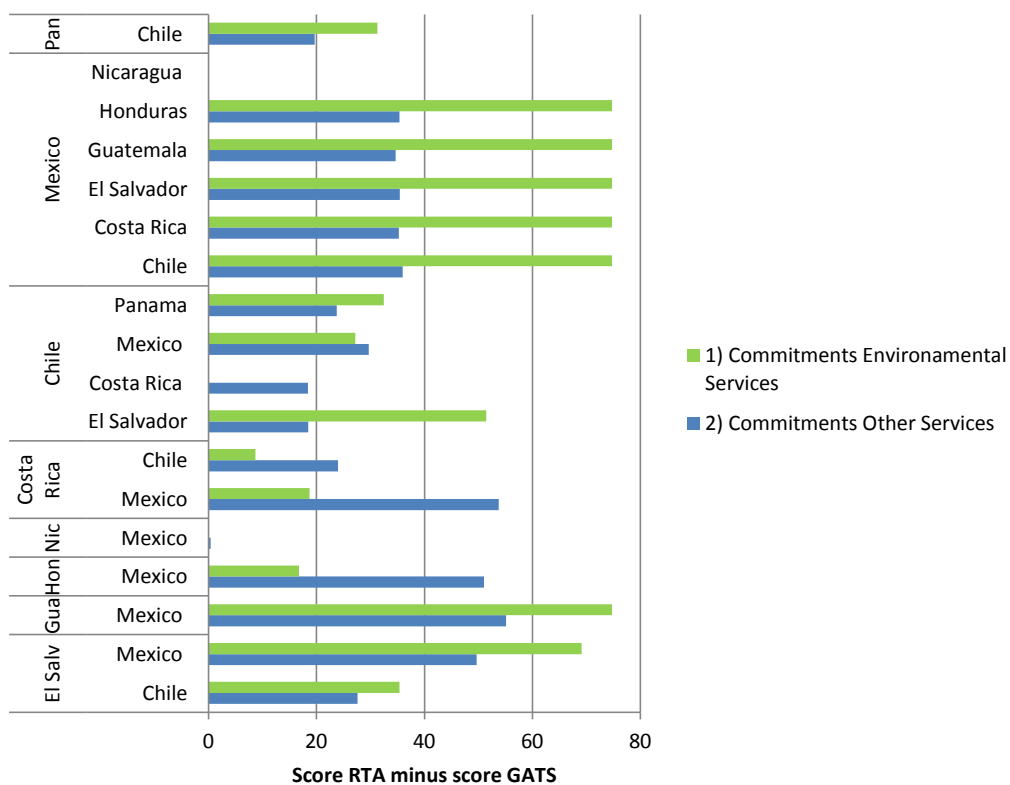
Figure B.9.: North-South Bilateral FTAs: Environmental services commitments vs. Other Services Commitments



Notes: Score reported is the difference RTA score minus multilateral score. All RTAs have greater commitments (positive scores ; higher score means greater commitment). Since no multilateral commitment corresponds to a score of 20 and a maximum commitment (full market access and full national treatment) to a score of 100, the maximum difference is 80. Each bar always follows the same order.

Figure B.10.: South-South Bilateral FTAs: Environmental services commitments vs. Other Services Commitments

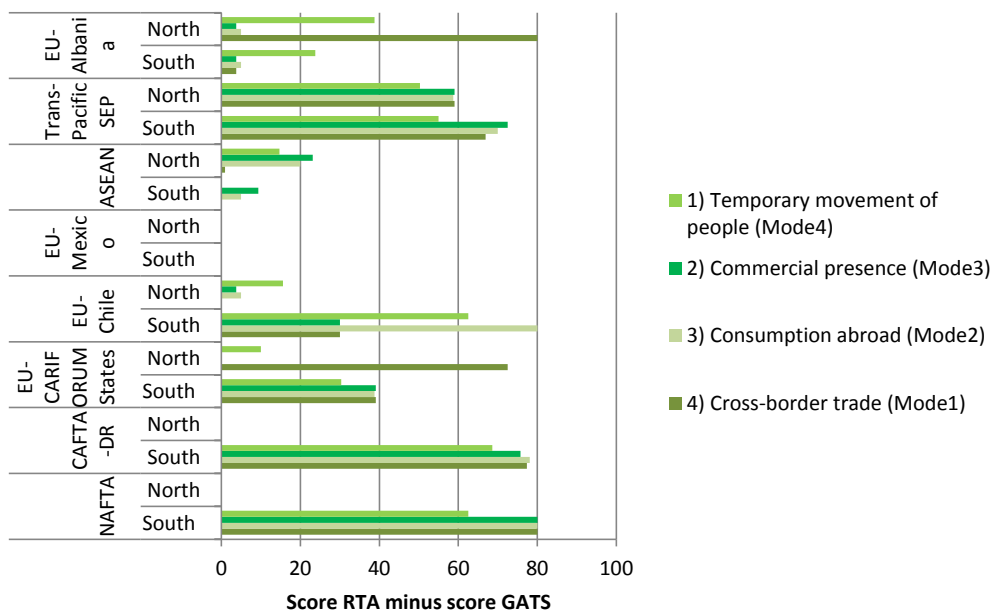
Do South-South FTAs go further in Env. Services liberalization?



Notes: Score reported is the difference RTA score minus multilateral score. The vertical country gives the commitment. All RTAs have greater commitments (positive scores ; higher score means greater commitment). Since no multilateral commitment corresponds to a score of 20 and a maximum commitment (full market access and full national treatment) to a score of 100, the maximum difference is 80. Each bar always follows the same order. A score of zero indicates no difference between the multilateral and regional commitment (e.g. Mexico-Nicaragua).

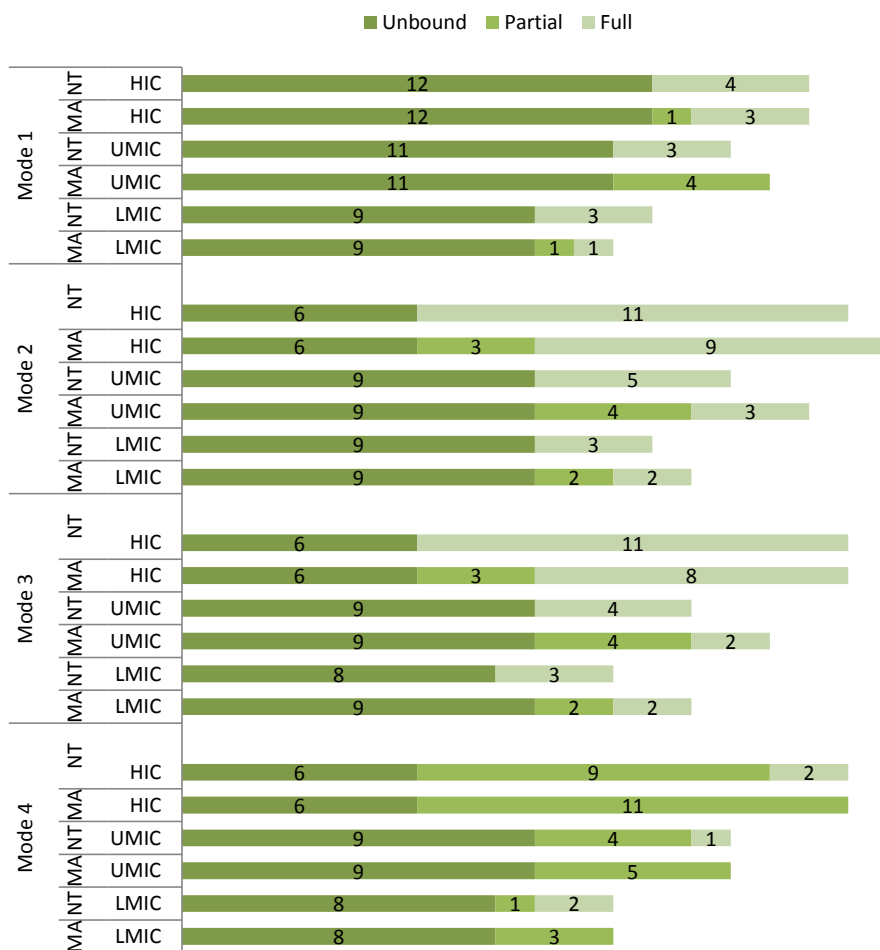
Figure B.11.: North-South Regional FTAs: Environmental services commitments vs. Other Services Commitments (by mode of supply)

Do North-South Regional FTAs go further in Env. Services liberalization? (by Mode of supply)



Notes: Score reported is the difference RTA score minus multilateral score. All RTAs have greater commitments (positive scores ; higher score means greater commitment). Since no multilateral commitment corresponds to a score of 20 and a maximum commitment (full market access and full national treatment) to a score of 100, the maximum difference is 80. Each bar always follows the same order. A score of zero indicates no difference between the multilateral and regional commitment (e.g. North commitments in CAFTA-DR)

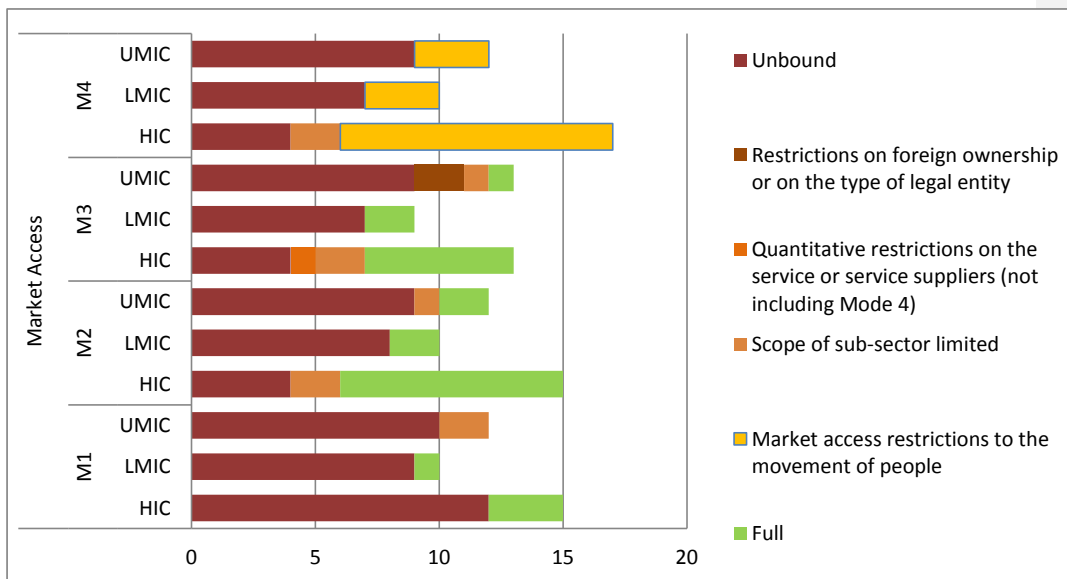
Figure B.12.: Environmental services commitments under GATS, by mode of supply



Source: Authors' calculations; Income categories from WDI (2012); HIC (15 countries), UMIC (12 countries), LMIC (10 countries). Market access (MA), National treatment (NT); Cross-border trade (Mode 1); Consumption abroad (Mode 2); Commercial presence (Mode 3); Temporary movement of people (Mode 4).

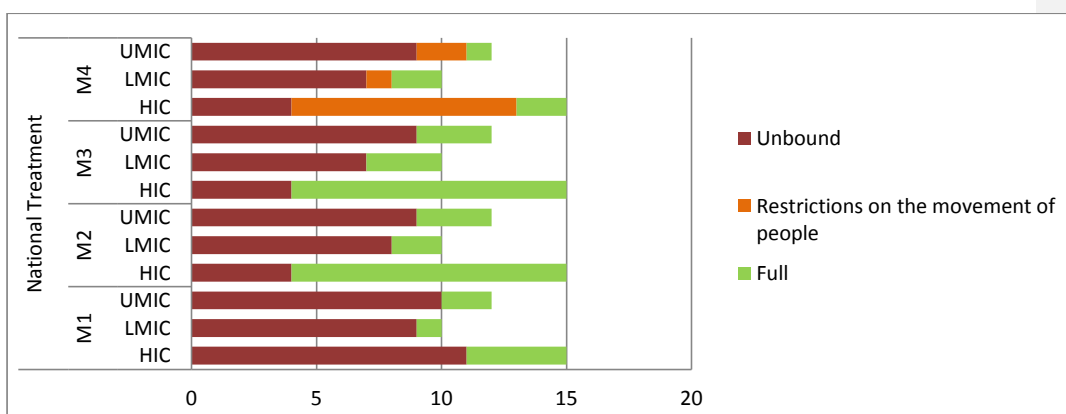
Annex C: GATS Commitments in terms of market access and national treatment, by ES sub-sector and mode of supply

Figure C.1.: Market access commitments under GATS for sewage services, by mode of supply and income group (number of countries)



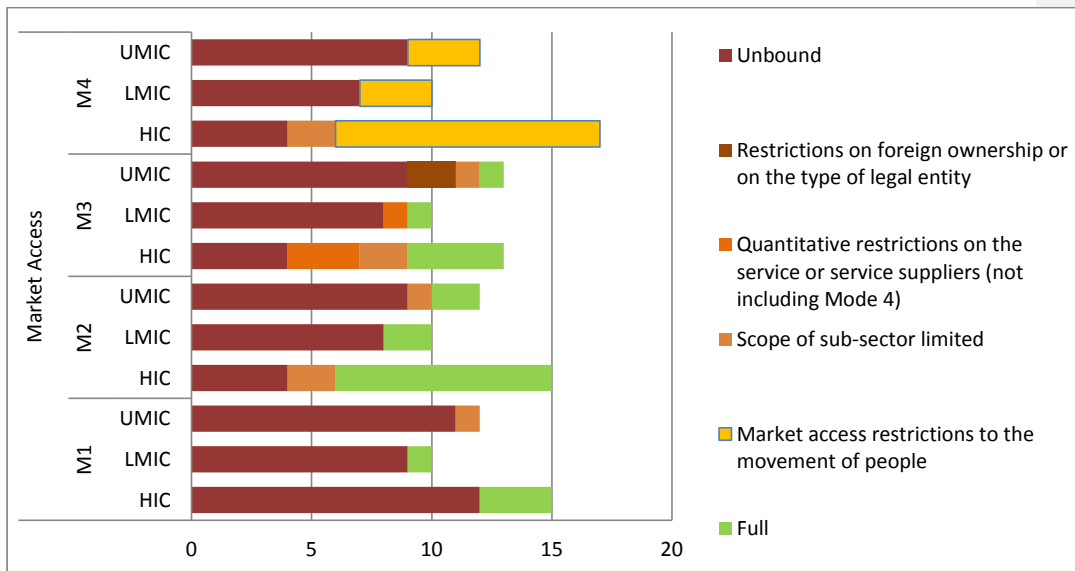
Source: Authors' calculations; HIC (15 countries), UMIC (12 countries), LMIC (10 countries).

Figure C.2: National Treatment commitments under GATS for sewage services, by mode of supply and income group (number of countries)



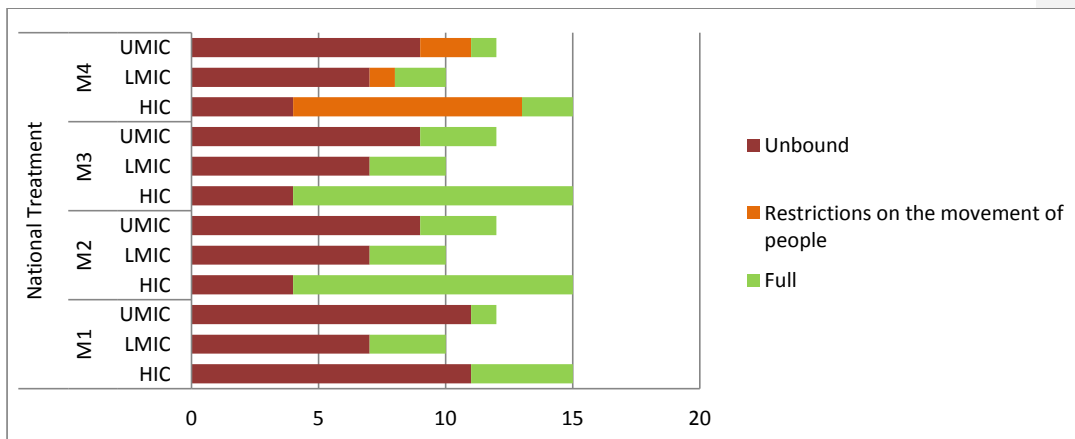
Source: Authors' calculations; HIC (15 countries), UMIC (12 countries), LMIC (10 countries).

Figure C.3: Market access commitments under GATS for refuse disposals services, by mode of supply and income group (number of countries)



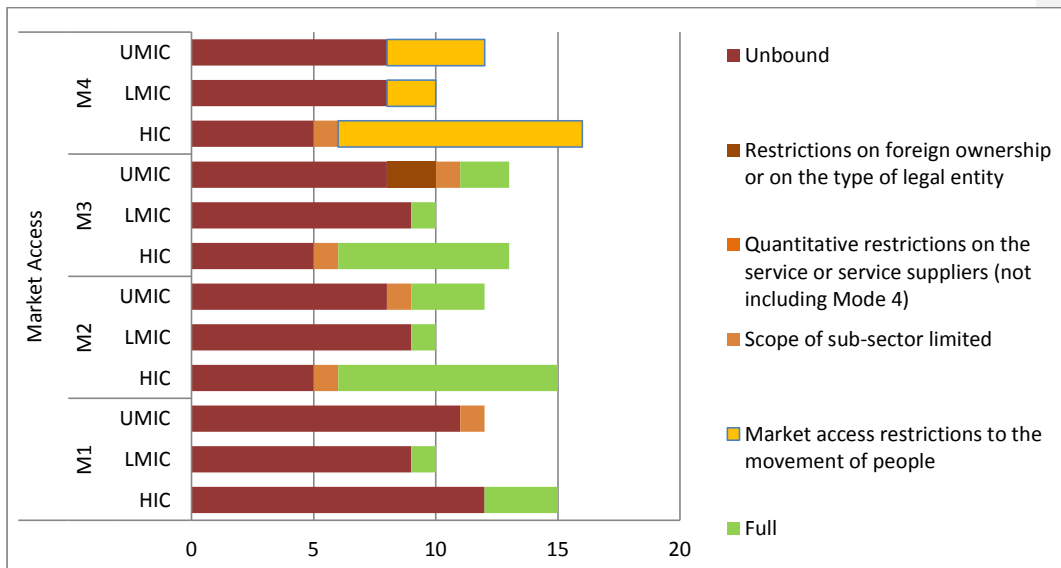
Source: Authors' calculations; HIC (15 countries), UMIC (12 countries), LMIC (10 countries).

Figure C.4: National treatment commitments under GATS for refuse disposals services, by mode of supply and income group (number of countries)



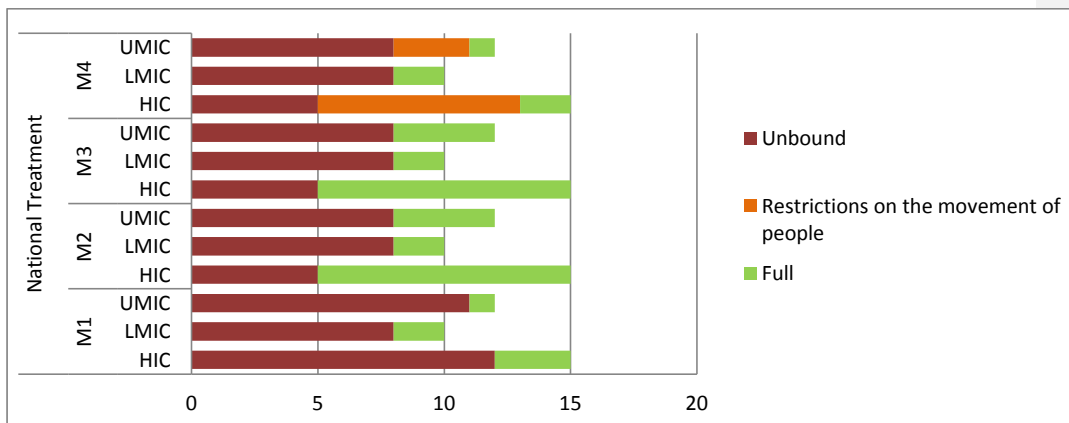
Source: Authors' calculations; HIC (15 countries), UMIC (12 countries), LMIC (10 countries).

Figure C.5: Market access commitments under GATS for sanitation and similar services, by mode of supply and income group (number of countries)



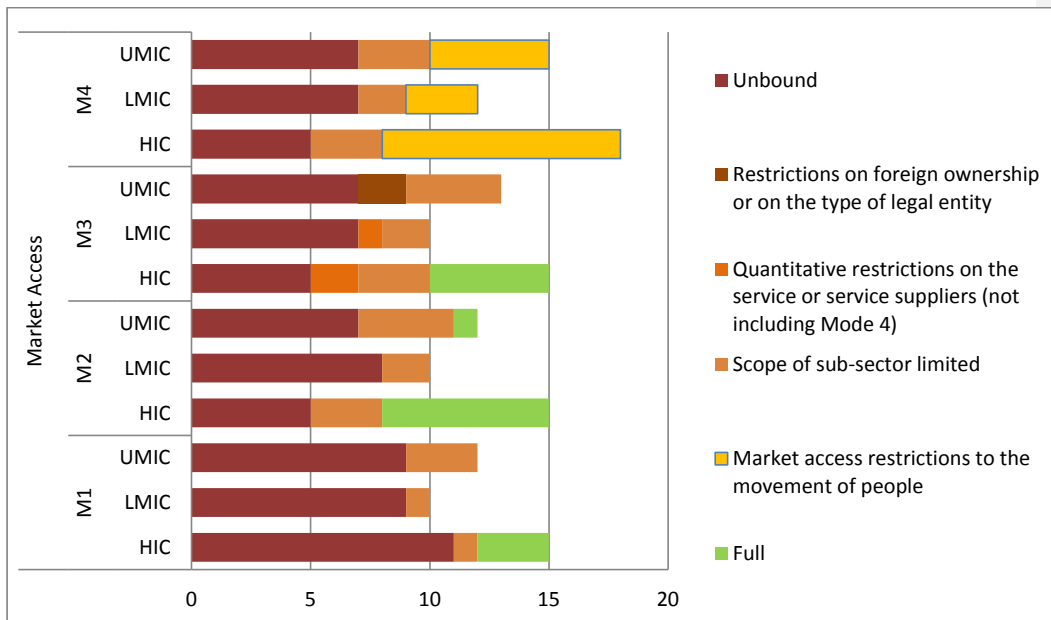
Source: Authors' calculations; Income categories from WDI (2012); HIC (15 countries), UMIC (12 countries), LMIC (10 countries).

Figure C.6: National treatment commitments under GATS for sanitation and similar services, by mode of supply and income group (number of countries)



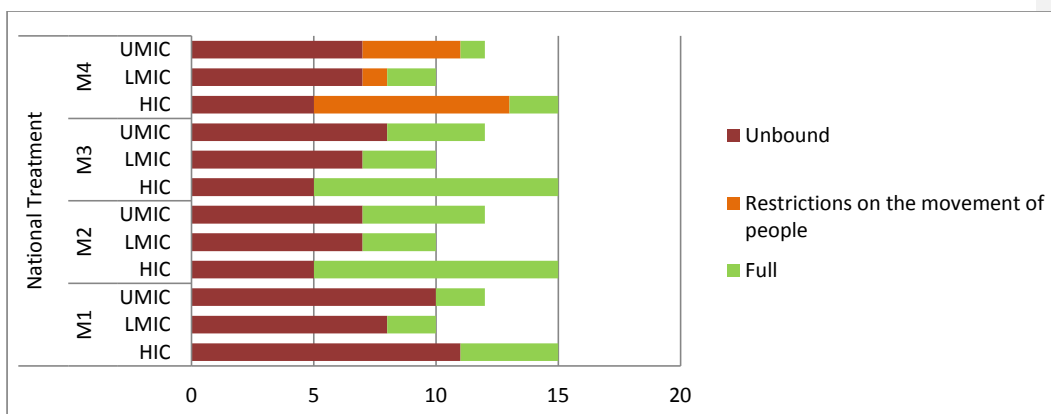
Source: Authors' calculations; Income categories from WDI (2012); HIC (15 countries), UMIC (12 countries), LMIC (10 countries).

Figure C.7: Market access commitments under GATS for other services, by mode of supply and income group (number of countries)



Source: Authors' calculations; Income categories from WDI (2012); HIC (15 countries), UMIC (12 countries), LMIC (10 countries).

Figure C.8: National treatment commitments under GATS for other services, by mode of supply and income group (number of countries)



Source: Authors' calculations; Income categories from WDI (2012); HIC (15 countries), UMIC (12 countries), LMIC (10 countries).

Annex D : GATS and RTAs scores for commitments in environmental services (by RTA)

Country	FTA	GATS score	RTA score	RTA – GATS score	Revenue group
Albania	EU-Albania SAA	90,125	100	9,875	LMIC
Australia	Australia-Chile FTA	66,125	85,125	19	HIC
Australia	Australia-New Zealand	66,125	100	33,875	HIC
Australia	Singapore-Australia F	66,125	93,0625	26,9375	HIC
Australia	Thailand-Australia FT	66,125	86,75	20,625	HIC
Australia	US-Australia FTA	66,125	90,8125	24,6875	HIC
Bahrain	US-Bahrain FTA	20	85	65	HIC
Brunei Daruss	Japan-Brunei Darussal	20	20	0	HIC
Canada	Canada-Chile FTA	89,5	94,75	5,25	HIC
Canada	Canada-Peru FTA	89,5	94,75	5,25	HIC
Canada	NAFTA	89,5	89,5	0	HIC
Chile	Australia-Chile FTA	20	47,1875	27,1875	UMIC
Chile	Canada-Chile FTA	20	40	20	UMIC
Chile	Chile-Costa Rica FTA	20	16,6875	0	UMIC
Chile	Chile-El Salvador FTA	20	71,4375	51,4375	UMIC
Chile	Chile-Mexico FTA	20	47,1875	27,1875	UMIC
Chile	EFTA-Chile FTA	20	46,75	26,75	UMIC
Chile	EU-Chile AA	20	64,75	44,75	UMIC
Chile	Japan-Chile EPA	20	91,375	71,375	UMIC
Chile	Korea-Chile FTA	20	91,375	71,375	UMIC
Chile	Panama-Chile FTA	20	52,4375	32,4375	UMIC
Chile	Trans-Pacific SEP	20	86,4375	66,4375	UMIC
Chile	US-Chile FTA	20	47,1875	27,1875	UMIC
China	China-Singapore FTA	68,5	73,75	5,25	UMIC
China	Mainland and Hong Kon	68,5	68,5	0	UMIC
China	Mainland and Macao CE	68,5	68,5	0	UMIC
China	New Zealand-China FTA	68,5	75,75	7,25	UMIC
Costa Rica	CAFTA-DR	20	91,1875	71,1875	UMIC
Costa Rica	Chile-Costa Rica FTA	20	28,6875	8,6875	UMIC
Costa Rica	Costa Rica-Mexico FTA	20	38,6875	18,6875	UMIC
Croatia	EU-Croatia SAA	81,5	100	18,5	HIC
Dominican Rep	CAFTA-DR	20	96,5	76,5	UMIC
Dominican Rep	EU-CARIFORUM States E	20	76,0625	56,0625	UMIC
El Salvador	CAFTA-DR	25,625	97	71,375	LMIC
El Salvador	Chile-El Salvador FTA	25,625	61	35,375	LMIC
El Salvador	El Salvador-Mexico FT	25,625	94,75	69,125	LMIC
European Unio	EEA	78	100	22	HIC
European Unio	EU-Albania SAA	78	100	22	HIC

Country	FTA	GATS score	RTA score	GATS – RTA score	Revenue group
European Unio	EU-CARIFORUM States E	78	88,25	10,25	HIC
European Unio	EU-Chile AA	78	85,0625	7,0625	HIC
European Unio	EU-Croatia SAA	78	100	22	HIC
European Unio	EU-FYROM SAA	78	100	22	HIC
European Unio	EU-Mexico EPA	78	78	0	HIC
European Unio	European Union	78	100	22	HIC
FYROM	EU-FYROM SAA	78	100	22	UMIC
Guatemala	CAFTA-DR	20	97	77	LMIC
Guatemala	Guatemala-Mexico FTA	20	94,75	74,75	LMIC
Honduras	Honduras-Mexico FTA	20	36,75	16,75	LMIC
Iceland	EEA	84,125	100	15,875	HIC
Iceland	EFTA-Mexico FTA	84,125	84,125	0	HIC
India	India-Singapore CECA	20	20	0	LMIC
Indonesia	Japan-Indonesia EPA	20	20	0	LMIC
Jamaica	EU-CARIFORUM States E	20	36,75	16,75	UMIC
Japan	Japan-Brunei Darussal	80,875	81,5	0,625	HIC
Japan	Japan-Chile EPA	80,875	86,75	5,875	HIC
Japan	Japan-Indonesia EPA	80,875	86,75	5,875	HIC
Japan	Japan-Malaysia EPA	80,875	86,75	5,875	HIC
Japan	Japan-Mexico EPA	80,875	81,5	0,625	HIC
Japan	Japan-Philippines EPA	80,875	86,75	5,875	HIC
Japan	Japan-Singapore EPA	80,875	86,75	5,875	HIC
Japan	Japan-Switzerland EPA	80,875	94,75	13,875	HIC
Japan	Japan-Thailand EPA	80,875	86,75	5,875	HIC
Japan	Japan-Viet Nam EPA	80,875	86,75	5,875	HIC
Jordan	US-Jordan FTA	48,875	62	13,125	UMIC
Korea	ASEAN-Korea FTA	57,5	65,375	7,875	HIC
Korea	EFTA-Korea FTA	57,5	61	3,5	HIC
Korea	Korea-Chile FTA	57,5	92,875	35,375	HIC
Korea	Korea-Singapore FTA	57,5	83,75	26,25	HIC
Malaysia	ASEAN-Korea FTA	20	20	0	UMIC
Malaysia	Japan-Malaysia EPA	20	20	0	UMIC
Mexico	Chile-Mexico FTA	20	94,75	74,75	UMIC
Mexico	Costa Rica-Mexico FTA	20	94,75	74,75	UMIC
Mexico	EFTA-Mexico FTA	20	20	0	UMIC
Mexico	EU-Mexico EPA	20	20	0	UMIC
Mexico	El Salvador-Mexico FT	20	94,75	74,75	UMIC
Mexico	Guatemala-Mexico FTA	20	94,75	74,75	UMIC
Mexico	Honduras-Mexico FTA	20	94,75	74,75	UMIC
Mexico	Japan-Mexico EPA	20	94,75	74,75	UMIC

Country	FTA	GATS score	RTA score	GATS – RTA score	Revenue group
Mexico	Mexico-Nicaragua FTA	20	20	0	UMIC
Mexico	NAFTA	20	94,75	74,75	UMIC
Morocco	US-Morocco FTA	63,75	81,4375	17,6875	LMIC
New Zealand	Australia-New Zealand	20	100	80	HIC
New Zealand	New Zealand-China FTA	20	87	67	HIC
New Zealand	New Zealand-Singapore	20	94,75	74,75	HIC
New Zealand	Trans-Pacific SEP	20	92,8125	72,8125	HIC
Nicaragua	Mexico-Nicaragua FTA	20	20	0	LMIC
Norway	EEA	81,5	100	18,5	HIC
Norway	EFTA-Chile FTA	81,5	90,75	9,25	HIC
Norway	EFTA-Korea FTA	81,5	94	12,5	HIC
Norway	EFTA-Mexico FTA	81,5	81,5	0	HIC
Norway	EFTA-Singapore FTA	81,5	81,5	0	HIC
Oman	US-Oman FTA	89,5	94	4,5	HIC
Panama	Panama-Chile FTA	29	60,25	31,25	UMIC
Peru	Canada-Peru FTA	20	47,75	27,75	UMIC
Peru	US-Peru TPA	20	93,125	73,125	UMIC
Philippines	ASEAN-Korea FTA	20	30,75	10,75	LMIC
Philippines	Japan-Philippines EPA	20	34,1875	14,1875	LMIC
Singapore	ASEAN-Korea FTA	20	48,25	28,25	HIC
Singapore	China-Singapore FTA	20	48,25	28,25	HIC
Singapore	EFTA-Singapore FTA	20	50	30	HIC
Singapore	India-Singapore CECA	20	55	35	HIC
Singapore	Japan-Singapore EPA	20	55	35	HIC
Singapore	Korea-Singapore FTA	20	66,75	46,75	HIC
Singapore	New Zealand-Singapore	20	55	35	HIC
Singapore	Singapore-Australia F	20	69,0625	49,0625	HIC
Singapore	Trans-Pacific SEP	20	60	40	HIC
Singapore	US-Singapore FTA	20	66,75	46,75	HIC
Switzerland	EFTA-Chile FTA	67,5	67,5	0	HIC
Switzerland	EFTA-Korea FTA	67,5	77,3125	9,8125	HIC
Switzerland	EFTA-Mexico FTA	67,5	67,5	0	HIC
Switzerland	EFTA-Singapore FTA	67,5	67,5	0	HIC
Switzerland	Japan-Switzerland EPA	67,5	92,8125	25,3125	HIC
Thailand	ASEAN-Korea FTA	77,625	83,875	6,25	UMIC
Thailand	Japan-Thailand EPA	77,625	83,875	6,25	UMIC
Thailand	Thailand-Australia FT	77,625	94	16,375	UMIC
US	CAFTA-DR	94	94	0	HIC
US	NAFTA	94	90,25	0	HIC
US	US-Australia FTA	94	94	0	HIC
US	US-Bahrain FTA	94	94	0	HIC
US	US-Chile FTA	94	94	0	HIC
US	US-Jordan FTA	94	94	0	HIC
US	US-Morocco FTA	94	94	0	HIC

Country	FTA	GATS score	RTA score	GATS – RTA score	Revenue group
US	US-Oman FTA	94	94	0	HIC
US	US-Peru TPA	94	94	0	HIC
US	US-Singapore FTA	94	87,25	0	HIC
Viet Nam	ASEAN-Korea FTA	62,75	62,75	0	LMIC
Viet Nam	Japan-Viet Nam EPA	62,75	62,75	0	LMIC

Source: Authors' calculations from Miroudot et al. (2010) data.