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What Has Been Left to Multilateralism to Negotiate On?

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Highlights

- MFN tariffs were cut by one third between 2001 and 2013, more than half of it as a result of countries' own initiatives.
- Regionalism has only cut marginally applied tariff duties worldwide, by 0.3 p.p. on average between 2001 and 2013.
- If concluded, on-going RTA negotiations may lift the share of world trade between RTA partners beyond 50%.
- Trade policy changes between 2001 and 2013 have divided by more than two the worldwide welfare gains to be expected from the tariff-cutting provisions of hypothetical Doha Agreement. Would all on-going RTA negotiations be concluded, expected gains would decline until one third of their 2001 level.

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Abstract

This paper proposes a unique overview of trade policies trends since the launch of the Doha Round, based on detailed data on tariffs and trade covering 130 countries. We show that regionalism has delivered limited effective liberalization so far, only originating a 0.3 percentage point (p.p.) cut in the worldwide average applied tariff duty between 2001 and 2013. WTO commitments (1.0 p.p. average cut) and unilateral liberalizations on an MFN basis (1.3 p.p.) mattered far more on average, with more uneven consequences. As a result, we reckon that trade policy changes between 2001 and 2013 have divided by three the worldwide welfare gains to be expected from the tariff-cutting provisions of hypothetical Doha Agreement. Would all on-going RTA negotiations be concluded, expected gains would decline until one quarter of their 2001 level.

Keywords: regional trade agreements, unilateral liberalization, Doha Development Agenda, WTO.

JEL: F10, F13, F14

1. Introduction

Fifteen years after the launch of the Doha Development Agenda (DDA), the successive multilateral agreements reached in Bali (2013) and in Nairobi (2015) cover only a tiny share of the initial working program. Their formal implementation, after shaky debates, remains moreover complicated: Bali's package on trade facilitation is not yet ratified by the required two-thirds majority. And prospects of reaching a wider agreement seem remote, to say the least. This stalemate is all the more striking given that there has been no shortage of trade policy reform during that period. Either as a result of their own policy initiatives or of their commitments upon World Trade Organization (WTO) accession, a number of countries have significantly liberalized access to their market —China and India being cases in point. Regional Trade Agreements (RTAs) have multiplied, up to a point where they are taking centre stage in the trade policy arena. Meanwhile, the number of preferential agreements quadrupled in twenty years, and ongoing negotiations between very large economic entities —the so-called mega-deals— could change dramatically the trade landscape. The varied nature of these crisscrossing policy changes (even the scope and depth of RTAs strongly differ from one another, as we document below) makes it difficult to understand how they redefined the trade policy landscape, and what the consequences may be in the near future, as illustrated by the differing interpretations offered: for instance, while Hufbauer and DeRosa (2007) emphasize that "global tariff-cutting over the past decade was dominated by preferential trade agreements", Krishna (2012) concludes instead that "the actual amount of liberalization that has been achieved through PTAs [Preferential Trade Agreements] is actually quite limited".

Against this background, this paper aims at addressing two questions: How do all these policy changes add up? What are their consequences, for trade, welfare and for multilateral negotiations?

Dealing with the first question requires providing a consistent overview encompassing the different policies at stake. To do this, we focus on tariff protection. Clearly, tariffs are not the only impediment to market access, and non-tariff measures are increasingly important. The growing emphasis on rules in trade agreements, already evident in the Marrakesh Agreement, is a consequence of this trend. However, the trade restrictiveness impact of non-tariff measures (NTMs) is not directly observable, and its assessment raises considerable methodological and data issues. Sophisticated analyses have been carried out to assess their trade impact, for instance through ad-valorem equivalent (AVE) estimations (Kee et al., 2009 is an example), through assessment of the NTM provisions in RTAs (e.g., Cadot and Gourdon, 2015), or by estimating the firm-level impact of NTMs on exports (Fontagné et al., 2015). While each of these approaches provides useful insights, we do not feel any of them can yet be considered an undisputable basis suitable to provide a robust, comparable and reliable assessment of the trade restrictiveness of NTMs worldwide, let alone of how they evolved over time or of how regional agreements influenced them. While restrictive, the focus on tariff protection allows us to rely upon an indisputable and consistent basis in measuring and comparing trade policy changes. Clearly, though, non-tariff issues remain of central

importance when thinking about the ensuing consequences. Due to data limitations, our focus is also restricted to tariffs applied on a permanent, as opposed to temporary, status. Contingent protection, well described in recent works (e.g., Bown, 2011) should also be taken into account to get the full picture of trade policy changes. While it is increasingly well documented,¹ available data did not make it possible to cover the period and countries considered here in a fully exhaustive and consistent way.

To carry out this broad assessment of the trade policy landscape through tariff protection, we put together an unparalleled database of product-level, consistent information about tariff protection worldwide, since 2001 up until the hypothetical situation where agreements now under negotiation would be signed and fully enforced. Country by country, partner by partner, the same method is used to compute bilateral *ad valorem* equivalent tariffs encompassing all protection components, across the different years considered. The different dimensions of tariff protection are taken into account, making it possible to disentangle commitments under the multilateral system, concessions in the context of reciprocal and non-reciprocal trade preferences, and countries' own trade policy choices. In addition to trade policies observed up until 2013, we also take into account on-going negotiations and their possible outcome, were they concluded. The tariff-cutting impact of a hypothetical multilateral agreement is also evaluated based on a product-by-product application of the latest circulated modalities. This uniquely detailed historical dataset makes it possible to provide with a comprehensive picture of multilateralism, regionalism and unilateralism² over a relatively long period.

Reflecting about the consequences of these policy changes reminds the hot debates already held in the 1990s, about whether regional agreements would be “stepping stones or stumbling blocks” for multilateralism. Some, like Bhagwati (1991) and Krugman (1991a), viewed regional agreements as potentially undermining the economic rationale for multilateral liberalization. Others, like Bergsten (1991), and Summers (1991), considered every liberalization (every “ism”), whatever its form, to be a step forward, paving the way for worldwide trade liberalization. An extensive literature has developed, analyzing the multiple mechanisms through which regional agreements may erode opposition to further liberalization, but also undercut incentives to engage in further trade reform (see Baldwin and Freund, 2011, for a survey). Despite its elaboration, this sum of works is not fully conclusive regarding the question asked above. The 1990s' literature was mainly theoretical, spelling out a number of mechanisms and results, finally showing that the influence of regionalism upon multilateralism could be mixed. More recently, applied investigations have been carried out, but they reached contrasting results, in accordance with the theoretical analysis showing the variety of possible mechanisms at stake. While several studies, in particular Estevadeordal et al. (2008), find that preferential agreements may favor multilateral liberalization, Limão (2006) and Karacaovali and Limão (2008) find the opposite for the EU and the US. The latter result is presumably linked to the different nature of the trade

¹ In particular, the World Bank's Temporary Trade Barriers database has vastly improved the quality and consistency of information available in this regard.

² “Unilateralism” refers here to liberalization at a country's own initiative.

agreements sealed by these two blocs, which likely aim *inter alia* at extracting non-trade benefits from their partners. Still, it remains difficult to reach a firm conclusion based on this literature, which in addition focuses on episodes differing significantly from the present predicament.

In the present context, the question of the consequences of unilateralism and regionalism for multilateralism thus remains essentially an empirical one. Addressing it first requires evaluating in-force and planned policies. An additional question, reminiscent of Krugman's (1991b) "Is bilateralism bad?", is about the welfare consequences of this accumulation of regional agreements. This question of welfare implications is also raised regarding unilateral liberalization, since it is difficult to infer a consistent appreciation of the global picture resulting from the accumulation of country-specific policy reforms.

General equilibrium model simulations are used to assess the impacts on trade and welfare of these various policy changes, as well as the consequences for the potential benefits to be drawn from a multilateral agreement. By doing so, we are able to evaluate to what extent the spread of regionalism may have eroded, or in some cases renewed, economic incentives to conclude the round.

The paper is organized as follows. Section 2 describes trade policies in the XXIst century, through tariffs and trade, and disentangles regional and unilateral contributions to liberalization since the turn of the century. Section 3 quantitatively assesses the interaction between regionalism, unilateralism and multilateralism, using model-based simulations. Concluding remarks are provided in the last section.

2. A quantified overview of trade policies in the XXIst century

In order to build a quantified summary picture of the various trade policy changes which have occurred since the turn of the century, we focus on tariffs and trade worldwide and build a detailed database, described below. Equipped with this unique tool, we successively review the main motives underlying trade policy changes: commitments in the multilateral arena, countries' own initiatives, and reciprocal trade agreements. A summary assessment of the consequences for world protection is then proposed.

2.1. Data, methodology and global preview

Our data work aims at documenting consistently tariff protection and trade at the 6 digit level of the United Nation's harmonized system (hereafter HS6, in its 1996 revision, featuring 5,113 products), for 130 importing countries (the European Union being considered as a single entity), over the period 2001-2013. It includes in addition an evaluation of the likely outcome of trade agreements presently under negotiation. Yearly bilateral trade flows at the HS6 level are drawn from CEPII's BACI database (Gaulier and Zignago, 2010), which is itself based on UN's COMTRADE database.

Tariff protection is measured every third year. For each country and each product, we distinguish the following concepts of tariff duty, which we collectively refer to as the "tariff ladder":

- (i) the bound duty, sometimes also called "bound MFN", or consolidated duty, i.e. the ceiling a country committed not to exceed, under the WTO;
- (ii) the "unilaterally applied" duty is the duty applied on an MFN basis, or as a result of non-reciprocal preferences.³ It is unilateral, in the sense of being set as a result of each country's own initiative (even though commitments taken in multilateral agreements may restrict their room for maneuver), as opposed to reciprocal commitments taken in the context of an RTA;⁴
- (iii) the preferential applied duty, additionally taking into account lower protection committed to under RTAs, i.e. reciprocal preferential agreements.
- (iv) the post-DDA applied duty, referring to the level of applied duty which would result from applying a hypothetical a Doha Round agreement, along the lines defined the most detailed modalities circulated during the negotiations.⁵

For bound duties, the information is drawn from WTO's Consolidated Tariff Schedules (CTS) database, based on Bchir et al. (2006) treatment, updated as needed (in particular to account for recent accession protocols). WTO commitment schedules define a final bound duty and a phase-in period, sometimes with intermediate objectives.

In order to make comparisons meaningful across tariff protection concepts and over time, we need this database to be exhaustive. This requires filling it in two cases, where bound duties are not defined. Firstly, some WTO members' non-agricultural products remain unbound. In the Doha Round negotiations, such cases were tackled computing base rates, used as an equivalent of initial bound tariffs. In the rev. 4 modalities, base rates are computed adding 25 p.p. to the MFN applied duty. We adopt this convention to complete our database in such cases. The second case where bound duties are not defined is when the country is not member of the WTO. In this case, product by product, the highest rate applied outside RTAs

³ Partners not members of the WTO sometimes apply tariffs higher than the MFN. This non-MFN tariff is taken into account in this case.

⁴ RTAs are reciprocal arrangements, whereby partner countries sign mutually binding commitments. By contrast, non-reciprocal preferential schemes, such as Generalized Systems of Preferences (GSPs) and their special schemes for least developed countries, are granted unilaterally and do not bind the countries granting them with respect to their partners. In this sense, they are not contractual in nature. They are set unilaterally and driven by development-oriented motivations.

⁵ For post-DDA tariffs, we use as a reference the latest draft modalities circulated by negotiations committee's chairman, namely revision 4 of 2008 modalities for agricultural and non-agricultural market access (WTO 2008a, 2008b). For each HS6 product, the relevant tariff-cutting formula is applied to the existing bound tariff to compute the new bound. The new applied tariff is then the minimum between the formerly applied tariff and this new bound. This is done taking into account each country status (developed, developing, LDCs, (very) recently acceded members, small and vulnerable economies, etc.). In accordance with the modalities, 4% sensitive products (selected using Jean's et al. 2011 method) are entitled to a more flexible treatment for developed countries, and a third more for developing countries. Special products are also taken into account in accordance with modalities. Quotas open in compensation are not taken in consideration, though.

over the period is used as an equivalent of bound duty.⁶ Indeed, such non-preferential tariff can be viewed as an upper bound when considering the prospect of a hypothetical accession, since WTO accession protocols generally involve consolidating protection at a level inferior on average to the one previously applied. Taking the highest level over the period also means that these pseudo-bound duties are constant over time.

In the Marrakesh Agreement, the phase-in period for tariff schedules ended in 2000 for developed countries and in 2004 for developing countries. Beyond marginal changes linked to renegotiations, bound tariffs thus remained constant throughout the period studied here for developed countries who were founding members of the WTO. Although this is not the case for developing countries and newly acceded members, we do not have information about the yearly phase-in schedule of their commitments. For each product, we thus assume the bound duty in a given year to be the maximum between the MFN applied and the final bound rate. This assumption may entail some approximations about yearly changes (although not about the final level), but only in the sense of overstating the speed of enforcement of committed cuts in bound rates, and only in cases where the cut is not binding for applied MFN duties (in such case, the final bound rate will be assumed to be implemented as of 2001, even when, in practice, its implementation is gradual). Given these conventions, the changes over time that we measure for bound tariffs are effectively binding for tariffs applied on an MFN basis.

Preferential applied duties must be measured not only at the product level for each country, but also separately for each partner (or at least each preferential regime), in order to take preferential regimes into account. With 130 countries and more than 5,000 products, this is challenging. To do this, we mainly rely upon the source data of MACMap-HS6 databases (ITC and CEPII) for years 2001, 2004 and 2007 (Guimbard et al., 2012). Additional, comparable source data from ITC are used for years 2010 and 2013.⁷ Where a tariff-rate quota (TRQ) applies, we only consider the outside-quota tariff rate. Because many countries apply specific, compound or mixed tariffs (e.g., Switzerland, EU, Japan), AVEs of these tariffs were also computed at the product level. Following Bouët et al. (2008) methodology, the conversion of specific duties into ad-valorem duties makes use of median unit values computed for exports of a reference group, instead of the exporting country itself. This approach minimizes the bias due to the so-called "shipping the good apples out" effect (Alchian and Allen, 1964), whereby higher specific tariff leads to export higher quality products. Similarly, when AVEs need to be aggregated up, the weights used are computed as shares in exports of a reference group instead of the exporting country itself, so as to limit the endogeneity bias ensuing from the observed inverse correlation between tariff levels of and trade flows. In order to prevent changes in trade patterns from blurring our analysis of trade policies, the same unit values and weighting schemes, computed using a three year-

⁶ Even though countries not members of the WTO are not bound by the MFN principle, they usually apply the same duty rate to their partners, outside RTAs. If different rates are applied, we take into account the higher one applied to at least three different partners.

⁷ We are indebted to Xavier Pichot and Mondher Mimouni (ITC) for making these data available to us.

average (2011-2013) statistics, are used for the sake of calculation and aggregation of ad valorem equivalents, whatever the year concerned.⁸

Applied MFN rates are retrieved from this applied preferential duties database, as the highest rate applied to at least three partners members of the WTO.⁹

Given the large number of trade agreements under negotiation, some of them of prominent importance, we also wanted to shed light on the possible consequences of their conclusion. The exact content of these would-be agreements cannot be known yet, and we have emphasized above (and will illustrate below) that their scope and depth varies widely across agreements. In theory, Grossman and Helpman (1995) show that, for a given sector, the likeliness to be exempted from liberalization commitments within an agreement depends upon a weighted sum of the impacts liberalization would entail on the sector's profits and on the economy's welfare. The relative weight of these two objectives depends upon the government's objective function. In practice, it also depends upon the capacity for a given sector to influence decision makers. This theoretical analysis makes it difficult to devise the precise form forthcoming agreements might take, but it suggests that potentially excluded sectors are those for which a fairly high initial protection level has a significant influence upon profits. While the influence of bilateral liberalization upon profits depends upon the competitiveness of the partner country's producers in the sector concerned, it follows that a given country is likely to focus on the protection of a given subset of sectors in most of its agreements.

Put differently, the pattern of protection remaining within an RTA is likely to depend mainly upon the importing country, and its willingness to protect a small set of sensitive products. To check whether this presumption is borne out by the data, we analysed the pattern of preferential tariff duties applied by countries with at least five RTAs in force.¹⁰ For each country, we ran a regression including only product dummies as independent variables to assess to what extent their distribution can be explained by the product dimension only, irrespective of the partner (See Table A1 in Appendix). Countries for which the predictive power of the product dimension is low include small countries (with R-squared statistics equal to 13% for Chile, 16% for Albania, 43% for Guatemala, 47% for Tunisia), presumably because their low bargaining power lead them to be more flexible in setting concessions schedules; they also include larger developing countries like China and India (respectively, 47% and 58%), which have tended so far to include an extensive list of sensitive products in their agreements, the definition of which was tailored to the ambition and specificity of each agreement. Still, the global picture remains supportive of the above mentioned presumption, with only 3 countries for which the product dimension explains less than 40% of the total

⁸ Using instead computations based on average statistics over the 2001-2013 period does not alter significantly the results.

⁹ Requesting that at least three different partners apply this same level allows preventing an exceptional regime from being considered as the MFN duty.

¹⁰ Looking for any specific pattern would make little sense for countries with a very low number of RTAs.

variance, and 11 out of the 22 countries considered, where it explains more than 90% of the total variance. This is particularly true for large, developed countries, with R-squared equal to 95% for the US, and larger than 99% for the EU, Switzerland and Japan.

In order to evaluate the possible consequences of forthcoming trade agreements, we thus make the assumption that, for each product, each partner will apply in its future agreements the average of the preferential tariffs it is applying in its agreements in force for more than five years.¹¹

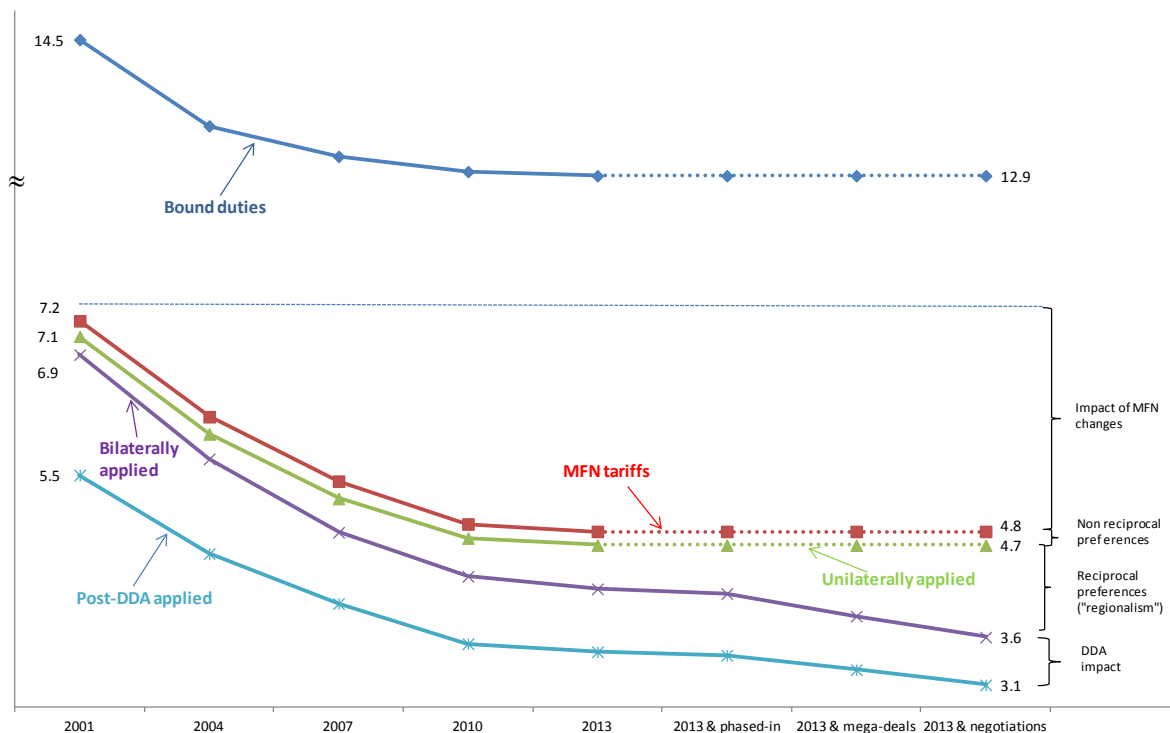
Equipped with this database, we can propose a quantified overview of how the trade policy landscape changed since the turn of the century. A preview at the global level shows that the same downward trend is shared by all rungs of the tariff ladder, with a sharper slope between 2001 and 2007 (Figure 1, and Appendix Figure 7 for results by country). However, closer examination shows that trends differed significantly across curves: while the worldwide average bound duty was cut by 1.6 percentage points (hereafter p.p) between 2001 and 2013, this cut was 2.4 p.p. for the average MFN duty, and 2.7 p.p. for the average preferential applied duty. The contrast is starker in relative terms since, by 2013, the 2001 level was cut by 11% for bound duties, compared to 33% for MFN duties and 39% for applied preferential duties. Would all on-going negotiations be concluded, the cut in the average applied preferential duty would reach 3.3 p.p., almost half its 2001 level. Noteworthy, the gap between applied and post-DDA duties, equal to 1.4 p.p. in 2001, declined to 0.7 p.p. in 2013, and would fall down until 0.5 p.p. if all on-going negotiations were concluded. This trend illustrates strikingly how policy changes eroded the potential value of a multilateral agreement over the period.

This preview shows that non-trivial changes took place over the period considered. The underlying causes cannot be directly identified from these aggregate figures, because opposite product-level effects may compensate at the aggregate level.¹² Disentangling them requires more refined calculations and policy interpretation, to which we now turn.

¹¹ The five-year period is chosen so as to limit the influence of the phasing-in period, while keeping a large enough number of agreements for each country.

¹² A parallel decline in average MFN and preferential duties is for instance consistent with two different changes: one would be a cut in MFN duties for products usually excluded from preferential agreements; another would be a cut in MFN duties for products usually included in RTAs, together with the enforcement of additional RTAs. In the former case, only unilateral liberalization is at stake; in the latter case, a combination of unilateral liberalization and regionalism caused the observed change.

Figure 1: The tariff ladder worldwide from 2001 onward (% AVE)



Source: Authors' calculations, MAcMap-HS6 database. Weighted averages computed using MAcMap-HS6 methodology (Bouët et al., 2008).

2.2. The rising tide of “regional” trade agreements

The most spectacular trade policy change since the turn of the century has probably been the multiplication of RTAs. From 123 in 1995, the number of RTAs notified to the WTO surpassed 200 in 2001 and reached as many as 625 in February 2016. 419 agreements were in force at that time; avoiding double counting of agreements on services and goods, it was still 265. This spectacular surge of RTAs is well documented (see WTO, 2011a, and Subramanian and Kessler, 2013, for detailed overviews). Its main causes can be traced back to a variety of factors: the competitive liberalization policy carried out under the Bush II administration as of 2001;¹³ the build-up of Asian trade regionalism; the activism of a few countries engaged in a strategy of “additive liberalization”, whereby the multiplication of RTAs was used to gain preferential access to as many partners as possible, in exchange of

¹³ As explicitly formulated, for example, in Robert B. Zoellick Statement Before the Committee on Finance of the U.S. Senate, Washington, DC, 21 June 2001.

the opening of its own market;¹⁴ and, finally, the competition between agreements, resulting from the increasingly entrenched fears—for both economic and political motives—to be left aside the tide of agreements.

A new wave of negotiations is under way with the so-called "mega-deals", whose scope is far wider than previous agreements' ones in terms of economic weight, with ambitious agenda announced by the parties involved: the Trans-Pacific Partnership (TPP, with formal agreement signed on February 4, 2016, but not yet ratified), the Transatlantic Trade and Investment Partnership (TTIP), and the EU-Japan FTA. The ASEAN+6 negotiation (Regional Comprehensive Economic Partnership) also covers a huge economic area by economic weight, but its ambition is far more limited (in what follows, we use the term "mega-deals" to refer to the first three above-mentioned agreements only). Should they all be concluded, these negotiations would potentially open a new era: it would be the first time trade agreements would be sealed between world's top trading countries. Accordingly, the consequences of RTAs should be reconsidered.

This surge in RTAs has been accompanied by qualitative changes. Mainly at the initiative of the EU and the US, RTAs are increasingly used to promote common rules on investment, competition, trade in services, sanitary and phytosanitary measures, technical barriers to trade, public procurement, environment, and sometimes labor standards (Horn et al., 2010; WTO, 2011a). However, for reasons stated in introduction, our quantitative analysis here focuses on tariffs and trade.

2.2.1. Does it matter for world trade and protection?

The extent to which this RTA tide did matter for world trade and protection patterns remains an open question. The WTO headcount of notified and enforced agreements is of little help to address it, because agreements vary widely by their breadth and depth.

To illustrate more meaningfully the spread of regionalism, we measure instead the share of foreign trade taking place between partners linked by a RTA (Figure 2). This share hardly moved for North American countries, remaining at a high level (around 42%) between 2001 and 2013, chiefly reflecting the importance of the North American Free Trade Area. In all other regions, though, this "intra-RTA" share significantly increased over the period, with a spectacular increase in Asia (from 2.5% to 38.1%). In addition to the years 2001-2013, three situations are considered in our calculations, reflecting respectively the situation in which RTAs already signed (between 2013 and 2015) but still to be implemented are enforced ("2013 & phased-in"), the hypothetical situation where the three mega-deals actually under negotiation between rich countries would be signed and fully enforced ("2013 & mega-deals", acknowledging that TPP's implementation should start within the next two years), and the situation where all agreements under negotiation would be concluded and enforced ("2013 &

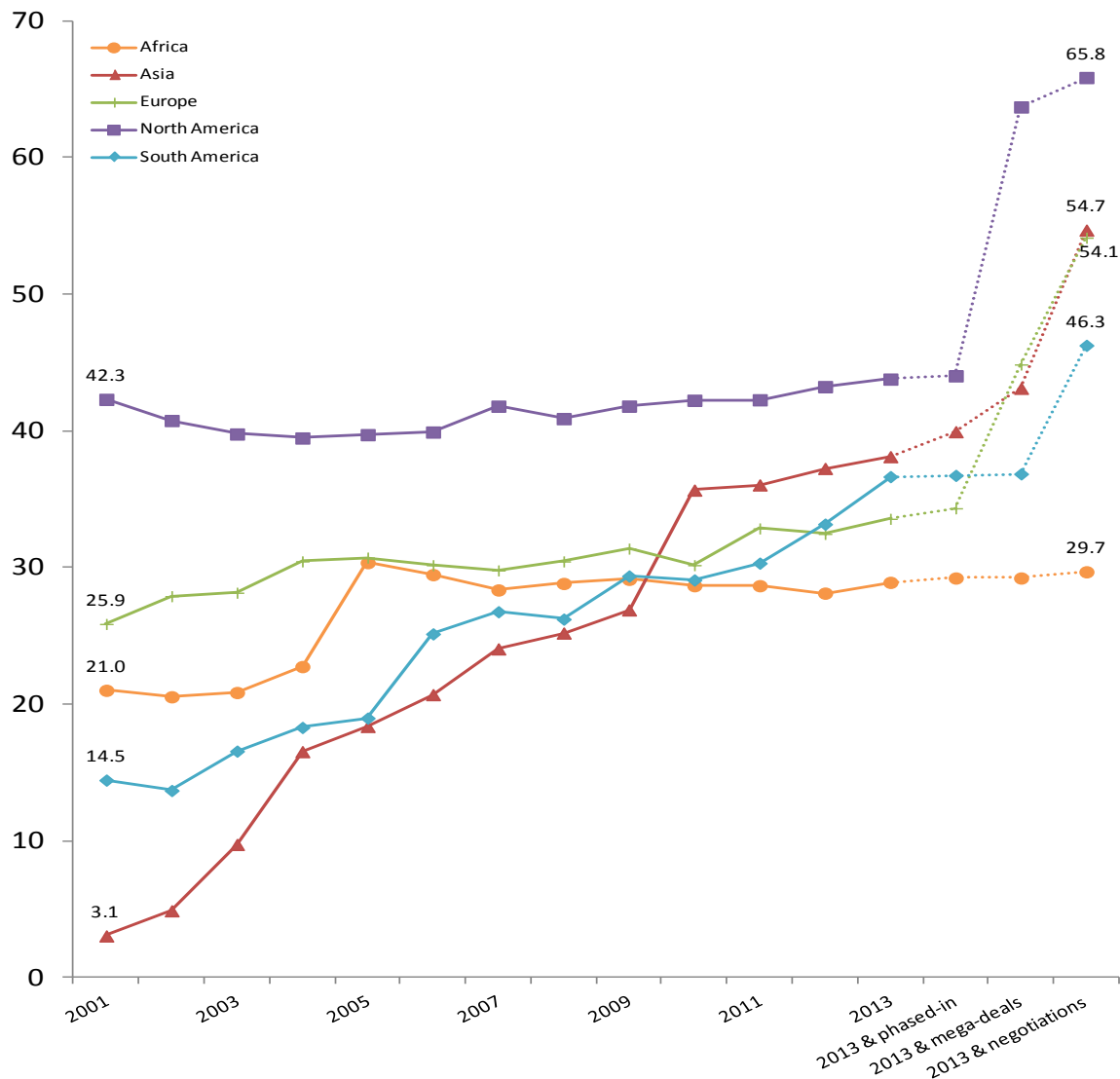
¹⁴ Chile is the most extreme example of this strategy, with bilateral agreements covering 60 partners (EU Member states are counted individually) and more than 90% of its imports. Mexico, Singapore and, to a lesser extent, ASEAN countries, can also be considered as having applied such a strategy.

negotiations”). Computations for these hypothetical situations are based upon 2013 trade flows, updating their RTA status (within-RTA or not). Since RTAs are expected to increase trade between partners, the figures hence computed for the share of within-RTA imports should be considered as lower bounds. Completing the mega-deals would increase the share of within-RTA trade spectacularly in North America (by almost 20 p.p.), in Asia (+5 p.p.) and in Europe (+11.4 p.p.). Completing other on-going negotiations would also make a significant difference, in particular in Asia (+17 p.p.), in Europe (+20 p.p.) and in South America (+17 p.p.). Strikingly, the African continent is the only one for which concluding on-going negotiations would make little difference, hence appearing as the left-side of this tide of agreements. The recently announced (2015) Tripartite Agreement may make a significant difference for African countries. However, given the uncertainties surrounding its effective implementation at the time of writing, this agreement was not included in the present calculations.

These results can be summarized as follows:

Fact 1: Between 2001 and 2013, the share of foreign trade carried out with RTA partners increased strongly for Asian and Latin American countries, but only moderately for others. Concluding on-going negotiations would drastically increase this share in Asia, Europe and North America.

Figure 2: Share of total foreign trade realized with RTA partners (“within a RTA”), by continent (%)



Note: For each region, the curve refers to the share of foreign trade (inside and outside the region) that the region’s countries are carrying out with a partner country with whom they have an RTA in force. For the sake of this figure and in what follows, Europe is defined as including, in addition to European countries *stricto sensu*, Community of Independent States —CIS countries; Africa includes Middle East countries; Asia includes Oceania. The calculations for the implementation of phased-in agreements and for the hypothetical situation where on-going negotiations would be concluded (“2013 & mega-deals” and “2013 & negotiations”) are made assuming trade flows unchanged, equal to their 2013 value.

Source: Author’s calculations, BACI database.

RTAs do not imply free trade. Rather, they are often used to manage trade liberalization in a way that makes it possible to preserve some protection for sensitive sectors, while being more easily manageable than multilateral agreements. For example, while the US often excludes some sensitive agricultural sectors such as sugar from RTAs with efficient would-be exporters (e.g., its agreement with Australia), the EU restricts liberalization of the beef sector through tariff rate quotas or simple import ceilings. As a result, significant protection remains within RTAs, especially in the agricultural sector, even though some agreements contain provisions which explicitly phase out some of these tariffs after a long phase-in period, or a clause stating that the agreement will be revised in order to cut tariffs further.

To illustrate this fact, Table 1 reports the level of tariff duties applied between partners of RTAs in force for more than 5 years —a period after which most the tariff-cutting commitments are usually applied.¹⁵ Nine countries are covered, the old “quad” of rich countries and the so-called BRICS. In computing average across products and countries, we use in what follows Bouët et al. (2008) methodology, which relies upon reference groups of importers to build a meaningful weighting scheme reflecting the importance of products and countries, while minimizing the endogeneity bias linked to the dependence of trade flows upon tariffs.

The results uncover two striking contrasts. The first appears across countries, with average applied tariff duties driven down to close-to-zero by the majority of importers within their RTAs, but maintained to a significant proportion of MFN levels by China, South Africa and most of all India. The latter countries clearly appear as having applied so far a fairly cautious approach to RTAs, restraining market opening under their agreements to a limited scale, as witnessed by the significant share of products left with non-zero applied tariff duties. The second contrast is across sectors, with agriculture exhibiting far higher remaining protection within RTAs than other products, with the only exception of Russia¹⁶ and Brazil. For India and Japan, preferential duties under RTAs differ little from MFN tariffs, meaning that agriculture is essentially excluded from their agreements. This is not the case for other countries, but half or more of the MFN protection level is maintained within agreement. Paradoxically, given that average MFN duties are far higher in agriculture than elsewhere, the ensuing average preference margin (i.e., the difference between the MFN and preferential duties) is larger for agricultural products in all countries considered here, except Brazil.

¹⁵ For more details upon phase-in periods of RTAs and the corresponding changes in applied tariffs, see Bureau and Jean (2014).

¹⁶ As regards Russia, it is worth mentioning that most agreements referred to here as signed with other CIS countries.

Table 1: Remaining protection within RTAs for selected importers in 2013 (in %, except number of RTAs)

	Nb of RTAs	All products			Agriculture		
		Within RTAs		Outside RTAs	Within RTAs		Outside RTAs
		Mean AVE pref. duty	Import share of duty-free products	Mean AVE MFN duty	Mean AVE pref. duty	Import share of duty-free products	Mean AVE MFN duty
"Quad"							
Canada	4	1.1	97.4	2.5	13.3	71.7	15.4
European Union	23	0.8	94.3	3.3	14.2	20.5	14.5
Japan	8	1.2	86.9	2.1	15.1	28.1	18.2
USA	10	0.3	95.1	1.5	3.1	79.2	4.7
BRICS							
Brazil	1	0.3	94.5	12.3	0.5	75.3	8.2
China	7	3.9	63.1	6.6	12.8	36.2	18.5
India	6	8.8	17.9	9.5	39.5	26.2	42.9
Russia	3	0.0	100.0	9.1	0.0	99.8	17.3
South Africa	3	2.8	79.0	6.9	12.1	38.6	16.6

Scope: Only RTAs in force for 5 years or more are considered. Partial Scope Agreements are not taken into account.

Note: The number of RTAs refers to agreements, many of which include several partners. The various, overlapping agreements of Russia with other CIS countries are not counted separately, only the CIS FTA is taken into account here.

Source: Authors' calculations using MAcMap-HS6 and BACI. Information on RTAs from WTO notifications and national sources.

2.2.2. Regionalism or "preferentialism"?

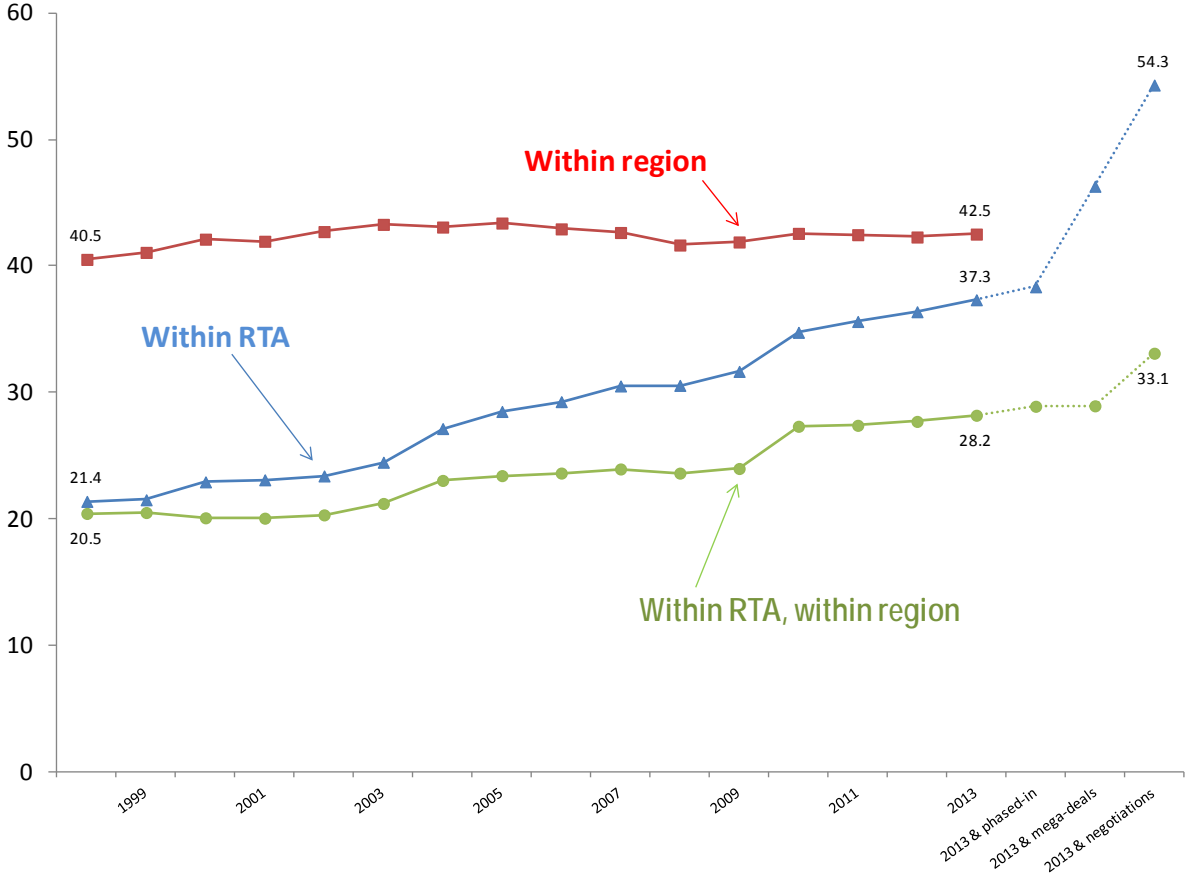
Another qualitative change concerned the geography of agreements. As their name suggests, RTAs used to be synonym of regional integration. Noteworthy examples include EU's successive enlargements and its agreements with its neighborhood, the North American Free Trade Area, the Mercosur agreement and the Andean Community in Latin America, or the agreement between ASEAN (Association of South East Asian Nations) countries and ASEAN agreements with neighboring countries in South-East Asia. Since the early 2000s, though, a growing number of bilateral trade agreements are being sealed with

geographically remote partners.¹⁷ Whether the surge in RTAs observed since the turn of the century can be adequately termed a regionalist tide is thus questionable.

To illustrate the geography of agreements, Figure 3 parallels the world level's share of trade realized within a RTA, with the share carried out within a region —where, for the sake of this calculation, a region is defined as one of the five continents singled out in Figure 2. The results confirm the growing disconnect between RTAs and geography: while the share of trade within a RTA increases from 21% in 2001 to 37% in 2013, the share realized within a region hardly budges (40% in 2001, 42% in 2013). While trade within a RTA was almost entirely intra-regional in 2001, this was not the case anymore in 2013: trade within a RTA, with partners in another region, accounted for 9% of world trade in 2013, compared to only 3% in 2001. On-going negotiations tend to exacerbate this trend, potentially lifting this within-RTA, extra-regional share of world trade up to 21% (17% if only mega-deals were enforced).

¹⁷ Against this background, the term “Preferential Trade Agreement” (PTA), would seem more suitable to refer to the phenomenon. Since it is often used in WTO parlance to refer specifically to non-reciprocal preferential agreements, we stick to the term “RTA” while referring to reciprocal preferential agreements, even though they frequently do not deserve anymore the “regional” qualification.

Figure 3: Share of world trade realized within a region, within a RTA, and within an RTA within a region (%)



Note: “2013 & phased-in”, “2013 & mega-deals” and “2013 & negotiations” refer to situation where, based on 2013 trade and tariffs, already signed agreements, mega-deals and all-ongoing negotiations would be concluded and enforced. Changes in intra-RTA trade can be computed on this basis, reflecting the increased coverage of RTAs (and assuming trade flows unchanged). In contrast, changes in the share of trade realized within each region cannot be characterized in this hypothetical situation.

Source: Author’s calculations, BACI database.

Referring to a surge in "regionalism" thus misleadingly suggests a movement towards regional integration. This is not what is actually going on, which would be more aptly termed a surge in “preferentialism”. This issue goes beyond a semantic technicality. Regionalism can be thought of as an attempt to rationalize trade relationships between neighbors; it generally relies upon strong political and cultural ties, with in many cases an integrative dimension, whereby rules and competition are streamlined in a geographically limited area. In contrast, purely mercantilist motives are dominant in the spread of preferentialism, which is mainly a way to seek commercial advantages, and increasingly to define new trade rules;

being in addition not restricted to given geographical areas, preferentialism is much more directly in competition with multilateralism.

We have thus established:

Fact 2: Would all on-going negotiations be concluded, RTAs would cover more than half world trade. Their development since 2001 has mainly concerned partners not belonging to the same region.

2.3. Liberalization on an MFN basis and its causes

The surge in RTAs should not hide the fact that, since the turn of the century, many countries have considerably lowered the tariffs they apply on an MFN basis. To analyze this trend, changes in MFN tariff rates between t_0 and t_1 can be decomposed arithmetically as follows:

$$(1) \quad MFN_{t_1} - MFN_{t_0} = \underbrace{[MFN_{t_1} - \min(MFN_{t_0}, Bound_{t_1})]}_{\text{Own initiative}} + \underbrace{[\min(MFN_{t_0}, Bound_{t_1}) - MFN_{t_0}]}_{\text{Commitment}}$$

Where *MFN* stands for the MFN rate applied, and *Bound* stands for the bound rate. The subscript refers to the year concerned. If the bound rate in t_1 falls below the initial MFN duty rate, MFN_{t_0} , then the country must lower its MFN level at most to this new bound level, in order to abide by its commitment. Accordingly, the term in the second square bracket corresponds to the change in MFN duty resulting from the country's commitments under the multilateral trading system. In contrast, further changes in the MFN duty (computed in the first square brackets) are the result of the country's own initiatives.

Putting this decomposition into practice shows that both phenomena played a role over the period under study (Table 2). Bound duties were themselves cut as a result of two kinds of newly implemented commitments: the end of the implementation of Uruguay Round commitments by developing countries, which had until 2004 to do so; and the implementation of accession protocols for the countries having acceded the WTO after its creation.

In most cases, the impact of the ending implementation of the Marrakesh Agreement was limited, the main exceptions being Egypt (-6.1 p.p.), and to a lesser extent Malaysia (-2.5 p.p.), Ghana (-2.3 p.p.), Nigeria (-1.8 p.p.), Korea (-1.7 p.p.), India (-1.4 p.p.) and Bangladesh (-1.3 p.p.). Although fewer countries are concerned, the changes ensuing from WTO accession are substantial. This is in particular the case for China (-8.4 p.p.), a change which is in itself of systemic importance, but also for Saudi Arabia (-4.7 p.p.), Vietnam (-3.5 p.p.) or Jordan (-1.9 p.p.).

Table 2: Decline in average (applied) MFN duty between 2001 and 2013, selected countries

	Av. MFN applied duty (AVE, %)						Av. MFN applied duty (AVE, %)				
	2001	2013	Total	Com-mitted	Lib. own Initiative		2001	2013	Total	Com-mitted	Lib. own Initiative
<i>Libya</i>	25.9	0.0	-25.9	0.0	-25.9	<u>Việt nam</u>	12.2	4.4	-6.5	-3.5	-3.0
India	30.0	9.7	-20.3	-1.4	-18.9	Malaysia	12.1	8.9	-3.2	-2.5	-0.7
Nigeria	28.0	10.8	-17.2	-1.8	-15.4	<i>Belarus</i>	10.9	7.7	-3.2	0.0	-3.2
Tunisia	22.8	8.5	-14.3	-0.2	-14.1	<u>Russia</u>	10.3	7.9	-2.4	-1.8	-0.6
Morocco	23.2	9.0	-14.2	-0.3	-13.9	<u>Ukraine</u>	5.5	3.1	-2.4	-0.9	-1.5
Peru	12.6	1.7	-11.0	0.0	-11.0	<u>Ecuador</u>	8.8	6.5	-2.3	0.0	-2.3
Egypt	19.9	10.1	-9.7	-6.1	-3.6	Thailand	11.1	8.9	-2.2	-0.5	-1.7
<u>China</u>	16.0	6.7	-9.3	-8.4	-0.9	Korea	10.4	8.2	-2.2	-1.7	-0.5
Bangladesh	19.3	10.4	-8.9	-1.3	-7.6	<u>Panama</u>	7.1	5.0	-2.1	-0.1	-2.0
<u>Saudi Arabia</u>	12.1	3.9	-8.2	-4.7	-3.5	Israel	6.4	4.7	-1.7	-0.4	-1.3
Kenya	17.3	11.5	-5.8	-0.1	-5.7	Australia	3.8	2.7	-1.1	-0.1	-1.0
Mexico	16.6	11.1	-5.5	0.0	-5.5	Brazil	10.4	9.4	-1.0	0.0	-1.0
<u>Cambodia</u>	13.0	7.9	-5.1	-0.2	-4.9	Canada	4.8	3.8	-0.9	0.0	-0.9
Colombia	10.3	5.5	-4.9	0.0	-4.9	Chile	6.9	5.9	-1.0	0.0	-1.0
Pakistan	14.1	9.4	-4.7	-0.5	-4.2	<i>Kazakstan</i>	4.7	6.4	1.7	0.0	1.7
<u>Jordan</u>	11.3	6.7	-4.6	-1.9	-2.7	Norway	4.1	6.0	1.9	-0.1	2.0
<u>Oman</u>	8.1	4.0	-4.1	-1.1	-3.0	Switzerland	4.2	6.9	2.7	0.0	2.7
Ghana	13.4	9.4	-4.0	-2.3	-1.7	<i>Iran</i>	5.2	17.6	12.4	0.0	12.4
<u>Taiwan</u>	8.1	4.2	-3.9	-0.8	-3.1	World	7.2	4.8	-2.4	-1.1	-1.3

Note: The countries shown are those accounting for more than 0.1% of world percent in 2013, for which average MFN applied duties changed by more than 1 p.p. in absolute value between 2001 and 2013. Countries are ranked by increasing total change over the period. Countries not member of the WTO in 2013 are featured in italics. Countries having acceded after WTO creation and no later than 2013 are underlined. "Committed change" refers to changes in MFN linked to commitments in the multilateral system, either in the Marrakech Agreement or upon WTO accession.

Source: Authors' calculations, MAcMap-HS6 database. Weighted averages computed using MAcMap-HS6 methodology (Bouët et al., 2008).

Beyond these changes linked to commitments in the multilateral system, a number of countries undertook significant unilateral liberalization, as a result of their own initiative. At the world level, the corresponding cut in average MFN tariffs (-1.3 p.p.) was even stronger than the one ensuing from newly implemented multilateral commitments (-1.1 p.p.). In most cases, this reflects a reconsideration of the costs and benefits of protectionism by a number of developing countries. The Uruguay Round contributed to their integration in world trade, pushing many of them to abandon rather outdated policies such as import substitution and the protection of "industrializing industries", which development record proved poor.

Increasingly, trade openness is viewed as a way to import market discipline, therefore helping to fight against rents and more generally against resource misallocation. India is probably the most outstanding example of such use of trade liberalization as a pro-growth policy. Following the already sweeping liberalization of the early nineties, India embarked in another policy of across-the-board cut in tariff protection, with its Foreign Trade Policy for 2004-09 stating explicitly the objective of “To double [India’s] percentage share of global merchandise trade within the next five years”.¹⁸ As a matter of fact, India’s average AVE MFN tariff was cut from 30% in 2001 down to 9.7% in 2013, and our decomposition shows 18.9 out of this 20.3 p.p. cut reflected the country’s own initiative.

Interestingly, the Indian strategy explicitly aimed at “neutralizing incidence of all levies and duties on inputs used in export products” and targeted facilitation of “import of capital goods and equipment”, pointing to a key aspect of this renewed use of trade liberalization as a development strategy: the need to adapt to the age of global value chains (GVCs), i.e., to a context where value chains are increasingly (finely) sliced up across countries, either globally or regionally. As pointed out by Baldwin (2011), this trend changes deeply the way developing countries approach development issues. Joining a global value chain, either by attracting foreign direct investment or just by being providers of multinational firms, makes it far easier to attract manufacturing activities, even though the consequences are not necessarily as far reaching as they used to be. Against this background, the cost of protection must be reconsidered, recognizing that lower tariffs (and transaction costs) may help the country in finding its place in such chains, and that liberalization in intermediate inputs may substantially improve domestic firms’ competitiveness (Goldberg et al., 2010; Topalova, 2010).

Many countries carried out reforms rooted in this pro-growth strategy. In Mexico, the October 2008 “Programme to Promote Growth and Employment” included ambitious unilateral cut in MFN tariffs. According to our calculations, the country’s own initiative resulted in a 5.5 p.p. cut in the average MFN tariff, between 2001 and 2013. Peru reduced progressively its MFN tariffs between 2007 and 2013, as Chile did a decade before. Egypt put in place an ambitious trade liberalization strategy in 2004. Mauritius divided its MFN protection level by three, as part of a strategy aiming at turning the island into a trade hub. And Lybia (admittedly a controversial example on other grounds) abolished duties on 3,500 products in 2005.

Noteworthy, unilateral liberalization can also be directly linked to RTAs. Nigeria is an interesting example of such link, since it cut its MFN rate from 28% in 2003 down to 10.8% in 2009, in a move to adopt Economic Community Of West African States' common external tariffs (WTO, 2011b, p. 28).

Summarizing:

¹⁸ See e.g. <http://dgft.gov.in/exim/2000/policy/contents.htm>.

Fact 3: MFN tariffs were cut by one third between 2001 and 2013, more than half of it as a result of countries' own initiatives.

2.4. Consequences for applied tariff protection, and underlying factors

To ease analysis and interpretation, changes in applied rates (for a given triplet importer-exporter-product) can be decomposed in the following way:

$$(2) \text{ Applied}_{t_1} - \text{Applied}_{t_0} = [\text{Applied}_{t_1} - \text{MFN}_{t_1}] + [\text{MFN}_{t_1} - \text{MFN}_{t_0}] - [\text{Applied}_{t_0} - \text{MFN}_{t_0}]$$

Where *Applied* stands for the duty rate applied. For a given year t , the difference $\text{MFN}_t - \text{Applied}_t$ is the preferential margin granted in this specific case. Such preferential margin may result from the application of either a reciprocal or a non-reciprocal trade agreement. We distinguish these two cases because they do not reflect the same policy rationale. Indeed, a reciprocal trade agreement (hitherto referred to as RTA, for regional trade agreement, as is usual in WTO parlance) reflects an exchange of commitments between two partner countries. In contrast, a non-reciprocal agreement, such as a country's Generalized System of Preferences, is a non-contractual scheme that a country decides to apply as a result of its own initiative, usually to pursue development goals. As we want to shed light on the nature of policy changes, we distinguish these two cases and note in what follows the corresponding preference margins as *RPref* and *NRPref* (for reciprocal and non-reciprocal preference margins). Accordingly, equation (2) can be re-written as follows:

$$(3) \Delta \text{Applied} = \Delta \text{MFN} - \Delta \text{RPref} - \Delta \text{NRPref}$$

Having already analysed changes in MFN duties, the interest of this decomposition lies in highlighting how changes in preferential schemes originated further changes in applied duties. The first learning of these calculations is that non-reciprocal preferential margins did not vary significantly over the period (Table 3). As a matter of fact, as apparent from the global preview given above (Figure 1), non-reciprocal preferences only influence marginally average applied duty, so that their changes have a negligible influence at the worldwide level. In addition, unilateral liberalizations erode the value of non-reciprocal preferential margins, potentially cancelling out at the aggregate level the effects of new schemes entering into force.

Reciprocal preferences, in contrast, did contribute to cut applied duties over and above what liberalization of MFN duties implied (their contribution to changes in applied duties is singled out in Table 3 under column "Reciprocal Pref.", where the value of term $-\Delta \text{RPref}$ in equation (3), i.e. the decrease in the average preferential margin, is reported). This contribution is sometimes significant, as is the case for Chile (-4.2 p.p.), Mexico (-2.2 p.p.) or Vietnam (-1.3p.p.). On average, however, this contribution turns out to be limited, only removing 0.3 p.p. to world applied duties. Despite all the talks about the regionalist tide, RTAs influence on applied protection since the start of the century thus remained minimal at the global level.

The main explanations for this result have already been mentioned: (i) RTAs have been spreading, but so far they have not been covering trade between key trading countries; (ii) tariff protection within RTAs is not zero, sometimes far from it; and (iii) significant liberalization on an MFN basis eroded the preferential margin associated with RTAs. The latest point explains why changes in RTA preferential margins may tend to increase average applied duties, as is the case for instance for Libya (+1.9 p.p.) or Tunisia (+0.7 p.p.).

These findings can be summarized as follows:

Fact 4: Regionalism only marginally contributed to cutting tariffs applied across the world, by 0.3 p.p. on average.

Table 3 : Decomposition of changes in average applied tariff duty between 2001 and 2013 for selected countries (AVE in %, variation in p.p.)

	Changes 2001-2013						Changes 2001-2013				
	Total	MFN	Non Reciprocal Pref.	Reciprocal Pref.	Applied 2013		Total	MFN	Non Reciprocal Pref.	Reciprocal Pref.	Applied 2013
<i>Libya</i>	-24.1	-25.9	0.0	1.9	0.0	<u>Ukraine</u>	-2.9	-2.4	-0.5	-0.1	2.4
India	-20.5	-20.3	0.0	-0.1	9.4	<u>Algeria</u>	-2.8	-0.9	0.0	-2.0	10.4
Nigeria	-17.2	-17.2	0.0	0.0	10.8	Korea	-2.5	-2.2	0.0	-0.3	7.9
Morocco	-14.5	-14.2	0.0	-0.3	6.6	<u>Ecuador</u>	-2.5	-2.3	0.0	-0.2	6.2
Tunisia	-13.5	-14.3	0.0	0.7	6.2	<u>Russia</u>	-2.3	-2.4	0.4	-0.3	7.6
Peru	-11.0	-11.0	0.0	0.0	1.6	Thailand	-2.2	-2.2	0.0	0.0	8.9
Egypt	-10.6	-9.7	0.0	-0.9	8.9	<u>Panama</u>	-2.1	-2.1	0.0	0.0	4.9
<u>China</u>	-9.9	-9.3	0.0	-0.6	6.1	South Africa	-1.9	-0.9	0.0	-1.1	5.7
Bangladesh	-8.9	-8.9	0.0	0.0	10.4	Philippines	-1.4	-0.3	0.0	-1.0	3.7
<u>Saudi Arabia</u>	-8.0	-8.2	0.0	0.2	3.8	Australia	-1.3	-1.1	0.0	-0.2	2.4
<u>Viêt nam</u>	-7.8	-6.5	0.0	-1.3	4.3	Brazil	-1.3	-1.0	0.0	-0.3	9.0
Mexico	-7.7	-5.5	0.0	-2.2	6.3	Argentina	-1.2	-0.9	0.0	-0.3	10.7
<u>Cambodia</u>	-7.1	-5.1	-0.1	-1.9	5.9	<u>Croatia</u>	-1.2	-0.8	0.7	-1.0	3.3
<u>Jordan</u>	-6.5	-4.6	0.0	-1.9	4.4	Guatemala	-1.1	-0.9	0.0	-0.3	3.0
Kenya	-5.9	-5.8	0.0	-0.1	10.8	Costa Rica	-1.1	0.1	0.0	-1.2	3.5
Chile	-5.1	-1.0	0.0	-4.2	1.7	Indonesia	-1.1	-0.2	0.0	-0.9	4.6
Colombia	-5.0	-4.9	0.0	-0.1	5.2	Israel	-1.0	-1.7	0.0	0.6	3.1
Pakistan	-5.0	-4.7	0.0	-0.2	9.2	Norway	1.7	1.9	0.1	-0.3	5.2
<u>Oman</u>	-4.4	-4.1	0.0	-0.3	3.4	Switzerland	1.9	2.7	-0.2	-0.7	5.1
<u>Taiwan</u>	-4.1	-3.9	-0.3	0.0	4.2	<u>Kazakstan</u>	2.0	1.7	0.6	-0.3	6.5
Ghana	-4.0	-4.0	0.0	0.0	9.3	<i>Iran</i>	12.4	12.4	0.0	0.0	17.6
Malaysia	-4.0	-3.2	0.0	-0.8	8.0	World	-2.7	-2.4	0.0	-0.3	4.2
<i>Belarus</i>	-3.0	-3.2	0.4	-0.2	7.5						

Note: The countries shown are those accounting for more than 0.1% of world percent in 2013, for which average applied duties changed by more than 1 p.p. in absolute value between 2001 and 2013 (results for countries not meeting the latter condition are shown in Appendix Table 5). Countries are

ranked by increasing total change in average applied protection between 2001 and 2013. “Committed” stands for the impacts due to WTO commitments; “Unilateral” stands for unilateral changes, including changes in unilateral preferences, of countries’ trade policies; “RTAs” stands for changes due to the implementation of reciprocal trade agreements.

Source: Authors’ calculations, MAcMap-HS6 database. Weighted average using MAcMap-HS6 methodology.

2.5. The eroding tariff-cutting impact of a Doha agreement

The combination of liberalization on an MFN basis and RTAs has been eroding progressively the impact, hence the potential for gains, of a multilateral agreement. The average tariff-cutting impact of a Doha agreement, measured as the difference between applied and post-DDA duties, was 1.4 p.p. in 2001. This difference was reduced to 0.7 p.p. in 2013 and would fall to 0.5 p.p., would on-going agreements be enforced.

In addition to being substantial on average, this erosion is very uneven across countries: applying the latest modalities used in DDA negotiations to India tariff schedule in 2001 would have implied a 7.5 p.p. cut in applied tariffs; by 2013, this would-be cut had shrunk to a mere 0.03 p.p., because India applied duties are worth only one quarter of its bound duties! India’s situation may be extreme, but several other important countries stand out: for Egypt, the tariff-cutting impact of a Doha agreement would have been 6.4 p.p. based on its 2001 tariff schedule, but only 0.6 p.p. based on its 2013 schedule; for Mexico, the cut fell from 2.1 p.p. in 2001 down to 0.5 p.p. in 2013; for Turkey, from 1.4 p.p. to 0.6 p.p. In addition, completing all agreements under negotiation would bring down further the expected cut ensuing from a DDA agreement: in the US, down to 0.3 p.p. (compared to 0.6 p.p. in 2013); in the EU, down to 0.7 p.p. (compared to 0.9 p.p. in 2013).

Among the countries accounting for at least 0.1% of world imports in 2013 (the EU being counted as one single country), 46 were members of the WTO before the Doha Ministerial in 2001. Out of these, the cut implied by a hypothetical DDA agreement would have overreached 1 p.p. in 16 countries in 2001; in 2013, only 7 would have been in this situation; were all agreements under negotiations be enforced, this number would fall to 6. In relative terms, a hypothetical DDA agreement would have cut protection by more than 5% in 19 out of these 46 countries, based on 2001 trade policies; this number would have fallen to 10 based on 2013 policies, and to four with all on-going negotiations concluded.

Put briefly:

Fact 5: Not only has the average cut resulting from a hypothetical conclusion of Doha negotiations been eroding over time, it has also become increasingly concentrated on a handful of countries. This trend would be worsened if all on-going RTA negotiations were concluded.

In order to focus specifically on policy changes, the calculations below have been carried out using constant weights. It worth mentioning, however, that changes in world trade tended, over the same period, to give increasing weight to countries initially more protected than the average. For instance, considering tariffs applied in 2001, the worldwide average is 5.5%

when weighted based on 2001 trade flows, but 6.9% based on 2013 trade flows. Providing a consistent assessment of the combined effects of these different changes requires a more elaborated analytical framework, to which we now turn.

3. How regionalism and multilateralism interact: moving across the tariff ladder's rungs

How do these recent and would-be trade policy changes impact trade and welfare? In order to address this question, we use model-based simulations to assess various thought experiments corresponding to moves across the above-described tariff ladder.

3.1. Model

The model used is a multi-sectoral, multi-regional computable general equilibrium model of the world economy. Our purpose in using such model is not theoretical elaboration, but rather consistency and transparency in assessing a variety of trade policy scenarios worldwide. Accordingly, the model's structure –a perfect competition version of the MIRAGE model, see Bhir et al (2002) or Fontagné et al. (2013)- is fairly standard for such trade policy analysis. On the demand side, the representative consumer's utility function is a LES-CES (Linear Expenditure System – Constant Elasticity of Substitution) function of sector-level subutility functions. Within each sector, products are differentiated by country of origin using a two-tier CES function –an elaboration upon the so-called Armington assumption. Varieties within each of these bundles are horizontally differentiated. On the supply side, each sector is modeled using a representative firm, which combines value-added and intermediate consumption in fixed shares. Value-added is a CES bundle of imperfectly substitutable primary factors (capital, skilled and unskilled labor, land and natural resources). For the sake of simplicity, perfect competition is assumed. The model's macroeconomic closure assumes savings-driven investment for each economy, with exogenous dynamic saving propensity taken from Fouré et al. (2013), and exogenous current account imbalances (in real terms).

Simulations are carried out in a sequential dynamic framework where installed capital is immobile, with capital reallocation resulting from depreciation and investment.¹⁹ In addition to the tariff data described above and in Appendix, the simulations below rely upon GTAP 9PR1 database,²⁰ with base year 2011 (Narayanan et al., 2012). In order to take into account forthcoming structural changes in the world economy, a baseline for the world economy is simulated up to 2025, based on standard assumptions about changes in technology, demographics and education, as described in Fouré et al. (2013). We focus on the impact each policy shock (assumed to be enforced as of 2015) might have on the world economy in 2025: a counterfactual trajectory of the world economy is simulated, and the results reported here refer to deviations from the baseline in 2025.

¹⁹ Details on the model can be found in the Appendix.

²⁰ The GTAP database provides social accounting matrixes for 140 regions, with 57 sectors. See <https://www.gtap.agecon.purdue.edu/>.

3.2. Experiment design

For each base year (2001, 2004, 2007, 2010, 2013, “2013 & phased-in”, “2013 & mega-deals”, “2013 & all agreements under negotiation”), we successively consider the hypothetical situation where each country would apply a tariff protection corresponding to a different level of this ladder, from bound duties down to zero. Each move corresponds to a hypothetical policy shock, which we name and interpret as follows:

- From bound to unilaterally applied duties, “standstill”: such scenario can be thought of as the opposite of the maximum protection uplift which is possible for all WTO members without infringing upon their commitments. An agreement whereby members would bind duties at their MFN level is sometimes referred to as a “standstill” agreement, and it would precisely aim at insuring against such move, hence the name given here to this shock.²¹
- From unilateral to applied duties, “regionalism”: this shock exactly corresponds to the joint enforcement of all RTAs, i.e. the phasing in of regionalism.
- From applied to post-DDA, “multilateralism”: this scenario reflects the application of a would-be Doha agreement.
- From post-DDA to zero, “full liberalization”: this full liberalization scenario, applied once a DDA agreement is assumed to have been applied, illustrates the distance remaining between the possible end point of a multilateral agreement and free trade.

The shocks simulated below reflect these (hypothetical) trade policy changes, applied to different base years: for instance, “standstill, 2001” is an hypothetical trade policy shock whereby tariff duties applied would be cut from an initial level equal to 2001 bound tariffs down to a final level equal to 2001 unilateral tariffs.

The simulations were run on an aggregation of countries in 22 regions, and 18 sectors, including 5 agricultural sectors (see Table 6 and Table 7 in the Appendix). For the sake of clarity and brevity, only aggregate results are presented below.

3.3. Results

The impacts of the various shocks on world trade are presented in Figure 4, both in a cumulative (Panel A) and non-cumulative way (Panel B). The diamond blue line describes the export gains from cutting protection from bound to unilateral tariffs: the corresponding “standstill” impact is significant throughout the period, and it increases from 7.3% based on 2001 trade policies up to 13.3% with 2013 trade policies. This strong increase illustrates how far-reaching unilateral changes in trade policies were during the 2000s. It also confirms that WTO disciplines are increasingly disconnected from applied protection, even disregarding RTAs.

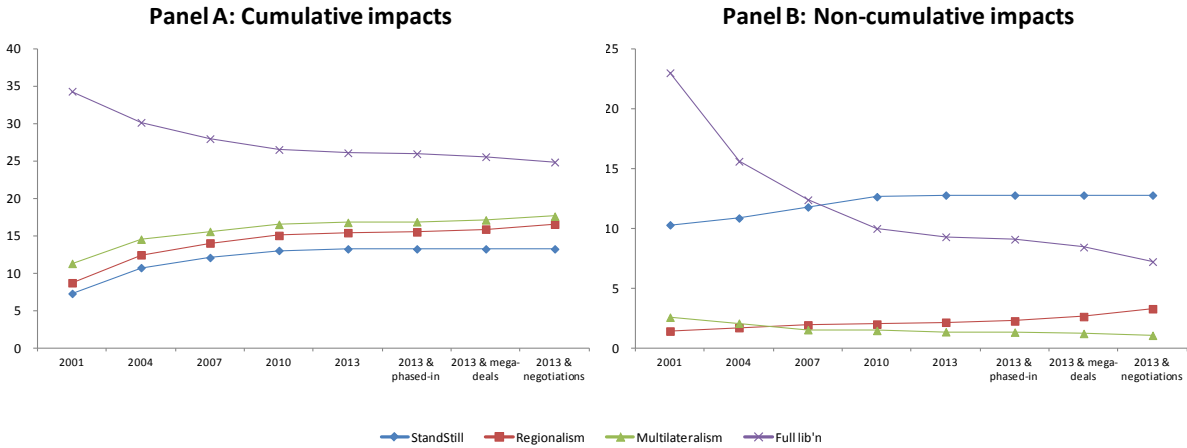
By comparison, regionalism had a far lower impact on world trade, even though it increased regularly over the period: from 1.4 % in 2001, it reached 2.2% in 2013, and would reach

²¹ Note however that unilaterally applied duties also take non-reciprocal trade preferences into account.

3.3% if all agreements under negotiation were enforced. These are very low figures for such sweeping changes, showing that trade creation effects resulting from RTAs' tariff provisions, although positive, remain very limited compared to the spread of trade flows concerned.

According to our simulations, applying a Doha Agreement based on 2001 policies would have increased world trade by 2.6%. Even though this assessed impact is already pretty low, it is almost twice as large as the one obtained based on 2013 policies (1.4%), and more than twice the impact obtained based on a situation where all on-going negotiations would be concluded (1.1%). Beyond their absolute level, these impacts are also small compared to the trade-creating impact of cutting post-DDA tariffs down to zero (see the "full liberalization" impact in Figure 4 Panel B, equal to 23% in 2001, and 9.3% in 2013).

Figure 4: Assessed impact of liberalization components on world exports (%)



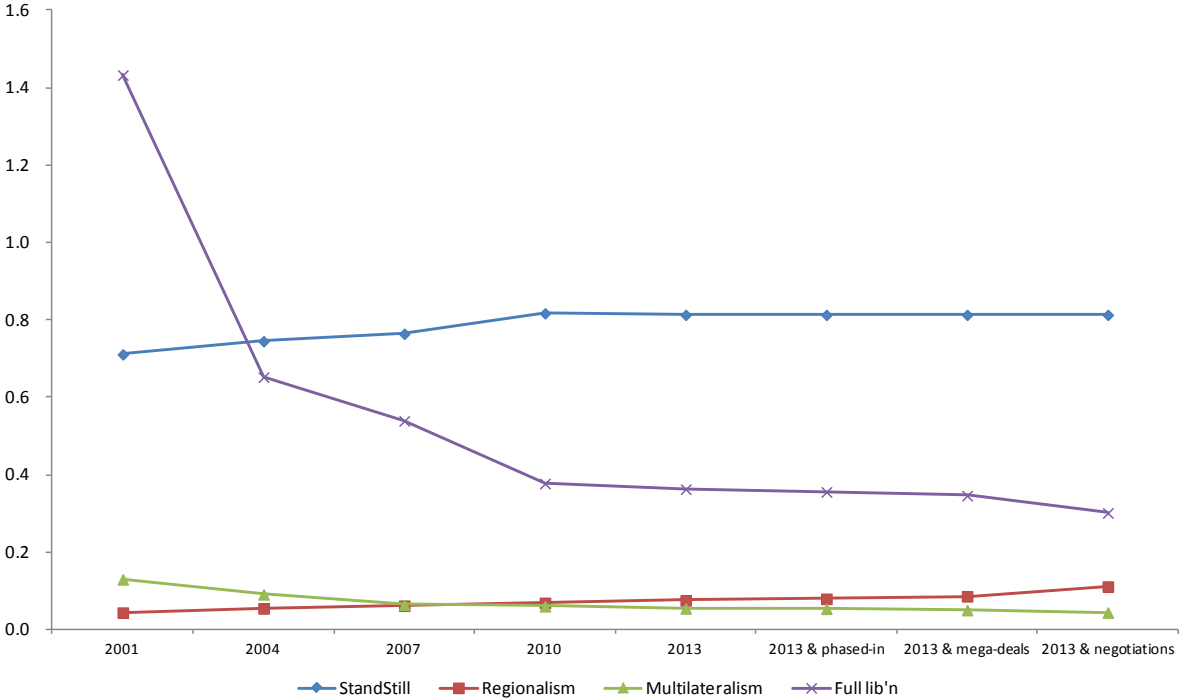
Note: All impacts expressed as deviations from the baseline in 2025. Years do not correspond to the time when the impact is evaluated, but to the year the trade policy shock refers to. Source: Authors' simulations based on Mirage model.

Assessed welfare impacts, measured here using equivalent variations, provide with a similar picture. The positive global welfare gains found for regionalism suggest overall a negative answer to Krugman's (1991b) question: "Is bilateralism bad?". Still, it does not suggest this is an efficient way to improve world welfare, with average gains (+0.04% with 2001 trade policies, +0.1% assuming all agreements under negotiation to be enforced) fairly low given the widespread reach of RTAs.

These welfare results also confirm that, as regionalism and unilateralism spread, the value of multilateralism erodes: the welfare gains associated with a Doha Agreement, assessed to 0.13% in 2001, would be as small as 0.05% in 2013, and 0.04%, would all on-going negotiations be concluded. In this latter hypothetical situation, expected gains from multilateralism would thus be only one quarter of what could have been expected in 2001, a

result consistent (and even a bit stronger) to those found based on tariffs and export creation.

Figure 5: Assessed impact of liberalization components on world welfare (% , non cumulative)



Note: All impacts expressed as deviations from the baseline in 2025. Years do not correspond to the time when the impact is evaluated, but to the year the trade policy shock refers to.
 Source: Authors' simulations based on Mirage model.

3.4. The eroding incentives to conclude the Doha Round

These results suggest that the changes in the trade policy landscape witnessed since the launch of the Doha Round have radically altered the economic incentives for completing the negotiation. To gain further insights about this trend, we split the whole change into two subperiods, respectively 2001 to 2013, and 2013 to the hypothetical situation where all agreements under negotiation are enforced. For different geographical areas, Figure 6 shows how the welfare impact of multilateralism and regionalism changed over each subperiod.

Between 2001 and 2013, the welfare impact from regionalism increased for most countries, with the highest gains found for CIS countries (including Russia), where the network of preferential trade was re-built, after the shaky period which followed the Soviet Union

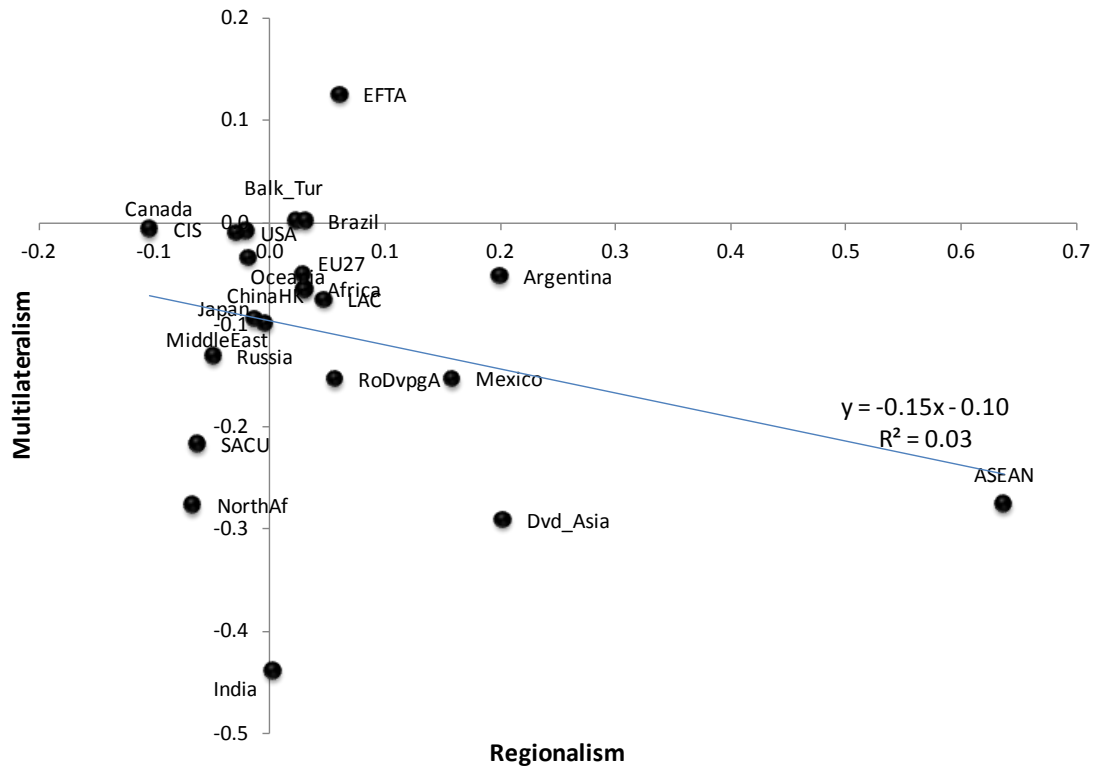
collapse, and for ASEAN countries. In contrast, the welfare gains to be reaped from a multilateral agreement declined for almost all regions considered, with European Free Trade Agreement (EFTA) members and Argentina as the only significant exceptions. The decrease was especially strong for India and North Africa, in both cases due to significant unilateral liberalization, and for ASEAN countries, where it can be related to the numerous RTAs they enforced during this period. In general, though, the two phenomena do not appear to be systematically related.

On the contrary, between 2013 and the hypothetical situation where agreements under negotiation would be enforced, changes in the welfare impact of regionalism and multilateralism are strongly, negatively correlated (Figure 6, Panel B). Of course, we cannot anticipate possible future changes in unilateral protection over the coming years. Yet, this correlation shows the negative impact regionalism may involve for the economic incentives to reach a multilateral agreement. Importantly, these impacts are far from homogenous, and countries like Japan, India and the rest of developed Asia may benefit significantly from regionalism, with significantly diminished gains from a possible multilateral agreement. This outcome may contribute to make an agreement difficult, given how asymmetric gains may hamper an agreement, as explained by Bagwell and Staiger (2013).

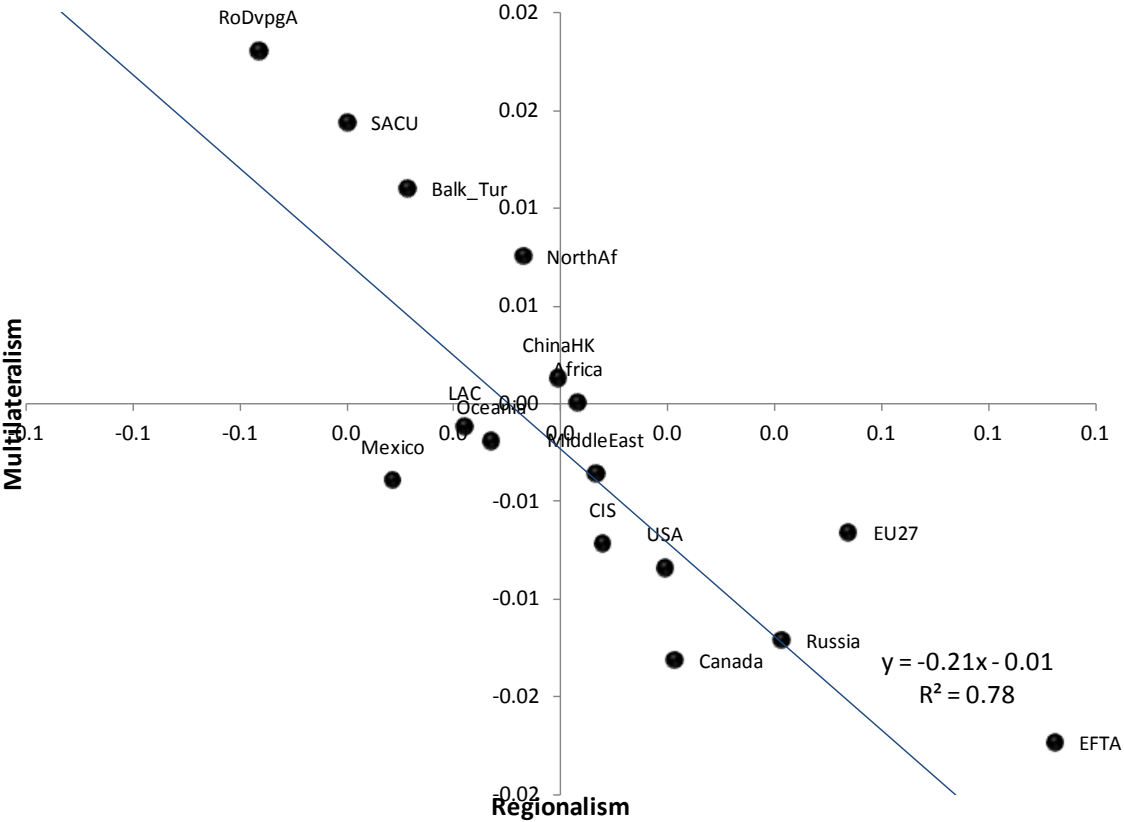
On the other extreme, the spread of regionalism would be deteriorating for China and the rest of developing Asia, but may also increase the gains they might expect from a multilateral agreement. This outcome may originate complementarities between regionalism and multilateralism, reminiscent of Bergsten's (1996) theory of competitive regionalism (and to Zoellick's (2003) practice, to some extent) as well as to Baldwin's (1993) domino theory of regionalism. This possible complementarity is not irrelevant in the present case, especially given the fact that China is often considered as lacking incentives to make serious concessions in multilateral negotiations. Yet, countries in such a position might also consider more seriously engaging in regional agreement negotiations.

Figure 6: Changes in the welfare impact of multilateralism and regionalism (p.p.)

Panel A: changes from 2001 to 2013



Panel B: changes from 2013, ensuing from the enforcement of all agreements under negotiation



Note: All impacts expressed as deviations from the baseline in 2025. Years do not correspond to the time when the impact is evaluated, but to the year the trade policy shock refers to.
 Source: Authors' simulations based on Mirage model.

4. Concluding remarks

This paper proposes a unique overview of trade policies trends since the launch of the Doha Round, based on detailed data on tariffs and trade. Not only does it cover all countries across the world in a consistent manner over the whole period, it also distinguishes, product by product, between bound, applied MFN, and applied preferential tariffs. In addition, the analysis takes into account the possible consequences of a DDA agreement as well as of the conclusion of all RTAs under negotiation. Beyond the pure statistical evaluation, the consequences for trade, welfare and terms of trade are assessed using a computable general equilibrium model.

A considerable number of new RTAs have been signed and enforced since 2001, and many are being negotiated, some of them unparalleled in potential importance. Accordingly, regionalism is widely described as the major development in trade policies. However, our results suggest that regionalism has delivered limited effective liberalization so far. The

situation may change if all on-going negotiations are concluded (they might bring the share of world trade carried out between RTA partners beyond 50%, compared to 37% in 2013). Still, we show that new RTAs only originated a 0.3 p.p. cut in the average applied tariff duty worldwide between 2001 and 2013. Commitments resulting from the ending implementation of the Marrakech Agreement and from WTO accessions, including China's one, mattered much more, resulting in a 1.1 p.p. cut in average applied protection over the same period. Even more important were unilateral liberalizations on an MFN basis, undertaken as a result of governments' own initiatives, as was the case in India and many other emerging and developing countries: they cut average applied tariff protection by 1.3 p.p. between 2001 and 2013. While our results do not make it possible to assess whether unilateral tariff cuts have been accompanied by a reduction in NTMs, anecdotal evidence as well as the underlying policy rationale suggests that both were correlated: motivations for such unilateral liberalization include easier insertion in global value chains, and cheaper imports as a corollary of export-oriented strategies, themselves being seen as a fast track towards development.²²

These sweeping changes deeply eroded the incentives for many countries to conclude ongoing multilateral negotiations. Based on the latest detailed modalities circulated during the negotiations, we show that the tariff-cutting impact of a Doha Agreement, assessed to 1.4 p.p. on average based on 2001 trade policy conditions, had fallen to 0.7 p.p. based on 2013 policies, and would fall to as little as 0.5 p.p., would all on-going negotiations be concluded. For many countries, the combination of own initiatives and RTAs (enforced or under negotiation) makes WTO disciplines increasingly irrelevant, meaning that any realistic multilateral agreement is unlikely to change significantly their applied protection. India is emblematic of this situation, but it is actually shared by many emerging countries. Our simulation-based evaluation of a hypothetical Doha Agreement suggests similar results for export creation and welfare: trade policy changes between 2001 and 2013 have divided by more than two the worldwide welfare gains to be expected from the tariff-cutting provisions of hypothetical Doha Agreement. Would all on-going RTA negotiations be concluded, expected gains would decline until one third of their 2001 level.

Regarding the controversial issue of whether regionalism is "good" or "bad", our results suggests that regionalism did increase welfare, even though its gains were small and concentrated on those countries that engaged actively in RTAs. The consequences for incentives to conclude a multilateral agreement were limited until now, but they may become significantly negative, would all agreements under negotiation be concluded: our results suggest that the on-going regionalist tide would be more discriminatory than liberalizing. In this sense, regionalism appears more as a stumbling block than a stepping stone, at least as their tariff provisions are concerned. A number of large emerging countries have benefited a lot from multilateralism when they joined the WTO, enjoyed the low MFN tariffs that OECD

²² The correlation is less straightforward when tariffs are cut as a result of commitments to trading partners, in which case countries may be tempted to use other protection instruments instead, as evidenced by Bown and Crawley (2013) in the case of temporary trade barriers.

countries had implemented thanks to 50 years of GATT negotiations, and implemented export-led growth strategies. Over the last decade, they have been a magnet for regional agreements, their fast growing domestic market proving attractive enough for OECD countries to move away from their historical commitments to the promotion of multilateralism. As a result, the world market is increasingly fragmented and multilateralism has stalled. At this point, emerging countries would reap little benefits from a further extension of regionalism. This may provide some incentives for them to put more weight behind the defense of multilateralism in the future, as they have often been called to do, so far in vain (Mattoo et al, 2011).

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Appendix

A1. Results of ANOVA regressions

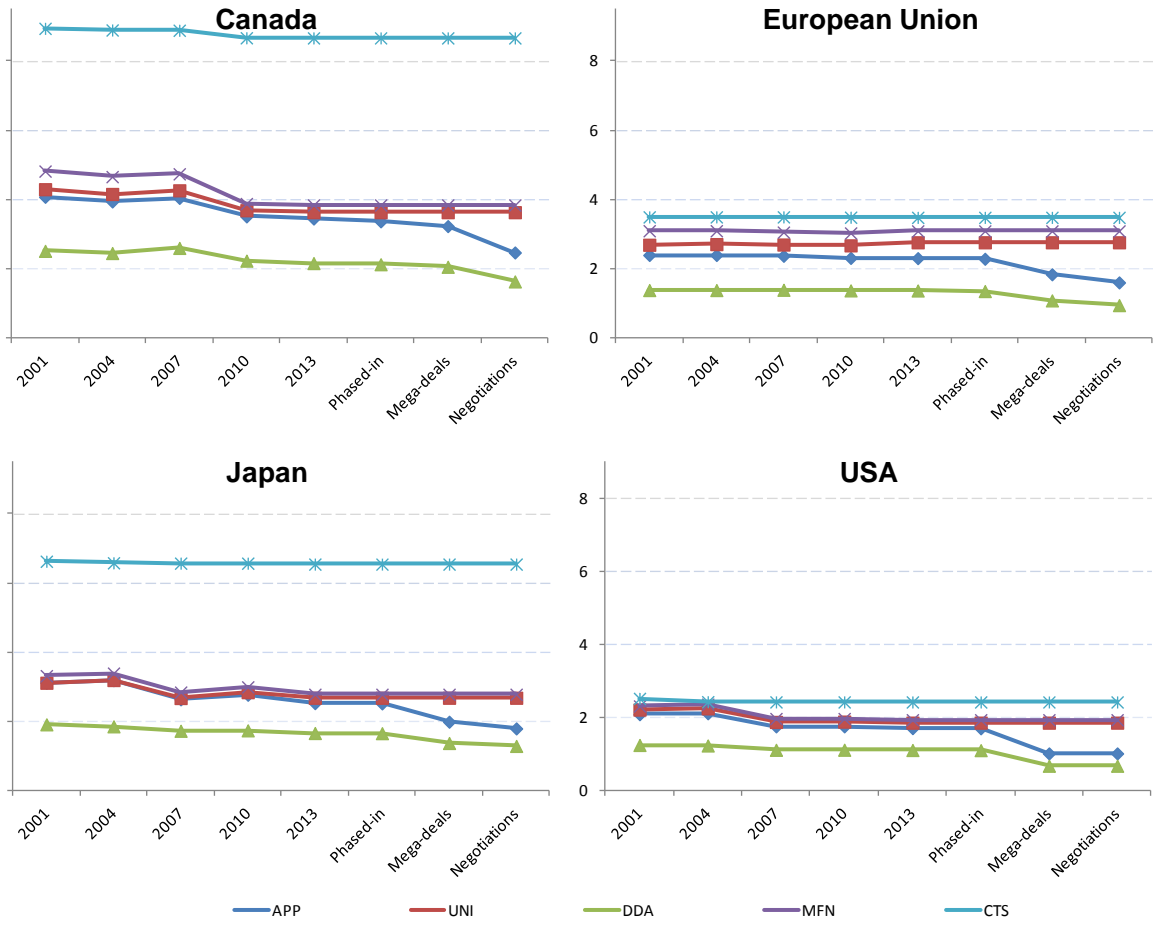
Importer	RSquare	Coeff. Of Variation	RootMSE	Number of RTAs
Japan	1.00	23.89	0.01	5
Switzerland	1.00	31.03	0.02	15
Iceland	1.00	25.40	0.03	15
Korea	0.99	37.41	0.04	5
Norway	0.99	18.16	0.11	15
European Union	0.99	47.11	0.01	21
Israel	0.98	68.18	0.05	6
Turkey	0.95	79.98	0.06	11
USA	0.95	178.90	0.01	10
Mexico	0.92	186.38	0.05	13
Costa rica	0.92	189.01	0.02	5
Morocco	0.89	216.66	0.06	6
El salvador	0.70	245.70	0.03	5
The former yugoslav rep.	0.67	244.60	0.04	6
Jordan	0.67	232.42	0.08	6
India	0.58	120.59	0.08	6
Tunisia	0.47	215.96	0.06	5
China	0.47	146.82	0.05	6
Guatemala	0.43	212.27	0.03	5
Egypt	0.27	833.36	0.26	5
Albania	0.16	225.69	0.04	5
Chile	0.13	226.06	0.02	12

Source: Authors' calculations. MAcMap-HS6 database.

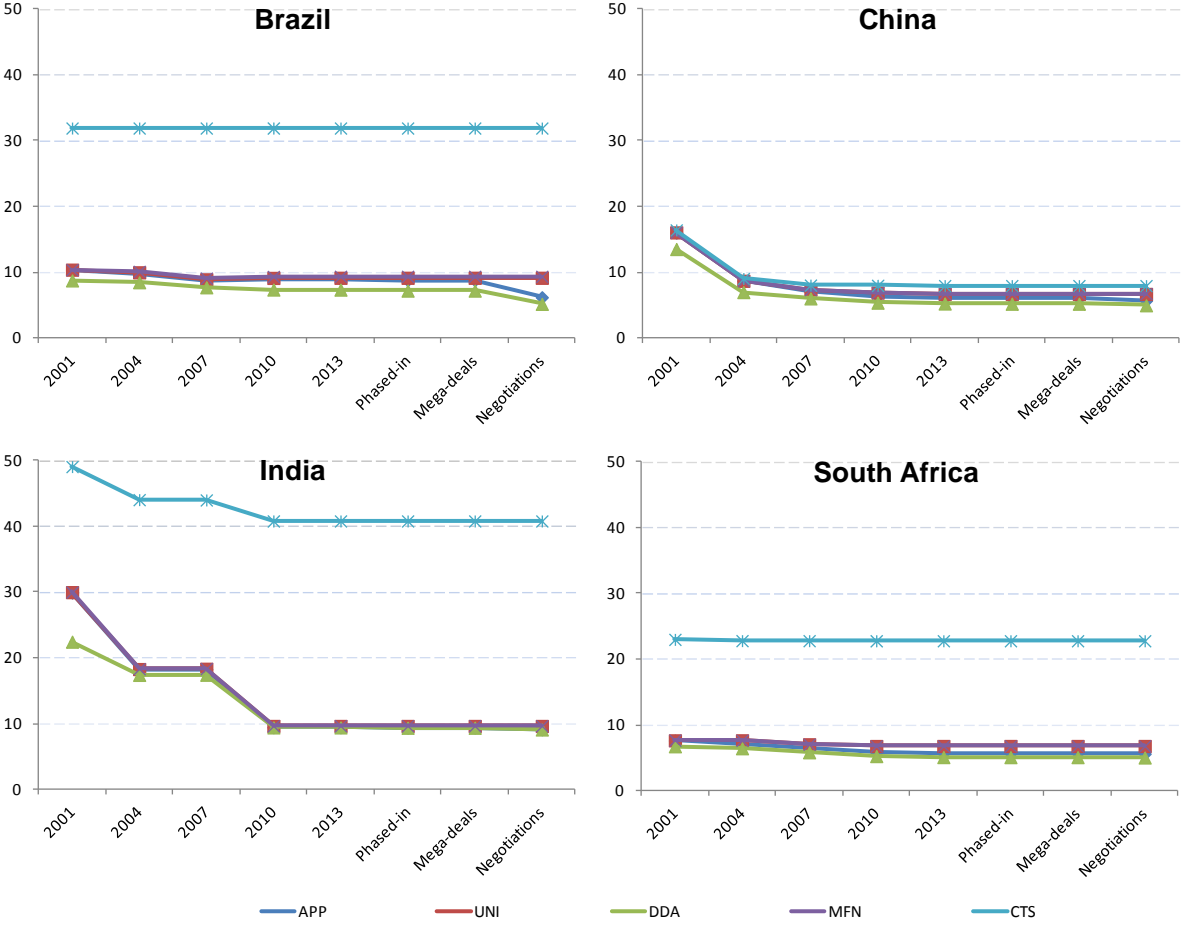
A2. The tariff ladder from 2001 onward for selected countries

Figure 7. The tariff ladder from 2001 onward for selected countries (AVE, world average)

Panel A: Rich countries



Panel B: Emerging countries



A3. Additional results on the decomposition of changes in average applied and mfn tariff duty between 2001 and 2013

Table 4: Decomposition of changes in average MFN tariff duty between 2001 and 2013, for selected countries (AVE in %, variation in p.p.)

	Av. MFN applied duty (AVE, %)		Change (p.p.)		
	2001	2013	Total	Com- mitted	Lib. own Initiative
Argentina	12.2	11.3	-0.9	0.0	-0.9
South Africa	7.7	6.8	-0.9	-0.1	-0.8
<i>Algeria</i>	13.3	12.4	-0.9	0.0	-0.9
Guatemala	4.2	3.3	-0.9	0.0	-0.9
<u>Croatia</u>	5.1	4.3	-0.8	-0.5	-0.4
Kuwait	4.8	4.0	-0.8	0.0	-0.8
Sri Lanka	7.4	6.9	-0.6	0.0	-0.6
Japan	3.3	2.8	-0.5	-0.1	-0.5
New Zealand	2.3	1.9	-0.4	0.0	-0.4
USA	2.3	1.9	-0.4	-0.1	-0.3
Philippines	5.2	4.9	-0.3	0.0	-0.3
Indonesia	5.8	5.6	-0.2	-0.1	-0.2
<u>Qatar</u>	4.2	4.0	-0.2	-0.1	-0.1
<i>Lebanon</i>	3.9	3.8	-0.2	0.0	-0.2
<i>Azerbaijan</i>	6.0	5.9	-0.1	0.0	-0.1
<u>United Arab Emirates</u>	4.0	4.0	0.0	0.0	0.0
European Union	3.1	3.1	0.0	0.0	0.0
Hong kong	0.0	0.0	0.0	0.0	0.0
Costa Rica	4.6	4.7	0.1	0.0	0.1
Turkey	6.6	6.7	0.1	-0.2	0.3
Myanmar	4.0	4.4	0.4	0.0	0.4
Venezuela	11.0	11.7	0.6	0.0	0.6
Singapore	0.1	0.8	0.8	0.0	0.8

Note: To complement Table 2, the countries shown are those accounting for more than 0.1% of world percent in 2013, for which average applied duties changed by less than 1 p.p. in absolute value between 2001 and 2013. Countries are ranked by increasing total change over the period. Countries not member of the WTO in 2013 are featured in italics. Countries having acceded after WTO creation and no later than 2013 are underlined. “Committed change” refers to changes in MFN linked to commitments in the multilateral system, either in the Marrakech Agreement or upon WTO accession.

Source: Authors' calculations, MAcMap-HS6 database. Weighted averages computed using MAcMap-HS6 methodology (Bouët et al., 2008).

Table 5: Decomposition of changes in average applied tariff duty between 2001 and 2013, for selected countries (AVE in %, variation in p.p.)

	Changes 2001-2013				
	Total	MFN	Non Reciprocal Pref.	Reciprocal Pref.	Applied 2013
Kuwait	-0.9	-0.8	0.0	-0.1	3.6
<i>Lebanon</i>	-0.8	-0.2	0.0	-0.6	3.0
New Zealand	-0.7	-0.4	0.1	-0.3	1.5
Canada	-0.6	-1.0	0.3	0.0	3.5
Sri Lanka	-0.6	-0.6	0.0	0.0	6.8
Japan	-0.6	-0.5	0.1	-0.1	2.5
USA	-0.4	-0.4	0.0	-0.0	1.7
Turkey	-0.4	0.1	-0.4	-0.1	5.2
<u>Qatar</u>	-0.3	-0.2	0.0	-0.1	3.6
<u>United Arab Emirates</u>	-0.1	0.0	0.0	-0.1	3.7
European Union	-0.1	0.0	0.1	-0.2	2.3
<i>Azerbaijan</i>	-0.1	-0.1	0.0	0.0	5.7
Hong kong	0.0	0.0	0.0	0.0	0.0
Myanmar	0.3	0.4	0.0	-0.1	4.3
Venezuela	0.3	0.6	0.0	-0.3	11.2
Singapore	0.7	0.8	0.0	-0.1	0.8

Note: To complement Table 3, the countries shown are those accounting for more than 0.1% of world percent in 2013, for which average applied duties changed by less than 1 p.p. in absolute value between 2001 and 2013. Countries are ranked by increasing total change in average applied protection between 2001 and 2013. Committed stands for the impacts due to WTO commitments; Uni stands for unilateral changes, including changes in unilateral preferences, of countries' trade policies ; RTA stands for changes due to the implementation of reciprocal trade agreements.

Source: Authors' calculations, MAcMap-HS6 database. Weighted average using MAcMap-HS6 methodology.

A4. Sectoral and geographical aggregation

Table 6: Sectoral decomposition used in the analysis

Sectoral aggregation	Code	List of GTAP sectors (long names)		
Cereals	Cereals	Paddy rice	Wheat	Cereal grains nec
Agriculture from Plant Origin	VegAgr	Vegetables. fruit. nuts Plant-based fibers	Oil seeds Crops nec	Sugar cane. sugar beet
Agriculture from Animal Origin	AnimAgr	Cattle.sheep.goats.horses Wool. silk-worm cocoons	Animal products nec	Raw milk
Forestry	Forestry	Forestry		
Fishing	Fishing	Fishing		
Primary Energy	PrimEne	Coal	Oil	Gas
Minerals	Minerals	Electricity	Gas manufacture. distribution	
		Minerals nec	Mineral products nec	
Food industries	Food	Meat: cattle.sheep.goats.horse Dairy products	Meat products nec Processed rice	Vegetable oils and fats Sugar
		Food products nec	Beverages and tobacco products	
Clothing industries	Clothing	Textiles	Wearing apparel	Leather products
Other industries	OthManuf	Wood products Manufactures nec	Paper products. publishing	Metal products
Energy Sector	SecEner	Petroleum. coal products		
Chemistry	Chemistry	Chemical.rubber.plastic prods		
Metals	Metals	Ferrous metals	Metals nec	
Vehicles	Vehicles	Motor vehicles and parts	Transport equipment nec	
Electronic	Electronic	Electronic equipment		
Equipment	Equipment	Machinery and equipment nec		
Transport	Transport	Transport nec	Sea transport	Air transport
		Water	Construction	Trade
Services sectors	Serv	Communication	Financial services nec	Insurance
		Business services nec	Recreation and other services	
		PubAdmin/Defence/Health/Education	Dwellings	

Table 7: Region aggregates used in the study

Geographical aggregation	Code	List of GTAP9 countries (140)
Oceania	Oceania	AUS NZL XOC
China and Hong Kong	ChinaHK	CHN HKG
Japan	Japan	JPN
Developed Asian Countries	Dvd_Asia	KOR TWN
ASEAN	ASEAN	KHM IDN LAO MYS PHL SGP THA VNM XSE
India	India	IND
Rest of asian developing countries	RoDvpgA	BRN MNG XEA BGD NPL PAK LKA XSA XNA XTW
Canada	Canada	CAN
USA	USA	USA
Mexico	Mexico	MEX
Argentina	Argentina	ARG
Brazil	Brazil	BRA
Latin American Countries	LAC	BOL CHL COL ECU PRY PER URY VEN XSM CRI
		GTM HND NIC PAN SLV XCA XCB DOM JAM PRI TTO
EU27	EU27	AUT BEL CYP CZE DNK EST FIN FRA DEU GRC
		HUN IRL ITA LVA LTU LUX MLT NLD POL PRT SVK SVN ESP SWE GBR BGR ROU
EFTA	EFTA	CHE NOR XEF
Russia	Russia	RUS
Commonwealth of Independent States	CIS	BLR UKR XEE XER KAZ KGZ XSU ARM AZE GEO
Turkey and Balkans countries	Balk_Tur	ALB TUR HRV
Middle East Countries	MiddleEast	BHR IRN ISR JOR KWT OMN QAT SAU ARE XWS
North Africa	NorthAfr	EGY MAR TUN XNF
Africa	Africa	BEN BFA CMR CIV GHA GIN NGA SEN TGO XWF
		XCF XAC ETH KEN MDG MWI MUS MOZ RWA TZA
SACU	SACU	UGA ZMB ZWE XEC BWA NAM ZAF XSC

A5. The Model

As a complement to the short description given in the main text, the main elements of the model's structure are sketched below. The model used here is the perfectly competitive version of the MIRAGE model, as documented in Fontagné et al. (2013).²³

Supply Side

On the supply side, each sector in MIRAGE is modeled as a representative firm, which combines value-added and intermediate consumption in fixed shares. Value-added is a CES bundle of imperfectly substitutable primary factors (capital, skilled and unskilled labor, land and natural resources). Firms' demand for production factors is organized as a CES aggregation of land, natural resources, unskilled labor, and a bundle of the remaining factors. This bundle is a nested CES aggregate of skilled labor and capital (that are considered as relatively more complementary).

MIRAGE assumes full employment of primary factors, whose growth rates are set exogenously, based on the macro projections on a yearly step, as detailed below. Population, participation in the labor market and human capital evolve in each country (or region of the world economy) according to the demographics embedded in the macro projections. This determines the labor force as well as its skill composition (skilled/unskilled). Skilled and unskilled labor is perfectly mobile across sectors, but immobile between countries. Natural resources are sector specific, while land is mobile between agricultural sectors. Natural resources for the mining sector and land for agricultural sectors are set at their 2011 levels: prices adjust demand to this fixed supply. In the baseline, natural resources for fossil fuel production sectors adjust to match the exogenous price target that is imposed (from the International Energy Agency, 2015) for coal, oil and gas, and according to the energy demand projected by the model. By contrast, in the simulations, changes in demand for fossil energy sources influence their price, while natural resources are fixed at their baseline level.

Installed capital is assumed to be immobile (sector-specific), while investments are allocated across sectors according to their rates of return. The overall stock of capital evolves by combining capital formation and a constant depreciation rate of capital of 6% that is the same as in the long-term growth models. Gross investment is determined by the combination of saving (the saving rate from the growth model, applied to the national income) and the current account. Finally, while total investment is saving-driven, its allocation is determined by the rate of return on investment in the various activities. For simplicity, and because we lack reliable data on foreign direct investment at country of origin, host and sectoral levels, international capital flows only appear through the current account imbalances, and are not explicitly modeled.

²³ The model is also documented in an interactive wiki-based website. See <http://www.mirage-model.eu>.

Demand Side

On the demand side, a representative consumer from each country/region maximizes instantaneous utility under a budget constraint and saves a part of its income, determined by saving rates projected in our first-step exercise. Expenditure is allocated to commodities and services according to a LES-CES (Linear Expenditure System – Constant Elasticity of Substitution) function. This implies that, above a minimum consumption of goods produced by each sector, consumption choices among goods produced by different sectors are made according to a CES function. This representation of preferences is well suited to our purpose as it is flexible enough to deal with countries at different levels of development.

Within each sector, goods are differentiated by their origin. A nested CES function allows for a particular status for domestic products according to the usual Armington hypothesis (Armington, 1969): consumers' and firms' choices are biased towards domestic production, and therefore domestic and foreign goods are imperfectly substitutable, using a CES specification. We use Armington elasticities provided by the GTAP database (Global Trade Analysis Project) and estimated by Hertel et al. (2007). Total demand is built from final consumption, intermediate consumption and investment in capital goods.

Dynamics

Efficiency in the use of primary factors and intermediate inputs is based on the combination of four mechanisms. First, agricultural productivity is projected separately, as detailed in Fontagné et al. (2013). Second, energy efficiency computed from the aggregate growth models is imposed on MIRAGE. Third, a 2 percentage point growth difference between TFP in manufactures and services is assumed (as in van den Mensbrugge, 2005). Fourth, given the agricultural productivity and the relation between productivity in manufacturing and services, MIRAGE recovers endogenously country-specific TFP from the exogenous GDP and production factors. Notice that TFP thus recovered from the baseline projections is subsequently set as exogenous in the alternative scenarios. Therefore, GDP becomes endogenous in such scenarios.

Dynamics in MIRAGE is implemented in a sequentially recursive way. That is, the equilibrium can be solved successively for each period, given the exogenous variations of GDP, savings, current accounts, active population and skill level coming from the growth models, as described above. Simulations extend up to 2025. Finally, MIRAGE is calibrated on the GTAP dataset version 9PR1, with 2011 as a base year.