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Agricultural Trade Liberalization in the 21st Century: Has it Done the Business?

Jean-Christophe Bureau, Houssein Guimbard & Sébastien Jean

Highlights

- While still relatively high (17.3%, compared to 3.1% for industrial products), tariffs applied in agricultural and food products have been cut by 27.4% between 2001 and 2013.

- Own-initiative liberalization was the dominant driver of agricultural tariff cuts between 2001 and 2007, while RTAs played a larger role afterwards.

- Deepening regionalism would only have a limited impact. In contrast, a "trade war" might result in world agricultural trade falling by almost 30%, with output falling by 10% or more in some regions.

RESEARCH AND EXPERTISE
ON THE WORLD ECONOMY

Abstract

Based on a novel, detailed, time-consistent tariff database to take stock of developments regarding import protection in the agricultural sector since 2001, we propose a statistical decomposition of the changes in the various types of tariffs. The results show that the multilateral system has played a limited role in trade liberalization over the period. Many countries have continued to apply much lower tariffs on agricultural products than their WTO ceilings. Moreover, there has been substantial unilateral dismantling of tariffs over the period, so that much of the liberalization took place outside WTO and regional agreements. The number of regional trade agreements has surged, but their impact on applied agricultural tariffs has been limited. Finally, we investigate the tariffs, trade and production implications for food and agricultural products of two extreme scenarios in the future development of trade negotiations: an ambitious surge of regional agreements and a trade war within the WTO context.

Keywords

Tariffs, Regional Trade Agreements, Agricultural Trade Liberalization, WTO.

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F10, F13, F14.

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RESEARCH AND EXPERTISE ON THE WORLD ECONOMY

Agricultural Trade Liberalization in the 21st Century: Has it Done the Business?

Jean-Christophe Bureau, Houssein Guimbard

and Sébastien Jean*

1. Introduction

The post-World War II process of trade liberalization is being questioned in many parts of the world (Irwin, 2015). No major progress has been made in the multilateral arena since the Uruguay Round, which ended in 1994. Governments with a protectionist agenda have recently been elected in major trading nations. This has led to some regional trade negotiations being discontinued, while ratification of a number of signed agreements now seems uncertain. Some long-lasting free-trade agreements are being questioned, with calls for renegotiations. More generally, protectionist measures are on the rise (Evenett and Fritz, 2015).

Nevertheless, the degree of trade liberalization achieved since the 1947 General Agreement on Tariffs and Trade (GATT) has been impressive (Caliendo et al, 2016). In particular, the depth of tariff cuts that has taken place since the launch of the Doha Round in 2001 is substantial. Indeed, considering agricultural as well as non-agricultural products, Bureau et al (2016) have shown that, overall, average applied tariffs worldwide were cut by almost 40% between 2001 and 2013.

The drivers of this recent liberalization are often misperceived. While World Trade Organization (WTO) discipline is usually quoted as a major driver, Bureau et al (2016) concludes that the multilateral channel has actually played a limited role in the decrease in global tariffs since 2004, when the implementation period of the 1994 Uruguay Round agreement ended. More surprisingly, this work shows that the considerable proliferation of Regional Trade Agreements (RTAs) has not dented the global level of tariff protection as much as unilateral tariff reductions. Indeed, "self-imposed" reductions in tariffs have been impressive in the manufacturing sector, in particular in developing countries. Such tariff reductions have taken place for a variety of reasons, a major one being the willingness of large emerging countries to integrate globalized value chains and attract foreign investment by removing tariffs on imported materials.

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In this paper, we question whether the patterns of trade liberalization, described by Caliendo et al (2016) and Bureau et al (2016) also apply to agriculture.[1] Agricultural products have long held a special place in trade policy. The sector is often described as remaining sheltered from the large reductions in tariffs that have taken place during successive GATT "rounds".[2] It is only with the 1994 Uruguay Round Agreement that tariff binding and (modest) tariff cuts were agreed. Since the large market fluctuations during the 1970s, many countries have been reluctant to rely on the world market for their supply of staple foods. Recent food price spikes in 2008 and 2011-13 convinced many net food-importing countries that it would be unwise to further expose their domestic production to imports. Agriculture has been a major stumbling stone that prevented a significant multilateral agreement at key moments of the Doha Round negotiations from being reached (Blustein, 2008; Bouët et al, 2007). And, under bilateral agreements, major trading partners such as the European Union (EU), the United States of America (US), South Korea and Japan exclude agricultural subsectors from tariff concessions.

We develop precise statistical information on various types of tariffs and trade covering the post-Uruguay Round period. We construct an original dataset on tariffs protection at a very high level of product disaggregation, from 2001 to 2013, to explore in detail the tariff changes that have taken place since the launch of the so called "Doha Round". We rely on the construction of a "tariff ladder", which graphically collates different types of tariffs, thus helping to disentangle the different drivers behind the observed reduction in tariffs over the period. We use this framework to assess the degree of actual trade liberalization in the agricultural sector, and the respective roles played by multilateral, regional and unilateral tariff concessions. To emphasize the specificities of the agricultural sector, we compare its changes in tariffs to those that have occurred worldwide over the recent period. We also investigate the potential impacts of two polar global tariff scenarios: (i) the successful completion of all trade agreements actually in negotiation, and (ii) a surge in protectionism that would lead all WTO members to raise their tariffs up to their bound level. We compare their impacts on agricultural trade and production, so as to bracket the potential consequences of future trade policy developments.

2. Agricultural tariffs and the "tariff ladder" approach

The idea that agriculture was not subject to GATT discipline before the 1994 Uruguay Round Agreement on Agriculture (URAA) is somewhat misleading, as shown by Tangermann (2016). However, during that period of almost half a century, the sector benefited from important exceptions to multilateral discipline; in particular, exemptions regarding quantitative import restrictions, export subsidies, import quotas and variable levies that were used by several countries to stabilize domestic agricultural prices, often at the expense of third countries' producers.[3] Since the protectionist surge of the early 20th century, the sector had also been characterized by a high degree of border protection in many countries, both

[1] Throughout this article, we refer to the WTO's definition of "agricultural products", which (roughly) includes all food products except fisheries products.
See https://www.wto.org/english/docs_e/legal_e/14-ag_02_e.htm

[2] Note that Bown and Irwin (2015) revise downwards the fall in tariffs that took place under the GATT rounds.

[3] Quantitative restrictions are covered by Article XI:2(c)(i) of GATT 1947 and export subsidies by Article XVI:3.

developing (e.g. India) and developed (e.g. EU, Japan, Norway). These high tariffs survived the successive rounds of negotiation until the URAA brought the sector into the overall framework of the WTO.

The URAA resulted in the binding of tariffs and the publication of consolidated tariff schedules by WTO members. It led to a compulsory 36% cut in the average bound tariffs between 1995 and the end of 2000 for developed countries (2004 for developing ones). In practice, this reduction was only reflected in a limited cut in actual tariff protection. Indeed, the conversion of variable levies and import restriction in tariff equivalent resulted in what was called "*dirty tariffication"*, an overestimation of previous levels of protection in many countries, in particular in developing countries that were free of setting an arbitrary "base" tariff. Another reason was the "*tariff cuts dilution*", a strategic allocation of the compulsory average tariff cuts across products.[4]

The conversion of quantitative import restrictions and variable levies into their tariff equivalents was a major achievement in terms of transparency and predictability of import policies. However, many countries still impose complex tariffs in agriculture, with specific components (per ton, per head of cattle, etc), *ad valorem* components (a percentage of the value of imports), or composite tariffs (a combination of the two, sometimes subject to maxima or minima), or as a function of the percentage of sugar or alcohol content. Some tariff structures include also seasonal tariffs that vary during the year. In some countries, there is still a large dispersion in rates between tariff lines beyond the United Nations' six-digit-level Harmonized System classification (HS6, e.g. Japan or the EU). All of this makes it difficult to assess agricultural protection and to carry out international comparisons.

Moreover, as for industrial products, bound tariffs are only part of the tariff picture in agriculture; they diverge widely from tariffs applied on a non-discriminatory basis (Most Favored Nation or MFN tariffs), while the latter differ from the tariffs applied under RTAs and custom unions, as well as a variety of arrangements targeting certain countries, such as the Generalized System of Preferences (GSP) or particular unilateral tariff concessions granted to the poorest countries.

To disentangle the different drivers of tariff changes, we define a "tariff ladder", which accounts for a hierarchy of tariff concessions, translated into *ad valorem* equivalent tariffs (AVE, i.e. a percentage). We break down a given WTO member country's tariffs hierarchy as:

- "*Bound MFN tariffs*" are the maximum tariff a country can apply to imports from another WTO member (with the exception of temporary safeguard measure or countervailing tariffs). Their levels are informative since they reflect the level of

[4] "Dirty tariffication" refers to the setting of initial base tariffs at a higher level than the one that resulted from former instruments, when quantitative import restrictions and variable levies were replaced by bound tariffs. See Hathaway and Ingco (1995), Tangermann (1995). "Tariff cuts dilution" refers to the creative solutions found by WTO members to reach a 36% average cut in tariffs. This includes cutting tariffs by a high percentage on products that faced almost zero protection, or those on products with minor economic importance, while making the minimal cut (at the time, 15%) on tariffs for products that could result in severe competition for local products (see Bureau et al, 2000).

protection that is not only maximum, but also the level of tariffs that WTO members negotiate in the multilateral arena.

- "*Applied MFN tariffs*" are the tariffs actually applied on a non-discriminatory basis to imports, equal to or lower than the bound rate. They give the level of protection that a standard would-be exporter faces when accessing a standard WTO member's market.
- "*Unilaterally applied tariffs"* concern products benefiting from the non-reciprocal tariff concessions granted for development purposes.[5]
- "*Preferential applied tariffs*" take into account the lower tariffs provided under reciprocal trade agreements, i.e. customs unions, and free-trade, bilateral and regional trade agreements.

Thus, at the finest level, we have the following relationship between the types of tariffs:

$$Bound\ MFN\ \geq Applied\ MFN\ \geq Unilaterally\ applied\ \geq Preferential\ applied$$

Our tariff ladder allows different types of protection and tariff concessions to be disentangled. The distance between *Bound MFN* and *Applied MFN* tariffs, often referred to as "binding overhang", shows by how much a country could potentially increase tariffs protection without infringing its WTO commitments. The distance between *Applied MFN* and *Unilaterally applied* tariffs reflects the influence of non-reciprocal preferences, granted mostly to overseas territories and developing economies. The distance between *Unilaterally applied* and *Preferential applied* tariffs provides information on the depth of reciprocal preferential trade regimes – what is often referred to as "regionalism". It measures the impact on tariff protection of bilateral free-trade agreements, custom unions or regional free-trade agreements that, under WTO rules, must be reciprocal and cover "substantially all trade". The database used collects the various tariffs that compose the tariff ladder between each pair of countries, at the HS6 level (the database sources and methods are described in the Appendix).

One original aspect of the paper is that we put together historical data on Bound MFN, Applied MFN and Preferential applied tariffs, bilateral trade flows, RTAs tariff concessions and quotas between 2001 and 2013 at the six-digit level of the United Nation's harmonized system (HS6). The main material is a recent version of the MAcMap-HS6 dataset on tariffs, a joint effort by the International Trade Commission and the Centre d'Études Prospectives et d'Informations Internationales (see Guimbard et al, 2012, and appendix for details). While each of these tariff data have been used by several research institutions, the construction of an historical database makes it possible to investigate in details the changes that have taken place for the different rungs of the tariff ladder. More precisely, in the following analyses,

[5] For example, those granted under the GSP and the US African Growth and Opportunity Act. GSP's tariffs also depend on the economic status of countries (e.g. Least Developed Countries often benefit from extra preferences from developing countries).

changes in each rung of the tariff ladder are calculated for the importer-exporter-HS6 product level before being aggregated.[6]

In Section 2, we look at the tariff ladder at the world level and compare the world average protection, in agriculture and in the rest of the economy. We then look at the level of agricultural tariffs across countries, before turning in Section 3 to the changes in the tariff ladder that have taken place since 2001.

3. A global picture of tariff protection in agriculture

3.1 Tariffs protection: does agriculture remain special?

Figure 1a depicts the tariff ladder for agricultural products. As a basis for comparison, Figure 1b reproduces the same for industrial products, i.e. agricultural as well as non-agricultural goods.

A striking difference between Figure 1a and 1b is that the world average level of *Bound MFN* tariffs is much higher in agriculture than in other sectors. In 2013, the average bound tariff worldwide was 36.5% for agricultural products versus 11.0% for industrial products. This reflects the fact that tariffs on industrial products result from decades of GATT rounds, and that agriculture remained much less affected by the GATT discipline until the URAA which, itself, led (as explained above) to only small actual tariff cuts.

Both Figures 1a and 1b exhibit considerable binding overhang at the world level (i.e. the distance between the two upper curves in 2013). In absolute terms, this amounts to 18.4 percentage points (hereafter pp) in agriculture, and just 7.2pp for the industrial products.[7] In relative terms, the binding overhang is such that *Applied MFN* tariffs are only half of the *Bound MFN* tariffs on average in agriculture, while they are one-third in industrial goods. In relative terms, the binding overhang is also larger in agriculture.

The comparison of the bottom curves in Figure 1a and 1b suggests that *Applied MFN* and *Preferential applied* tariffs are very similar in agriculture, while, in Figure 1b, a gap appears after 2010, in particular between *Unilaterally applied* and *Preferential applied* tariffs. This indicates the relative role of the numerous RTAs concluded during this period. The difference between the average *Applied MFN* and *Preferential applied* tariffs is 0.9pp in agriculture in 2013, while the difference is 0.6pp for industrial sectors in Figure 1b.[8] That is, the average tariff liberalization brought about by RTAs is larger in agriculture than in other sectors in

[6] We did not consider possible tariffs higher than the bound tariffs e.g. imposed on non-WTO members such as those applied by the US to Cuba. Their use is limited, since most WTO members grant non-WTO members the same conditions as to WTO ones.

[7] When considering all products, *Applied MFN* tariffs are only 37% of the bound tariffs on average. The average *Applied MFN* tariff is 4.8% and the average *Bound MFN* tariff is 12.9%. The world average binding overhang amounts to around 8pp. See Bureau et al (2017) for a global analysis.

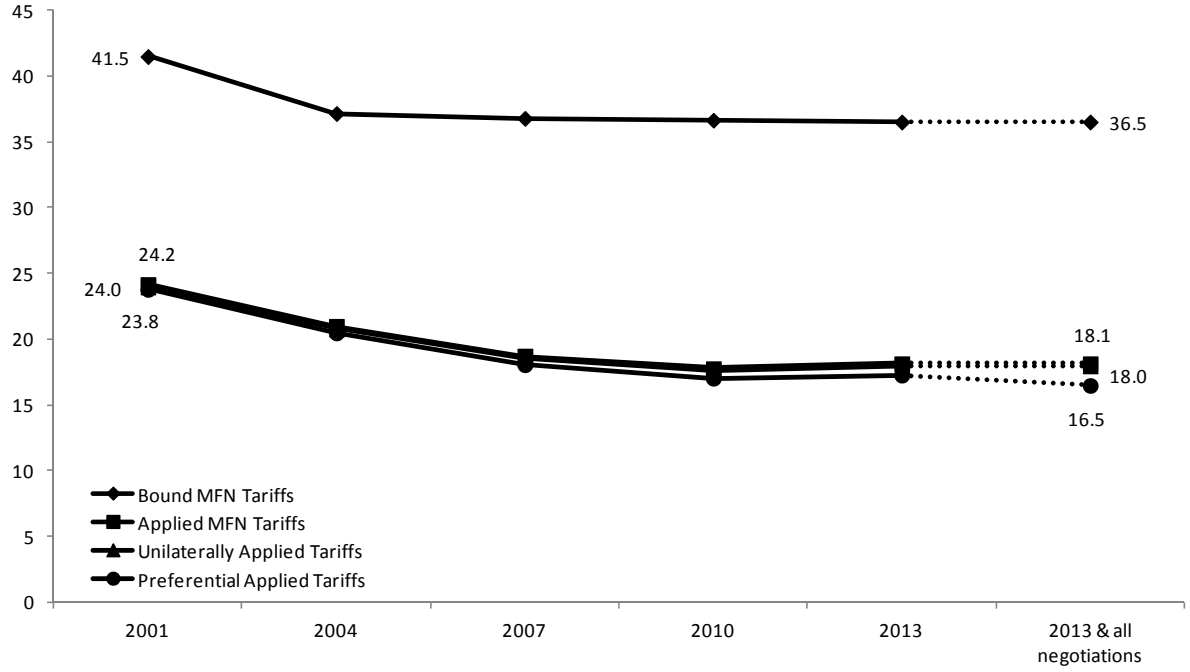
[8] For agricultural goods, the average *Applied MFN* tariff was 18.1% and the average *Preferential applied tariff* was 17.3% in 2013 (see Table 1). If we only consider industrial products, the figures were respectively 3.7% and 3.1% (not displayed in tables here).

absolute value, but lower as a proportion of the MFN tariffs. Overall, one may conclude that the tariff concessions granted to agricultural products under preferential agreements are roughly in line with those granted to other products. This suggests that the idea of agriculture (as a whole) remaining largely excluded from RTAs is somewhat misleading. Clearly, agricultural products are frequently excluded from tariff concessions schedules. But exemptions are often limited to a narrow list of sensitive products (e.g. milk products, sugar, beef, rice), while the bulk of the tariff lines covering raw commodities and processed products is liberalized in the same way as industrial products under many RTAs.

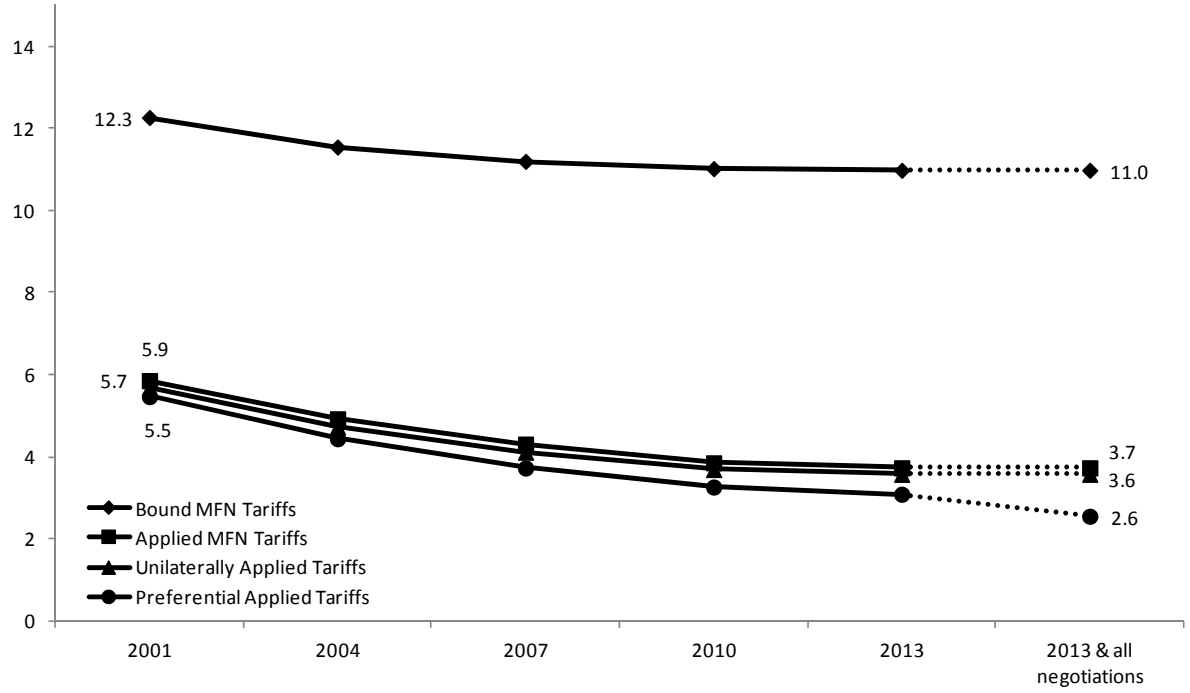
Finally, a major difference with other sectors is that the average *Preferential applied* tariffs (i.e. accounting for all tariff preferences) remain much higher in agriculture (average 17.3%) than in industry (3.1%).

Figure 1. Changes in average world tariffs in agricultural products and industrial products, historical trend and simulations of future changes (in percentages)

Panel A: agricultural products



Panel B: industrial products



Source: MAcMap-HS6, Authors' computations

3.2 Bound tariffs and binding overhang in agriculture

We now focus on the difference in *Bound MFN* tariffs across countries in 2013. The fact that the latter remain high in agriculture compared to the rest of the economy has several consequences. In some countries, this simply shows that agriculture remains a highly protected sector. Table 1 provides examples of countries that have both high *Bound MFN* and *Applied MFN* tariffs for agricultural products, meaning that these countries actually impose high duties. Examples are Norway, Switzerland, Korea and Turkey, where applied tariffs are around 50% or more in *ad valorem* equivalent (Table 1).[9]

However, few countries actually apply their bound tariffs, even on a non-discriminatory basis. Table 1 shows that, in 2013, the average *Applied MFN* tariff for agricultural products was 18.1%, i.e. half the *Bound MFN* average tariff worldwide. This considerable difference results from the precautionary attitude of many countries during the Uruguay Round, reflecting their concerns about agricultural trade liberalization. Those countries that bound their tariffs much higher than their MFN tariffs were often developing and emerging countries, such as India, Brazil, Pakistan, Columbia and Ghana. Most were not required to base their bound tariffs on protection equivalents at the time, but were given latitude in setting their initial "base" tariffs in 1994, on which the binding took place. In the case of Nigeria, Peru and Bangladesh, the tariffs applied on an MFN basis were roughly one-tenth of the tariffs bound under the WTO discipline. These are extreme materializations of the widespread desire to have the option of raising agricultural tariffs, rather than committing to a legally binding tariff straitjacket, while at the same time applying relatively low duties on food products.

Several conclusions can be drawn from Table 1. Foremost, *Bound MFN* tariffs (which serve as the basis for tariff negotiations within WTO) have a limited connection to the degree of applied tariff protection. While this is true in all sectors, it is even more the case in agriculture where the binding overhang is often considerable. Figure 1a and Table 1 clearly show that even large tariff concessions based on bound tariffs would not reduce applied tariffs. In many countries, very large cuts in bound tariffs under the Doha Round would be necessary to achieve actual agricultural trade liberalization, India and Indonesia being cases in point. Besides, if WTO members raised their agricultural tariffs to the bound level, there would be a significant surge in actual protection. Eventually, a potential multilateral agreement binding tariffs at their currently applied level would be a major accomplishment, even if countries did not agree on further cuts in applied protection, which confirms the finding by Bouët and Laborde (2010) on this issue.

3.3 Tariff concessions under preferential agreements in agriculture

We now focus on applied tariffs across countries in 2013. *Applied MFN* tariffs are the ones that an arbitrary exporter will face when attempting to access an arbitrary market among the 164 WTO members, i.e. without discrimination. However, many (but not all) countries can access even lower tariffs agreed within RTAs or allowed by non-reciprocal concessions granted for other motives (e.g. facilitating development, fighting drug trafficking, promoting

[9] Note that the figures quoted are mean-weighted averages and, even though the methodology used to compute *ad valorem* equivalents (see Bouët et al, 2008) and weighting schemes aims at minimizing endogeneity, average figures may underestimate tariff peaks such as those characterizing the rice sector in some Asian countries, dairy products in the US and Canada, beef cuts in the EU, etc.

good governance, etc). Despite accounting for all RTAs, Table 1 attests to the high level of applied agricultural protection in 2013. The *Preferential applied* average tariff is particularly significant in countries such as Norway and Switzerland (above 60% in *ad valorem* equivalent), Egypt, India and Morocco (above 30%). Furthermore, countries with high protection concentrated on a few products, such as Canada, have relatively high average tariffs in agriculture, as a result of the weighting system used to average tariffs.[10]

The distance between the average *Applied MFN* and *Unilaterally applied* tariffs is small in 2013 (Figure 1a and Table 1), suggesting that non-reciprocal preferences do not significantly affect the average tariff worldwide. There are, obviously, exceptions, such as the EU "Everything but Arms" agreement or the US non-reciprocal preferences for Least Developed Countries, but these only applied to a small share of trade. Moreover, only a small number of countries implement a broad set of tariff concessions under the GSP, and, in some cases, their GSP concessions exclude significant agricultural subsectors.

Finally, the average distance between *Unilaterally applied* and *Preferential applied* tariffs is small as depicted by Figure 1a in 2013, reflecting the small impact of RTAs in agriculture. However, Table 1 shows that this average distance hides contrasting situations. In a few countries, the gap can be significant. This is the case in Norway (the gap exceeds 8pp), Switzerland, Vietnam, Israel (more than 4pp), and Mexico and Chile[11] (more than 3pp). In these countries, RTAs significantly reduce the protection on agricultural imports, in a context where the sector is highly protected at the MFN level. By contrast, large markets such as the U.S. (0.4pp), the EU (0.2pp), Japan (0.5pp) and China (1.1pp) have average *Preferential applied* tariffs close to their *Applied MFN* tariffs. For these countries, tariff concessions under preferential agreements hardly change the structure of protection, either because many tariff lines are already duty-free under the MFN regime (e.g. the US), because agricultural goods are mostly treated as sensitive and excluded from the RTAs (e.g. Japan), or because the country has concluded few RTAs.

4. Disentangling the drivers of trade liberalization in agriculture

We now use our tariff ladder approach to look at the main drivers of changes in tariff protection since the beginning of the Doha Round. The objective is to assess which types of trade liberalization, between the multilateral, unilateral and regional channels, have had more impact on actual tariff protection over the period.

Figure 1a provides a dynamic vision of the changes in the tariff ladder between 2001 and 2013. Note that all the calculations are made on the basis of the changes that took place for each individual tariff lines, i.e. at the HS6 level, and then aggregated so as to produce the tables in the text. To explore further the dynamics of tariff protection, we use an arithmetical

[10] Tariff averages are computed using MAcMap-HS6's reference groups' weighting scheme (see Appendix). Endogeneity between trade and tariffs leads to underestimates of average protection when using bilateral trade weights (as high tariffs generally induce low or zero trade flows). Using the import structure of a group of countries similar to the importer (its "reference group") as a weighting scheme allows this endogeneity bias to be minimized (see Bouët et al, 2008 and Guimbard et al, 2012).

[11] Note that results for Norway, Switzerland and Chile are not included in Table 1. Results for all countries can be provided on demand.

decomposition of tariff changes between two periods, t_o and t_1 for each country (see Box 1). Results are provided in Table 1, for a sample of countries. They illustrate the consequences of changes due to WTO commitments, countries' unilateral liberalization and RTAs, in terms of tariff protection, between 2001 and 2013.

Box 1. Arithmetic decomposition of changes in the tariff ladder

Changes in MFN tariff rates between t_0 and t_1 can be decomposed arithmetically as follows:

$$AMFN_{t_1} - \mathrm{A}MFN_{t_0} =$$

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

where $AMFN$ stands for the *Applied MFN* tariff rate applied, and $Bound$ stands for the *Bound MFN* tariff rate. If the bound rate in t_1 falls below the initial *Applied MFN* duty rate, $AMFN_{t_0}$, then the country must lower its *Applied 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 *Applied MFN* duty resulting from the country's commitments under the multilateral trading system. In contrast, further changes in the *Applied MFN* duty (computed in the first square brackets) are the result of the country's unilateral tariff change.

Moreover, to isolate the contribution of RTA, changes in applied rates (for a given triplet, importer-exporter-product) can be decomposed in the following way:

$$Applied_{t_1} - Applied_{t_0} =$$

$$\left[Applied_{t_1} - MFN_{t_1}\right] + \left[AMFN_{t_1} - \mathrm{A}MFN_{t_0}\right] - \left[Applied_{t_0} - AMFN_{t_0}\right] \quad (2),$$

where $Applied$ stands for the *Preferential applied* tariff. For a given year t, the preferential margin $AMFN_t - Applied_t$ may result from the application of either a reciprocal or non-reciprocal trade agreement. A reciprocal trade agreement reflects an exchange of commitments between two partner countries. In contrast, a non-reciprocal agreement, such as a country's GSP, is a non-contractual scheme that a country decides to apply through 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 rewritten as follows:

$$\Delta Applied = \Delta MFN - \Delta RPref - \Delta NRPref \quad (3).$$

4.1 A global vision of tariff changes since 2001

The global picture displayed in Figure 1a suggests that average world tariffs in agriculture experienced a limited but significant decline after the URAA. Overall, the lower curve (the average agricultural *Preferential applied* tariff) decreased by 6.5pp between 2001 and 2013, i.e. from a 23.8% to 17.3%. Acknowledging the higher base value, this represents a larger absolute cut than the one observed for industrial products quoted above, i.e. -2.4pp (Figure 1b).

In Figure 1a, the distance between the various components of the tariff ladder varies. In particular, the distance between the upper and lower curves increases. This shows that there are several phenomena behind the decrease in applied tariffs. One can distinguish the reduction in *Bound MFN* tariffs, which is visible in the early period (upper curve in Figure 1a), but also a decrease in *MFN applied* tariffs compared to the bound ones, in particular between 2003 and 2010. Figure 1a also suggests that reciprocal concessions under RTAs contributed, albeit marginally, to the decrease in applied tariffs (the distance between the *Unilaterally applied* and *Preferential applied* tariffs shows a slight increase after 2007).

Regarding each type of tariff in itself, the worldwide average *Bound MFN* tariff in agriculture went down by 5pp, or 12% between 2001 and 2013, slightly lower (in absolute terms) than the average *Applied MFN* (-6pp i.e. -25%, starting from 24.2%) and than the average *Preferential applied* tariff (6.5pp i.e. -27.4%, from 23.8%, see Table 1).

Examination of the tariff ladder at the country level shows that most of the observed cuts in applied tariffs implemented since 2001 occurred in emerging countries. The cut in the average *Preferential applied* tariff was particularly large in some Asian countries: 39.2pp in China, 24.9pp in India and 21.7pp in South Korea. Cuts have also been important in other emerging countries such as Nigeria (36.1pp), Peru (13.8pp) and Mexico (8.6pp).

In the following sections we use the arithmetic decomposition described in Box 1 to disentangle the impact of multilateral discipline, unilateral trade liberalization and preferential agreements.

Table 1. Changes in average agricultural tariffs between 2001 and 2013, selected countries

Importer	Bound MFN 2013	Applied MFN 2013	Preferential Applied 2013	Changes in Applied tariffs (2001-2013)				
					Due to:			
				Total	*Comm-itted (WTO)*	*Lib. on own initiative*	*Non reciprocal pref.*	*Reciprocal pref. (RTAs)*
China	24.3	20.3	19.2	-39.2	-34.2	-3.9	0	-1.2
Nigeria	150.0	15.1	15.1	-36.1	0	-36.1	0	0
India	146.8	38.7	38.1	-24.9	-1	-23.3	0	-0.5
South Korea	63.3	50.2	49.8	-21.7	-20.1	-1.3	0	-0.3
Peru	35.0	2.6	2.4	-13.8	0	-13.7	0	-0.1
Vietnam	21.7	15.6	11.4	-11.2	-5.5	-1.5	0	-4.2
Mexico	61.9	31	27.2	-8.6	-0.1	-7.1	0	-1.5
Saudi Arabia	13.5	5.1	5	-8.3	-2.7	-5.8	0	0.2
Bangladesh	177.3	12.2	12.2	-8	-0.1	-7.9	0	0
Japan	31.6	22.3	21.8	-6.5	-0.1	-6.1	0	-0.3
Ghana	92.1	15.5	15.2	-4.4	0	-4.0	0	-0.4
United Arab Emirates	41.3	5.9	5.9	-2.4	0	-2.4	0	0
European Union	19.0	14.7	14.5	-0.9	0	-1	0.1	-0.1
Indonesia	52.6	9.4	8.9	0	0	0.5	0	-0.5
USA	7.8	6	5.6	0	0	0.1	0	-0.1
Canada	30.6	27.9	27.4	0	0	-1.6	1.7	-0.1
Russian Federation	15.7	14.4	12.5	0.9	-0.8	2.6	0	-1
Israel	92.0	34	28.7	3.2	-1.1	5.5	0	-1.2
Malaysia	28.7	13.6	13.3	5.1	-0.2	5.4	0	-0.1
Turkey	79.8	47.9	45.7	8.9	-0.5	10.6	-0.2	-1
Iran	39.0	21	21	15.8	0	15.8	0	0
Egypt	59.7	44.2	41.9	28.1	-0.6	30.8	0	-2
World	36.5	18.1	17.3	-6.5	-4.8	-1.2	0.0	-0.5

Source: MAcMap-HS6, Authors' computations

Note: *Bound MFN, Applied MFN* and *Preferential applied* tariffs are those of 2013, in %. In columns 5 to 9, changes in tariffs between 2001 and 2013 are expressed in pp. Data and methodological choices are described in the Appendix and box n°1.

4.2 Multilateral developments: URAA and new WTO members

As shown by the "tariff ladder", part of the observed average tariff cut since the URAA originates from a decrease in the average *Bound MFN* tariffs (Figure 1a). This decrease, observed in the beginning of the period of interest (i.e. between 2001 and 2004), does not correspond to multilateral trade liberalization under the Doha Round. Rather, it mainly corresponds to the end of the URAA's implementation period (the transition period for the cuts decided in 1994 ended in 2004 for developing countries). For example, some WTO members with a "developing country" status and very high agricultural tariffs were still implementing the 1993 compulsory cuts between 2001 and 2003 in a way that significantly

diminished bound tariffs (e.g. Egypt, South Korea). Another explanation for the fall in the average *Bound MFN* tariff was that several latecomers in the WTO were asked to reduce significantly their agricultural protection for joining the "club". This is particularly the case for China and Vietnam. Indeed, WTO membership resulted in a significant reduction in their agricultural protection in their bound tariffs. For example, the average *Bound MFN* tariff for agriculture went down from 58.6% to 24.3% between 2001 and 2013 in China, i.e. a 34.3pp cut. Those in Vietnam went down by 6.6pp and Ukraine by 11.9pp.

4.3 Unilateral MFN liberalization

Interestingly, the reduction in *Bound MFN* tariffs between 2001 and 2004 (which partly resulted from the final years of implementation of the URAA commitments for developing countries) was accompanied by a similar decrease in *Applied MFN* tariffs (Figure 1a). That is, while the initial binding overhang could have led to a reduction in bound tariffs without changes in the applied tariffs in many cases, this was not the case. Overall, the large level of binding overhang even slightly increased over time.

The changes that took place in the gap between *Bound MFN* and *Applied MFN* tariffs provide information on unilateral tariff reductions, i.e. that are driven neither by multilateral discipline nor by reciprocal concessions (Such reductions in tariffs could be considered as "self imposed" but it is noteworthy that in some developing countries some of them resulted from structural adjustment and are in practice imposed by creditors or international organizations). An interesting question is whether the tariff cuts that countries implemented unilaterally play a role as central in agriculture as the one pointed out when considering all traded goods by Bureau et al (2016), over the recent period.

The gap between the average worldwide *Bound MFN* and *Applied MFN* agricultural tariffs slightly increased between 2001 and 2013 (by more than 1pp, from 17.3pp to 18.4pp). This is a small amount, but it suggests that unilateral liberalization also took place in the agricultural sector.[12] Indeed, after the implementation period of the URAA commitments for developing countries, a period of declining applied (non-discriminatory) agricultural tariffs continued for several years. This was particularly the case in Nigeria, where the decrease in agricultural *Applied MFN* tariffs reached 36.1pp between 2001 and 2013, in India (24.9pp), Peru (13.7pp) and Mexico (7.2pp). During this period, these countries uniterally opened their borders on a non-discriminating basis, i.e. outside WTO commitments. This type of trade liberalization has become less significant since 2010; countries such as India did not pursue this tariff reduction policy after the 2009 economic crisis, for example.

Tariff reductions at a country's own initiative may have served several objectives, as pointed out by Bureau et al (2016). After the Uruguay Round, many middle-income countries managed to expand successfully their integration in world markets. Even when they secured high bound tariffs, some have seen in greater trade openness a way to import market discipline, by helping to fight against rent-seeking and resource misallocation. Those countries that increased their insertion in global markets abandoned policies such as import

[12] The gap between *Bound MFN* and *Applied MFN* was 7.2pp in 2001 and 8.1pp in 2013, i.e. an increase of 0.9pp for all products in the economy over the period. Again, because initial bound tariffs were much higher in agriculture than in other sectors, self-imposed tariff reduction appears smaller in relative terms in agriculture, but is comparable in absolute terms.

substitution and the protection of "industrializing industries", a policy that had a poor record. Joining globalized value chains, or the risk of being excluded from them, have been major motivations for unilateral cuts in tariffs on raw materials, parts, and the various inputs in the manufacturing sector, as described by Baldwin (2011).

In agriculture, unilateral tariff cuts may have different objectives than in the manufacturing sector. Recalling that, in this paper, "agriculture" encompasses the whole food sector, reducing the cost of inputs for processed food may be a motivation for tariff cuts, as in other industrial sectors. Indeed, the insertion in global food chains appears to be part of the development strategy of several developing countries, and some have registered success stories (Maertens and Swinnen, 2014). However, the food industry has often developed on the basis of local agricultural production. Hence, the risk of being excluded from large and dynamic markets when imposing duties on some raw materials is probably less an issue than in the automobile or electronic goods sectors. A more compelling motivation for unilateral cuts in agricultural tariffs lies in the political interest of keeping domestic food prices at a low level. Lower food costs help avoid political unrest and to reduce salaries, hence labor costs in the manufacturing sector. Such cuts may also reflect a growing political bias in favor of urban consumers, in some developing countries. This bias probably existed at the beginning of the period and was reflected in the 2001 tariff structure, but it may have increased because of the higher share of urban population at the end of the period. Overall, both the initial binding overhang and the unilateral cut in applied MFN tariffs observed since the URAA suggest that developing and emerging countries have shown considerable restraint in protecting their agriculture, compared to what they are allowed to do under the WTO discipline.

4.4 Changes in non-reciprocal schemes

Tariff reductions under non-reciprocal schemes are a form of "self-imposed" trade liberalization, mostly in favor of poorest countries. The narrow gap between *Applied MFN* and *Unilaterally applied* tariffs tends to remain constant over time (0.2pp, Figure 1a). This suggests that non-reciprocal preferences have not lowered significantly the average agricultural tariff worldwide. The impact of non-reciprocal regimes, such as the 2001 EU's Everything but Arms or the US Africa Growth and Opportunity Act, were factored in at the beginning of the period. Reforms of the GSP (e.g. in the EU) expanded preferential margins, but, at the same time, narrowed the list of eligible countries, resulting in minor changes in worldwide protection. The list of emerging countries that granted non-reciprocal preferences to the poorest ones expanded over the period, with newcomers like China, India and Brazil.[13] However, the overall impact over world tariff protection also remains limited. This may show a lack of ambition of non-reciprocal schemes implemented by emerging countries to the benefit of poorest ones. Another explanation is that some of these emerging countries cut a part of their *MFN Applied* tariffs, hence eroding the preferential margin of non-reciprocal preferences granted to Least Developed Countries.

[13] After the 2005 Hong Kong WTO Ministerial Declaration called on both developed and developing countries "declaring themselves in a position to do so" to provide duty-free and quota-free market access for products originating from LDCs, China implemented new preferences for LDCs, followed by India in 2008, and later by South Korea and Brazil, even though these schemes are limited in ambition.

4.5 The growing but limited importance of RTAs

The stalemate in the multilateral arena contrasts with the developments that have taken place in regional and bilateral negotiations. The increasing number of RTAs can be explained by a variety of factors: the competitive liberalization policy carried out under the US administration after 2001; 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 as a strategy to gain preferential access to as many partners as possible in exchange for the opening of one's own market (e.g. Chile); the willingness of some countries to access fast-growing markets without waiting for a long-delayed multilateral agreement, and the competition between agreements, resulting from the increasingly entrenched fears – for both economic and political motives – of being left outside the tide of agreements.

The number of RTAs multiplied by three over 25 years, reaching 647 in 2017.[14] The WTO headcount of notified and enforced RTAs is often quoted to illustrate how regionalism and bilateralism have progressed, and how this preferential trade is now the dominant path for trade liberalization. However, because agreements vary widely in breadth and depth, counting RTAs actually tells us little about the importance of preferential trade, and about the extent to which these agreements deliver effective trade liberalization (Grant, 2013).

Agriculture generally receives special treatment in RTAs. In many cases, some agricultural products are excluded from tariff concessions, or are subject to smaller tariff cuts (typically beef and dairy products in EU bilateral agreements). The US has also excluded sensitive sectors from a variety of agreements (e.g. specific provisions for sugar in the US-Australia agreement). A question, therefore, is whether RTAs have been effective in lowering tariffs in this sector.

Changes in the bottom ladder, i.e. between the *Unilaterally applied* and *Preferential applied* tariffs, isolate the role of RTAs in the global trade liberalization process. For agriculture, RTAs contributed only 0.5pp to the 6.5pp changes in global applied tariff protection between 2001 and 2013 (Table 1). This suggests that RTAs have only marginally affected the level of agricultural protection provided by the combination of MFN and GSP tariffs in a majority of countries. However, it also shows that RTAs have played a comparable role in lowering agricultural tariffs as in the rest of the economy.[15] And that, after 2010, the role of RTAs in the (small) decline of average applied tariffs has become larger than the role of unilateral cuts in *MFN Applied* tariffs. Indeed, the gap between the average *Unilaterally applied* and *Preferential applied* tariffs worldwide was only 0.2pp in 2001, leading to the highest impact of RTAS in the very recent period (0.7pp in 2013).

The countries where RTAs between neighboring countries contributed most to the cut in applied tariffs are part of the Association of Southeast Asian Nations (ASEAN) and Mercosur

[14] The figure of 647 agreements refers to the number of agreements in force notified to the World Trade Organization in 2017. See https://www.wto.org/english/tratop_e/region_e/regfac_e.htm.Note that the figure includes agreements in services and agreements with a limited scope. Hence the OECD counts 284 "actual" (or "physical") RTAs on goods in October 2017.

[15] Concerning all goods in the economy, while there has been a decrease of 2.7pp in applied tariffs between 2001 and 2013, RTAs account for only 0.3pp. That is, RTAs have played a larger role in absolute value in agriculture but a lower role in relative terms, given the higher level of protection in the agricultural sector.

agreements. For example, agreements between ASEAN countries contributed to the cut of more than 4pp in agricultural tariffs observed in Laos and Vietnam. However, since the early 2000s, a growing number of RTAs have been concluded with geographically remote partners. The case of Chile, which signed RTAs with a large number of European and Asian countries, is illustrative: its bilateral agreements contribute to an average *Preferential applied* tariff that is less than half of its *Applied MFN* tariff.[16]

5. The future of agricultural tariffs

5.1 Stylized scenarios on future tariff changes

Recent political developments raise questions about the future of trade policies. Some newly elected leaders have openly refused to go further with free-trade agreements, both in the multilateral and bilateral arena. Some of the recently launched trade negotiations between large economic entities have already been shelved (e.g. transatlantic and transpacific treaties). The US has long been a strong defender of freer trade and a major driver of multilateralism, but has recently been showing a tendency to move toward more protectionist policies. However, several other countries are still inclined to reinforce regional integration, as a way to boost economic growth, China being a case in point. For good or bad reasons, such developments make uncertain the future of freer trade. Possible scenarios range from pursuing incremental multilateral liberalization, to the regional fragmentation of trade, and the return to a Smoot-Hawley type of protectionism.

Agriculture holds a particular place in this debate. On the one hand, those stakeholders who have long claimed that agriculture should be kept out of trade liberalization agreements, for the sake of food security or sovereignty, feel comforted by the rise of protectionist ideas in the public debate. On the other hand, many countries, in particular developing ones, considering that they have a comparative advantage in agriculture, keep pushing for trade liberalization in this sector.

To gauge the contrasting effects on trade and welfare, we use a multi-sectoral and multi-regional general equilibrium model. We do not investigate in more novel modeling of trade policies (Costinot and Rodriguez-Clare, 2013., 2007; Eaton and Kortum, 2002; Caliendo et al., 2016) as we wanted to stick to previous quantitative assessments of trade policies. In doing so, we decided to keep our model as stylized as possible. The set up of the supply side is rather standard and its main characteristics are described in Appendix. In such simple and standard framework, it is possible to account for cross-sectoral adjustments and for domino effects that cascade across markets when tariff changes result in a deformation of the global price vector for outputs and inputs. Calibration is performed using the GTAP 9 database, with base year 2011, from which we simulate a dynamic baseline (up to 2030) for the world economy as described in Fouré et al (2013). We also update tariffs to 2013, keeping the status quo in this arena for the subsequent years. Two counterfactual scenarios are then computed as pairwise bilateral tariff changes at the HS6 level and integrated in our model at a more aggregate level, including 21 regional aggregates, 16 agricultural sectors and five non-agricultural sectors (see details in the Appendix).

[16] It is noteworthy that Chile also imposes *MFN Applied* tariffs much lower than its bound tariffs for agricultural products: in 2013, the level of *Bound MFN* tariffs was 26.6%, that of *Applied MFN* tariffs 6.3% and that of *Preferential applied* tariffs 3%.

In the following sections, we explore the potential consequences of the two polar scenarios on agricultural trade and production. In the first counterfactual scenario, "deepened regionalism", we consider that free traders will eventually win the debate, and assume that all ongoing negotiations declared under the WTO framework, such as "second-generation RTAs", will be conclusive, including the Trans-Pacific Partnership (TPP) and the Transatlantic Trade and Investment Partnership, even though this sounds an unlikely prospect in the short term after the 2017 withdrawal of the US from the TPP. That is, the "deepened regionalism" scenario is intended to provide an upper bound for a situation where trade liberalization keeps progressing over the coming decade.[17]

In the second scenario, nicknamed "trade war", we assume that all WTO members raise their applied tariffs to the 2001 bound tariffs levels, except within an official custom union (e.g. the EU or South African Custom Union). This does not imply that any country violates the WTO discipline on tariffs. Nor is a possible collapse of the WTO considered here. However, this scenario is a rather extreme case where ongoing surges in protectionism escalate, capturing the essence of the retaliatory surge in tariffs that took place between 1930 and 1933.

These two cases are, obviously, stylized situations. While they are not particularly realistic from a political standpoint, contrasting their results provides some information on the impact of the relative paths that agricultural trade could follow in the coming years.

Each scenario is enforced as of 2020, in one shot, and results are computed as deviation to the baseline in 2030. While the scenarios include changes in tariffs for all products, we focus on the consequences for agricultural sectors in the following sections. It is noteworthy that general equilibrium effects are at stake behind variations in our sectors of interest, their changes being linked to those happening in the industrial sector and in the services sector.

5.2 The consequences for agriculture of contrasting tariff changes

Table 2 opposes the results (trade and production) of our two counterfactual scenarios, "deepened regionalism" and "trade war", compared to the baseline in 2030, for our panel of countries or regional aggregates. We comment on each in the two following subsections.

[17] An alternative would have been to assume that the Doha Round would result in an ambitious agreement in the market access area. However, Bureau et al (2017) showed that the scenario where RTAs would include "megadeals" between the world's top trading countries would have a larger impact than a multilateral agreement, and that such deals would be rather redundant in the sense that they would leave little for multilateralism to negotiate on.

Table 2. Consequences of "deepened regionalism" and "trade war" on agricultural trade and production

Country	Variable	Baseline (Billions of 2011 USD)	Deepened regionalism %	Trade War %	Country	Variable	Baseline (Billions of 2011 USD)	Deepened regionalism %	Trade War %
Argentina	Exports	80.8	3.9	-30.2	Latin America & Caribbean	Exports	181.9	1.3	-51
	Imports	8.4	5.2	-61.9		Imports	137.3	1.9	-51.2
	Production	242	1.5	-10		Production	1110.5	0	-3.2
ASEAN	Exports	328.4	0.4	-31.6	Mexico	Exports	51.1	1.1	-37.9
	Imports	250.8	3.1	-52.5		Imports	71.7	0	-41.4
	Production	1529.3	-0.4	2.2		Production	408.3	0.1	1.4
Turkey and Balkans countries	Exports	40.2	1.6	-24.8	Middle East Countries	Exports	51.9	-0.5	-40.9
	Imports	42.2	1.1	-40.8		Imports	224.2	0.5	-24.7
	Production	493.5	0	2.2		Production	564.9	-0.3	5.6
Brazil	Exports	389.4	6	-35.6	North Africa	Exports	35	0.9	-48.6
	Imports	28.4	4.6	-50.7		Imports	90.3	0.3	-33.2
	Production	1492.9	1.9	-10.8		Production	459.2	0	3.6
Canada	Exports	152.1	-0.6	-6.8	Oceania	Exports	146.3	3.2	-27.9
	Imports	86.4	0.8	-8.2		Imports	67.1	2.9	-16.2
	Production	531.8	-0.4	-1.7		Production	556.5	0.8	-7.7
China & Hong Kong	Exports	230.7	2.2	-26.6	Rest of Asian countries	Exports	71.7	1	-26.9
	Imports	830.4	0.8	-24.3		Imports	167.8	1.3	-44.5
	Production	7335.9	0	-0.7		Production	1038.2	-0.2	6.3
Commonwealth of Independent States	Exports	61.9	1.2	-46.9	Russia	Exports	60.7	0	-29.8
	Imports	73.6	1.5	-30.2		Imports	95.5	1.4	-21.3
	Production	635.1	-0.1	-1.8		Production	910.3	-0.2	-0.6
EFTA	Exports	45.1	2.4	-15	SACU	Exports	26.4	0.2	-33.2
	Imports	70.7	1.1	-21.9		Imports	20.5	1	-43
	Production	253.4	0.3	4.7		Production	206.7	-0.1	0.5
EU28	Exports	1062	0.4	-20.7	Africa (SSA Countries)	Exports	67.1	-0.2	-60.2
	Imports	1142.3	0.7	-19.9		Imports	131.2	0.3	-68.2
	Production	4279.3	-0.1	-0.3		Production	949.9	-0.1	5.4
India	Exports	82.9	0.2	-38.2	USA	Exports	517.3	-0.4	-24.6
	Imports	54	5.2	-74		Imports	321.1	1.1	-13.3
	Production	1751.5	0.1	1.2		Production	3263	-0.2	-2.8
Japan	Exports	34.6	3.8	-14.5	World	Exports	3717.4	1.3	-28.1
	Imports	140.6	5.4	-22.4		Imports	4054.4	1.3	-28.3
	Production	954.4	-0.8	6.9		Production	28966.7	0	-0.5

Source: Authors' computations. Initial values (baseline) are expressed in 2011 billions of USD. Variations of each scenario are expressed in % deviation from the baseline in 2030.

5.2.1 Deepening of regionalism, through mega-deals and other negotiations

The first striking result is the potential limited increase (+1.3%, i.e. less than 50 billion 2011 USD) in exports linked to the completions of RTAs (both already signed and in negotiation), world trade being expected to increase by almost USD370 billion.

Under this scenario, EU agricultural exports would increase by 0.2% and imports by 0.7%, while production would experience a limited reduction. While these figures are small, they suggest that agriculture is not among the sectors where the EU would benefit from a deepening of trade liberalization. Japan and the ASEAN countries are in a similar situation. Overall, it is only South and Central America that would see an increase in production, by a limited percentage (1.9% in Brazil, 1.5% in Argentina). In the US and Canada, the expansion of some agricultural exports would be offset by the growth in imports of the most protected commodities (e.g. dairy). It is noteworthy that the situation hardly changes for Sub-Saharan Africa, mostly because signed agreements have been factored in the baseline, and that the continent has remained largely outside the recent wave of trade negotiations (Guimbard and Le Goff, 2017).

Overall, this potential set of regional agreements would have limited impact on the global agricultural sector. Several reasons[18] can explain this. First, the observed design of current RTAs allows generally important flexibilities in agriculture. Our methodology relies on the assumption that agriculture will keep its particular status in RTAs that are negotiated. Thus, the lists of sensitive products (see Appendix) in each agreement we include contain, more or less, an important share of agricultural products, limiting, therefore, the expected consequences due to trade liberalization.[19] Second, the share of agricultural goods that are traded internationally is small compared to actual production. Table 2 figures for the "baseline" (third column) show that agricultural imports often account for less than 10% of aggregate production (figures for India, China and the US, the high degree of integration of agriculture in world trade in the EU and EFTA being exceptions). Finally, even if many countries are involved in RTAs negotiations, this represents a tiny share of the possible country pairs. Moreover, some major players in agriculture are excluded from (or little involved in) those RTAs, such as BRICS countries or African countries (whose overall agricultural exports decline by -0.2%).

At the world level, enhanced regionalism provides increasing positive impacts on the trade of all sectors (see Table A03). Sectors to undergo the largest variations of their exports would be Red and White Meat (resp. +3.3% and +2.6%), e.g. in the case of an EU-Mercosur agreement, Crops NEC (+2.3%), due to agreements in Asia, Sugar (+2.1%), and Beverages and Tobacco (+1.6%).

Finally, the impact of this scenario on world prices is also limited. With the exception of sugar (+2.9%) and beef (+2.6%), world prices of agricultural products show only small variations compared to the baseline (Table A3 in the Appendix).

5.2.2 A "Trade War" within the WTO framework

The situation would be very different with the "trade war" scenario under which all WTO members would raise their applied tariffs to the bound ones. The rise in tariffs would be considerable, as shown by the current gap between *Preferential applied* tariffs and *Bound MFN* tariffs in Section 2. Under the "trade war" scenario, agricultural tariffs would more than double worldwide, and in some countries, such as India, they would almost quadruple. Thus,

[18] Another reason comes from modeling assumptions. Indeed, in a CES framework, trade flows are bound to remain nil when it is the case initially.

Table 2 shows that the contraction of world agricultural trade would be considerable, about -28% (almost 1,05 billion 2011 USD), i.e. 22 times higher than the potential increase of trade linked to RTAs. Agricultural exports from large producers such as Brazil, Oceania, the US and Russia would fall by a fourth or a third. In the poorest countries, trade would experience a dramatic fall, but the actual impact on domestic production would be positive (+5.4% relative to the baseline in Sub-Saharan Africa). Such a positive impact is also observed in North Africa, Rest of Asia, and Japan. If we focus on the impacts for farmers, the approximation provided by the real returns to land shows contrasting results across countries.[20] Returns to land would fall significantly in Argentina and Brazil. Among the countries keener to engage in protectionist measures, the US would experience a large fall in real returns to land (-12%), contrasting with the "deepened regionalism" scenario in which this factor remains unaffected. By contrast, the "trade war" scenario would have positive effects on farmers in Sub-Saharan Africa, where returns to land would increase slightly (by 2.6%) compared to the baseline, because of the reduced competition from imports.

6. Conclusion

We put together a comprehensive database that makes it possible to investigate, in considerable detail, the different levels of agricultural tariffs and how they have changed since the beginning of the century. For that purpose, we developed a "tariff ladder" approach, and used an arithmetic decomposition of the changes in the various levels of tariffs over time. We assessed the actual degree of trade liberalization in agriculture since 2001, and attempted to disentangle the different drivers, between multilateral, unilateral, non-reciprocal and regional/bilateral tariff reductions and concessions, that have taken place.

Several conclusions can be drawn. First, in spite of the URAA and the many regional agreements, agricultural tariffs in 2013 remain much higher than those in other sectors, whatever the type of tariffs we refer to (bound, MFN, unilaterally or bilaterally applied). However, the reduction in applied tariffs has been substantial; once multilateral, unilateral and regional concessions are considered, there is a 27.4% reduction in the average agricultural tariff worldwide.

Second, applied agricultural protection is much lower than allowed by multilateral discipline. Many developing and transition countries' applied tariffs correspond to a small fraction of their bound tariffs, even on a non-discriminatory basis. Thus, in the agricultural sector, the vision of a WTO that forces developing countries to open their market against their will remains largely a fiction, since the binding overhang is not only considerable, but has increased over time.

Third, since the end of the implementation period of the Uruguay Round (2004), self-imposed tariff reductions have played a significant role. Own-initiative liberalization was the dominant driver of tariff cuts at the beginning of the period, while RTAs played a larger role after 2007. Previous work has shown that this unilateral reduction in tariffs was a major driver

[20] Real returns to land are not provided in the tables, but under the "trade war" scenario, they would fall by 17% in Argentina, 15% in Brazil, and 9% in Oceania, compared to the baseline. They would increase significantly in Japan (+11%), Rest of Asia (10%), Mexico (+8%), Sub-Saharan Africa (+3%), the Middle East and North Africa (+2%).

of the world trade liberalization that has taken place in the manufacturing sector, where many emerging countries have chosen to lower their barriers to imports, in particular to position themselves in global value chains. Our results show that this movement can also be observed in agriculture. There might be other motivations for lowering actual tariffs, such as ensuring cheaper food for an urban population or enabling lower salaries in the manufacturing sector.

Another finding is that the surge of bilateral and regional agreements that has taken place since the mid-2000s has only marginally dented tariff protection. However, the modest impacts of regional agreements on average tariffs are in line with those granted to non-agricultural products. This is somewhat surprising, since the EU and the US have often excluded sensitive agricultural products from their tariff concessions schedules.

Finally, we looked at the future of agricultural tariffs. Recent policy developments suggest that we are at a crucial period for trade policies. We considered two polar scenarios. The first one involves the conclusion and implementation of all the regional agreements under negotiation, including some of the transatlantic and transpacific “mega-deals” recently postponed. The other scenario is of a general rise of all WTO members’ applied tariffs up to the bound ceiling, that is, a “trade war” scenario. Because these countries would remain under WTO discipline, this scenario is probably not as extreme as a (possible) collapse of the WTO itself. We use a full-blown general equilibrium model to simulate the effects of both scenarios, focusing on agricultural trade and production.

Overall, the “deepened regionalism” scenario has a rather limited impact on world trade and on domestic production. Compared to the baseline, domestic agricultural production changes by less than 2% in most countries. Brazil and Argentina would experience a slight increase, but overall the changes linked to tariff concessions are unimpressive. The other extreme scenario, “trade war”, shows far more dramatic consequences. Here, world prices would go down, and agricultural world trade would fall considerably. Variations in production could exceed -10% and +6% in some regions of the world. Interestingly, farmers in some of the poorest countries would gain in this scenario, but the losses would be large for key agricultural exporters such as Brazil, Argentina, Australia and New Zealand. Farmers in the US, the country that has been the keenest at vetoing regional agreements and threatening to impose tariffs, would experience large losses.

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Appendix: Data, model and conventions used

Data sources for tariff and trade.

Our analysis relies upon detailed data (HS6 level) on Bound MFN, Applied MFN and Preferential applied tariffs, bilateral trade flows, RTAs tariff concessions for the years 2001, 2004, 2007, 2010 and 2013.

- Source data

The main material is the MAcMap-HS6 dataset on tariffs, a joint effort by the International Trade Commission and CEPII (see Guimbard et al, 2012 for details). ITC collects information (applied tariffs) directly from the customs of each country, leading to an exhaustive coverage of preferential agreements (FTAs, GSP…). Our dataset does not include any re-construction of applied tariffs, but we used data on RTAs (mainly relying upon WTO and Asian Development Bank) to check for consistency.

MAcMap-HS6 is also matched with the tariff schedules of each WTO member, based on the Bchir et al (2006) treatment, updated as needed (in particular to account for recent accession protocols, since 2004, such as Vietnam). WTO commitment schedules define a final bound duty and a phase-in period, sometimes with intermediate objectives. 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. First, some WTO members' non-agricultural products remain unbound. In the Doha Round negotiations, such cases were tackled by computing base rates, used as an equivalent of initial bound tariffs. In the rev. 4 modalities, base rates are computed adding 25pp to the MFN applied duty. We adopt this convention to complete our database when needed for non-agricultural products. The second case where bound duties are not defined is when the country is not a member of the WTO. In this case, product by product, the highest rate applied outside RTAs over the period is used as an equivalent of bound duty.[21] Regarding non consolidated agricultural tariffs (a small share as almost 100% of WTO members' tariffs are consolidated in this sector) , we use the MFN tariff instead.

Because many countries have specific or compound tariffs (e.g. Switzerland, EU, Japan), *ad valorem* equivalents of these tariffs were constructed, following the methodology proposed by Bouët et al (2008). This requires using "reference groups" for the computation of reference unit values, so as to reduce the bias due to the observed inverse correlation between the level of tariff and trade flows, and the "shipping the good apples out" effect, in which higher specific tariffs affect the composition of trade, leading to exporting higher-quality products only. Data on trade flows at the HS6 level come from the CEPII's BACI database (see Gaulier and Zignago, 2010, for details), and those on trade unit values come from the CEPII's TUV database (see Berthou and Emlinger, 2011).

To prevent changes in trade patterns from blurring our analysis of trade policies, the same unit values and weighting schemes, computed using 2013 statistics, are used for the sake of calculation and aggregation of *ad valorem* equivalents, whatever the year concerned.

[21] Even though countries that are 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.

- The final dataset

The result gives *ad valorem* equivalent tariffs of Bound MFN, Applied MFN and bilateral Preferential applied tariffs imposed by 130 importing countries (the 28 European countries are considered as a single entity) to 174 exporting entities, for the years 2001, 2004, 2007, 2010 and 2013

Note that in all the figures presented in the text, intra-EU trade is ignored, and the EU is considered as a single entity, consistent with the fact that external trade policy is designed and managed at the EU level. We focus here on the EU28 as a way to keep the definition of the EU consistent over the period in spite of the successive enlargements and Brexit.[22]

Regarding the simulations, we use the GTAP 9 database[23] (Global Trade Analysis Project), which provides social accounting matrices (i.e. input-output tables, trade…) for 140 countries or composite regions in 57 sectors, for the year 2011.

The general equilibrium model. MIRAGE (Modelling International Relationships in Applied General Equilibrium) is a multi-sectoral and multi-regional computable general equilibrium model dedicated to trade policy analysis. MIRAGE exhibits a sequential dynamic framework where installed capital is immobile, but where depreciation and investment involve capital reallocation.[24]. The dynamic baseline for the world economy is constructed with a reference simulation based on assumptions about changes in technology, demographics and education described in Fouré et al (2013) and the statu quo (2013) in terms of trade policies.

Sectors and regions. We recall here that the definition of the agricultural sector is the one used by WTO. The sectoral decomposition used in the simulations is detailed in Table A1 whereas regional aggregates are given in Table A2. We also aggregate the detailed dataset on tariffs used in this study for the simulations, using the MAcMap-HS6 methodology as defined in Bouët et al (2008).

Scenarios. For the "deepened regionalism" scenario, we built an additional database describing the hypothetical situation where ongoing negotiations are concluded and the corresponding agreements phased in. There is no change in the protection of the service sectors (nor NTM measures in goods, acknowledging that a number of agreements currently being negotiated include provision on this aspect) in our scenarios, since we only deal with tariffs, but changes in industrial tariffs are accounted for when they are included in RTAs. As emphasized in the text, tariff protection remaining within agreements is generally not negligible. We take this into account by assuming, product by product, that each partner will apply under forthcoming agreements the same residual protection level that it was applying

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[22] In our simulations, we ignore some recent developments, such as the United Kingdom leaving the EU. We assume that the tariff protection remains unchanged between the UK and the rest of the EU (as in the actual single market, i.e. "soft Brexit" in terms of tariffs), as well as between the UK and the rest of its partners with which it has an RTA. We also do not assume a "hard removal" of NAFTA.

[23] The GTAP 9 database is a collective effort developed by the Global Trade Analysis Project consortium, under the supervision of R. McDougall, T. Walmsley and B. Dinamaran.
See https://www.gtap.agecon.purdue.edu/databases/v9/default.asp

[24] Details on the model, with all its equations and parameters, can be found in Decreux and Valin (2007) and Fontagné et al (2013). A wiki-based website is also available at www.mirage-model.eu/. All results of the simulations can be provided upon request.

on average in 2013 for the agreements that it had been enforcing for more than five years. This crude assumption is likely to provide a qualitatively correct approximation of the level potentially applied in these would-be agreements, because countries tend to apply similar patterns of residual protection across their preferential agreements, which are mainly guided by the politically motivated desire to protect a limited number of sensitive products.

Table A1. Sectoral decomposition

Sectoral aggregation	GTAP sectors
Cereals	PDR WHT GRO PCR
Vegetable, fruits and nuts	V_F
Oils seeds	OSD
Sugar	C_B SGR
Plant-Based Fiber	PFB
Other crops	OCR
Other Meat Products	CTL OAP
Dairy products	RMK MIL
Wool	WOL LUM PPP
Forestry	FRS
Fishing	FSH
White Meat	CMT
Red Meat	OMT
Vegetable oil and fats	VOL
Other food products	OFD
Beverage and tobacco	B_T
Primary Energy	COA OIL GAS OMN
Clothing Industry	TEX WAP LEA
Industrial sector	NFM OMF P_C NMM CRP I_S MVH NFM OTN ELE OME GDT ELY
Transport	OTP WTP ATP
Services sectors	WTR CNS TRD CMN OFI ISR OBS ROS OSG DWE

Source: Authors. See the correspondence table between GTAP codes and sectors' names at: https://www.gtap.agecon.purdue.edu/databases/v9/v9_sectors.asp

Table A2. Region aggregates

Geographical aggregation	GTAP9 countries (140)
Oceania	AUS NZL XOC
China and Hong Kong	CHN HKG
Japan	JPN
ASEAN	KHM IDN LAO MYS PHL SGP THA VNM XSE
India	IND
Rest of Asian countries	BRN MNG XEA BGD NPL PAK LKA XSA XNA XTW KOR TWN
Canada	CAN
USA	USA
Mexico	MEX
Argentina	ARG
Brazil	BRA
Latin American Countries	BOL CHL COL ECU PRY PER URY VEN XSM CRI GTM HND NIC PAN SLV XCA XCB DOM JAM PRI TTO

Geographical aggregation	GTAP9 countries (140)
EU28	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 HRV
EFTA	CHE NOR XEF
Russia	RUS
Commonwealth of Independent States	BLR UKR XEE XER KAZ KGZ XSU ARM AZE GEO
Turkey and Balkans countries	ALB TUR
Middle East Countries	BHR IRN ISR JOR KWT OMN QAT SAU ARE XWS
North Africa	EGY MAR TUN XNF
Africa	BEN BFA CMR CIV GHA GIN NGA SEN TGO XWF XCF XAC ETH KEN MDG MWI MUS MOZ RWA TZA UGA ZMB ZWE XEC
SACU	BWA NAM ZAF XSC

Source: Authors. See the correspondence table between GTAP code and countries' names at: https://www.gtap.agecon.purdue.edu/databases/regions.asp?Version=9.211

Table A.3. Changes in worldwide trade and world prices for agricultural products under alternative tariff changes scenarios

Sector	Wordwide Exports			World Prices	
	Baseline (USD billion 2011)	Deepened regionalism (%)	Trade War (%)	Deepened regionalism (%)	Trade War (%)
Beverage and tobacco	208.2	1.6	-28.8	0.1	-0.8
Cereal	232.4	1	-43	-0.1	-1.9
Clothing Industry	1749.1	2.9	-28.3	-0.1	1.9
Other crops	206	2.3	-26	-1	-2.1
Dairy products	126.8	1.5	-46.7	0.1	-1.6
Primary Energy	2553.5	0.2	-17.7	0	-2.9
Fishing	40.1	0.7	-11.3	0.6	-2
Other food products	671.9	1.3	-27.5	0	-0.9
Forestry	1011.6	0.9	-19	0	-1.5
Other meat products	92.9	0.5	-12.4	-0.1	-0.7
Meat_Red	94.7	2.6	-38.4	-0.5	0.5
Meat_White	198.4	3.3	-37.1	-0.8	0.4
Oils seeds	210.2	0.5	-35.3	-0.5	-6.8
Industrial sector	20081.4	1.3	-25.1	0.1	-0.2
Plant-Based Fiber	69.4	0.8	-43.9	-0.4	-7.1
Services sectors	3370.3	-0.2	0.9	0.2	-1.7
Sugar	80.2	2.1	-46.1	-0.7	1.2
Transport	1088.3	0.1	-1.6	0.1	-0.5
Vegetable, fruits and nuts	231.1	0.8	-20.5	0	-2.8
Vegetable oil and fats	219	1	-35.1	-0.2	-1
Wool	24.5	0.5	-15.8	-0.3	1.5

Source: Authors' computations. Initial values (baseline) are expressed in 2011 billions of USD. Variations of each scenario are expressed in % deviation from the baseline in 2030.